Banking, Finance,
and Accounting

Banking, Finance, and Accounting:

Concepts, Methodologies, Tools, and Applications

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Acar, Okan / *Banker, Turkey* 886
Achehboune, Amale / *Al Akhawayn University, Morocco* 68
Adelaja, Adesoji / *Michigan State University, USA* 797
Adhikary, Anindita / *Sikkim Manipal Institute of Technology, India* 614
Akaeze, Henry / *Michigan State University, USA* 797
Akbari, Fatemeh / *Mazandaran University of Science and Technology, Iran* 1115
Alexandrova-Kabadjova, Biliana / *Banco de Mexico, Mexico* 1228
Al-Hasan, Said / *University of Glamorgan, UK* 1328
Alhawari, Samer / *The World Islamic Sciences and Education University, Jordan* 919
Ali, Sadiq Shahbaz / *Shaheed Zulfikar Ali Bhutto Institute of Science and Technology, Pakistan* 532
Alma, Jaqueline / *Electronic Arts – Vancouver, Canada* 1421
Aloud, Monira / *University of Essex, UK* 350
Angelou, Georgios N. / *University of Macedonia, Greece* 544
Arciero, Luca / *Bank of Italy, Italy* 218
Arora, Vishal / *Indian Institute of Technology Delhi, India* 1554
Aslanova, Kemale / *Beykent University, Turkey* 1510
Asogwa, Benjamin Chijioke / *University of Agriculture, Nigeria* 1081
Assefa, Temtim / *Addis Ababa University, Ethiopia* 978
Ater, Peter Iorhon / *University of Agriculture, Nigeria* 1081
Aydoğan, Berna / *Izmir University of Economics, Turkey* 1303
Ballas, Apostolos / *Athens University of Economics and Business, Greece* 832
Blanco, Amanda / *University of Florida, USA* 776
Bolat, Nursel / *Istanbul Arel University, Turkey* 1384
Bora, Bedanta / *Sikkim Manipal Institute of Technology, India* 614
Çakan, Sinan / *Anadolu University, Turkey* 501
Cao, Nhi Y. / *School of Banking and Finance, National Economics University, Vietnam* 484
Cardholm, Lucas / *Coromatic Group, Sweden* 1056
Castellanos-Pascacio, Sara G. / *BBVA Research, Mexico* 1228
Celik, Ismail Erkan / *Beykent University, Turkey* 127

Chandran, Kailas Sree / *St.Thomas Institute for Science and Technology, India* 1212
Charfeddine, Lanouar / *College of Business Administration, Najran University, Saudi Arabia* 818
Chatzipoulidis, Aristeidis / *University of Macedonia, Greece* 247
Choong, Yap Voon / *Multimedia University, Jalan Multimedia, Malaysia* 467
Chopra, Shalu / *VES Institute of Technology, India* 728
Choudhury, Masudul Alam / *College of Commerce and Economics, Sultan Qaboos University, Oman* 1521
Cipolla-Ficarra, Francisco V. / *ALAIPO – AINCI, Spain and Italy* 1421
Constantelou, Anastasia / *University of the Aegean, Greece* 1368
Copur, Zeynep / *Hacettepe University, Turkey* 776
Cortés-Romero, Antonio M. / *University of Granada, Spain* 330
Das, Ramesh Chandra / *Katwa College, India* 54
Das, Rituparna / *National Law University Jodhpur, India* 435,452,948
De, Sanjoy / *Burdwan University, India* 661
Diehl, Martin / *Deutsche Bundesbank, Germany* 1577
Dinçer, Hasan / *Beykent University, Turkey* 127
Dinda, Soumyananda / *Sidho-Kanho-Birsha University, India* 54
Dorożyński, Tomasz / *University of Lodz, Poland* 740
Dostál, Petr / *Brno University of Technology, Institute of Informatics, Czech Republic* 1462
Dwivedi, Rajeev / *Institute of Management Technology, India* 728
Economides, Anastasios A. / *University of Macedonia, Greece* 544
Ekanayake, E. M. / *Bethune-Cookman University, USA* 89
Eken, Mehmet Hasan / *Istanbul Commerce University, Turkey* 1151
Elgahwash, Fouad Omran / *University of Wollongong, Australia* 714
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Eshraghi, Arman / *University of Edinburgh, UK* 867
Favre-Bonte, Véronique / *Laboratory Institut de REcherche en Economie et en GEstion (IREGE), University of Savoie, France* 1539
Fazlollahtabar, Hamed / *Iran University of Science and Technology, Iran* 1115
Freeman, Mark Bruce / *University of Wollongong, Australia* 714
Galbiati, Marco / *Bank of England, UK & European Central Bank, Germany* 644
Garcia-Almanza, Alma L. / *Banco de Mexico, Mexico* 1228
Garfield, Monica / *Bentley University, USA* 978
Geng, Zhongyuan / *School of Management, Harbin Institute of Technology, P.R. China* 518
Giansante, Simone / *University of Bath, UK* 561
Gonenc, Halit / *University of Groningen, The Netherlands* 137
Gupta, Priya / *Shaheed Sukhdev College of Business Studies, University of Delhi, India* 410
Gupta, Shruti / *University of Jammu, India* 1004
Gurbuz, A. Osman / *Istanbul Commerce University, Turkey* 311,385
Gutter, Michael S. / *University of Florida, USA* 776
Hacioğlu, Ümit / *Beykent University, Turkey* 127
Hailu, Yohannes G. / *United Nations Commission for Africa, Rwanda* 797
Hamza, Haitham S. / *Cairo University, Egypt* 1263
Hanson, Steve / *Michigan State University, USA* 797
Hjouj, Khaled / *Management Consulting Executive, Canada* 1031

Huemann, Martina / *WU Vienna, Austria* 1
Jha, Pawan Kumar / *Banaras Hindu University, India* 1202
Kainth, Jyoti / *Institute of Management Technology, India* 410
Kale, Suleyman / *Ziraat Bank, Turkey* 1151
Karabay, Melisa Erdilek / *Marmara University, Turkey* 18
Kargidis, Theodoros / *Alexandrian Technological Educational Institute of Thessaloniki, Greece* 247
Kaur, Gurjeet / *University of Jammu, India* 1004
Khan, M. N. A. / *Shaheed Zulfikar Ali Bhutto Institute of Science and Technology, Pakistan* 532
Kishk, Mohammed / *The Scott Sutherland School of Architecture and Built Environment, Robert Gordon University, UK* 962
Kornecki, Lucyna / *Embry-Riddle Aeronautical University, USA* 89
Kumar, Jitendra / *Sikkim Manipal Institute of Technology, India* 614
Kumar, Raj / *Banaras Hindu University, India* 1202
Kuna-Marszałek, Anetta / *University of Lodz, Poland* 740
Lai, Jung-Yu / *National Chung Hsing University, Taiwan* 159
Lara-Rubio, Juan / *University of Granada, Spain* 330
Liakeas, Konstantinos / *University of the Aegean, Greece* 1368
Lin, Ching-Tsung / *Graduate Institute of Information Management, National Taiwan University, Taiwan* 159
Liu, Chunhui / *University of Winnipeg, Canada* 1344
Lopez-Castañon, Calixto / *Banco de Mexico, Mexico1* 282
Lopez-Gallo, Fabrizio / *Banco de Mexico, Mexico* 282
M. K., Normalini / *Universiti Sains Malaysia, Malaysia* 685
Mahdavi, Iraj / *Mazandaran University of Science and Technology, Iran* 1115
Mansour, Ayman / *University of Glamorgan, UK* 1328
Markose, Sheri M. / *University of Essex, UK* 561
Martínez-Fiestas, Myriam / *ESAN University, Perú* 330
Martinez-Jaramillo, Serafin / *Banco de Mexico, Mexico* 282
Marzouk, Ahmed M / *IBM Egypt, Egypt* 1263
Maurya, Upendra K. / *National Institute for Micro, Small, and Medium Enterprises (Ni-MSME), India* 907
Meshesha, Million / *Addis Ababa University, Ethiopia* 978
Mia, Mohammad Badruddozza / *Open University, UK* 699
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Nguyen, Thanh D. / *Ho Chi Minh City University of Technology, Vietnam* 484
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Omankhanlen, Alex Ehimare / *Covenant University, Nigeria* 625
Ong, Chorng-Shyong / *National Taiwan University, Taiwan* 159
Özkök, Yıldız / *Hasan Kalyoncu University, Turkey* 1284
Padmavathy, Chandrasekaran / *Vellore Institute of Technology, India* 932

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Pele, Daniel / *Bucharest University of Economics, Romania* 108
Pham, Long / *College of Business, Minot State University, USA; & School of Banking and Finance, National Economics University, Vietnam* 484
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Pupović, Elvira / *University of Montenegro, Montenegro* 850
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Sami, Ben Jabeur / *IESEG School of Management, France* 236
Santos, Henrique / *University of Minho, Portugal* 1253
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Zhou, Bin / *Southern Illinois University Edwardsville, USA* 1179
Zouag, Nada / *Al Akhawayn University, Morocco* 68

Table of Contents

Preface xx

Volume I

Section 1
Fundamental Concepts and Theories

This section opens this three-volume set with a look at Banking, Finance, and Accounting in a modern, global context. In the wake of financial distress, increased awareness of all aspects of baking and investment, however fundamental, is critical. This section investigates many of these topics, including project management, international investment, and risk analysis, among others. In the opening 15 chapters of this extensive reference source, readers will obtain a clear understanding of the fundamental concepts and theories integral to the field of Banking, Finance, and Accounting.

Chapter 1
Project Initiation: Investment Analysis for Sustainable Development 1
Claudia Weninger, WU Vienna, Austria
Martina Huemann, WU Vienna, Austria

Chapter 2
Innovation and Competitiveness: An Exploratory Study on Turkish Financial Sector 18
Melisa Erdilek Karabay, Marmara University, Turkey

Chapter 3
Internet Banking Adoption by the Customers of Private Sector Banks in India 43
G. Varaprasad, National Institute of Technology Calicut, India
R. Sridharan, National Institute of Technology Calicut, India
Anandakuttan B. Unnithan, Indian Institute of Management Kozhikode, India

Chapter 4
Causality between Credit Deposit Ratio and Credit Share in Major Indian States during 1972 -2008 54
Ramesh Chandra Das, Katwa College, India
Soumyananda Dinda, Sidho-Kanho-Birsha University, India

Chapter 5

Production, Trade, Knowledge Economy, and ICTs in Arab Countries 68
Nada Zouag, Al Akhawayn University, Morocco
Amale Achehboune, Al Akhawayn University, Morocco

Chapter 6
The State-Based Factors Affecting Inward FDI Employment in the US 89
Lucyna Kornecki, Embry-Riddle Aeronautical University, USA
E. M. Ekanayake, Bethune-Cookman University, USA

Chapter 7
The Situation of Knowledge Economy in the Arab and EEE Regions 108
Daniel Pele, Bucharest University of Economics, Romania

Chapter 8
Investment and Development Banks and Strategies in Turkey 127
Ismail Erkan Celik, Beykent University, Turkey
Hasan Dinçer, Beykent University, Turkey
Ümit Hacioğlu, Beykent University, Turkey

Chapter 9
International Evidence on Financing of R&D 137
Halit Gonenc, University of Groningen, The Netherlands

Chapter 10
Factors Driving Value Creation in Online B2B Banking 159
Jung-Yu Lai, National Chung Hsing University, Taiwan
Khire Rushikesh Ulhas, Graduate Institute of Technology Management, National Chung Hsing University, Taiwan
Ching-Tsung Lin, Graduate Institute of Information Management, National Taiwan University, Taiwan
Chorng-Shyong Ong, National Taiwan University, Taiwan

Chapter 11
Overview of Mobile Payment: Technologies and Security 180
Vibha Kaw Raina, Birla Institute of Technology, India

Chapter 12
Liquidity Management in the Large Value Payment Systems: Need for an Agent-Based Model's Complex Approach 218
Luca Arciero, Bank of Italy, Italy
Cristina Picillo, Bank of Italy, Italy1

Chapter 13
Financial Distress and Bankruptcy Costs 236
Ben Jabeur Sami, IESEG School of Management, France

Chapter 14
IT Security Governance in E-Banking 247
Theodosios Tsiakis, Alexandrian Technological Educational Institute of Thessaloniki, Greece
Theodoros Kargidis, Alexandrian Technological Educational Institute of Thessaloniki, Greece
Aristeidis Chatzipoulidis, University of Macedonia, Greece

Chapter 15
Systemic Risk, Stress Testing, and Financial Contagion: Their Interaction and Measurement 282
Calixto Lopez-Castañon, Banco de Mexico, Mexico1
Serafin Martinez-Jaramillo, Banco de Mexico, Mexico
Fabrizio Lopez-Gallo, Banco de Mexico, Mexico

Chapter 16
Behavioral Finance in Theory and Practice 311
Mustafa Okur, Marmara University, Turkey
A. Osman Gurbuz, Istanbul Commerce University, Turkey

Section 2
Development and Design Methodologies

This section covers some of the most cutting-edge tools and techniques used by professionals in the fields of Banking, Finance, and Accounting. As bankers and industry leaders discover new methods of managing customers and predicting market trends, sharing such insights with the greater community leads to higher profits and growth. Investor management, predictive analytics, portfolio management, and emerging ICT tools are only some of the areas seeing constant improvement. The 14 chapters that make up this section explore the development and design methodologies that bridge the gap between fundamental concepts and real-world applications of Banking, Finance, and Accounting.

Chapter 17
Drop-Out Risk Measurement of E-Banking Customers 330
Juan Lara-Rubio, University of Granada, Spain
Myriam Martínez-Fiestas, ESAN University, Perú
Antonio M. Cortés-Romero, University of Granada, Spain

Chapter 18
Modeling the FX Market Traders' Behavior: An Agent-Based Approach 350
Monira Aloud, University of Essex, UK
Edward Tsang, University of Essex, UK
Richard Olsen, University of Essex, UK

Chapter 19
A Competitive Approach to Financial Issues: Modern Finance Theory 385
Mustafa Okur, Marmara University, Turkey
A. Osman Gurbuz, İstanbul Commerce University, Turkey

Chapter 20
Impact of NPAs on Bank Profitability: An Empirical Study 399
Saurabh Sen, Sunbeam College for Women, India
Ruchi L. Sen, Sunbeam College for Women, India

Chapter 21
Enhancement of Efficiency and Effectiveness in Banking through CRM Systems: A Case of Indian Banking Industry 410
Priya Gupta, Shaheed Sukhdev College of Business Studies, University of Delhi, India
Kanhaiya Singh, Fore School of Management, India
Jyoti Kainth, Institute of Management Technology, India

Chapter 22
A Game Theoretic Approach to Corporate Lending by the Banks in India 435
Rituparna Das, National Law University Jodhpur, India

Chapter 23
Money Supply: Predictive Analytics in India 452
Rituparna Das, University Jodhpur, India

Chapter 24
A Conceptual Framework for Online Stock Trading Service Adoption 467
Alireza Abroud, Multimedia University, Jalan Multimedia, Malaysia & Ministry of Science, Research and Technology, Islamic Republic of Iran
Yap Voon Choong, Multimedia University, Jalan Multimedia, Malaysia
Saravanan Muthaiyah, Multimedia University, Jalan Multimedia, Malaysia

Chapter 25
Structural Models for E-Banking Adoption in Vietnam 484
Long Pham, College of Business, Minot State University, USA; & School of Banking and Finance, National Economics University, Vietnam
Nhi Y. Cao, School of Banking and Finance, National Economics University, Vietnam
Thanh D. Nguyen, Ho Chi Minh City University of Technology, Vietnam
Phong T. Tran, School of Banking and Finance, National Economics University, Vietnam

Chapter 26
International Stock Investment Portfolio Management Strategies for Emerging Economies 501
H. Cem Sayin, Anadolu University, Turkey
Sinan Çakan, Anadolu University, Turkey

Chapter 27
Monetary Policy Instruments and Bank Risks in China 518
Zhongyuan Geng, School of Management, Harbin Institute of Technology, P.R. China
Xue Zhai, School of Management, Harbin Institute of Technology, P.R. China

Volume II

Chapter 28
ICT Infrastructure Framework for Microfinance Institutions and Banks in Pakistan: An Optimized Approach 532
Sadiq Shahbaz Ali, Shaheed Zulfikar Ali Bhutto Institute of Science and Technology, Pakistan
M. N. A. Khan, Shaheed Zulfikar Ali Bhutto Institute of Science and Technology, Pakistan

Chapter 29
ICT Investments and Management for Organizations 544
Georgios N. Angelou, University of Macedonia, Greece
Anastasios A. Economides, University of Macedonia, Greece

Chapter 30
Multi-Agent Financial Network (MAFN) Model of US Collateralized Debt Obligations (CDO): Regulatory Capital Arbitrage, Negative CDS Carry Trade, and Systemic Risk Analysis 561
Sheri M. Markose, University of Essex, UK
Bewaji Oluwasegun, University of Essex, UK
Simone Giansante, University of Bath, UK

Section 3
Organizational and Social Implications

This section considers risk in Banking, Finance, and Accounting, and how the human element of financial decision-making can both support and hinder the process. Ultimately, finance relies on people: the investors and professionals who make everyday decisions that have the potential to change the economies of nations. Only with careful consideration of risk, investor perceptions, and technological integration in portfolio management can international firms thrive in a global, multicultural environment. In these 16 chapters, readers will find an in-depth discussion of some of the most pressing organizational and social implications of Banking, Finance, and Accounting.

Chapter 31
The Global Financial Crisis and Central Bank Speak 592
Pierre L. Siklos, Wilfrid Laurier University, Canada

Chapter 32
Mutual Fund Performance and Investor's Perception: An Indian Perspective 614
Anindita Adhikary, Sikkim Manipal Institute of Technology, India
Bedanta Bora, Sikkim Manipal Institute of Technology, India
Jitendra Kumar, Sikkim Manipal Institute of Technology, India

Chapter 33
Agricultural Investment Risk Relationship to National Domestic Production 625
Alex Ehimare Omankhanlen, Covenant University, Nigeria

Chapter 34
Liquidity Saving Mechanisms and Bank Behavior in Payment Systems 644
Marco Galbiati, Bank of England, UK & European Central Bank, Germany
Kimmo Soramäki, Aalto University, Finland

Chapter 35
Banks and People in the Development Process: A District-Level Analysis of the Banking Habits in India 661
Atanu Sengupta, Burdwan University, India
Sanjoy De, Burdwan University, India

Chapter 36
Customers' Perspectives of Internet Banking Adoption in Developing Economies 670
G. Varaprasad, National Institute of Technology Calicut, India
R. Sridharan, National Institute of Technology Calicut, India
Anandakuttan B. Unnithan, Indian Institute of Management Kozhikode, India

Chapter 37
Understanding Security in Consumer Adoption of Internet Banking: Biometrics Technology Implementation in the Malaysian Banking Context 685
Normalini M. K., Universiti Sains Malaysia, Malaysia
T. Ramayah, Universiti Sains Malaysia, Malaysia

Chapter 38
Use and Management of Conventional ICT and Mobile Technology in Microfinance: A Bangladesh Perspective 699
Mohammad Badruddozza Mia, Open University, UK
Magnus Ramage, Open University, UK

Chapter 39
Self-Service Technology Banking Preferences: Comparing Libyans' Behaviour in Developing and Developed Countries 714
Fouad Omran Elgahwash, University of Wollongong, Australia
Mark Bruce Freeman, University of Wollongong, Australia

Chapter 40
Leveraging Technology Options for Financial Inclusion in India 728
Shalu Chopra, VES Institute of Technology, India
Rajeev Dwivedi, Institute of Management Technology, India
Arun Mohan Sherry, Institute of Management Technology, India

Chapter 41
Investment Attractiveness of Visegrad Group Countries: Comparative Analysis 740
Tomasz Dorożyński, University of Lodz, Poland
Anetta Kuna-Marszałek, University of Lodz, Poland

Chapter 42
Racial Differences in Financial Socialization and Financial Behaviors of U.S. College Students 776
Michael S. Gutter, University of Florida, USA
Zeynep Copur, Hacettepe University, Turkey
Amanda Blanco, University of Florida, USA

Chapter 43
Explaining International Land Transactions in Africa 797
Yohannes G. Hailu, United Nations Commission for Africa, Rwanda
Adesoji Adelaja, Michigan State University, USA
Henry Akaeze, Michigan State University, USA
Steve Hanson, Michigan State University, USA

Chapter 44
The Behavior Intention of Tunisian Banks' Customers on using Internet Banking 818
Lanouar Charfeddine, College of Business Administration, Najran University, Saudi Arabia
Wadie Nasri, The Higher Institute of Management of Gabes, University of Gabes, Tunisia

Chapter 45
An Investigation of Greek Firms' Compliance to IFRS Mandatory Disclosure Requirements..... 832
Apostolos Ballas, Athens University of Economics and Business, Greece
Nicos Sykianakis, Technological Education Institute of Piraeus, Greece
Christos Tzovas, Athens University of Economics and Business, Greece
Constantinos Vassilakopoulos, Athens University of Economics and Business, Greece

Chapter 46
Corruption's Effect on Foreign Direct Investment: The Case of Bosnia and Herzegovina 850
Elvira Pupović, University of Montenegro, Montenegro

Section 4
Managerial Impact

This section presents strategies, methods, and words of caution for managers and organizational leaders invested in Banking, Finance, and Accounting institutions. More than any other industry, the individuals in charge of banks and other financial firms have a tremendous impact on the stability of not only their own organization, but all organizations to which they have ties. As such, careful consideration of risk management and corporate investment strategies is critical to success. This section's 12 chapters examine the managerial impact of key topics in the field of Banking, Finance, and Accounting.

Chapter 47
Fund Manager Overconfidence and Investment Narratives 867
Arman Eshraghi, University of Edinburgh, UK

Chapter 48
Modern Risk Management Techniques in Banking Sector..... 886
Okan Acar, Banker, Turkey
Aslı Beyhan Acar, Istanbul University, Turkey

Chapter 49
Managing Customer Knowledge in Service Economy: Proposing a Conceptual Model of CKM for Services 907
Satyendra C. Pandey, Xavier Institute of Management, India
Mahendra Kumar Shukla, Xavier Institute of Management, India
Upendra K. Maurya, National Institute for Micro, Small, and Medium Enterprises (Ni-MSME), India

Chapter 50
Impact Evaluation of Customer Knowledge Process on Customer Knowledge Expansion: An Empirical Study in Jordanian Banking Sector 919
Samer Alhawari, The World Islamic Sciences and Education University, Jordan

Chapter 51
The Role of Relational Mediators in the CRM-Performance Link: Evidence from Indian Retail Banks 932
Chandrasekaran Padmavathy, Vellore Institute of Technology, India

Chapter 52
Computing Skills in Forecasting for Liquidity Risk Management in the Indian Banking Industry ... 948
Rituparna Das, National Law University, India

Chapter 53
An Investigation into the Risk of Construction Projects Delays in the UAE 962
Omayma Motaleb, The Scott Sutherland School of Architecture and Built Environment, Robert Gordon University, UK
Mohammed Kishk, The Scott Sutherland School of Architecture and Built Environment, Robert Gordon University, UK

Chapter 54
Enabling Factors for Knowledge Sharing among Employees in the Workplace 978
Temtim Assefa, Addis Ababa University, Ethiopia
Monica Garfield, Bentley University, USA
Million Meshesha, Addis Ababa University, Ethiopia

Chapter 55
Establishing the Linkage between Internal Market Orientation and Service Innovation 1004
Gurjeet Kaur, University of Jammu, India
Shruti Gupta, University of Jammu, India

Chapter 56
The Royal Credit Bank Strategy and Transformation Program: The Gulf Management Strategic Planning 1031
Khaled Hjouj, Management Consulting Executive, Canada

Chapter 57

Business Intelligence Enterprise Solution at Abu Dhabi Finance: Issues and Challenges 1046
Salam Abdallah, Abu Dhabi University, UAE

Volume III

Chapter 58
Identifying the Business Value of Information Security 1056
Lucas Cardholm, Coromatic Group, Sweden

Section 5
Critical Issues

This section explores and evaluates strategies and tricks-of-the-trade in Banking, Finance, and Accounting for institutions around the world. Because banking takes place in such a high-risk environment, and especially considering the mistakes of the past, managers must take careful consideration of the facts before making any decision. Factors such as region and culture, investor behavior, and the interconnected nature of banking institutions around the world are only some of the concerns decision-makers face on a daily basis. In this section, 12 chapters explore some of the critical issues driving advances in Banking, Finance, and Accounting.

Chapter 59
Impact of Microfinance Bank Credit Scheme 1081
Benjamin Chijioke Asogwa, University of Agriculture, Nigeria
Peter Iorhon Ater, University of Agriculture, Nigeria
Sani Madi Yakubu, University of Agriculture, Nigeria

Chapter 60
Measurement of Service Efficiency in Different Types of Banking Services: Mass Services, Service Factories, Service Shops, and Professional Services 1094
Markku Tinnilä, Aalto University School of Business, Aalto University, Finland

Chapter 61
An Uncertain Decision Making Process Considering Customers and Services in Evaluating Banks: A Case Study 1115
Fatemeh Akbari, Mazandaran University of Science and Technology, Iran
Hamed Fazlollahtabar, Iran University of Science and Technology, Iran
Iraj Mahdavi, Mazandaran University of Science and Technology, Iran

Chapter 62
Analyzing the Efficiency of European Banks: A DEA-Based Risk and Profitability Approach 1151
Mehmet Hasan Eken, Istanbul Commerce University, Turkey
Suleyman Kale, Ziraat Bank, Turkey
Huseyin Selimler, Ziraat Bank, Turkey

Chapter 63
Does Geography Matter? A Study of Determinants of Bank Office Size in Illinois 1179
Bin Zhou, Southern Illinois University Edwardsville, USA

Chapter 64
A Diagnosis of the Determinants of Dividend Payout Policy in India: A Factor Analytical Approach 1202
Raj Kumar, Banaras Hindu University, India
Pawan Kumar Jha, Banaras Hindu University, India

Chapter 65
An Empirical Investigation on Credit Card Adoption in India 1212
G. Varaprasad, National Institute of Technology Calicut, India
Kailas Sree Chandran, St.Thomas Institute for Science and Technology, India
R. Sridharan, National Institute of Technology Calicut, India
Anandakuttan B. Unnithan, Indian Institute of Management, India

Chapter 66
The Adoption Process of Payment Cards: An Agent-Based Approach 1228
Biliana Alexandrova-Kabadjova, Banco de Mexico, Mexico
Sara G. Castellanos-Pascacio, BBVA Research, Mexico
Alma L. Garcia-Almanza, Banco de Mexico, Mexico

Chapter 67
Determinants of Behavioral Intention to Mobile Banking in Arab Culture 1253
Abdullah Rashed, University of Minho, Portugal
Henrique Santos, University of Minho, Portugal

Chapter 68
Assessing the Maturity of Control Objectives for Information and Related Technology (COBIT) Framework in the Egyptian Banking Sector 1263
Hisham M. Abdelsalam, Cairo University, Egypt
Ahmed M Marzouk, IBM Egypt, Egypt
Haitham S. Hamza, Cairo University, Egypt

Chapter 69
Analysis of the Analytical Balance Sheet of Central Bank of Republic of Turkey During 2000 - 2009 Period in Terms of Crises 1284
Yıldız Özkök, Hasan Kalyoncu University, Turkey

Chapter 70
International Portfolio Diversification Benefits among Developed and Emerging Markets within the Context of the Recent Global Financial Crisis 1303
Gülin Vardar, Izmir University of Economics, Turkey
Berna Aydoğan, Izmir University of Economics, Turkey
Ece Erdener Acar, Izmir University of Economics, Turkey

Section 6
Emerging Trends

This section focuses on the new technologies and investment strategies that have become a prevalent part of Banking, Finance, and Accounting in the wake of the recent global economic crisis. In business, to stagnate is to perish, so business leaders in particular are constantly looking to the future. Recent developments discussed in this section include international banking operations, pervasive and social computing tools, and online and mobile investment portfolios. The final 12 chapters of this extensive three-volume reference conclude with a detailed look at emerging trends in the field of Banking, Finance, and Accounting.

Chapter 71
The Impact of Internet Adoption on the International Marketing of the Jordanian Banking Sector: Some Emerging Practices 1328
Said Al-Hasan, University of Glamorgan, UK
Brychan Thomas, University of Glamorgan, UK
Ayman Mansour, University of Glamorgan, UK

Chapter 72
XBRL: A New Global Paradigm for Business Financial Reporting 1344
Chunhui Liu, University of Winnipeg, Canada

Chapter 73
Innovation in Business Models of Banks in Europe: Towards a Methodological Approach 1368
Konstantinos Liakeas, University of the Aegean, Greece
Anastasia Constantelou, University of the Aegean, Greece

Chapter 74
The Role of Social Media Strategies in Competitive Banking Operations Worldwide 1384
Nurdan Oncel Taskiran, Kocaeli University, Turkey
Recep Yilmaz, Beykent University, Turkey
Nursel Bolat, Istanbul Arel University, Turkey

Chapter 75
Banking Online: Design for a New Credibility 1421
Francisco V. Cipolla-Ficarra, ALAIPO – AINCI, Spain and Italy
Jaqueline Alma, Electronic Arts – Vancouver, Canada

Chapter 76
Emerging Technologies for User-Friendly Mobile Payment Applications 1432
Vibha Kaw Raina, Birla Institute of Technology, India

Chapter 77
The Use of Soft Computing for Optimization in Business, Economics, and Finance 1462
Petr Dostál, Brno University of Technology, Institute of Informatics, Czech Republic

Chapter 78
Emerging Legal Issues in Banking Operations 1510
Kemale Aslanova, Beykent University, Turkey

Chapter 79
A New Macroeconomic Architecture for the Stock Market: A General-System and Cybernetic Approach 1521
Masudul Alam Choudhury, College of Commerce and Economics, Sultan Qaboos University, Oman

Chapter 80
Identifying Different Forms of Innovation in Retail Banking 1539
Véronique Favre-Bonte, Laboratory Institut de REcherche en Economie et en GEstion (IREGE), University of Savoie, France
Gardet Elodie, Laboratory Institut de REcherche en Economie et en GEstion (IREGE), University of Savoie, France
Catherine Thevenard-Puthod, Laboratory Institut de REcherche en Economie et en GEstion (IREGE), University of Savoie, France

Chapter 81
Data Mining using Advanced Ant Colony Optimization Algorithm and Application to Bankruptcy Prediction 1554
Vishal Arora, Indian Institute of Technology Delhi, India
Vadlamani Ravi, Institute for Development and Research in Banking Technology, India

Chapter 82
The Use of Simulations as an Analytical Tool for Payment Systems 1577
Martin Diehl, Deutsche Bundesbank, Germany

Index xxiii

Preface

The constantly changing landscape of Banking, Finance, and Accounting challenges experts and practitioners to stay apprized of the field's most up-to-date research. That is why Business Science Reference is pleased to offer this three-volume reference collection that will empower students, researchers, and academicians with a strong understanding of critical issues within Banking, Finance, and Accounting by providing both broad and detailed perspectives on cutting-edge theories and developments in the field. This collection is designed to act as a single reference source on conceptual, methodological, organizational, and managerial issues, as well as provide insight into emerging trends and future opportunities within the discipline.

Banking, Finance, and Accounting: Concepts, Methodologies, Tools, and Applications is organized into six distinct sections that provide comprehensive coverage of important topics. The sections are (1) Fundamental Concepts and Theories, (2) Development and Design Methodologies, (3) Organizational and Social Implications, (4) Managerial Impact, (5) Critical Issues, and (6) Emerging Trends. The following paragraphs provide a summary of what readers may expect from this invaluable reference tool.

Section 1, "Fundamental Concepts and Theories," opens this three-volume set with a look at Banking, Finance, and Accounting in a modern, global context. The first chapter, *Project Initiation* by Claudia Weninger and Martina Huemann, considers project management in the financial industry, and how careful consideration of values and consequences at the outset of a project can lead to greater rewards later. Additional chapters in this section discuss banking around the world, featuring countries such as India (*Causality between Credit Deposit Ratio and Credit Share in Major Indian States during 1972 -2008* by Ramesh Chandra Das and Soumyananda Dinda), the United States (*The State-Based Factors Affecting Inward FDI Employment in the U.S.* by Lucyna Kornecki and E. M. Ekanayak), and the Arab world (*The Situation of Knowledge Economy in the Arab and EEE Regions* by Daniel Pele), among others. Additionally, this section covers topics related to technology and security and risk management, as seen in chapters such as *IT Security Governance in E-banking* by Theodosios Tsiakis, Theodoros Kargidis, and Aristeidis Chatzipoulidis, and *Factors Driving Value Creation in Online B2B Banking* by Jung-Yu Lai, Khire Rushikesh Ulhas, Ching-Tsung Lin, and Chorng-Shyong Ong.

Section 2, "Development and Design Methodologies," covers some of the most cutting-edge tools and techniques used by professionals in the fields of Banking, Finance, and Accounting. The section opens with several chapters discussing the prediction of risk in markets predicated on consumer behavior, including *Drop-Out Risk Measurement of E-Banking Customers* by Juan Lara-Rubio, Myriam Martínez-Fiestas, and Antonio M. Cortés-Romero, and *Modeling the FX Market Traders' Behavior* by Monira Aloud, Edward Tsang, and Richard Olsen. From investor management, this section moves on to the topics of predictive analytics and portfolio management for bankers and investors. Notable chapters include *A Conceptual Framework for Online Stock Trading Service Adoption* by Alireza Abroud, Yap Voon Choong, and Saravanan Muthaiyah, and *International Stock Investment Portfolio Management*

Strategies for Emerging Economies by H. Cem Sayin and Sinan Çakan, two chapters that provide insight into the nuanced inner workings of finance and investment. Finally, the section concludes with chapters on ICT tools for risk management, such as *Multi-Agent Financial Network (MAFN) Model of US Collateralized Debt Obligations (CDO)* by Sheri M. Markose, Bewaji Oluwasegun, and Simone Giansante—a discussion critical to the prevention of and recovery from financial crisis.

Section 3, "Organizational and Social Implications," considers risk in Banking, Finance, and Accounting, and how the human element of financial decision-making can both support and hinder the process. This section begins with *The Global Financial Crisis and Central Bank Speak* by Pierre L. Siklos, a chapter that considers how banks and their customers interact today compared to before the recent global financial crisis. To prevent a similar collapse, banks and other financial institutions must learn to take investors and consumers better into account when making decisions and analyzing risk, a concept well-documented in the chapters of this section, which include *Banks and People in the Development Process* by Atanu Sengupta and Sanjoy De; *Understanding Security in Consumer Adoption of Internet Banking* by Normalini M. K. and T. Ramaya; and *Mutual Fund Performance and Investor's Perception* by Anindita Adhikary, Bedanta Bora, and Jitendra Kumar. The chapters in this section also investigate banking from a global perspective, as in the chapters *The Behavior Intention of Tunisian Banks' Customers on using Internet Banking* by Lanouar Charfeddine and Wadie Nasri, and *Leveraging Technology Options for Financial Inclusion in India* by Shalu Chopra, Rajeev Dwivedi, and Arun Mohan Sherry.

Section 4, "Managerial Impact," presents strategies, methods, and words of caution for managers and organizational leaders invested in Banking, Finance, and Accounting institutions. The first few chapters in this section discuss risk management, including how to avoid risk and how to mitigate risk when risk is unavoidable. Notable chapters include *Modern Risk Management Techniques in Banking Sector* by Okan Acar and Aslı Beyhan Acar, *An Investigation into the Risk of Construction Projects Delays in the UAE* by Omayma Motaleb and Mohammed Kishk, and *Computing Skills in Forecasting for Liquidity Risk Management in the Indian Banking Industry* by Rituparna Das. Part of managing risk is understanding consumer behavior, so customer relation management is an important element of banking and finance for managers to take into consideration. This topic is discussed in, among others, the chapters *The Role of Relational Mediators in the CRM-Performance Link* by Chandrasekaran Padmavathy and *Managing Customer Knowledge in Service Economy* by Satyendra C. Pandey, Mahendra Kumar Shukla, and Upendra K. Maurya. This section concludes by offering managers insight into corporate investment strategies and estimating value, a primary focus of Section Five.

Section 5, "Critical Issues," explores and evaluates strategies and tricks-of-the-trade in Banking, Finance, and Accounting for institutions around the world. The majority of the chapters in this section have a particular regional focus, an invaluable resource for managers and decision-makers looking to invest in counties around the world. *An Uncertain Decision Making Process Considering Customers and Services in Evaluating Banks* by Fatemeh Akbari, Hamed Fazlollahtabar, and Iraj Mahdavi (Iran); *Does Geography Matter?* by Bin Zhou (US); *A Diagnosis of the Determinants of Dividend Payout Policy in India* by Rajesh Kumar and Pawan Kumar Jha; and *Determinants of Behavioral Intention to Mobile Banking in Arab Culture* by Abdullah Rashed and Henrique M.D. Santos all discuss banking and investment with case studies and regional analyses pertinent to specific countries and cultures. This section also includes chapters with a technological focus, such as *The Adoption Process of Payment Cards* by Biliana Alexandrova-Kabadjova, Sara G. Castellanos Pascacio, and Alma L. García-Almanza, a chapter that offers a transition into the next section's focus on recent innovations and their impact on the industry.

Section 6, "Emerging Trends," focuses on the new technologies and investment strategies that have become a prevalent part of Banking, Finance, and Accounting in the wake of the recent global economic crisis. One notable topic covered in this section is international banking, including how new business models and technologies can aid in foreign investment. *The Role of Social Media Strategies in Competitive Banking Operations Worldwide* by Nurdan Oncel Taskiran, Recep Yilma, and Nursel Bolat discusses how an interconnected society impacts financial decisions, while *XBRL* by Chunhui Liu focuses on a specific digital tool used in international negotiations and business transactions. Another topic covered in this section is computing, with several chapters discussing new computer technologies that can assist in predictive analytics, risk management, and customer relationship management. The section concludes with a look to the future in the form of several emerging technologies that promise to revolutionize the banking industry, including *The Use of Simulations as an Analytical Tool for Payment Systems* by Martin Diehl, a chapter that considers how managers and leaders can improve the accuracy of the data utilized in making critical business decisions across the globe.

As a comprehensive collection of research on current findings related to the development of interdisciplinary technologies, *Banking, Finance, and Accounting: Concepts, Methodologies, Tools, and Applications* provides researchers, administrators, and all audiences with a complete understanding of the latest advances, applications, and concepts in Banking, Finance, and Accounting. Although the primary organization of the contents in this multi-volume work is based on its six sections, offering a progression of coverage on the important concepts, methodologies, social issues, managerial considerations, critical concerns, and emerging trends, the reader can also identify specific content by utilizing the extensive indexing system found at the end of each volume. Given the vast number of issues concerning usage, successes and failures, policies, strategies, and applications of Banking, Finance, and Accounting in countries around the world, *Banking, Finance, and Accounting: Concepts, Methodologies, Tools, and Applications* addresses the demand for a resource that encompasses the most pertinent research on the technologies being employed to globally bolster the knowledge and implementation of Banking, Finance, and Accounting.

Section 1
Fundamental Concepts and Theories

This section opens this three-volume set with a look at Banking, Finance, and Accounting in a modern, global context. In the wake of financial distress, increased awareness of all aspects of baking and investment, however fundamental, is critical. This section investigates many of these topics, including project management, international investment, and risk analysis, among others. In the opening 15 chapters of this extensive reference source, readers will obtain a clear understanding of the fundamental concepts and theories integral to the field of Banking, Finance, and Accounting.

Chapter 1
Project Initiation:
Investment Analysis for Sustainable Development

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ABSTRACT

The consideration of Sustainable Development (SD) becomes more and more important for investments and the projects which implement those investments. In the project initiation process, the decision regarding the realization of an investment is made. Analyzing the investment is one of the main tasks of the project initiation process. Thus, this process is identified as most important for the integration of SD principles. The authors define SD with the following principles: economic, ecologic, and social-orientation; short, mid, and long term orientation as well as local, regional, and global-orientation. Furthermore, SD is value-based and considers values such as transparency, fairness, trust, etc. In this chapter, the authors describe the concept of responsible and ethical investment, which may also provide the basis for an investment decision within a project's initiation. While global project and program management standards show very limited consideration of comprehensive investment analysis, the authors draw on the Logical Framework Approach used by the World Bank to see how SD principles are considered in investment analysis methods. They then propose the integration of SD principles into the discipline of project initiation. This more holistic approach considers the investment life cycle, the consideration of different stakeholders, and investment method, which explicitly integrates SD principles.

INTRODUCTION

The Brundtland Report defines Sustainable Development (SD) as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (World Commission on Environment and Development 1987: 41). The challenge lays in operationalizing the meaning of SD for projects which are per definition temporary and only of short to mid-term duration, while SD is long term oriented.

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The long term perspective can be brought into projects, when considering the investment initiated by the project. Gareis et al. (2013) propose that the highest potential of influence to consider SD in a project is taken in the project initiation process, when the investment decision is taken. Thus it is essential that SD principles are considered in the investment analysis to take an adequate decision and to contribute to the SD of the investor´s organization and other relevant stakeholders.

In the context of project management, process related rather than content related definitions of SD are of relevance, therefore we consider the SD principles (Gareis et al. 2013) economic, ecologic and social-orientation; short, mid and long term-orientation; local, regional and global-orientation as well as values-based as those principles relevant for SD in the initiation of a project.[1]

We analyzed project and program management standards such as PMBOK® Guide, the Standard for Program Management (both Project Management Institute 2008a), PRINCE 2, Managing Successful Programmes (both Office of Government Commerce 2009) as well as ICB (International Project Management Association 2006) for their explicit and implicit consideration of SD principles in the investment analysis. We found little evidence of considering SD principles, therefore we turned to the Logical Framework Approach (*LFA*) (Norad 1999; The World Bank 1997), used by the World Bank, to see what we can learn from the initiation of development projects regarding investment analysis.

Typical investment analysis methods only focus on economic aspects, and are therefore rather limited. We discuss different investment analysis methods such as business case analysis, cost benefit analysis, social cost benefit analysis as well as the environmental impact analysis and see how SD principles are considered.

Based on the concept of responsible investment and what we could learn from the initiation of development projects, we propose a more holistic project investment analysis which considers SD principles. We argue that it is not enough to consider SD principles only in the investment analysis itself, but also the consideration of different stakeholder perspectives in the investment decision is essential.

This chapter is structured as following. First, we clarify the term investment as well as responsible and ethical investment. Then we discuss the difference between project and investment and introduce the project initiation process and important investment analysis methods. After briefly presenting our analyses results of project and program management standards, we more describe the *LFA* and analyze how SD principles are considered in the initiation of development projects. Then we indicate potentials to implement SD principles in the investment life cycle and propose a more holistic approach of project initiation, which considers the investment method as well as the design of the initiation process of a project.

INVESTMENT AND PROJECT

Investment

Different definitions of the term *investment* exist. Traditionally, the finance sectors defines investments very narrowly as “the purchase of a financial product or other item of value with an expectation of favorable future returns. In general terms, investment means the use of money in the hope of making more money (Webfinance 2010). The business sector describes it as the purchase or development of a product or service with the hope of improving future business (Investorwords 2011). Investments are characterized by a number of payments and can be perceived as long-term investigation in real assets e.g. investments in buildings, machines and also in customer relationships or products (Gareis 2005). Organizations invest in objects because they expect the financial returns from the investment to be greater than the money they invested initially (Mills/Turner 1995: 3).

Responsible and Ethical Investment

In the 1970s the concept of responsible investments was developed by societal and environmental activists in the United States. Responsible investments are defined as "[…] the integration of Environmental, Societal, and Governance (ESG) issues into investment decision-making" (Louche/Lydenberg 2011: 2). This approach is mostly used by the finance sector for monetary investments. The key characteristics of responsible investments can be defined as following (Louche/Lydenberg 2011: 17)

- *Responsible investment encourages a long-term perspective […]*
- *RI adopts a stakeholder perspective […]*
- *Responsible investment encourages interaction between society and corporation […]*

Furthermore Louche and Lydenberg (2011) defined four different motivations for using the concept of responsible investments. The first motivation is avoiding profiting from unethical behavior, the second is to encourage corporations to enter positive business lines or to develop strong stakeholder relations. Furthermore responsible investments avoid underperforming stocks and seek to change the corporate behavior.

In 2005 UN General Secretary Kofi Annan invited representatives of the biggest global investors to develop responsible investment principles (PRI). The principles were developed between 2005 and 2006 in workshops and individual works. The result of this development process was a list of principles that are used as guiding principles for responsible investments. These are (UN Global Compact/UNEP Finance Initiative 2006: 6):

- *We will incorporate ESG[2] issues into investment analysis and decision-making processes.*
- *We will be active owners and incorporate ESG issues into our ownership policies and practices.*
- *We will seek appropriate disclosure on ESG issues by the entities in which we invest.*
- *We will promote acceptance and implementation of the Principles within the investment industry.*
- *We will work together to enhance our effectiveness in implementing the Principles.*
- *We will each report on our activities and progress towards implementing the Principles.*

For all principles different actions and measures were defined. The use of these guiding principles is optional for companies but increased attention is observable in the business sector.

In addition to the concept of responsible investments the concept of ethical investments was developed. Ethical investment combines the model of sustainability, environment, responsibility and ethics in its overall process and in the investment methods (O'rourke 2003). These investments are defined as "[…] the integration of personal values, social considerations and economic factors into the investment decision" (Michelson et al. 2004: 1).

The concepts of responsible investment as well as ethical investment focuses both on the integration of SD in the investment analysis method as well as in its overall processes. The concept of responsible investment is more holistic and should be integrated in all organizational units of a company. While responsible investments focus on environmental, social and governance issues the concept of ethical investment focuses also on the integration of personal values such as fairness in the investment decision. Furthermore ethical investments have a big focus on responsibility (regarding stakeholder, the environment, etc.) and ethics. One big difference is that UN Global Compact developed responsible investment

principles and therefore made them more visible for the business sector. Companies can use the principles as guiding principles for the integration of responsible investments in the company. Furthermore they can use these guiding principles for the realization of more sustainable investments initiated by projects.

Both concepts can be used as basis for the integration of SD principles into the project initiation.

Differentiating Investment and Project

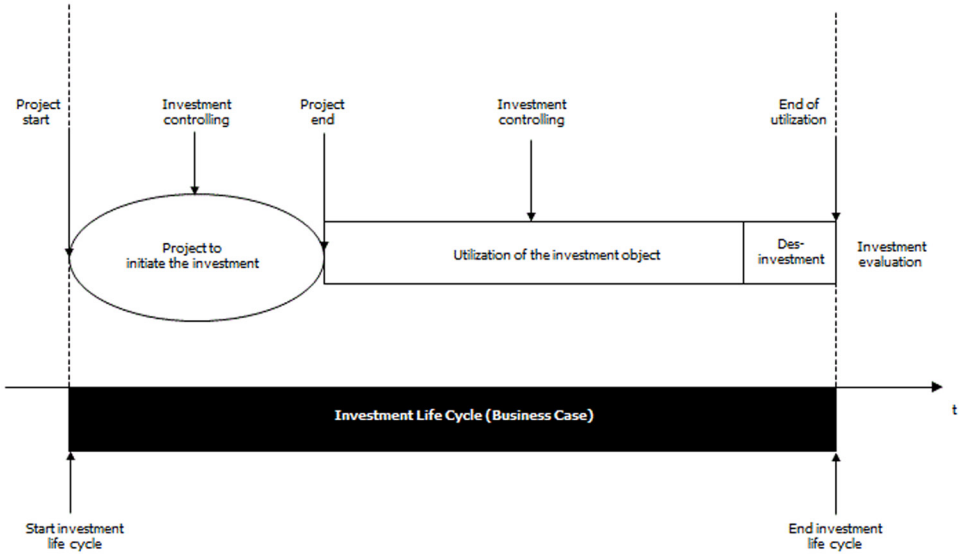
In literature different understandings of projects exist. We use the definition provided by Gareis (2005: 41) who defines a project is a temporary organization for the performance of a relatively unique, short to medium term strategic business process of medium or large scope. It is perceived as a social system and social construct.

In project management literature the project and the investment is often not differentiated. This differentiation is important because the management of the investment and the management of a project require different processes, roles and methods. Furthermore this differentiation allows to clearly differentiating between the project initiation process, the project management process and the investment life cycle. In general the project initiation process includes two main decisions. First, a decision regarding the realization of an investment and second the decision regarding the organization form in which the investment is to be initiated (Gareis 2005). Both processes (project initiation and project management) are business processes. These processes fulfill different objectives, require different tasks for their performance, and different organizations are responsible for their performance. Furthermore different stakeholders are important for the investment and the project. The long term orientation of investments contradicts with the short term orientation of projects. Further it is important to clearly differentiate investment and project costs and benefits. Investment costs include in addition to the costs for investment initiation also costs for operating and maintain the investment.

Figure 1 shows how project and investment can be differentiated and related to each other.

Investments can be initiated by a single project, a chain of projects or by programs (Gareis 2005).

Figure 1. Investment and project (Gareis, 2005, p. 456)



INITIATING A PROJECT

Initiation Process for a Project[3]

The initiation process of a project starts with the investment analysis and ends with the development of the project charter. The main objectives of the initiation process are to make a decision regarding the realization of an investment, to generate information about the investment and to define the project. Figure 2 shows the initiation process for a project after Gareis et al. (2013).

The description of the investment idea or the problem formulation lays the basis for the investment analysis. For the investment analysis, different methods exist, such as the business case analysis, cost benefit analysis, social cost benefit analysis, and environmental impact analysis. These methods are briefly described later.

The results of the investment analysis and the definition of the investment idea are the basis for the development of an investment proposal. The investment proposal is an important communication document. The customer, the company board, and other important stakeholders achieve central information from this document (Robb 2007). This document set the ground for the investment decision.

A positive investment decision represents the start point for the development of the project proposal. One important step in the development of the project proposal is the project definition. A project must be differentiated from its context (Gareis 2005). The project definition determines what a project includes and is very important for a successful performance of a project (Cano/Lidon 2011; Kähkönen 1999). This method provides a common understanding of the project boundaries (Wijnen/Kor 2000). In the project proposal, general structures of the project become clear and are the basis for the initiation of a project (Steyn 2003). Furthermore the project proposal lays the basis for the project decision.

If the project decision is yes, the project charter is developed. This document is a further development of the project proposal and is a formal summary of important project information between the project manager and the project owner. Signing the project assignment is the start event for the project that initializes the investment (Gido/Clements 2008).

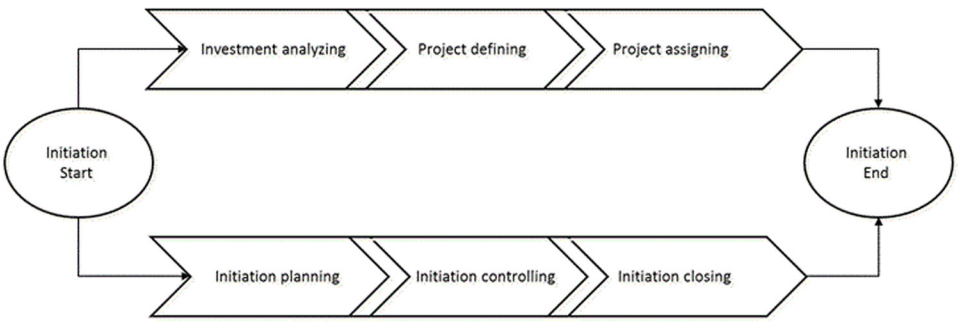
Investment Analysis as Central Method of Project Initiation

As described previous the investment analysis lays the basis for the decision regarding the realization of an investment. Different investment methods exist such as:

Business Case Analysis

A business case analysis is a very traditional and only economic based analysis method. It consid-

Figure 2. Initiation process for a project (Gareis, et al., 2013)



ers the cash in-flows and out-flows and possible an investment calculation or a simulation. Only cash-effective consequences of the investment are considered and typically analyzed as well as rated with static or dynamic investment calculations such as net present value, internal rate of return or the annuity method. In contrast to static investments methods dynamic investment methods are payment flow oriented and consider a wider investment period (Hirth 2008).

Cost Benefit Analysis

The main objective of the cost benefit analysis is to find the investment with the best costs and benefits relation (Drews/Hillebrand 2007). It is important to analyze at least one alternative to each investment. In this analysis method different types of costs and benefits are analyzed. These are direct costs and benefits; indirect costs and benefits; tangible costs and benefits; intangible costs and benefits.

Social Cost Benefit Analysis

The social cost benefit analysis is a further development of the original cost benefit analysis. Brent (2006) describes the social cost benefit analysis as more holistic in comparison to a traditional cost benefit analysis as it is more long-term oriented and prefers future generations in the social discount factor.

Environmental Impact Analysis

Ecologic aspects are not considered in the previously described analysis methods. It is the main focus of the environmental impact analysis to consider the environmental impact which is caused by the investment. To cover environmental impacts of the investment in the planning phase and minimize their negative impact is the main objective of this analysis (Morris/Therivel 1995).

Consideration of SD Principles in Investment Analysis Methods

The investment analysis methods described before consider SD principles in different degrees. Table 1 gives a short summary about the relation of SD principles to different investment analysis methods. Traditional methods, such as the business case analysis or the cost benefit analysis, focus only on economic principles and are short to mid-term oriented. The social cost benefit analysis is a more holistic further development of the classic cost benefit analysis and considers also social principles. Furthermore, a wider investment period and a social discount factor are considered. Ecologic principles are not considered in the social cost benefit analysis. The environmental impact analysis considers ecologic as well as social factors and is mid to long term oriented.

Companies often use traditional investment analysis methods. Therefore, most investment decisions are based on economic and short-term aspects.

PM STANDARDS AND INVESTMENT ANALYSIS

Global recognized project management standards offered by international project management associations have a big influence on the practices of the project management community (Hodgson/Muzio 2011). Most of the standards are developed by practitioners and aim to represent best or common practices across organizations and industries within the field (Garcia 2005).

Standards are the basis for the certification of project and program manager and thus these standards reflect a common understanding of project initiation and project management. Furthermore these standards offer a generic project management approach.

We analyzed globally recognized project and program management standards if and how they

Table 1. The consideration of sustainability principles in investment methods

SD Principle Investment Analysis Method	Economic, Ecologic and Social Orientation	Short, Mid, and Long Term Orientation	Local, Regional, and Global Orientation
Business Case Analysis	Consideration of economic principles	Short term orientation	-
Cost Benefit Analysis	Consideration of economic principles	Short to mid term orientation	-
Social Cost Benefit Analysis	Consideration of economic and social principles	Mid term orientation	-
Environmental Impact Analysis	Consideration of ecologic as well as social principles	Mid to long term orientation	Local, regional as well as global orientation

consider SD principles in the investment analysis. Furthermore, we analyzed documents that influence the investment analysis of a project. Table 2 provides an overview over the analyzed documents:

We structure the analysis as following. First, we analyzed which investment analysis methods are considered in the standards. Then we analyzed how stakeholders are considered in the performance of the investment analysis as well as in the decision process. Furthermore, we analyzed which values are the basis for using the analysis method. Table 3 provides a summary about the analysis results. The results are discussed briefly.

Investment Analysis Method: All standards consider a business case as central method for analysis of the investment, while the focus mainly lays on economic aspects. The *PMBOK® Guide* as well as *the Standard for Programme Management* describes in addition to the monetary and economical results of the cost benefit analysis, other principles like customer requests, technological advances, legal requirements, as well as environmental impacts and social needs.

In addition to the business case the *PMBOK® Guide*, *the Standard for Programme Management*, *PRINCE 2* as well as *MSP* describes a cost benefit analysis. In the *PMBOK® Guide* the cost benefit

Table 2. Overview analyzed documents

Organization	Documents	Initiation Process
Project Management Institute (PMI)	A Guide to the Project Management Body of Knowledge (PMBOK® Guide) (Project Management Institute 2008a)	Initiating Process Group
	The Standard for Program Management (Project Management Institute 2008b)	Initiating Process Group
	Code of Ethics and Professional Conduct (Project Management Institute 2006)	
International Project Management Association (IPMA)	International Competency Baseline 3.0 (ICB) (International Project Management Association 2006)	Project development phase
Office of Government Commerce (OGC)	Managing Successful Projects with PRINCE2 (PRINCE2) (Office of Government Commerce 2009)	Starting Up A Project process
	Managing Successful Programmes (MSP) (Office of Government Commerce 2007)	Identifying a Programme
	Management of Value (MoV) (Office of Government Commerce 2010)	

Table 3. Summary analysis results

Organization	Document	Investment Analysis Method	Additional Methods/ Documents	Consideration of SD Principles	Consideration of Values	Stakeholder Involvement
Project Management Institute (PMI)	PMBOK® Guide (PMI 2008a)	Business case; cost benefit analysis		Traditional cost benefit analysis – focus on economic principles; business case document considers customer requests, technological advances, legal requirements, environmental impacts and social needs.	Consideration of Code of Ethics in all decisions.	Involvement in project charter development. No involvement in investment decision process.
	The Standard for Programme Management (PMI 2008b)	Business case; cost benefit analysis; feasibility study	Feasibility study; comparative advantage analysis	Cost benefit analysis includes in addition to traditional financial costs and benefits also the description of non-financial benefits.	Consideration of Code of Ethics in all decisions.	No involvement in investment decision process.
International Project Management Association (IPMA)	ICB (IPMA 2006)	Business case	Environmental impact plan;	Traditional business case –focus on economic principles. Ecologic principles are considered in the environmental impact plan.	Behavioral competence part in ICB – values like ethics, values appreciation and reliability are listed and need to be considered in all decisions.	Involvement in development of business case. No involvement in investment decision process.
Office of Government Commerce (OGC)	PRINCE2 (OGC 2009)	Business case; cost benefit analysis	Investment appraisal	Benefit of an investment can be described with non-monetary facts – social and ecologic description of benefit possible. Consideration of long-term costs in investment appraisal.	Management of Value as guiding framework for all decisions. Stakeholder participation is mentioned as relevant but not integrated in standards.	Involvement of stakeholder in development of business case. No involvement in investment decision process.
	MSP(OGC 2007)	Business case; cost benefit analysis		Benefit of an investment can be described with non-monetary facts – social and ecologic description of benefit possible.	Management of Value as guiding framework for all decisions. Stakeholder participation is mentioned as relevant but not integrated in standards.	Involvement of stakeholder in development of business case. No involvement in investment decision process.

analysis is not described in detail, the assumption taken is that a traditional cost benefit analysis taken. In contrast to that *the Standard for Program Management* the described cost benefit analysis includes, in addition to the traditional financial cost and benefits, also the description of non-financial benefits such as increased market share. Thus a qualitative benefit description is possible.

PRINCE2 as well as *MSP* provide no detailed description of the cost and benefit analysis but indicate that the benefit of an investment can also be described in non-monetary facts. Thus the benefits of an investment are described in a qualitative way and the consideration of intangible costs and benefits is possible. This is allows better to consider social and ecologic issues, as these are often not easy express monetary and therefore are not considered in traditional cost benefit analysis.

In addition to the business case the *ICB* describes an environmental impact plan. In the environmental impact plan ecologic principles are analyzed and considered.

Involvement of Stakeholder: All standards recommend an involvement of stakeholders during the development of the business case. Stakeholder interests are not considered in the investment analysis and therefore are not considered in the investment decision. Furthermore, stakeholders are not involved in the investment decision process. Stakeholder participation is mentioned as relevant in the MoV but not integrated in *PRINCE2* or *MSP*.

Consideration of Values: Behavior and decisions are driven by values. Thus the investment decision is driven by values of organizations or communities as well as personal values of individuals taking the investment decision. Values are often only implicitly traceable in standards. Nevertheless, some values are explicitly defined in standards e.g. ethics in the *ICB*. Other values are not integrated in the standards itself but explicitly mentioned in additional documents, e.g. the code of ethics of PMI. These additional documents are guiding documents for the standards and need to be considered in every decision. One limitation of these documents is the focus on the project manager as the investment decision is made e.g. by the project portfolio group and not by the project manager itself. Thus these documents are very limited considered when analyzing the investment. OGC developed the MoV as a guiding framework for benefit management in project and programs. It focuses on values like stakeholder participation and mentions that the economic, ecologic as well as social orientation is relevant. This document should be used as guiding framework for all decision and lays the basis for *PRINCE2* and *MSP*.

Summarizing our findings, all standards describe a business case to evaluate an investment. In some standards further investment analysis methods are recommended e.g. the environmental impact plan. Further developments of traditional investment analysis methods such as the social cost benefits analysis are not recommended. SD principles are implicitly considered but there is no explicit consideration in the investment decision.

LOOKING OUTSIDE THE PM STANDARDS WORLD: THE LOGICAL FRAMEWORK APPROACH

The previously discussed standards offer a generic project management approach (i.e., applicable for all project types) and do not consider different contexts (e.g., industries or project types) (Garcia 2005). Furthermore because they didn't provide much evidence for the consideration of SD principles in the project initiation, we were looking for recognized project management approach, which would per nature of the project consider SD principles. SD is an important issue in regional development projects (Stockmann 1997). A well known approach for these projects is the Logical Framework Approach (*LFA*) (Norad 1999) which is applied by the World Bank (The World Bank 1997).

The participative process design of the *LFA* is based on a participatory analysis (stakeholder

analysis) as first step of the initiation process. All important stakeholders are invited to participate in the process and contribute actively to the decision regarding the realization of an investment. The LFA defines important stakeholders as all organizations and individuals that are necessary to fully understand the investment and/or that have an interest regarding the investment. Each stakeholder has the possibility to define investment ideas and to share his/her opinion.

In the *LFA* a more holistic cost benefit analysis considering economic, social as well as ecologic principles described. The cost benefit analysis described in the *LFA* defines the following criteria: total costs, benefits to main stakeholder, probability of achieving objectives, and social risks (Norad 1999; The World Bank 1997). Furthermore, the *LFA* defines following possible additional criteria (See Table 4).

A central value of the *LFA* is transparency. Problems, causes and effects are analyzed and communicated to the stakeholders. This open and transparent communication form leads to a more holistic investment decision because the identified problem, cause and effects can be considered in the decision.

Values like participation, transparency and acceptance are very important in the *LFA*. No decision is done without the confirmation of the stakeholders. A high social responsibility about countries but also about the stakeholders itself is observable.

The described cost benefit analysis in the *LFA* is a potential to further develop investment analysis methods for other project types. Nevertheless, one limitation of the *LFA* is its focus only on the project initiation and not the consideration of managing the whole investment life cycle.

PROPOSING A COMPREHENSIVE INVESTMENT ANALYSIS METHOD

The traditional cost benefit analysis and its further developments can be used as basis for the integration of SD principles into the investment analysis of a project. The use of a comprehensive investment analysis method considering SD principles lays the basis for a holistic and sustainable investment.

The selection of an adequate investment analysis method that fits to the organizational need and ensures a high flexibility to include SD aspects is the basis for a holistic investment decision. Traditional investment analysis methods consider only economic aspects and some methods are not flexible in integrating SD principles. Further developments such as the social cost benefit analysis are more holistic and focus also on social cost and benefits but don't allow the description of ecologic aspects. Environmental Impact Assessments focus on social and ecologic aspects but exclude economic aspects. Approaches from multilateral development agencies focus on the consideration of SD principles in the project initiation, especially

Table 4. Criteria according to the investment analysis of LFA (Norad, 1999, p. 44)

Criteria type	Criteria
Technical	Appropriateness, use of local resources, market suitability, etc.
Financial	Costs, financial sustainability, foreign exchange needs, etc.
Economic	Economic return, cost effectiveness, etc.
Institutional	Capacity, capability, technical assistance, etc.
Social/distributional	Distribution of costs and benefits, gender issues, socio-cultural constraints, local involvement, and motivation, etc.
Environmental	Environmental effects, environmental costs vs. benefits

when analyzing the investment. The social cost benefit analysis methods from UNIDO or the World Bank (Bruce et al. 1976; Dasgupta et al. 1972; Little/Mirrlees 1974; Squire/Van Der Tak 1975), the concept of responsible investments (Louche/Lydenberg 2011), ethical investments (Michelson et al. 2004; O'rourke 2003), or the *LFA* (Norad 1999) are good examples of how SD principles can be integrated into investment analysis methods.

Based on our analysis of standards and the literature, we summarize the following topics as important for a comprehensive investment analysis method:

- The consideration of a stakeholder perspective.
- A qualitative and non-monetary cost benefit description.
- The consideration of economic, ecologic, social as well as local, regional and global consequences when analyzing the investment.
- Costs and benefits for the investment but also for the project initiating the investment.

The Consideration of a Stakeholder Perspective: It is one guiding principles of responsible investment to adopt a stakeholder perspective in the investment analysis. This means that e.g. the costs and benefits of the stakeholders are considered. Knowing costs and benefits of important stakeholder allows one the one hand to consider these aspects when making the investment decision and on the other hand allows to plan actions and measures to minimize the costs of the stakeholders. Stakeholder costs are often non-monetary e.g. noise disturbance during construction and therefore not considered in traditional investment analysis methods. Gareis et al (2013) mentioned the importance to analyze the stakeholder perspective when analyzing the investment.

A Qualitative and Non-Monetary Cost Benefit Description: To allow a qualitative and non-monetary description of costs and benefits is one further step to reach a more holistic investment analysis method. In *PRINCE2* and *MSP* a non-monetary description of benefits is possible. Therefore the consideration of ecologic and especially social factors is possible. Another result of a qualitative description is a better description of costs and benefits of different stakeholder. This is important because stakeholder often have non-monetary costs such as noise disturbance during construction.

The Consideration of Economic, Ecologic, Social as well as Local, Regional and Global Orientation: Traditionally costs and benefits are only economic based. The qualitative and non-monetary cost and benefit description allow the consideration of ecologic as well as social costs and benefits. This is important as investments, which have a focus on social or ecologic aspects, becomes more important. The analysis is more balanced and other facts get a higher visibility. Furthermore it is possible to classify costs and benefits in the spacial scale and differentiate them into local, regional and global. This is also important as social or especially ecologic costs sometime have little influence on the local level but a high influence on the regional or global level. It is also possible to have a combination of two or more aspects e.g. local and regional. E.g. a new factory may have influence on local but also on regional level. Gareis et al (2013) defined the consideration of economic, ecologic and social as well as local, regional and global consequences as basis for a comprehensive investment analysis. Furthermore they defined the short, mid and long term orientation as essential.

Costs and Benefits for the Investment but also for the Project Initiating the Investment: Investments in contrast to project or programs are long term oriented. Thus it is not possible to differentiate the costs and benefits of an investment into short, mid and long term. But different costs and benefits during investment initiation and after investment initiation exits. Different costs and benefits during

investment initiation and utilization exist such as noise disturbance of neighbors during construction of a hospital. This differentiation is more important for the stakeholder perspective than the investor perspective. The costs during investment initiation represent the costs of the project and are mostly very economic driven. But for stakeholder different costs and benefits during investment initiation and after initiation exists. Knowing the stakeholder costs during investment imitation increase potentials to define measures and actions to minimize these costs. Furthermore potentials for optimizing stakeholder benefits during and after investment initiation can be identified. Costs during investment initiation are linked to risks for stakeholder during project performance. Risks can have a positive or a negative meaning. The awareness of these risks gives the possibility to plan measures and actions to minimize the risks and therefore the costs.

Table 5 shows one possible way to explicitly consider SD principles when analyzing an investment. As basis for the development of the investment analysis a stakeholder analysis needs to be done. The investor perspective can be done as a draft in internal workshops and meetings. It is suggested to do the final analysis together with important stakeholder in workshops and actively involve them in the investment decision process. This integration lays the basis for an open and transparent decision process. Based on the identity model of organizations (Gareis/Stummer 2008) the costs and benefits of the investment are analyzed. This first step represents the investor perspective and focus on costs and benefits for the investor itself when realizing the investment. It is possible to describe the costs and benefits in a monetary or non-monetary way. Thus tangible as well as intangible costs and benefits can be considered. In a next step the cost and benefit type is selected. It is possible that one cost or benefit is a combination between different types e.g. that one benefit is social as well as economic. The evaluation of the described costs and benefits can also be done in a monetary or non-monetary way. As described before, a differentiation between costs and beneftis during and after investment initiation is made.

In a next step the stakeholder perspective is analyzed. Thus the costs and benefits of important stakeholder are analyzed and evaluated. The costs and benefits can be described in a qualitative and non-monetary way and can relate to more than one type e.g. to social and economic. This section can be perceived as most important part for stakeholder because in this part it is possible to explicitly consider the costs and benefits of stakeholder. The active involvement of important stakeholder in this section is absolutely necessary to achieve meaningful and authentic information. A good balance between costs and benefits of stakeholders is the basis for a high acceptance regarding the investment. This information is also important for the future project manager as it give information how stakeholder may react during project performance. Furthermore this information can be used as basis for different actions and measures. It may also be considered when developing a communication plan. An important differentiation between costs and benefits is the previously described differentiation between costs and benefits during and after investment initiation. One advantage of this differentiation is the possibility to define specific measures and actions to minimize stakeholder costs and maximize stakeholder benefits. The definition of optimal measures requires this differentiation.

CONSEQUENCES FOR THE DESIGN OF THE INITIATION PROCESS

The application of a comprehensive investment analysis method has considerable effects on designing the initiation process of a project, which includes a clear differentiation between project and investment and stakeholder participation and engagement.

Table 5. Further developed cost benefit analysis

INVESTMENT ANALYSIS																		
	Cost/Benefit during Investment Initiation									Cost/Benefit of Investment								
INVESTOR PERSPECTIVE																		
Cost/Benefit Type	**Cost Description**	**Benefit Description**	**Type**						**Evaluation**	**Cost Description**	**Benefit Description**	**Type**						**Evaluation**
			Economic	*Ecologic*	*Social*	*Local*	*Regional*	*Global*				*Economic*	*Ecologic*	*Social*	*Local*	*Regional*	*Global*	
Services																		
Technologies																		
Organization																		
Personnel																		
Infrastructure																		
Finance																		
Relations to Stakeholders																		
STAKEHOLDER PERSPECTIVE																		
Stakeholder	**Cost Description**	**Benefit Description**	**Type**						**Evaluation**	**Cost Description**	**Benefit Description**	**Type**						**Evaluation**
			Economic	*Ecologic*	*Social*	*Local*	*Regional*	*Global*				*Economic*	*Ecologic*	*Social*	*Local*	*Regional*	*Global*	
Investment ratios																		
Cost-benefit ratio for the investor:																		
Amortization period for the investor:																		
Overall cost-benefit ratio:																		
Overall amortization period:																		

Clear Differentiation between Project and Investment: A clear differentiation between project and investment is the basis for the development of an adequate organizational design to ensure a holistic understanding of the investment. In point 3.3. the differentiation between investment and project was explained. As described, these processes fulfill different objectives, require different tasks for their performance, and different organizations are responsible for their performance.

Furthermore the clear differentiation of project and investment allows the management of the whole investment life cycle. The management of the whole investment is done by a business analyst. The business analyst supports the investment from the idea until the deinvestment. Furthermore the business analyst consults the performance of the investment analysis. During project performance it is necessary that the project manager communicates with the business analyst.

Stakeholder participation and engagement in the project initiation process especially in the investment analysis process leads to a better acceptance regarding the investment and regarding the project that initiates the investment.

The consideration of stakeholder in the analysis process of the investment is the first step to achieve a more holistic and sustainable investment. The development of strong stakeholder relations is a main driver of responsible investments. A participative process design allows a more holistic and transparent decision process (Gareis et al 2013). The analysis of important stakeholders is the basis for such an involvement. The *LFA* shows that the involvement of stakeholders in the process allows them to define criteria for the analysis that are important for them. Stakeholders are involved in the whole initiation and decision process. Via workshops, a strong participatory process design is realized. All decisions are made along with the workshop participants. A transparent investment decision leads to a higher acceptance of stakeholders regarding the investment. The outcome of a higher acceptance is to minimize risks.

Stakeholder participation and a comprehensive stakeholder management represent one of the biggest potentials to integrate SD principles into the project initiation process as well as into the project management process. In this field increasing research interest is observable (e.g. Eskerod/ Huemann 2012; Gareis et al. 2013; Huemann et al. 2014). Huemann and Eskerod (2012) discuss the importance of a comprehensive project stakeholder management and the integration of stakeholder in decision processes.

CONCLUSION

The project initiation process starts with the investment analysis and ends with the assignment of the project. Analyzing the investment is one main key task of this process. For this analysis different methods exists. Traditional methods such as the business case analysis or the cost benefit analysis consider only economic aspects and are short to mid-term oriented. Further developments such as the social cost benefit analysis consider also social costs and benefits are have a wider investment period. The environmental impact analysis considers social as well as ecologic aspects and is long-term oriented.

The concept of responsible investments is mostly used for financial investments. The concept tries to integrate economic, social as well as ecologic aspects in the investment analysis. Furthermore it encourages a long-term perspective and adopts a stakeholder perspective when analyzing the investment. The concept of ethical investments considers personal values and social considerations in addition to economic aspects.

Globally recognized project and program management standards represent a common understanding and knowledge in the project

management community. All analyzed standards describe the business case analysis as basis for the investment decision. Some standards recommend further investment analysis methods but do not describe them in detail. All standards do not explicitly consider SD principles when analyzing the investment.

The Logical Framework Approach (*LFA*) (Norad 1999; The World Bank 1997) is used by the World Bank mostly for initiating regional development projects. The *LFA* uses a participative process design to perform the investment analysis. Important stakeholders are actively involved in the investment decision process and the project definition. The described cost benefit analysis considers economic, social as well as ecologic aspects.The chapter proposes a more comprehensive investment analysis method based on the explicit consideration of SD principles, which includes

- The consideration of a stakeholder perspective.
- A qualitative and non-monetary cost benefit description.
- The consideration of economic, ecologic, social as well as local, regional and global consequences.
- Costs and benefits for the investment but also for the project initiating the investment.

The application of a comprehensive investment analysis method has considerable effects on designing the initiation process of a project, which includes a clear differentiation between project and investment and stakeholder participation and engagement.

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ENDNOTES

[1] A detailed description about the SD principles defined by Gareis et al. (2013) can be found in chapter 8 – "Re-thinking Project Initiation and Project Management by Considering Principles of Sustainable Development" written by Roland Gareis.

[2] ESG: Environmental Social and Governance

[3] A detailed description of the project initiation process can be found in chapter 8 – "Re-thinking Project Initiation and Project Management by Considering Principles of Sustainable Development" written by Roland Gareis.

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Chapter 2
Innovation and Competitiveness:
An Exploratory Study on Turkish Financial Sector

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ABSTRACT

While the fostering effect of globalization continues, the traditional perspectives of corporations regarding competition lose their significance as the conventional strategies have started to give way to new approaches in the business world. Many firms have realized the fact that it is fundamentally necessary to revise their competitive strategies to maintain their sustainability. Therefore, "innovation," one of the emerging strategies of competition, has globally become more and more dominant. However, the debate on the strategic value of innovation is still ambiguous not only in the theoretical framework but also in practice. The main purpose of this chapter is to make clear the theoretically informed definition of "innovation" and express its potential for providing competitive advantage in the financial sector. The chapter discusses some of the main scholarly sources of the issues related to the innovation strategies supported by the cases in the Turkish Banking and Insurance Industries.

INTRODUCTION

Competition, known as a mutual struggle between different people or organizations working in a particular field to achieve the same goal, is fostered by new dynamics that lead to the change in the concept of competition. The new strategic trend in the emerging markets has become to consider the innovation strategies as a competition tool for the purpose of obtaining a sustainable competitive power in the global arena. Therefore, in order to survive in today's rapidly changing competitive environment, corporations must continuously change and renew their products and services as well as their production methods. This is only possible by adopting innovation in designing products and services as well as process dimensions throughout an organization. Since the early 1980s, the generations of innovation models have increased and begun to influence the internation-

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alization of research and development (Krahmer and Regerr, 1999, 51). Innovation, as a unique resource, has begun to take place in business as well as in competency models. However, sustainable competitive advantage can only be accomplished by the resources that cannot be imitated or substituted. This reveals the need for managing innovation practices within an organization. In this sense, the innovation phenomenon has become a necessity not only for manufacturing but also for the service sector due to its dynamic nature. This is also important for the financial services. Banks and insurance companies are of great importance for the allocation of the resources contributing to economic growth and employment (Etan, 1998, 1).

Despite a great variety of research fields in the literature, the issue of innovation within its competitive dimensions seems far from significant research. This chapter is an attempt to fill the gap in the research of innovation and explore the emerging value of innovation phenomenon with a strategic perspective. In this respect, the paper aims to provide a better understanding of innovation that is required for the potential for providing competitive advantage for banks and insurance companies. The paper proceeds as follows: The first section draws a conceptual framework of innovation. The second section explores the importance of innovation in business, along with various types of innovation and the relationship between innovation and competition. The third section outlines the fundamental innovation strategies that financial services implement in today's financial sector, especially in the cases of the Turkish Banks and Insurance Companies.

BACKGROUND

The most important question for how to create and maintain competitive advantage through innovation has become one of the main strategic concerns of the corporations today. In the new business era, in order to survive in the highly competitive arena not only manufacturing but also service industries need to innovate. This is mostly valid for the financial sector because of its role as a service provider of the economy. Innovation makes a major contribution to the survival of banks. In this context, banks and insurance companies have to redefine their core strategies in a creative manner to acquire sustainability in the market. However, there is a lack of evidence for innovation to provide an adequate discussion for the scholars or corporations. Moreover, the literature is diversified by a number of approaches, prescriptions and practices that can be confusing and sometimes contradictory. The study focuses on exploring the determination of innovation, its theoretical background and the innovation strategies that are discussed in the Turkish Financial Sector, particularly in the banks and insurance companies.

THEORETICAL FRAMEWORK

In the 21st century, the transition to "innovation economy" determines countries' overall performance of sustainable economic growth and social development. While innovation guarantees employment growth and particularly sustainable growth, it also empowers the social well-being and quality of life for the countries (Tutar et al, 2007, 197). Innovation provides entry into new markets and enlargement of the existing market, while increasing the productivity and profitability for the companies. Therefore, it is clearly a very important competitive tool. This is apparently more obvious in the business world. Since the rapid change of competition has modified the conditions of business to compete, firms are required to create differential value. For a long time, the dynamics of competition have been dependent on how the firms acted according to the changing needs of customers in line with their requests (Örücü et al, 2011, 58-59). Today the strategies of corporations need to be created through innovative behaviour

(Erdem, 2011, 78; Satı and Işık, 2011, 538-539). Enhancing the innovative ability in organizations appears to be one of the most important levers to increase profitability and growth in the market. Nevertheless, traditional strategies are short-lived and it is greatly imperative for companies to find new avenues for growth and sustainability. Successful value creating requires organizations to invest in undervalued business platforms to consider customer insights or aggressively pursue positioning advantage (Satı and Işık, 2011, 538-539). Accordingly, strategies that are defined as innovative load an important leverage for businesses (Yavuz, 2010, 145; Satı and Işık, 2011, 538-539).

As mentioned above, considerable literature has been accumulated on the subject of innovation, which is widely seen as the basis of a competitive economy (Adams et al, 2006, 21). The studies on innovation have been based on a broad range of disciplines, including management science, economics, geography, sociology, and psychology. Therefore, they have adopted very different methods, definitions and samples. As a result, this diversity of research has limited the accumulation of knowledge regarding innovation management (Tidd, 2001, 174). The following section consists of a brief theory of innovation.

Definitional Landscape

The word 'innovation' comes from a Latin term "innovatus" that concerns mainly using new methods (Tutar et al, 2007, 197; Yalçınkaya, 2010, 382; Karagöz, 2009, 151; Çeliktaş, 2008, 5). The first and seminal definition of innovation was proposed by Schumpeter (1934). The term was associated with economic development and was defined as a new combination of productive resources. Schumpeter, by and large, was interested in defining five specific cases connected to innovation like the introduction of new products, new production methods, exploration of new markets, conquering of new sources of supply and new ways of organizing business (Schumpeter, 1934; Elçi et al, 2008, 25). Since then, the concept of innovation has evolved significantly over the last 40 years. One of the reasons for innovation being one of the most discussed topics in today's business, as well as political and academic area, is that innovation is now vital for institutions, industries and countries due to high competitiveness of homogeneous products and services (Arıkan et al, 2003, 362; Satı and Işık, 2011, 538-539).

The innovation processes that the firms deal with have changed very little although the business environment has changed significantly (Tidd, 2001, 165). Despite many models of innovation at the firm level, it occupies a variety of theoretical positions (institutional theory, cognitive theories, transaction cost economics, and resource-based view) where each theory contributes a piece to the innovation puzzle (Lawson and Samson, 2001, 378).

Today there are several scopes and definitions of the term 'innovation' (see Table 1). However, an accepted comprehensive framework guiding managers toward successful innovation does not yet exist (Lawson and Samson, 2001, 378). The concept is notoriously ambiguous and lacks either a single definition or a measure (Adams et al, 2006, 22; Çeliktaş, 2008, 4).

Drucker defines the concept of innovation management as "the activities of the company to perform innovation activities in a process under control by stimulating administrative activities, as well as irregular and complex structure in order to adapt to changes in the internal and external environment" (Drucker, 2003,120). According to Çeliktaş (2008), "Innovation, involving a process formed by challenging ideas adopted to commercialization, is a series of organizational and individual behaviour patterns associated with defined resource allocation decision-points" (Çeliktaş, 2008, 5).

Considering the statements mentioned above, we can define innovation as "The development of new ideas giving added value and the applica-

Table 1. Perspectives on innovation

Author	Scope	Definition
Arıkan et al, 2003	Knowledge	The transformation of knowledge to economic and social utility.
Atik, 2005 Çeliktaş, 2008 EU and OECD Aranda et al, 2001	Process	Involves both the renewal process and the outcome upcoming from his process.
Tutar et al, 2007 Yalçınkaya,2010	Recovery, Renewal	The transition of new ideas to economy.
Drucker, 1998	Entrepreneurship	Concerns the welfare production of entrepreneur by establishing new resources and increasing the potential usage of these resources.

tion of these ideas in individuals' lives" or in the corporate dimension it is "The application of an idea to a marketable product or service, as well as a new or improved production process or distribution method." In this regard, it can be stated that innovation refers to a process in which a business differentiates its products and services from its competitors and develops them through renewal or regeneration.

Growing Importance of Innovation

Today, the importance of innovation for corporations has grown so much that (Çalıpınar and Baç, 2007, 445) maintaining productivity, increase in the market share, and competition between organizations depend on innovation (Yalçınkaya, 2010, 384). Innovation has become an indispensable source of dynamism of economic growth of countries, increasing employment and better quality of life (Çalıpınar and Baç, 2007, 446; Satı and Işık, 2011, 539-540). However, in order to call it as an innovation, the product or service must be gradually "new for the company" and the economic value must be provided (Satı and Işık, 2011, 538-539). For larger organizations, innovation fulfills the important tasks in innovation process such as;

1. Increase in profits,
2. Increase in the number of new products on their portfolio,
3. Increase in sales and market share and distribution performance,
4. Reduction in deployment time in increasing productivity and
5. Reduction in costs with better use of resources and time (Satı and Işık, 2011, 545-546).

In addition, the factors that result in the emergence of innovation can be summarized as follows.

The requirement of new products and services: Since corporations operate under complexity and uncertainty, the internal organization (functional structure) of the firm, the definition of business divisions based on product-market linkages, and networks with other organizations (suppliers, customers and collaborating organizations) influence the capability of a firm to develop and commercialize new products and services (Tidd, 2001,181).

Acceleration of the new economic order: In the competitive environment, it becomes more and more difficult to survive only by imitating the work of the competitors and their products (Satı and Işık, 2011, 539-540). As a matter of fact, the transformation from the industrial society to the knowledge society has revealed the need for administrators who have acquired the related information to be able to obtain and maintain the advantage of efficiency and competitiveness of the company. For this aim, corporations tend to implement policies based on information technology rather than industrialization strategies (Karabay, 2010, 2).

*Changing Competition Policies***:** Today's enterprises are faced with intense competitive pressures from the global market where the economic globalization limits have been removed (Bayındır, 2007, 244; Karabay, 2010, 3). Consequently, the pressures from the environment compel the corporations to make continuous innovation activities, to follow the latest developments, and adapt to these developments. Evidently, the competititon makes companies gravitate to the capabilities and resources necessary in a natural and flexible way (Bayındır, 2007, 244).

Changing Customer Profile: By enhanced innovation capacity, it becomes possible for the organization to meet customer requirements more effectively by evaluating the strengths in strategic market opportunities ahead of the competition (Satı and Işık, 2011, 539). From this perspective, innovation should be considered in a strategic manner (Nijssen and Frambach, 2000; Burmaoğlu and Sepen, 2011, 12).

Development of Technology: Innovation can emerge from new technological and non-technological knowledge. Non-technological innovations are closely related to the know-how, skills, and working conditions which are embedded in organizations (Wef, 2012, 7). The most related indicator regarding technological innovation is research and development activities (R&D) (Çalıpınar and Baç, 2007, 447).

The question of "Why do corporations innovate?" is another common concern both in academic and business atmospheres. There appear to be various purposes in the background of innovation. Here, we can state three purposes of innovation below:

- **The viability of the business:** This is associated with the production of more than one product or providing more than one service. The variety of products and services brings about more competition in the market. A company, therefore, has to renew itself constantly.
- **To become a leader in the market:** In order to be a leader, a corporation should adopt the major innovations in the market. In this sense, the company can manipulate the market in its own interest and find an opportunity to define the conditions of competition alone.
- **To increase profit:** Profitability is one of the most important business goals for success. Innovations may reduce the cost, shorten the production process, and increase performance and efficiency if they manage and measure it successfuly. All these positive developments will increase the profitability of the company (Örücü et al, 2011, 62; Taylan, 1996, 5-6).

As mentioned above, innovation has critical importance on economic growth, prosperity, international trade and regional development. However, in order to measure innovation capacity, corporations need significant indicators. Some of the key innovation indicators may be listed as follows (Karaöz and Albeni, 2004, 4):

- Periodical innovation surveys (micro and macro perspective),
- Patents, patent applications and patent usage rights for sale,
- Scientific publications,
- R&D expenditures and activities,
- Number of researchers,

Above all, R&D expenditures appear to be the widely used innovation indicator both by the academics and practitioners.

Types of Innovation

In the related theory, there are various conceptualizations that have come so far regarding the types of innovation. However, due to the heterogeneity of services, it is not appropriate to make a precise classification dividing innovation into

types (Çeliktaş, 2008, 12). The types of innovation that have been widely classified in the literature are described:

Product Innovation

This type of innovation involves changes in the products or services that an organization offers (Tidd, 2001, 179; Yavuz, 2010, 146; Elçi et al, 2008, 26). Product innovation can be defined as a reflection of a firm's commitment to developing and marketing products that are new to the firm and/or the market (Li and Gima, 2001, 1124). Although it is a common practice in manufacturing firms in general, product innovation plays much more important role in the food industry (Çalıpınar and Baç, 2007, 448).

Market Innovation

Market innovation is associated with the implementation of new marketing methods including fundamental shifts in product design/packaging, product promotion or pricing, and product placement (Elçi et al, 2008, 27). Such innovation focuses on differentiating the behaviors of potential customers during the purchasing process (Yavuz, 2010, 147).

Technological Innovation

This type of innovation covers both technological products/services and processes. There can be significant technological changes in the existing products and processes that are also included in the scope of the technological innovation as well as the development of a new product or process (Çalıpınar and Baç, 2007, 447). Technological innovation of products can either be a new product, a technologically improved product or a product that can be technologically introduced (TUSIAD, 2003, 27).

Process Innovation

Process innovation appears as an optimized implementation method of production or a significantly improved way of production or distribution (Elçi et al, 2008, 25; Tidd, 2001, 179). This definition is general enough to apply to a wide variety of products, processes, and administrative kinds of innovations (Van de Hen, 1986, 591). It could be argued that process innovations are related to the innovative act of business on the development of or creation of the product (Yavuz, 2010, 147). Process innovation comprises the introduction of information systems, telecommunication systems, the perfection of expert systems, and methodologies that are used to support the process (Gadrey et al, 1994, 9). It can be stated that each innovation activity can be undertaken alongside other activities, but with different degrees of emphasis. For example, in predominantly technology-driven companies, the emphasis is frequently placed on product innovation rather than on *market innovation*. Similiarly, for companies that are under threat, considerable emphasis is placed on *process innovation* (Johne and Davies, 2000, 7).

Organizational Innovation

Innovation activities carried out in all companies other than technology-based companies not only include technological innovation but also organizational innovation (Çalıpınar and Baç, 2007, 447). Generally, this type refers to the new or different embodiments bringing together human and material resources within an organization in the most optimal way (Yavuz, 2010, 147). Organizational innovation aims to increase the company's performance, job satisfaction, labor productivity and reduce the cost of supply by reducing transaction costs or administrative costs (Çeliktaş, 2008, 18).

Organizational innovation and marketing innovation can be categorized as non-technological

innovations, and are at least as important as technological innovation. For example, in the event that the company makes technological innovation by using the results of Research & Development (R&D) but not marketing innovation, it becomes impossible for the company to be able to capture enough commercial success with the product developed compared to the competitiors' (Elçi et al, 2008, 27). Investments, in this sense, build the necessary physical infrastructure for technological development to create and spread technological innovations throughout firms (Arıcan et al, 2011, 37-38). Despite the importance of technological investments, for the innovation to provide sustainability the firms have to consider also its strategic perspective. In this regard, the association between strategy and innovation are analyzed in the following sections.

INNOVATION AND COMPETITIVE ADVANTAGE

Since the traditional strategies started to lose their significance, they have started to give way to global approaches in the rapidly changing business world. Therefore, organizations consider it necessary to continuously revise their core strategies (Karabay, 2010, v-2). Innovation represents today's competitive advantage supported by strong capabilities of corporations in quality, efficiency, speed and flexibility (Lawson and Samson, 2001, 380-381). Acquiring a competitive advantage and providing its sustainability particularly depends on the managerial competence. If the managers are to become more effective, there is a need to change from traditional management approaches to an approach that focuses on processes, R&D, cost savings and stand-alone improvements. This places a strong emphasis on the value of knowledge and innovation. Moreover, innovative efforts foster faster new product development and increased cost-effectiveness if managerial strategies are entirely aligned with the corporate objectives (Terziovski and Morgan, 2006, 546). If the senior management supports the innovation process and creates favorable climate within the company, then it will be much easier to gain a sustainable competitive advantage.

The innovation performance, therefore, is a concept particularly linked directly to the innovative aspect of a firm (Yavuz, 2010, 147-152). Competitive advantage also rests on distinctive processes, shaped by the firm's asset positions and the evolutionary paths followed (Lawson and Samson, 2001, 379).

Firms competing in the global markets face challenges as well as opportunities of change in the markets and technologies. One of the most important functions of competition appears to be the stimulation of innovation and technical progress (Arıcan et al, 2011, 37-38). Corporations will have to consider different stages in the process through efficient management of innovation. In order to begin the process, new ideas should be developed within the organization (Örücü et al, 2011, 63).

In the literature, the issue of the stages of innovation is investigated in a number of phases (Rothwell, 1994; Galanakis, 2006). Rothwell's five generations of innovation explaines the stages of innovation in five phases. The first stage is referred to as the stage of "technology push," which assumes that "more R&D in" results in "more successful new products out." The second-generation stage is explained through market pull model of innovation, where the market is the source of ideas for directing R&D, which has a merely reactive role in the process. The third phase is associated with the coupling model of innovation. According to this phase, innovation is rarely the outcome of technology push or market pull forces, but rather the result of the combination of the two. On the other hand, the fourth stage is accompanied by a growing awareness of the strategic importance of the evolving generic technologies, with increased strategic emphasis on technological accumulation. The final stage of the generation phase is the process of systems integration and networking

(SIN) in which the technology of technological change is itself changing (Rothwell, 1994, 7-15).

According to Adams et al (2006), the innovation process is complex, comprising a myriad of events and activities some of which can be identified as a sequence and some of which occur concurrently. So, it is clearly possible that innovation processes differ, to some degree, across organizations and even within organizations on a project-by-project basis (Adams et al, 2006, 36).

Again, Veugelers and Cassiman (1999) state in their study that the innovation process consists of a complex sequence of strategic decisions. First, the firm decides whether or not to innovate and second, the firm decides which innovation strategy to develop and how to acquire the necessary technology to accomplish its innovation goals. For the first step, the firm and industry characteristics influencing innovativeness play a vital role (Veugelers and Cassiman, 1999, 64). In this sense, firm-level innovation occurs not in a simple process but in a process where there are important feedbacks obtained from complex interactions between people, organizations and the media in which they exist (systemic innovation model) (Elçi et al, 2008, 29). Furthermore, the process of innovation, created by technical, economic and social processes, requires the implementation of openness to change and request for innovation in society and individuals with a long-term, cooperative, collaborative and participatory approach. In order to satisfy this requirement, it is necessary to examine the relationship between innovation and strategic management of an enterprise, the discovery of the points adding value, and managing of this association (Satı and Işık, 2011, 538-539).

Strategy is critical because it determines the configuration of resources, products, processes and systems that the firm adopts so as to deal with the uncertainty in their environment. In this sense, the firm is required to make decisions about what businesses and functions it should be performing and in which markets. So, successful innovation requires a clear articulation of a common vision and powerful expression of the strategic direction. This is an essential step in institutionalising innovation. Without a strategy for innovation, interest and attention will become probably too dispersed (Lawson and Samson, 2001, 389).

In terms of businesses each activity has to be understood as a process since innovation has a dynamic structure in its nature, consisting of various stages. Furthermore, a corporation that does not have an effective strategy may not be able to take the necessary steps for innovation management. In this regard, strategy becomes an administrative tool in controlling the changes that take place by providing, first of all, innovation progress and continuous adaptation to the environment so as to be mutually compatible (Cormican and O'sullgvan, 2004, 819; Satı and Işık, 2011, 538-539).

Innovation increasingly emerges from a network of companies interacting in a variety of ways (Cassiman and Veugelers, 1999, 63). High-performing innovators are able to bring new high quality products to the market faster, more frequently and at a lower cost than their competitors. So, they become more competent to achieve an outstanding performance (Lawson and Samson, 2001, 378). As mentioned above, corporations have much to do with more than traditional strategies. They have to organize and implement new strategies different from their competitors. In the following section, the strategies that turn up to be the innovative strategies are explained.

Innovation Strategies

As mentioned above, innovation is about creating economic value from new ideas (Bercovits and Feldman, 2005, 3). Organizations have to explicitly articulate a strategy to induce innovative activities (Elçi et al, 2008, 29). Firms determine an innovation strategy depending on the expectations related to innovation. The basic strategies of enterprises and innovation strategies are highly dependent on each other so the process of determining is

like that of the managerial strategy of enterprises (Satı and Işık, 2011, 538-539). Then what is an innovation strategy?

The innovation strategy consists of financial goals and growth area related to a novel product or service. It is a set of strategic roles in defining the strategic mission of new products or services and a set of criteria with a series of filters in which the new products or service ideas must pass through (Satı and Işık, 2011, 545-546). In principle, innovations and innovation strategies have to be separated analytically since firms can attempt to pursue, say, an offensive innovation strategy (Freeman and Soete, 1997, 268).

In distinguishing innovation strategies, the corporations take into consideration the key dimensions connected to the strategic issues and to broader aspects of economic coordination and control, including the role of ownership as well as other forms of integration (Whitley, 2000, 865). Differences between firms in the same industry are said to be the essence of innovation strategy (Bercovits and Feldman, 2005, 4).

In the given literature, there is still a lack of consensus regarding the types of innovation strategies. In this study, I will categorize the emerging types of innovation strategies as entrepreneurial strategies, benchmarking strategies, imitative strategies, and knowledge based strategies. (see Figure 1)

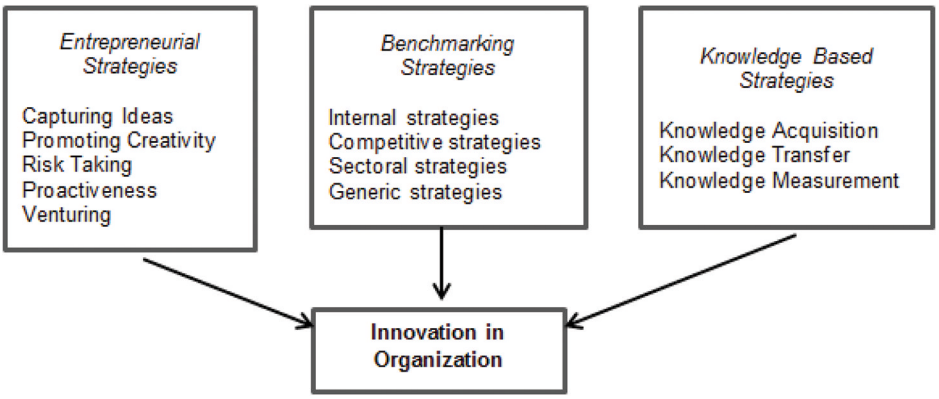
Entrepreneurial Strategies

Entrepreneurship and innovation are positively related to each other and often complementary which help an organization flourish (Zhao, 2005, 25). The basis for effective innovation in an organization is initially the adoption of an entrepreneurial strategy determined by the executive level (Saleh and Wang, 1993, 14). More specifically, this type of strategy entails three main components: promoting, risk taking, proactiveness, and persistent commitment to innovation (Saleh and Wang, 1993, 14).

Benchmarking Strategies

As mentioned above, organizations have been forced to consider and in many cases adopt or implement a wide variety of innovative management techniques. One of them is known as the benchmarking (Yasin, 2002, 217). The goal of benchmarking is to provide employees in charge of processes with an external standard for measuring the quality and cost of internal activities and to help identify where opportunities for further improvement stand (Alstete, 2000, 200). Benchmarking strategies can be industrial, internal, and generic strategies.

Figure 1. Strategies of innovation



Knowledge Based Strategies

As the market conditions vary continuously, increasing pressure of competition and customers' expectations also appear to be the elements which define the knowledge as a factor providing strategic competitive advantage (Karabay, 2010, v-2). Fostered by the new economic developments, knowledge has begun to be an intangible asset and a valuable resource for corporations. So, managing knowledge as an asset within an organization has raised the importance of knowledge-based strategies. Knowledge-based strategies are essential for the success of a business on organizational competencies or on the operational performance improvement (Grant and Grant, 2005, 3). Developing a knowledge management strategy enables a firm to leverage the different types of knowledge, to identify competencies required to become a innovator with capability to provide sustainability. As Renko et al (2001) suggest young firms may develop social capital as a competitive strategy to aid in acquiring new knowledge (Renko et al, 2001, 589). Another component of knowledge strategy is the knowledge transfer that happens in organizations as a process through which one unit (e.g., group, department, or division) is affected by the experience of another (Argote and Ingram, 2000, 151). Knowledge measurement is also vital for companies to ensure that they are achieving their goals. Measurement provides an important mechanism to evaluate, control and improve upon existing performance (Ahmed et al, 1999, 310).

In the innovation literature, there is also a type of strategy called imitative strategy. Also known as the copycat strategy, corporations that follow this innovation strategy try to use the available technology and information usually following the innovations at a distance. In innovations protected by patents, waiting for the expiration of the patent is the result in such a strategy. In this way there is no need for business to pay any license fee. If such businesses may reach new markets, they may achieve more profit from innovations than their competitiors (Örücü et al, 2011, 63). Innovations in financial services and products are easily copied and, as a result, it is difficult for organizations to maintain a competitive advantage through product differentiation (Devlin, 1995, 25).

Besides the strategies mentioned above, external innovation strategies like mergers and acquisitions (Saleh and Wang, 1993, 14) have become significantly appropriate in scope. This is especially true for knowledge-based and high-tech industries. As a matter of fact, innovation activities carried out in cooperation with foreign institutions as well as competitors bring a wide variety of advantages such as reducing risks, ensuring economies of scale, and shortening the duration of innovation (Elçi et al, 2008, 13). Moreover, as countries move into the innovation-driven stage, owing to the higher wages, the standard of living can only be improved only if the companies are able to compete with new and/or unique products, services, models and processes (Schwab, 2012, 9). According to Gadrey et al (1994), the primary concern about the innovations in "service products" is to develop a new service which many firms tend to call a new "product." A new service product is a new formula for managing the financial problems of a client or group of clients. This is often associated with a new contract. The second concern is the innovations in processes and organization for an identical (or almost identical) service (Gadrey et al, 1994, 7-8). This is mostly true for the financial services like banks, insurance companies and other financial intermediaries.

INNOVATION IN FINANCIAL INDUSTRY

Providing sustainability has gained considerable importance in every field of global business as well as in the banking services (Karabay and Okay, 2012, 6). The Banking Sector is highly dynamic with its nature and considered as an influential engine of the economy. On the other

hand, the Insurance Sector plays an active role in the economy and is one of the most emerging industries in financial services. In industrialized economies, the elasticity of demand for insurance and significant shift of the fund to this sector has attracted attention to the financial industry. In the literature, it can be observed that researchers often use indicators of the R&D capability of countries and R&D expenditures of a company (see, Table 2).

The management of risky R&D expenditures has become even more influential for the survival of a firm (Cassiman and Veugelers, 1999, 63). Research and development activities appear to be one of the most important activities required for innovation, especially technological innovation (Tsai, 2005, 796). Investing in R&D has many benefits like ;

1. R&D investments create a large number of innovative products and services (Korkmaz, 2010, 3322),
2. R&D investments provide business growth and support the competitive advantages (Korkmaz, 2010, 3320; Çalıpınar and Baç, 2007, 446),
3. R&D expenditures are associated with the business outcomes of the innovation activities (Türkoğlu and Çelikkaya, 2011; Çalıpınar and Baç, 2007; Tüylüoğlu and Saraç, 2012; Korkmaz, 2010), and
4. Information obtained from R&D activities is used in the development of a new product and the detection of a new market. This information contributes to development of a company by increasing its competitiveness (Işık and Kılınç, 2011, 17).

With the impact of globalization and liberalization, the restructuring of the markets fostered by the new entry of domestic and foreign banks and other financial institutions, concerns of the firms continue to increase regarding the protection of their market shares. The firms that offer the fastest and best service to customers at the lowest cost anticipate and meet the needs of the evolving economic environment are likely to remain alive. At this point, the financial reform of innovation emerges as a defining element of the competitive process (Yağcılar, 2010, 84-85). While the attention to innovation in financial business remains so strong, the literature, on the other hand, presents various studies regarding

Table 2. Global competitive index 2012-2013

Capacity for Innovation			Company Spending on R&D		Innovation and Sophistication Scores		
Country	**Value**	**Rank**	**Country**	**Value**	**Country**	**Rank**	**Score**
Japan	5.9	1	Switzerland	5.9	Switzerland	1	5.79
Switzerland	5.8	2	Japan	5.8	Japan	2	5.67
Germany	5.7	3	Finland	5.6	Finland	3	5.62
Finland	5.6	4	Germany	5.5	Germany	4	5.57
Sweeden	5.5	5	Sweeden	5.5	Sweeden	5	5.56
Israel	5.4	6	Israel	5.4	Netherlands	6	5.47
United States	5.2	7	United States	5.3	United states	7	5.42
Netherlands	5.1	8	Singapore	5.1	United kingdom	9	5.32
Austria	5.0	9	Denmark	4.9	Austria	10	5.30
France	5.0	10	Taiwan,China	4.9	Singapore	11	5.27

Source: Schwab, K. 2012. WEF, The Global Competitiveness Report, 2012–2013

innovation in financial services. The next section consists of a brief survey of the literature from a number of outstanding studies.

Literature Review

Benfratelo et al (2006) investigate the effect of local banking development on firms' innovation activities, particularly for a large number of Italian banks during the 1990s. According to the findings, the probability of introducing a process or product innovation is significantly and positively related both to the firm size and the degree of banking development. They also present some evidence which indicates that banking development reduces the cash flow sensitivity of fixed investment spending, particularly for small firms, and that it increases the probability they will engage in R&D.

Uchupalanan (2000) examines the dynamic relationship between competitive strategy and information technology-based product and process innovation in financial services, particularly for the Thai banking industry in the late1960s. The results show the basic limitations of the Reverse Product Cycle approach and concludes with an alternative conceptual framework on a country-specific innovation model.

Polatoğlu and Ekin (2001) illustrate evidence on the consumer acceptance of the Internet banking (IB) services of a Turkish bank. They examine both consumer-related factors that may affect the adoption of an innovation or a product as well as organizational factors such as marketing effort. The results suggest that internet banking not only reduces operational cost to the bank but also leads to higher levels of customer satisfaction and retention.

Jayawardhena and Foley (2000) reveal that the Internet provides many opportunities for banks. An Internet bank can act as an online payment facilitator or as a provider of other services and shopping opportunity and therefore assist the growth of electronic commerce.

Another research was conducted by Santomero and Trester (1998) who state that the risky asset portfolio held by the banking sector unambiguously increases as a result of the innovations considered. As a matter of fact, a reduction in illiquidity increases the banking sector's willingness to provide risk capital for real sector investment.

Tiwari et al (2007) investigate in their study the impact of Mobile Banking. They present five propositions about the role of innovative business solutions in the banking sectors.

When the insurance industry is considered, the number of studies are insufficient compared to the banking sector. The reason for this, in my opinion, is related to the dynamics of insurance sector. This is significantly observed in the related literature.

Pearson (1997) examines innovation in the British Insurance Sector between 1700 and 1914. In his study, the factors determining innovation were surveyed and comparisons were drawn with European Insurance. The findings suggest that insurance innovation ran broadly counter-cyclical to the innovation in the industry during this period, and was relatively undynamic.

Lado and Olivares (2001) reveal that there is a statistically significant and positive association between market orientation and business innovation performance in both the US and EU financial markets. According to them, more market oriented insurance firms are more innovative and have higher innovation success.

Barrett (1995) in his paper uses the case study method to explore how a Jamaican general insurance company responds to pressures by establishing a cross-cultural joint venture for IT development. The study focuses on visionary leadership which utilises the knowledge of the business along with double loop learning capabilities. According to the results, during the implementation of the innovation, leadership styles do not cope adequately with cultural characteristics.

Apart from the studies summarized above, there are various studies contributing to the in-

novation in the banking sector (Buzzacchi et al, 1995; Pennings and Harianto, 1992; Morgan et al, 1995) and the insurance sector (Storey and Christopher, 1996; Johne and Davies, 2000; Pontremoli, 2002; Lehmann and Zweifel, 2004). In the following section, the phenomenon of innovation will be assessed within the context of banking and insurance sectors in Turkey.

Innovation in the Turkish Banking Sector

The level of competition in the financial sector has a significant impact on the efficiency of the production of financial services, quality of financial products and degree of innovation in the sector (Claessens and Laeven 2004, 565; Karabay and Okay, 2012, 10). As the dynamics of the competition between the banks have begun to change after the restructuring program in the Turkish Banking Sector, measuring the competitive behavior of the banks has attracted a greater attention (Karabay and Okay, 2012, 3). Although innovation has been on the agenda since the early 1900s in the developed countries, the concept of innovation in Turkey began to take its place on the agenda in the mid 2000s (Elçi, 2008, 6). By virtue of the increasing pressure within the market and especially from the non-banking financial services sector, the banks now aim to move towards multi-channel banking services, provide innovative products and offer a wide range of choices with lower costs to customers. In addition, under the intense competition, a number of leading private Turkish Banks have been implementing programs and systems to provide better quality services (Yavas et al, 1997). They focus on innovating new products/services (including offering multi-channel banking services) for their customers, in order to increase efficiency and customer satisfaction (Polatoğlu and Ekin, 2001, 156).

The process of transition to the new economy affects the maturity of the Turkish Financial Sector. The Turkish Banking Sector can manage investments to increase the effectiveness of the marketing strategies more quickly than the banks in many countries around the world. For instance, transition to electronic commerce in the banking sector in Turkey has been much faster than in other sectors (Tolon, 2012, 1). Namely, a large number of customers in the sector consist of debit-card customers, depositors, lenders and credit card customers.

The Turkish Banking Sector, following the main developments in the last decade, has undergone a significant transformation since the 2001 crisis. In this period, several banks went bankruptcy because of their sunk costs. Later, the mergers and acquisitions, strategic investments, regulatory framework, risk management and market dynamics reshaped the global participation in the sector, as their relative shares changed.

The banking sector, a major locomotive of the financial system, is one of the fastest growing sectors in Turkey. As illustrated in Table 3, there are 49 banks as of 2012: 3 public deposit, 11 private deposit, 16 foreign deposit, 4 public investment, 5 private investment, 4 foreign investment, 4 participation banks and 2 banks under the supervision of the SDIF (Saving Deposit and Participation Funds) (TBB, 2012, ii-9).

Table 3. Structure of financial system in Turkey

Banks	**49**
Factoring	**78**
Leasing	**31**
Financial Intermediaries	**13**
Asset Management	**9**
Intermediary Institutions	**73**
Portfolio Companies	**36**
Insurance Companies	**64**
Registered Institutions	**755**
Reinsurance Companies	**2**

Source: BDDK, 2012,20. Data taken from the reports of BDDK, SPK, TSAKB. (November 2012 data are used.).

The banks operate in accordance with the provisions of the Banking Law No. 5411. As of 2010, 92, 6% of the assets of the sector belong to deposit banks; 4,3% of participation banks and 3,1% belong to development and investment banks (BDDK, 2010, iii-iv). Within the functional range, it can be seen that a large part of the sector's total R&D expenditures are made by deposit banks. As illustrated in Table 4, the share of R&D expenditures of the commercial banks in 2010 was 96, 9%; the share of the investment and development banks stood at 2, 7% and 0, 4% of participation banks, respectively.

When we look at the Turkish Banking Sector, it can be seen that most of the merger and acquisition investments become from the growing consolidation among large banks and the foreign corporations' willingness of affiliation with Turkish market. The largest deal of 2010 was the purchase of the Turkish Garanti Bank by Spanish banking giant "Banco Bilbao Vizcaya Argentaria SA (BBVA)" as BBVA purchased the 24.9% stake in the price of € 4.2 billion. Lately, Turkish Economy Bank (TEB) and Fortis Bank merged under the name of Turkish Economy Bank (TEB) (KPMG, 2011, 26).

Technology is intensely used for the development of the Turkish Banking Sector and for the diversification of products and services, which has facilitated the increase on the demand of mobile and internet banking. Furthermore, by the process of harmonization within the financial sector, the growth of the volume of transactions within the mobile banking has also accelerated (BDDK, 2012, 21).

As mentioned before, R&D expenses are one of the most significant indicators of the development of a country as well as industries and corporations. R&D expenditures are of great importance not only for the development of new products and methods but also for the efficient use of existing or imported technology, adaptation or modification of activities at every stage of technological processes (Arıcan et al, 2011, 38). In the sector, large-scale banks are expected to take part more in R&D activities whereas small-scale banks have to invest more in R&D. It may be possible to enhance the financial capacity and that of financial innovations by increasing the investments on R&D activities (BDDK, 2010, vi).

The development of information technologies plays a central, though not exclusive, role in the

Table 4. Research and development expenses: Concentration indicators

R&D Expenses	2005	2006	2007	2008	2009	2010
Top 5 Banks	91,4	91,6	93,4	97,1	95,3	94,5
Top10 banks	98,9	99,0	99,4	99,7	99,7	99,7
Distribution by Scale						
Large-Size Banks	70,6	63,4	86,3	89,4	72,5	73,4
Medium-Size Banks	26,0	33,2	12,2	9,4	24,4	23,2
Small-Size banks	3,5	3,3	1,5	1,2	3,1	3,4
Total	100	100	100	100	100	100
Functional Distribution						
Deposit Banks	99,9	99,8	98,7	98,9	97,1	96,9
Development and Investment Banks	0,1	0,0	1,3	1,0	2,1	2,7
Participation Banks	0,0	0,2	0,0	0,1	0,7	0,4
Total	100	100	100	100	100	100

Source: BDDK, 2010, p.82.

innovation of many service activities. The implications of the rise of knowledge systems for the activities of service firms and, more specifically, for R&D innovation activities are complex and have to be analyzed at several levels. At the most immediate level, technology (in the commonsense usage of the word) is penetrating into the systems for processing and circulating information in a growing number of service firms. Some of them (banking and insurance in particular) have developed new technologies, for instance, expert systems and image processing techniques (Gadrey et al, 1994, 7).

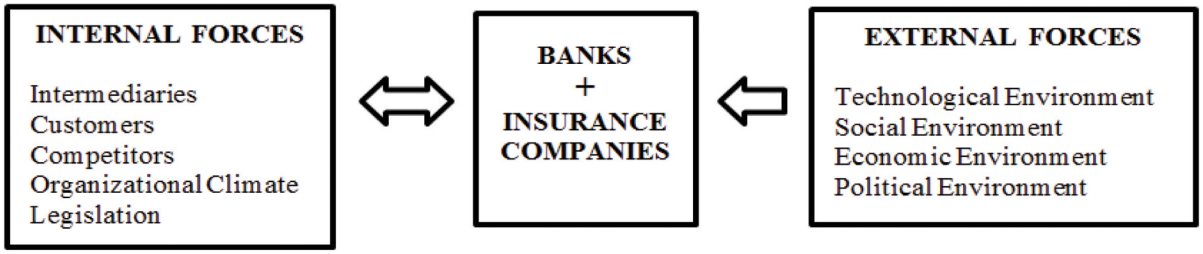
However, banks are structurally different from other sectors: that is to say, few resources are allocated to R&D and banks are fast in copying each other. In the Turkish Financial System the banks prefer to outsource the financing of an R&D activity and employ professionals for R&D divisions owing to the fact that outsourcing has today become a widely used funding method by enterprises. The information and specialization are intensively provided by consultancy firms or through R&D sector. When the expenses are considered, they are usually covered by general administrative or staff expenses. Regarding the banks, small-scale banks mainly may hesitate to outsource because they fear to lose direct control. The same is true for the insurance sector. Especially for the insurance services, the companies require significant market research (Yu, 2010, 17). Another contributing reason is that less resource is provided for organizational learning. Following the liberalization of the sector in the last decade, competition has greatly increased and banks have focused on innovation in order to remain competitive (Gopalakrishnan and Brierly, 2001, 126). This may have resulted from various reasons. First of all, although the basic functions of banks remain the same, financial intermediaries and banking services are under continuous structural change due to new technologies and liberalization. Secondly, lower cost or greater access to credit may affect product or process innovation playing an important role on the firm level inputs (fixed capital, etc.) (Benfratelo et al, 2006, 10). The change has also been encouraged by the development of storage and speed of data transfer (Joseph et al, 1999, 182).

The properties of the environment in which businesses operate directly affect the performance of innovation, competitiveness through innovation, and the nature of the facilities (Elçi et al, 2008, 13). As illustrated in Figure 2, the banking sector is subject to both internal and external forces (Jayawardhena and Foley, 2000, 19).

The decision of implementing innovative strategies in banking is a managerial issue. Considering the innovation types explained in the previous sections, the introduction of process or product innovations is an inherently a riskier business than a mere expansion of the existing activities. Product innovation is so risky and uncollateralizable because it is related to expenditures on human capital or entrants in the banking sector that provide substantial funding (Benfratelo et al, 2006, 8-9).

Banks, therefore, have to manage the innovation process accurately. The challenge that lies

Figure 2. Dynamics of Turkish financial sector



ahead for the banks is critical for several reasons. First, they need to satisfy customer needs that are complex and difficult to manage. Second, they need to face the increased competition from within the sector and from the new entrants coming into the financial services market. Third, they need to address the demands placed upon their intermediaries. Finally, they must continually invent new products and services in the light of the change described above (Jayawardhena and Foley, 2000, 29).

The new strategic trend in the financial services is to consider the knowledge-based strategies as a competitive approach with the purpose of obtaining and maintaining a sustainable competitive power in the rising markets (Karabay, 2010, ii). The World Bank has adopted these strategies as a strategic breakthrough (Drew, 1999, 131). Similarly, on the global scene, all the positive developments in the Turkish Banking Sector encourage innovation in the sector (Arıcan et al, 2011, 147). There are various examples regarding innovation in the banks which mostly focus on the digital platform. For instance, Garantibank, a leading Turkish bank in the sector, has developed a service offered to customers, including a bank guarantee-warranty- for the new social media users, called "Ask Garanti." By virtue of this campaign, the Bank's Bonus Card holders will benefit from special campaigns and advantages of Garanti Link application through their facebook and twitter accounts. Banks also acquire a strong competitive advantage through creative products and distribution channels (Tolon, 2002, 3).

Innovation in the Turkish Insurance Sector

On account of the differences in structure, the innovation strategies have become a much more complex issue for the insurance services. This is because of the complex nature of the insurance services offered. Consumers sometimes find insurance services difficult to understand and evaluate. Therefore, they need additional services offered (i.e. branches, staff and other physical evidence) to judge the nature and quality of the insurance service. This is especially important for the financial services as the material benefits may be realized only in the long-term in the case of insurance services (Storey and Easingwood, 1994, 31).

Because of the rapidly rising share in the financial sector and increasing number of insurance companies, the insurance sector has become one of the locomotives in the Turkish Financial System. Today insurance is not only a must for all kinds of trade and industry but it is an important part of the social structure. Insurance, in conjunction with securement qualifications, is also an element of trust (Kuşçu and Revanoğlu, 2011, 131). Furthermore, fostered by the new regulations and law abidements, such as the private pension system, the number of investors and equity participation funds shows an increase compared to the previous years. However, the number of customers has remained relatively low in relation to the banking sector (BDDK, 2012, 20). By the end of 2012, 64 insurance and 2 reinsurance companies have been operating in the insurance sector. There are 53 private and 6 publicly-owned companies, of which 44 companies work with foreign partners (Retrived 18.04.2013 from http://www.tsrsb.org.tr/sayfa/turkiyede-sigortacilik).

Turkish Insurance Sector needs not only a more dynamic structure but also extra financial sources in order to accommodate the changing conditions in the market structure. Increasing competition in the insurance sector, facilitated by globalization, makes the mergers & acquisitions compulsory. This contributes to the enchancing premium production volumes, product and service variety, which makes foreign capital inflows more noteworthy. On the other hand, several obstacles which the sector faces (Uğur and Akdemir, 2011, 25) can be summarized as:

1. Gaps and deficiencies in the legislation,
2. Lower pricing as a result of intense competition,
3. Problems arising from the auditing and legal structure,
4. Problems emerging from imperfect competition, and
5. Lack of capital.

When the overall view of the sector is considered, the total premium production increased by 27,72% in the first quarter of 2013, compared to the same period last year and reached 2 billion 246 million euro. Part of the premium production of 2 billion 259 million euro came from non-life premium production while 386 million euro was obtained from life insurances. AXA was the top leading company with 289 million euro in the first quarter. This was followed by the production of 284 million euro by Anadolu Insurance and that of 203 million euro by Allianz (www.tsb.org.tr). In recent years, the premiums have declined in the developed countries, whereas in the developing countries the premium production has increased despite the crisis, as in the case of Turkey (Kuşçu and Revanoğlu, 2011, 141). However, new legal arrangements have been carried out in the Turkish Insurance Industry in recent years (Başturk, 2012, 1084). By 2002, the Turkish Insurance Market, for general insurance (broadly defined as non-life insurance), had become fiercely competitive. Local investors are not the only potential innovators in the insurance market. The rise of GDP/capital and the fall in inflation began to create huge growth for the insurance market in Turkey, becoming attractive for new entrants to the market (Deloitte, 2010, 13). New entrants within mergers and acquisitions to the market had fostered the development of attractive new insurance products. Asian investors are considerably interested in investing in Turkish Insurance sector. Sompo Japan Insurance, one of the insurance subsidiaries of NKSJ, bought the Fiba Insurance Co. in 2010 (KPMG, 2011, 26).

Furthermore, important changes especially the separation of life and pension companies in 2008 fostered the restructuring of the sector. Traditionally, the insurance companies in Turkey distribute their general products through corporations, agencies and brokers.

New forms of competition also continue to arise within the external market, such as banks, which have started offering general insurance products on a cross-selling basis called "bancassurance." Both the requirements of the related laws, marketing and operational processes assert that the sector is under revision. Since Turkish Financial Industry has a banking-weighted structure and the rise in the share of "bank insurance" practices continues, technological infrastructure and data system have to be revised to obtain competitive advantage. In the sector, the insurance and individual retirement industries took part on the fourth line until the year 2007. Then it increased to the third line in the year 2008 and it maintained its place in the years 2009 and 2010 (Başturk, 2012, 1085). Technological developments are influential in the insurance sector. Insurance companies can follow their customers' damage or loss practices through the websites. They are also able to perform online transactions like "Health Price Description," "Claims Processing," "Provisioning Operations on Pharmacy and Hospital," "Market Operations on Damaged Cars," "Portal Operations on Purchasing," "Insurance Operations," and "Policy & Receipt Imaging." The technological developments and new innovative efforts have a positive effect in some branches. Intelligent building control systems, with its various functions in terms of insurance, have a significant impact on the insurance industry. One of them is the ability of protecting the buildings against fire as it will reduce the risk of personal harm. The early- warning of fire, by activating the anti-system or sprinkler system, allows people to evacuate the building quickly and safely. Secondly, it is important in terms of protection of the assets of households. Smart buildings can take control

of the assets in case of floods and fires. This may help to reduce the cost to society. Finally, the third effect would be saving energy costs.

The importance of innovation strategies has been well recognized and the industry is growing by adopting technological and innovative requirements (Bayraktutan and Şahin, 2007, 96). Besides the innovation of products/services in the sector, the insurance industry also continue to invest in institutional developments. One of the significant developments in innovation is the TRAMER case. TRAMER was established to enable the database of the industry related to insurance and road traffic. TRAMER, co-operating with other databases of E-government, aims to provide reports, data and information for the users within the scope of the project.

Another similar development was in 2008, when the Insurance Information Centre (SBM) was established. SBM's purpose of foundation was to collect all the information about life, health and traffic insurance at one center so that the branches of compulsory insurance and the insurance operations could be conducted within a more comprehensive and effective way (Uğur and Akdemir, 2011, 26).

Again one of the companies known as "Ray Insurance Co" has brought about new applications and innovations in the insurance sector. The company aims to expand in the foreign reinsurance market to promote the potential of insurance of the responsibilities of the stakeholders in order to be more competitive in the global reinsurance market so that they may obtain the best terms and prices (Retrieved 01.05.2013 from http://www.raysigorta.com.tr).

Another company, "Ergo Insurance" promotes another innovative campaign to attract new customers. The company has developed a new product called "Our Housing Policy" for individuals who want to insure their houses, household goods and belongings against the damages caused by home accidents. "Our housing policy" offers provision for the damages of the risks that the tenant, the landlord, and the neighbour can face (Akıllı Yaşam, 2012, 8). The companies offering general insurance products provide excellent examples of how chief executives of medium-sized companies react to the major changes in the competitive environment (Johne and Davies, 2000, 6). Companies that aim to have a significant economic part of the private pension market need to emerge with customer-focused and creative approaches to differ from their competitors. Similar to life and pension markets, these approaches will determine the winners and losers in the market considering the private pension market is relatively a new born branch in the sector (Bayraktutan and Şahin, 2007, 104).

However, the insurance market has several obstacles that prevent the sector from growing faster. The most significant one is the legal abidements that force one to one relationship with customers. For instance, in the individual pension system provision for pension intermediaries, licensed representatives can not perfom sales unless they have a wet signature. In addition to the services, pre-sales and post-innovation efforts for the implementation of alternative distribution channels in the sector appear to be essential (Bayraktutan and Şahin, 2007, 103).

Another impediment is related to R&D activities. R&D activities which are an important determinant of innovation capacity haven't reached the expected levels in Turkey (Napier et al, 2004, 43). Moreover, decisions taken for the support of innovation in enterprises in Turkey still has severe problems, such as tax liabilities. Addtionally, special incentive mechanisms to support the formation and development of innovative companies are still insufficient (Çalıpınar and Baç, 2007, 447). Finally, it is essential to notify that the Turkish financial sector is quite susceptible to financial crises due to its fragile nature. 2008 has comprised significant affects of crisis and the sectoral mergers, take overs and acquisitions

in the sector. This characteristic is assumed to be one of the critical factors preventing the sector to improve in terms of innovative capacity (Çağıl and Karabay, 2011, 2-7).

Despite these obtacles acknowledged so far, the importance of the issue has been well recognized and the industry is growing by adapting technological and innovative requirements (Bayraktutan and Şahin, 2007, 96). In the recent years, the insurance industry has not only gained an increasing importance in the financial markets but has also begun to constitute a more dynamic structure. In this way, the insurance industry can realize the aims of generating profit, growth and preserving its existence while achieving the main objectives of sustaining the changing technology and the development of new services to customers (Yücememiş et al, 2011, 54-55).

FURTHER RESEARCH DIRECTIONS

As highlighted in the study, corporations that do not have an effective strategy for the management of innovation will not able to take the necessary steps to adopt rapid technological changes and promote sustainability. Innovation capability may have a different potential for providing a significant contribution in the management of innovation strategies. Further research should be directed at identifying and refining measures for different forms or degrees of innovation capability in the financial services. Therefore, a comprehensive study will provide a much clear picture of innovation perspective within the banking sector and insurance sector.

CONCLUSION

As the new economic order forces firms to introduce changes and new ideas in business, increasing competitiveness through globalization requires corporations to innovate more than ever before. The most important capability of how to create and maintain competitive advantage through innovation is the core question in today's management. This is mostly valid for the financial sector owing to its role as a major service provider in economy. Innovation, on the whole, makes a major contribution to the survival of banks and insurance companies, which are crucial to the economic growth of developing countries. In this context, the financial services need to innovate and redefine their core strategies in a creative manner. Although acknowledged by a variety of conceptual reserches from the literature, the issue of innovation through its strategic dimensions is far from providing adequate discussion for the scholars or corporations. This study has focused on exploring the determination of innovation, theoretical infrastructure and identification of its strategic value for the banks and insurance companies. Moreover, the study has illustrated the overall picture for the Turkish Financial Industry, particularly the banks and insurance services. Furthermore, the current innovative operations of the sector and the impediments against implementing innovation strategies have also been discussed.

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KEY TERMS AND DEFINITIONS

Competition Strategy: Refers to how a corporation competes in a particular business in the market.

Competitive Advantage: An advantage that provides the firm to generate greater sales or margins and/or retain more customers than its competitiors through differentiated products or services.

Innovation: The application of new products, services and processes of business that aims to meet new requirements and inarticulate needs of existing market and customers.

R&D Expenditures: Current capital expenditures (both public and private) that are undertaken to increase the use of knowledge for new applications of business which comprise the basic researches of a firm and its experimental development.

Strategy: Is a plan of action of a corporation that is designed to achieve a defined goal which will lead to acquire competitive advantage within a specified period of time.

Sustainability: This is generally a term related to business dymanics which is associated with the capacity of corporation to endure its operations, profit and overall practices.

Technological Innovation: Type of innovation that composes the dynamic network of agents involved in the generation, diffusion, and the utilisation of technology in a particular industrial area.

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Chapter 3
Internet Banking Adoption by the Customers of Private Sector Banks in India

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ABSTRACT

The rapid advancements in communication and information technology have changed the functional scenario of the banking sector significantly. The savings in time, money and effort by a novel channel of banking called as internet banking has been found to be an optional channel for the traditional banking. The objective of this study is to identify the determinants of internet banking adoption in private sector banks of India. Factors such as perceived usefulness, perceived ease of use, perceived risk, relative advantage and trialability have been found to be the determinants of internet banking in the previous studies. A new variable called conspicuousness has been introduced in the present study. Such a study has not been conducted in the Indian context antecedently. A model has been proposed and tested using various statistical techniques. The findings are of great use primarily for the banks which are planning to offer internet banking services, and for already existing banks to focus on the gaps.

INTRODUCTION

Globalization has opened the doors for foreign banks to expand their businesses in India. This resulted in the increase in the number of private banks in India. These private banks have revolutionized the banking sector significantly by providing the best of the services to its customers. The Indian banking sector is going through a series of innovations in its operational aspects. With the growing demand for convenience products and services, banks are striving hard to maintain the equilibrium. The economic fluctuations in the markets may result in positive and negative

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shocks to the banks Nathan et al. (2010). These external shocks for the banks may be inevitable if the business and funding models are faulty Aidan et al. (2008). Fadzlan (2010) empirically finds that foreign banks have higher technical efficiency compared to their domestic bank counterparts.

Financial service providers are trying to differentiate their products and services to gain an advantage over their competitors, by trying to offer services at customer's home. Even mobiles service providers have a large array of financial service offerings to attract new customers and to retain the existing. Internet has emerged as a convenient channel for these service providers Arpan et al. (2012). Organizations have been investing heavily in building information links with their suppliers and buyers to reduce costs and lead times to improve the timely customized delivery of products and services Jagdish et al. (2011). The recent and rapid developments in communications and information technology have brought unprecedented change in the lives of the people as well for banks. Internet has touched almost all aspects of human lives. The way we live, shop, entertain and interact all purely depend on the short word 'net' called Internet. With this rapid development in communication and information technology, various activities are handled electronically from the home or workplace. In fact, internet is a global phenomenon, making both time and distance irrelevant. Gordian et al. (2011) states that service industries started investing in information technology to bring cost savings in their operations. It has emerged as a convenient channel for many service providers. Therefore, internet definitely tries to influence the way people save and invest. The financial service providers, from the developed countries have been using internet as a channel to deliver their services more effectively and efficiently. Internet banking is defined as the delivery of banking services to customers through the internet Chi et al. (2007). Majority of the service providers from the developing countries started reaping the benefits by using internet as a service channel. The adoption of agile technologies and methodologies by the managers made the information system, qualitative and foolproof Kenneth et al. (2010). The financial institutions use information technology as a tool to grant loans and maintains records of individuals and enterprises that have been evaluated as credible Tarik et al (2009). Tero et al. (2004) define internet banking as the internet protocol through which customers can use different banking services ranging from bill payment to making investments. The costs of information technology appear to have a stronger positive impact on bank performance when there are greater environmental changes Abbaset al., (2012). Ruiliang et al. (2012) examines that, it is very much essential for banks to share the information between the online and traditional retailers for a profitable e-business

Internet banking is the tool which allows consumers to do the banking transactions from the comfort of a home with the help of an internet connection. Today, bank consumers round the globe are looking for the ease and convenience of internet banking to take care of their financial needs. People are being comforted by the newer methods and technologies of accessing the internet to check the status of their finances by the click of a mouse. Internet banking uses more traditional technologies such as personal computers and internet in order to pay bills, transfer funds and obtain account information Mavri (2006). The benefits of internet banking are vivid which add value to customers' satisfaction in terms of quality of services as well to gain competitive edge over the competitors. Managing and integrating the financial data of the consumers globally is a major concern for banks as the data is spread worldwide.

The diffusion of latest technology, computers and growth of internet make customers crave for varieties of services and more of convenience. The diffusion of innovations model proposed by Rogers (1962) includes five characteristics such as relative advantage, compatibility, complexity,

observability, trialability which influences the consumer acceptance of new products or services. The rate of adoption of a innovation depends on the complexity of the innovation, the more complex is the innovation, the lower is its rate of adoption (Tornatzky & Klein, 1982). According to Black et al. (2001), it would take more time for the diffusion of innovations if the service is complicated and difficult to understand. These have given rise to the need for such a study on internet banking in the Indian context. Though numerous studies have been conducted on this topic before, still this research is not superfluous because internet banking is a very vivacious in today's scenario and hence it needs to be constantly updated and studied. This paper seeks further to understand the development of internet banking in the Indian context through an investigation of the factors that influence customers' acceptance of internet banking services. Only the private sector banks of India have been considered in the present study. Intention to use internet banking services has been taken as the dependent variable in the present study.

The rest of the paper is organized as follows. First, we deal with the review of the relevant literature. Then, we outline the proposed research model and the hypotheses. Next, we describe the salient aspects of data collection. Afterwards we provide data analysis and results. Followed by the conclusions.

LITERATURE REVIEW

Internet banking channel has been found out to be the cheapest delivery channel for delivering the banking products and services once established (Sathye, 1999). The lack of awareness about the benefits offered by internet banking services and security concerns have been found out to be the impediments for the adoption of internet banking services by consumers. The objective of internet banking is to provide financial services to consumers round the clock from any remote location across the globe. Hence, in order to be successful in providing these services, banks are keen to understand the reasons for adoption of internet banking services. This has led to the enormous research in the field of banking. Recent literature on banking industry reveals that several researchers have investigated the adoption of internet banking. It has been proved that internet banking channel is the cheapest delivery channel for banking products once established. Cost savings, time and freedom from place have been found to be the main reasons for the acceptance of internet banking (Blacket al., 2002). Several studies indicate that perceived usefulness and perceived ease of use are the crucial factors for any innovation or technology acceptance which was adopted from the technology acceptance model proposed by Davis (1989). Perceived usefulness has been defined as the degree to which a person believes that using a particular system would enhance his/her job performance (Davis, 1989). Whereas perceived ease of use is the degree to which a person believes that using a system would be free of effort Davis (1989).

Customers comprehend internet banking transactions to be risky and more prone to fraud as there is a monetary value involved. Therefore, perceived risk has been found to be one of the major factors which hinder the acceptance of internet banking (Sathye, 1999; Tan & Teo, 2000). Perceived risk may include financial, physical, or social risks which are associated with trying an innovation (Polatoglu et al., 2001). Bauer (1960) defines perceived risk as the risk involved in any action of a consumer that will produce consequences, which cannot be anticipated with certainty, and some of them are likely to be unpleasant. Walker et al. (2002) state that customers are worried that technology based service delivery systems will not work as expected. If the level of willingness to take risk exceeds the level of perceived risk only then consumers adopt internet banking services. The opportunity to try an innovation is an effec-

tive way of reducing perceived risk and hence may lead to adoption of the innovation. According to Rogers (1983), consumers might adopt an innovation if they are given the opportunity to try the innovation. Gerrard et al. (2003) defines trialability as the degree to which an innovation may be experimented with on a limited basis. Tan and Teo (2000) suggest that by trying a technology users feel more comfortable with the innovation and are more likely to adopt it.

Relative advantage has been found to be an important element in the adoption of internet banking. It is often referred to as convenience, cost, time and effort savings with a decrease of discomfort in the adoption of an innovation (Rogers, 1983). Internet banking has been found to be hassle free and more advantageous compared to other banking options. (Blacket al., 2001). Derrick (2012), consumers consider not only the relative advantage afforded by currently available products, but also the relative advantage expected from future generation products. It is presumed that a consumer who perceived internet banking to advantageous over other banking options would adopt the services.

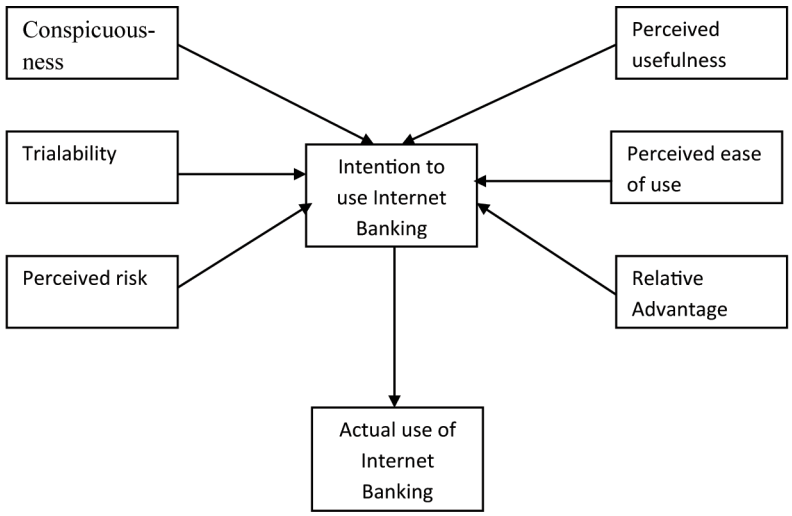
A high visibilty of the internet banking services in the media is termed as conspicuousness which has been derived from the model of diffusion of innovation (Rogers, 1983). Rogers (1983) considers visibility as observability and later Moore and Benbasat (1991) redefine it as two constructs namely visibility and result demonstrability. But, Blacket al. (2001) find that a simple visibilty has no effect on the adoption of any innovation.

In the present research, a new construct called conspicuousness which means a high level of visibility has been introduced. The utilization of the traditional theoretical models with minor modifications and variety of analyses in the Indian context makes this study unique. This study focuses on individual perspective and proposes to identify factors that influence adoption and use of internet banking services by customers of private sector banks in India.

RESEARCH MODEL

From the literature review, the crucial factors for the adoption of internet banking services have been identified as perceived usefulness, perceived ease of use, perceived risk, relative advantage, trialability, and conspicuousness. The following hypotheses have been formulated and tested. Figure 1 illustrates the proposed research model.

Figure 1. Proposed research model



FORMULATION OF HYPOTHESES

- **Perceived Usefulness (PU):** Davis (1989) defines PU as the degree to which a person believes that using a particular system would enhance his or her job performance. From the technology acceptance model proposed by Davis (1989), it is evident that PU is a significant factor affecting acceptance of an information system. Further, from the prior studies on internet and internet banking, perceived usefulness has been found to be an important determinant in the adoption of internet banking services. So, in the context of internet banking, perceived usefulness may be explained as performing the banking tasks anytime and from any location. Therefore, the following hypothesis has been tested:
  H1: Perceived usefulness will have a positive effect on the intention to use internet banking.
- **Perceived Ease of Use (PEOU):** Davis (1989) defines PEOU as the degree to which a person believes that using a system would be free of effort. From the technology acceptance model, PEOU is a major factor which affects the acceptance of information system (Davis et al., 1989). In the context of internet banking, perceived ease of use may be explained as using a system which is perceived to be easier to use than the conventional one. A significant number of studies suggested that perceived ease of use influences intention (Agarwal & Prasad, 1997). Thus, the following hypothesis has been proposed:
  H2: Perceived ease of use will have a positive effect on the behavioral intention to use internet banking.
- **Perceived Risk:** Perceived risk, in the context of internet banking may be associated with the financial loss as a result of using the services or with the electronic delivery channel. Black et al. (2001) have analyzed perceived risk in terms of risk of error and the level of security. A large number of studies have found that perceived risk is one of the major factors affecting user adoption of internet banking. Thus, the following hypothesis has been formulated:
  H3: Perceived risk will have a negative effect on the behavioral intention to use internet banking.
- **Relative Advantage:** Rogers (1962) defines relative advantage as the degree to which an innovation is perceived as being better than the idea it supersedes. Relative advantage in the context of internet banking may be explained as allowing customers to access their bank accounts from any location and at any time of the day in contrary to the traditional banking. Tornatzky et al. (1982) find relative advantage to be an important factor in determining the adoption of new innovations. Also, a large number of studies have found relative advantage as a crucial factor in the adoption of internet banking. This leads to the following hypothesis:
  H4: Relative advantage will have a positive effect on the behavioural intention to use internet banking.
- **Trialability:** According to Rogers (1983), consumers might adopt an innovation if they are given the opportunity to try the innovation. Gerrard et al. (2003) define trialability as the degree to which an innovation may be experimented with on a limited basis. In the context of internet banking, trialability can be viewed as the ability to access one's own account and carrying out the banking transactions on a trial basis preferably at bank premises with the help of bank personnel who will be able to demonstrate how it works and the benefits it offers. This reduces the fear of adopting internet banking services and

encourage the potential customers to adopt it. Thus, the following hypothesis has been tested:

H5: Trialability will have a positive effect on behavioral intention to adopt internet banking

- **Conspicuousness:** Conspicuousness can be defined as high visibility. It can be viewed as the coverage of internet banking in the media i.e attracting the attention of the society. With such an exposure of internet banking, potential customers could gain knowledge about the services and its benefits. If such information about the services and benefits can be shared with friends and colleagues, then there is a chance of adoption. Thus, the following hypothesis has been tested:

  H6: Conspicuousness will have a positive effect on behavioral intention to adopt internet banking.

DATA COLLECTION

The data for this study has been collected by means of a survey conducted in a metropolitan city in India, with the help of a questionnaire. Filled in questionnaires were obtained from three different locations i.e., colleges, corporate offices and banks. This results in a sample that is well distributed in terms of demographics. A total of 450 questionnaire forms were delivered to the customers of private sector banks, out of which 347 filled in forms were received giving a response rate of 77 percent. The questionnaire consists of questions that are related to demographic information, the possible factors affecting the acceptance of internet banking and the use of internet banking services.

The questionnaire has been developed and tested with a focus group consisting of banking professionals. The focus group verified that the hypotheses developed might be the affective factors in explaining the adoption of internet banking. Based on the feedback from the focus group, the questionnaire was modified. Before proceeding with the main survey, the questionnaire was validated through pre-testing. This resulted in an error-free final questionnaire. A five point Likert scale ranging from strongly agree to strongly disagree is used as a basis to know the respondent's views. The intention to use internet banking services has been chosen as the dependent variable in the model.

The sample size is calculated using the following general formula.

$$N = P\,(1 - P)\,Z^2_{\alpha/2}/e^2$$

where,

N= number of observations required
P= 0.085 = percentage of internet proportion in India
(internet penetration in India) =8.5%
$Z_{\alpha/2}$ = 1.96, standard normal variate at 95% confidence interval
e = error = 0.05

Thus, the sample required has been obtained as 119. In the actual study, the sample size is chosen as almost thrice the required sample size so that the resultant sample represents the entire population.

RESULTS AND ANALYSES

The data was analysed using SPSS version 16.0 (statistical package for social sciences). The demographic profile of the respondents is shown in Table 1.

From Table 1, it is found that 41.9% of the respondents are in the age group 26-35 years, 71.2% of the respondents are male, 40.3% of the respondents are post graduates, 65.1% of the respondents are professionals/officers, 37.5% of the

Table 1. Characteristics of the sample

Variable		Frequency	Percentage
Gender	Male	247	71.2
	Female	100	28.8
Age	18 - 25	145	41.9
	26 - 35	138	39.8
	36 - 45	46	13.3
	46 - 55	9	2.3
	56-65	9	2.6
Education	Pre-degree	2	0.6
	Degree	137	39.5
	Post Graduation	140	40.3
	Research	25	7.2
	Diploma	43	12.4
Occupation	Student	20	5.8
	Faculty	39	11.2
	Professional	226	65.1
	Supervisor	8	2.3
	Technician	6	1.7
	Business	22	6.3
	Retired	26	7.5
Income (Rs./-)	< 1.6 Lakhs	38	11
	1.6 - 3 Lakhs	85	24.5
	3 - 5 Lakhs	130	37.5
	5 - 8 Lakhs	62	17.9
	8 - 10 Lakhs	15	4.3
	> 10 Lakhs	17	4.9
Internet Usage	1 - 2 Years	16	4.6
	2 - 3 Years	27	7.8
	3 - 5 Years	87	25.1
	5 - 7 Years	92	26.5
	> 7 Years	125	36

respondents are in the income range Rs.3 Lakhs - 5 Lakhs and 36% of the respondents have been using internet for more than 7 years.

Reliability Analysis has been carried out to check the internal consistency of items. Construct reliability has been analysed by calculating the values of Cronbach's alpha. Nunnally (1978) recommends the value of Cronbach's alpha to be at least 0.7 to show high internal consistency. Cronbach's alpha values of the factors are shown in Table 2.

In the present study, the Cronbach's alpha values of all the factors have been found to be higher than the recommended value which shows a high internal consistency of the measures.

A confirmatory factor analysis has been conducted on the items comprising perceived usefulness, perceived ease of use, perceived risk, relative advantage, trialability, conspicuousness and intention to use. The Kaiser criteria of eigen values greater than 1 has been used to determine the initial number of factors to retain. The Kaiser-Meyer-Olkin (KMO) measure was 0.833. From the Bartlett's sphericity test, the value of chi-square is found to be 7251 with a significance of 0.000. Hence, the constructs have been found to be valid.

Multi-regression analyses are performed to test the hypotheses and to examine the associations among the constructs. The results have been reported in Table 3, Table 4, and Table 5.

Table 2. Cronbach alpha values

Factor	Cronbach Alpha Value
Perceived usefulness	0.854
Perceived ease of use	0.883
Perceived risk	0.810
Relative advantage	0.931
Trialability	0.778
Conspicuousness	0.833
Intention to use	0.837

Table 3. Regression model

Model	R^2	Adjusted R^2	Std. Error of the Estimate
1	0.645	0.639	0.66406

Independent Variables: Conspicuousness, Perceived Risk, Perceived ease of use, Trialabilty,

Relative advantage, Perceived usefulness, Dependent Variable: Intention to use

Table 4. ANOVA result

Model	Sum of Squares	df	Mean Square	F	Sig.
Regression	272.766	6	45.461	103.092	0.000
Residual	149.932	340	0.441		
Total	422.698	346			

Table 5. Regression result

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	0.070	0.268		0.263	0.793
Perceived usefulness	0.504	0.059	0.423	8.490	0.000
Perceived ease of use	-0.084	0.040	-0.069	-2.126	0.034
Perceived risk	-0.044	0.042	-0.034	-1.030	0.304
Relative advantage	0.261	0.061	0.229	4.248	0.000
Trialability	-0.031	0.048	-0.021	-0.638	0.524
Conspicuousness	0.277	0.057	0.248	4.887	0.000

A linear multiple regression analysis has been carried out on the proposed model, where intention to use is the dependent variable and perceived usefulness, perceived ease of use, perceived risk, relative advantage, trialability and conspicuousness are the independent variables. From the ANOVA result shown in Table 4, it is evident that the model applied is significantly good enough in predicting the outcome variable. From the results of regression analysis shown in Table 3 it is found that the coefficient of determination R^2 is 0.645. This means that 64.5% of the variability in the dependent variable (i.e intention to use internet banking) can be explained by the independent variables such as perceived usefulness, perceived ease of use, perceived risk, relative advantage, trialability and conspicuousness. The R^2 value and the adjusted R^2 value are very close which implies that the model includes only the factors that are significant, i.e., the model is not over specified.

Hence, the multiple regression equation is:

Intention to use internet banking services = 0.070 + 0.504*Perceived usefulness - 0.084 * Perceived ease of use - 0.044*Perceived risk + 0.261*Relative advantage -0.031*Trialability + 0.277*Conspicuousness

According to the hypothesis H1, perceived usefulness will have a positive effect on the intention to use internet banking. From Table 5, perceived usefulness is found to be statistically significant at 0.05 level ($\beta = 0.423$, $p = 0.000$). Thus, the hypothesis H1 has been supported. This suggests that the bank customers perceive internet banking to be useful.

The hypothesis H2 states that perceived ease of use will have a positive effect on the behavioral intention to use internet banking. Table 5 reveals that perceived ease of use is found to be statistically significant at 0.05 level ($\beta = -0.069$, $p = 0.034$). Thus, the hypothesis H2 is supported. This suggests that the bank customers perceive internet banking as easy to use.

According to the hypothesis H3, perceived risk will have a negative effect on the behavioral intention to use internet banking. It is found from Table 5 that perceived risk is statistically insignificant at 0.05 level (β = -0.034, p = 0.304). Thus, the Hypothesis H3 is negated. This means that the bank customers are not finding internet banking transactions to be risky. This may be because of the efforts taken by banks in making the internet transaction more secure.

The hypothesis H4 states that relative advantage will have a positive effect on the behavioural intention to use internet banking. The findings from Table 5 show that relative advantage is statistically significant at 0.05 level (β = 0.229, p = 0.000). Thus, the hypothesis H4 is supported. This means that bank customers are perceiving internet transactions to be relatively advantageous than the traditional banking.

Hypothesis H5 states that trialability will have a positive effect on behavioral intention to adopt internet banking. It is observed from Table 5 that trialability is statistically insignificant at 0.05 level (β = -0.021, p = 0.524). H5 is therefore negated. The possible reason for the failure of the hypothesis is lack of support from the banks to offer the services on a trial basis.

The hypothesis H6 states that conspicuousness will have a positive effect on behavioral intention to adopt internet banking. Table 5 reveals that conspicuousness is found to be statistically significant at 0.05 level (β = 0.248, p = 0.000). Thus, the hypothesis H6 is supported. This means that the higher the visibilty of the banks services in the public media, the higher would be the rate of adoption.

In summary, out of the six hypotheses, four were found to be statistically significant in this empirical study. Rejection of hypothesis H3 reveals that perceived risk has a positive effect on internet banking. Hence, only one hypothesis H5 is rejected.

CONCLUSION AND FUTURE RESEARCH DIRECTIONS

In India, internet banking is an emerging banking service and has not been widely accepted by customers because of various reasons. Many banks are striving hard to provide the best internet banking services to their customers. It is important for bank managers to frame their problems appropriately and address them in a proper manner. Otherwise, the problems poorly addressed may create more problems and take longer time to fix in the long run (John, 2010). Hence, it is of prime importance for bank managers to identify the factors that influence the adoption of these services. The aim of this paper is to determine the significant factors which influence the consumer's adoption of internet banking services. The results of this study show that perceived usefulness, perceived ease of use, perceived risk, relative advantage, and conspicuousness are the important determinants of internet banking adoption. The findings clearly state that the factors which were discarded in the prior studies have shown a significant influence in the Indian context in this present study. This might be a result of the cultural and perceptual differences. As such, there is still room for further investigation into the adoption of internet banking in India. We could investigate our research model in different time periods and make comparisons, thus providing more insight into the phenomenon of internet banking adoption. Only private sector banks have been covered in the present study. An investigation of the consumer adoption of internet banking services offered by public sector banks can be carried out. Further, a comparison of both public sector and private sector banks is an extensive area for future research. Also, a study on the perspectives of corporate banking customers can be an ideal work for future.

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Chapter 4
Causality between Credit Deposit Ratio and Credit Share in Major Indian States during 1972 –2008

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ABSTRACT

The Indian economy has undergone different structural shifting in its history of development since 1947. One major break was the liberalization of the economy in the period 1991-92 and the reforms in the banking and financial sectors deserved a special attention in the study. The banking sector reform was done under the intention to make more investible banking funds for real investment to raise credit-deposit ratio along with proper allocation of banking funds to all the states so that share of credit of each state is balanced. Literature shows the falling tendency of credit-deposit ratio in the immediate decade after the reform and the rising tendency of divergence in credit possession among the states. At the same time, the states lacking in credit-deposit ratio are either with higher, lower, or moderate shares of credits. This study, hence, tried to examine the direction of causalities between credit-deposit ratio and credit share for the major 16 states of India. Using the time series econometrics technique, this study found 4 states where the causality works for the entire period and less than half of the state where causality works in either pre-reform or post-reform periods.

BACKGROUND

Indian financial system in its history has experienced different phases of developments ranging from the state control to relatively much market oriented status from the pre-independence to post independence era. During the post-independence era the financial sector has faced the nationalization regime that is the establishment of the state control mechanism and the liberalization regime that is the status of making the economy towards market orientation. The financial system of the

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country has several wings out of which the commercial banking sector occupies a vast area. Indian financial system, particularly the banking system had experienced a string of crises in terms of bank failures resulting into slow growth of this sector during the pre-independence period. Banking sector reform was done on the expectation of allocation of more commercial banks' credit in particular relative to their levels of deposits to the existing real sectors vis-à-vis reducing operating costs of banks and statutory reserve and cash reserve ratios. Empirical researches in this area have shown that there are phenomenal growth of levels of credits and deposits of the commercial banks of the major states in India after the reform process initiated compared to the pre-reform phase but the level of credit deposit ratio have unquestionably gone down in the first decade of the reform era and then tend to rise (Das & Maiti 1998, Misra 2003, Das & Ray 2009, and Das 2011). At the same time, the states are diverging in terms of the credit possession by them after the reform periods. Some states are improving in terms of credit deposit ratio but lacking in credit share out of the total credit and on the other hand some states are improving in credit share also improving in credit deposit ratio.

There are also plenty of literatures related to role of financial development upon economic growth. Its variant which is very popular in the field of research is the economic growth and financial inclusion. This leads to study of causality between financial development and economic growth in different economies. Different research works consider different financial and banking variables as the proxy of financial development like aggregate credit, credit-deposit ratio, credit shares, credit to GDP ratio, etc. The noted studies in this area are Schumpeter (1911), Patrick (1966), Diamond (1984), Greenwood & Jovanovic (1990), King & Levine (1993), Demetriades & Hussein (1996), Beck et al (2000), Kiran et al (2009), Bhanumurthy & Singh (2009), Kar and Pentecost (2000), Hussain and Chakraborty (2012). There are some studies which point out that financial development has no such role in economic development (Lucas 1988, Demetriades & Luintel 1996, Sarkar 2009).

But it is a matter of debate that an economy with good performance in converting its deposits to credits may or may not perform well in the field of possessing credit out of the total economies. In the other way to state, particularly with reference to the study on Indian states, can a state with dominance in credit delivery out of the total credit of the country can also have efficiency in utilizing its total deposit, or the reverse. That particular issue has been the central part of our study. There is really a scarcity in the literature on that particular issue. Hence, our present study concentrates on the relations between these two banking variables for the Indian states.

Objective of the Study

This study tries to examine the direction of causality between credit-deposit ratio and credit share for the major states in India.

Plan of the Study

This study has been organized in the following manner. Section 4 establishes the data source and methodology. Section 5 highlights the trends of credit-deposit (C/D) ratios and credit shares of the states. Section 6 analyses the causality results for the short runs (both pre and post reforms periods) and long run (for the entire period of study). Section 7 concludes.

DATA AND METHODOLOGY

The present study uses the annual data on credit and deposit (both in current values) of the scheduled commercial banks situated in different states published by The Reserve Bank of India. The period of study is 1972-2008 out of which the pre

reform phase is 1972-1992 and the post reform phase is 1993-2008. It is assumed that the amounts of deposits created by any bank within a state are used as credit for the investors of the same state. Our analysis covers sixteen major states in India combining both developed and backward features. The states are Andhra Pradesh (AP), Gujarat (Guj), Maharashtra (Maha), Orissa (Ori), Tamil Nadu (TN), Uttar Pradesh (UP), Delhi (Del), West Bengal (WB), Assam (Asa), Bihar (Bih), Madhya Pradesh (MP), Haryana (Har), Punjab (Pun), Rajasthan (Raj), Karnataka (Kar) and Kerala (Kera).

Primarily we have applied the graphical tools for representing our data on credit deposit (C/D) ratio and credit share of each of the states over time where the latter is computed by the amount of credit of any state in a year divided by the aggregate credit of the sixteen states taken together as they cover around 75 per cent of the total credit in India. Since we have time series data for 37 year points the series may suffer from unit root problem or the series may not be stationary. Our analysis of causality tests between C/D ratio and credit share needs regression analysis and the regression of two non stationary time series variables give spurious results. Hence, we need basic time series exercises to be done.

In this paper we have used two different econometric methodologies, which are described briefly as follows. Section *4.1* discusses the econometric methodology of Granger Causality Test (GCT) and Section *4.2* fully describes the procedures of unit root test and cointegration and related error correction model (ECM).

The Methodology of GCT

In this section we describe the methodology of GCT that we have used in the present study (Granger (1969), Hamilton (1994)). The GCT is a statistical technique that helps to detect the nature of causality between two variables X_t and Y_t that may be present in a given time series data set on the variables. Application of the test requires the time series of the concerned variables to be stationary. Thus, it is necessary to examine first whether the time series of the variables are stationary or not. In case they are found non-stationary, they are transformed into stationary series by successive differencing until the differenced series become stationary. The augmented Dickey-Fuller *(ADF)* and Phillips–Perron *(PP)* unit root tests are used to test for presence of unit root in the original (level)/differenced time series of the variables to ascertain the required stationarity. The *GCT* for a pair of non-stationary (integrated of order 1) variables *X* and *Y* is performed by estimating the following pair of *autoregressive distributed lag* regression equations:

$$\Delta Y_t = \alpha_{11} + \sum_{i=1}^{T_{11}} \beta_{11i} \Delta Y_{t-i} + \sum_{j=1}^{T_{12}} \beta_{12j} \Delta X_{t-j} + u_{12t} \quad (1)$$

$$\Delta X_t = \alpha_{21} + \sum_{i=1}^{T_{21}} \beta_{21i} \Delta X_{t-i} + \sum_{j=1}^{T_{22}} \beta_{22j} \Delta Y_{t-j} + u_{22t} \quad (2)$$

Here Δ denotes the difference operator, Y_t and X_t denote the values of the variables *X* and *Y* at time *t*, respectively, *T's* denote the number of lags, α's and β's denote regression parameters, and u_t's denote the equation disturbances.

The null hypothesis that X_t does not cause Y_t is rejected, if H_0: $\beta_{12j}=0$, for all *j* is rejected. Analogously, rejection of the null hypotheses H_0: $\beta_{22j}=0$ for all *j* signifies that Y_t does not cause X_t. F tests are performed to test these hypotheses.

The *GCT* gives rise to one of the following four conclusions:

1. *X* causes *Y*, but *Y* does not cause *X*,
2. *Y* causes *X*, but *X* does not cause *Y*,
3. Both *X* and *Y* cause each other, and finally
4. Neither *X* causes *Y* nor *Y* causes *X*.

While (1) and (2) are cases of unidirectional causality, (3) and (4) correspond to bidirectional causality and absence of causality, respectively.

Unit Root Test

As already mentioned in above section of this paper we have examined whether credit deposit ratio – credit share data for different states were cointegrated using the Engle-Granger (1987) bivariate cointegration analysis framework and estimated *ECM* for each state for which cointegration was observed to be significant, using econometric techniques appropriate for these data set[1]. The econometric exercise involved three steps. In the first step, the unit roots test was performed for all the states' series of credit-deposit ratio and credit share to ascertain whether or not the time series of the variables contained stochastic trend. In the second step, cointegration of credit deposit ratio and credit share series for all the states was examined. Finally, in the third step, the *ECM* was estimated for those states for which cointegration of credit deposit ratio and credit share had been found.

In the first step test procedure was used to test the presence of unit root in the time series data sets for individual states. The same procedure was also used in the second step while performing the Engle-Granger bivariate cointegration analysis. Finally, the third step was estimated by using ECM technique.

Unit Root Test

For a data set (y_t, $t = 1, 2, \ldots, T$), where t denotes time let us consider the following linear regression set up for unit root test for two versions of the *ADF(p)* (1979) regression–viz.,

$$\Delta y_t = \alpha + \beta y_{t-1} + \sum_{j=1}^{p} \gamma_j \Delta y_{t-j} + error$$

for the *without time trend case* and

$$\Delta y_t = \alpha + \delta t + \beta y_{t-1} + \sum_{j=1}^{p} \gamma_j \Delta y_{t-j} + error$$

for the *with time trend case*.

Co-Integration Test

Given a data set on two variables (y, x) the single equation cointegration test proceeds as follows: First, the linear regression equation $y_t = \beta x_t + U_i$ is estimated separately for individual state and the estimated regression residuals given by the following equation

$$e_t = y_t - \hat{\beta} x_t, \; t = 1,2,\ldots, T \qquad (3)$$

are obtained, where $\hat{\beta}$'s denote the estimated parameters of the regression equation for each state. These estimated linear regression equations may be taken as estimate of the long run equilibrium relationship between y and the x, in case the variables turn out to be cointegrated.

Next, for each *state* the following *ADF (p)* equation is estimated:

$$e_t = \lambda e_{t-1} + \sum_{j=1}^{p} \theta_j \Delta e_{t-j} + v_{tp} \qquad (4)$$

where ν_{tp} is the equation disturbance term assumed to be a white noise. Methodology of cointegration test for the set of variables under consideration thus involves the test of unit root for the regression residuals $\{e_t\}$ i.e., the null hypothesis H_0: $\lambda=1$ (i.e., no cointegration) is tested against the alternative hypothesis H_1: $\lambda<1$ (i.e., cointegration).

Estimation of ECM for Individual State

Once the pair of variables (x, y) has been found to be cointegrated, the next step in the Engle–Granger methodology is to model the short run variations of the variables. This is done by estimating the

ECM. For a bivariate case as the present one, the *ECM,* which is implied by the well known *Granger Representation Theorem* (Hamilton, 1994), is expressed as either of the following linear regression equations:

$$\Delta y_t = \mu_{yx} + \sum_{j=1}^{T_{11}} \alpha_{1j} \Delta y_{t-j} + \sum_{j=1}^{T_{12}} \beta_{1j} \Delta x_{t-j} + \eta_{yx} ECY_{t-1} + u_{1t} \quad (5)$$

$$\Delta x_t = \mu_{xy} + \sum_{j=1}^{T_{21}} \beta_{2j} \Delta x_{t-j} + \sum_{j=1}^{T_{22}} \alpha_{2j} \Delta y_{t-j} + \eta_{xy} ECX_{t-1} + u_{2t} \quad (6)$$

Here Δ denotes the first difference operator; T_{lm}, l, $m = 1, 2$ denotes the number of lagged values of Δy and Δx that affect the current value of these *differenced* variables; μ, α, β, and η denote regression parameters; u_{lt}, $l = 1, 2$ are the equation disturbance terms (that should be white noises when the *ECM* has been adequately specified); and finally, $ECY_t = y_t - \hat{\varphi}_0 - \hat{\varphi}_1 x_t$ and $ECX_t = x_t - \hat{\phi}_0 - \hat{\phi}_1 y_t$ are the error correction terms (hereafter referred to as *EC terms*) measuring deviation of $y_t(x_t)$ from the corresponding long run equilibrium value, given $x_t(y_t)$.[2] The parameters η_{yx} and η_{xy} in Equations (5) and (6) are called the adjustment parameters. They are expected to have negative values[3]. In this set up the nature of Granger causality is determined as follows:

1. If $\beta_{1j}=0$ for all j and $\eta_{yx}=0$, x may be said not to *Granger cause y*.
2. If $\alpha_{2j}=0$ for all j and $\eta_{xy}=0$, y may be said not to *Granger cause x*.
3. If (1) holds but (2) does not, *Granger causality* may be said to be *unidirectional from y to x*.
4. Conversely, if (1) does not hold but (2) does, *Granger causality* may be said to be *unidirectional from x to y*.
5. If both (1) and (2) do not hold, *Granger causality* between x and y may be said to be *bi- directional*.
6. If both (1) and (2) hold, *Granger causality* between x and y may be said to be absent (see Enders (1995), Glasure and Lee (1997) and Asafu-Adjaye (2000) for details).

In the present exercise, Equations (5) and (6) were estimated separately for each state. State-specific inference about the nature of *Granger causality* between x and y were then drawn by performing appropriate test of hypothesis for the relevant parameters of model, as laid down above.

GRAPHICAL PRESENTATION OF CREDIT DEPOSIT RATIO AND CREDIT SHARE OF STATES

Credit Deposit ratio represents the actual loans and advances as a proportion of total deposit collected in a particular year for any state. It also indicates the efficiency and productivity of the bankers as well as total fund for productive purpose. The ratio, in other words, presents the coefficient of conversion of total investible funds of the banks to real sectors' investment after deducting the statutory reserves to be kept in different forms in line with the guidelines of the Reserve Bank of India, the central bank of India. A state with high C/D ratio means it is efficient in utilizing its total deposit money and is expected to have positive impact upon the domestic product of that particular state. Conversely, a low C/D ratio state means it is weak in efficiency ground so far as conversion of deposit into credit is concerned.

On the other hand, share of credit of any state out of the total credit of the sixteen states clubbed together represents the position of the state in

holding an expected power to utilize it into productive purposes. A high share state implies that it has high capacity to utilize the fund in different purposes and also in aggregate domestic product so that it can lead the country in terms of output, investment and employment opportunities.

A state with high credit share is expected to have high C/D ratio and a low share with a low C/D ratio. But in reality there can be different combinations of results between these two credit variables. Figure 1 and Figure 2 present the C/D ratio of all the selected states over time and Figure 3 and Figure 4 present the credit share of states over time.

The observed series of C/D ratio of the states show fluctuations over time and they are seemed to be non stationary at their level values. Tamil Nadu has been the top state with a C/D ratio of around 95 per cent throughout the entire period. The states to follow it are Karnataka, Maharashtra and Andhra Pradesh etc. The states in the bottom line are Uttar Pradesh and Bihar who are able to convert 40 per cent of their deposit money into credit for their own economic activities. For most of the states, the trends follow downward up to the year 2002 and after that the rising trends start.

It is observed from the Figure 3 and 4 that the trends of credit shares of all the states are also non

Figure 1. Credit-deposit ratio of states

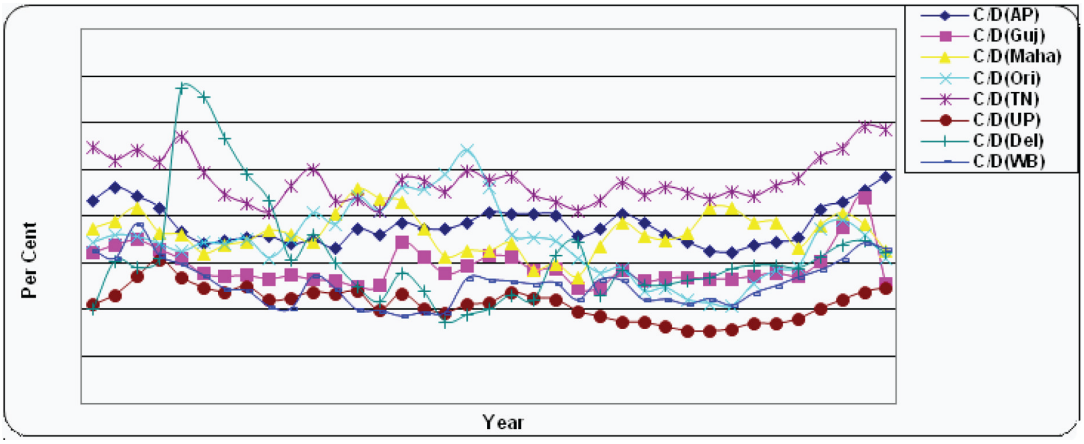


Figure 2. Credit-deposit ratio of states

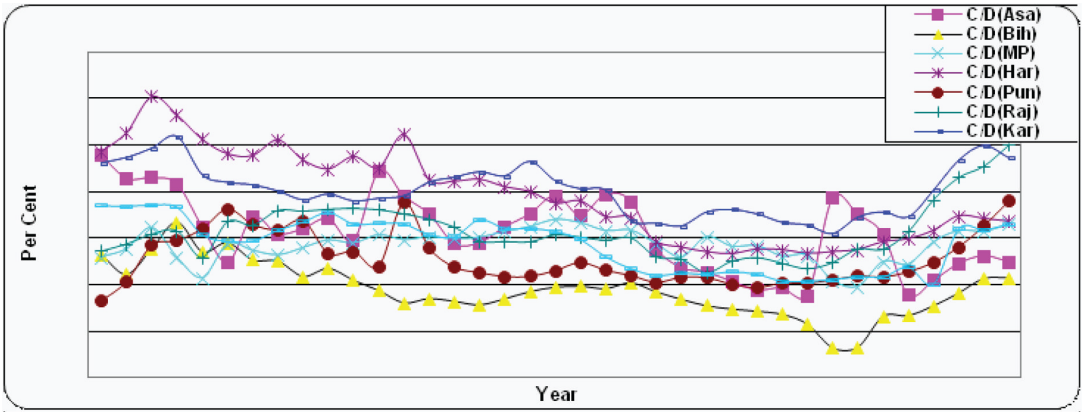


Figure 3. State-wise share of credit

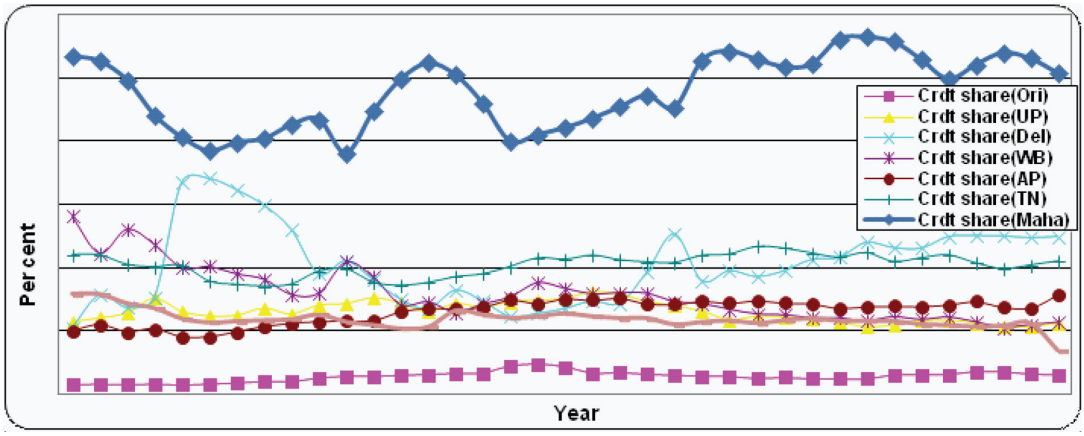
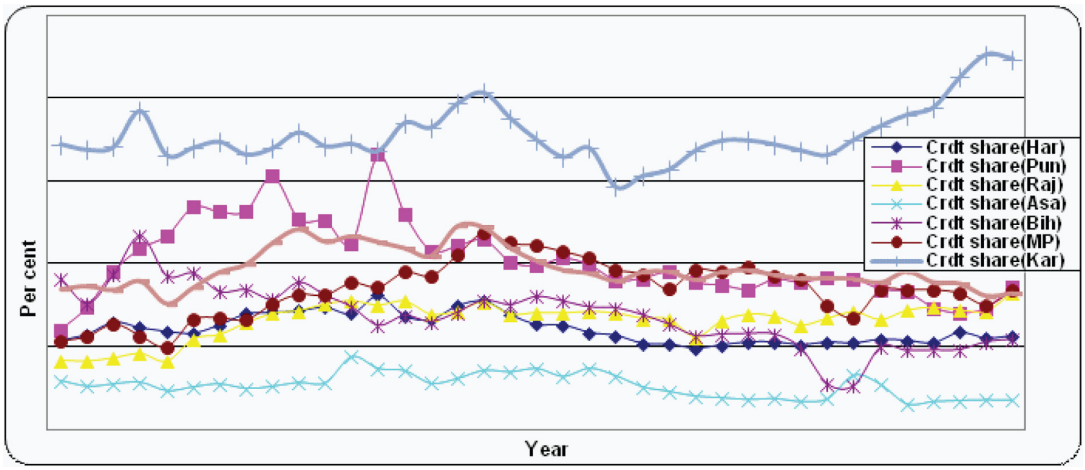


Figure 4. State-wise share of credit



stationary at their level values. Maharashtra is the top state in the list possessing around 25 per cent of credit of the all states' credit clubbed together. The states following Maharashtra are Tamil Nadu, Delhi, and Karnataka etc. In some states the shares of credit takes upward trend during the pre reform phase but downward in the post reform phase. The states that are lying at the trough are Assam, Orissa, Haryana and Rajasthan, etc.

The figures of credit shares show the presence of disparity as the top four states possess over half of the total credit allocated for their economic activities. The rest twelve states occupy less than half of the total credit for their economic activities. Now it is a natural question of whether a state improving in C/D ratio is also improving in its credit share or not. To explore this we need to study further the state specific trends of C/D ratio and credit share.

To have closer look on the interrelations between the C/D ratio and credit shares for states we have ranked the states in some specific time points with respect to these two credit variables. It is observed from Table 1 that for five time points (1972, 1982, 1993, 2003 and 2008) the states in most cases are varying in their positions. In respect

Table 1. Ranks of states in C/D ratio and credit share over periods

Year/ States	1972 (C/D)	1972 (Share)	1982 (C/D)	1982 (Share)	1993 (C/D)	1993 (Share)	2003 (C/D)	2003 (Share)	2008 (C/D)	2008 (Share)
Andhra Pradesh	5	8	7	8	2	6	4	5	3	5
Assam	3	14	10	16	3	16	5	16	14	16
Bihar	12	9	16	12	16	12	16	14	16	14
Delhi	15	7	6	2	7	3	6	2	11	2
Gujarat	10	4	14	7	11	7	9	8	13	8
Haryana	2	13	2	14	5	14	7	13	6	13
Karnataka	4	5	4	6	6	8	3	4	4	4
Kerala	7	10	9	10	13	10	13	9	7	11
Maharashtra	6	1	8	1	10	1	2	1	10	1
Madhya Pradesh	13	12	11	11	8	9	12	11	8	10
Orissa	8	16	3	15	4	15	8	15	12	15
Punjab	16	11	12	9	15	11	14	10	5	9
Rajasthan	11	15	5	13	9	13	10	12	2	12
Tamil Nadu	1	3	1	4	1	2	1	3	1	3
Uttar Pradesh	14	6	15	5	14	5	15	7	15	7
West Bengal	9	2	13	3	12	4	11	6	9	6

to C/D ratio Tamil Nadu is at first position but it's rank in credit share slightly fluctuating. On the other hand, Maharashtra ranks first in credit share but ranks differently in terms of C/D ratio. Therefore, we need to study which series causes whom for a particular state that is the central objective of the present study.

RESULTS AND DISCUSSION

Following the methodology regarding the examination of the natures of time series on C/D ratio and credit share of states and the graphical view of the series we have tested first whether the series are stationary or not. In other words, we have first run the unit root test of both the series for all the selected states for the entire period. The results are presented in Table 2. It is observed that all the series, except a few one, are non stationary at their levels but they are all I(1) series. This means their first difference series values will be stationary. The regression analysis for two first differenced series will not produce any spurious results. At the same time, if two series of a particular state are I(1) series then their errors will be stationary that means the series will be cointegrated to each other.

The Johansen cointegration results and the associated Eigen values and Trace statistics are given in Table 3. In major Indian States, Credit deposit ratio and credit share are cointegreted of order one, i.e., I(1). Significance level is high (5% and above) in almost all states except Punjab, Tamil Nadu and West Bengal.

For long run time series on C/D ratio and credit share with I(1) property there should be at least one equilibrium relation and short run deviation from the equilibrium is corrected by the ECM. After incorporation of the estimated values of the error correction term of each of the states we have run

Table 2. Results of unit root test (during 1972-2008)

State	C/D Ratio		Credit Share	
	Level	1st Difference	Level	1st Difference
Andhra Pradesh	NS	S*	NS	S***
Assam	S*	S***	NS	S***
Bihar	NS	S***	NS	S***
Delhi	NS	S***	NS	S***
Gujarat	S***	S***	NS	S***
Haryana	NS	S***	NS	S***
Karnataka	NS	S***	NS	S***
Kerala	NS	S**	NS	S***
Maharashtra	S**	S***	S**	S***
Madhya Pradesh	NS	S***	NS	S***
Orissa	NS	S**	NS	S***
Punjab	NS	S***	S***	S***
Rajasthan	NS	S***	NS	S***
Tamil Nadu	NS	S***	S***	S***
Uttar Pradesh	NS	S***	NS	S***
West Bengal	NS	S***	NS	S***

Note: ***, ** and * represent significant results at 1%, 5% and 10% respectively. S stands for stationary and NS stands for non stationary.

Table 3. Results of cointegration test

State	Eigen Value	Trace Statistic	P Value
Andhra Pradesh	0.1505**	5.38	0.020
Assam	0.4063**	18.224	0.019
Bihar	0.5005**	18.22	0.019
Delhi	0.1473**	5.10	0.024
Gujarat	0.424***	25.48	0.009
Haryana	0.4105***	22.13	0.004
Karnataka	0.3746***	23.685	0.002
Kerala	0.588***	33.28	0.005
Maharashtra	0.4497**	28.61	0.022
Madhya Pradesh	0.1184**	4.157	0.041
Orissa	0.2865**	16.26	0.038
Punjab	0.3804*	16.928	0.079
Rajasthan	0.496**	26.431	0.043
Tamil Nadu	0.0998*	3.47	0.062
Uttar Pradesh	0.3413**	16.829	0.031
West Bengal	0.3079*	18.4	0.074

Note: '***', '**' and '*' denote level of significance at 1%, 5% and 10%, respectively.

Table 4. Results of causality during 1972 -2008

State	Long Run Relation	Error Correction	Short Run Causality Direction (Lag Value)
Andhra Pradesh	Yes	Yes	-
Assam	Yes	Yes	-
Bihar	No	-	-
Delhi	Yes	Yes	-
Gujarat	No	-	-
Haryana	Yes	No	-
Karnataka	Yes	Yes	-
Kerala	Yes	Yes	-
Maharashtra	No	-	-
Madhya Pradesh	Yes	No	C/D → Cr. Share (L2)
Orissa	No	-	C/D ← Cr. Share (L4)
Punjab	Yes	Yes	C/D ← Cr. Share (L4)
Rajasthan	Yes	Yes	-
Tamil Nadu	No	-	C/D ← Cr. Share (L3)
Uttar Pradesh	No	-	-
West Bengal	No	-	-

Note: The → sign represent the unidirectional causality

the Granger causality test for the long run period 1972-2008. The results are presented in Table 4.

Table 4 provides the results of (i) existence of long run relationship between credit deposit ratio and credit shares of the states during the period 1972 -2008, (ii) short run causality direction between credit deposit ratio and credit share and (iii) finally, error adjustment if any departure from long run equilibrium occurs. Causality direction results are not clear for all major states in India in Table 4. It is may be due to major break in the name of economic reforms in India in 1990s and onwards. Since economic reform starts in India during 1991-1992 we divide the whole period into two sub-periods – pre and post reform period. Pre-reform period is 1972 -1992 and post reform period is 1993-2008. Now we apply the Granger causality test and results are given in Table 5.

The causality direction is running from credit deposit ratio to credit share in Andhra Pradesh and Uttar Pradesh in the pre-reform period. This means falling trends of credit deposit ratio of both Andhra Pradesh and Uttar Pradesh are causing the rising trends of credit share (refer to Figure 1 and 3) of the states. It implies that for these states falling efficiency leads the banks to invest their funds in other areas like government securities other than to give credit to the productive private sectors and as a result rise in volume of credit share leads further for supply of credit for safe investment like securities. There is bidirectional causality in Delhi, Madhya Pradesh, Orissa and Tamil Nadu in pre-reform period (1972-1992). Out of the four states positive direction of feedback causalities are found in Orissa, Madhya Pradesh and Delhi where rising trends of credit deposit ratio are causing rising trends of credit share for Orissa and Madhya Pradesh. That means both the states of Orissa and Madhya Pradesh have improved in the pre reform phase in both the credit aspects and both are causing the both. But for Delhi, falling credit deposit ratio is causing falling credit share and vice versa.

Table 5. Results of causality in pre and post reform period

State	Directional (Granger) Causality	
	Pre Reform (1972-1992)	**Post Reform (1993-2008)**
Andhra Pradesh	C/D => Cr. Share	-
Assam	-	C/D => Cr. Share
Bihar	-	-
Delhi	C/D <=> Cr. Share	C/D <=> Cr. Share
Gujarat	-	C/D <=> Cr. Share
Haryana	-	C/D => Cr. Share
Karnataka	-	C/D => Cr. Share
Kerala	-	C/D <=> Cr. Share
Maharashtra	-	-
Madhya Pradesh	C/D <=> Cr. Share	-
Orissa	C/D <=> Cr. Share	-
Punjab	-	C/D <=> Cr. Share
Rajasthan	-	-
Tamil Nadu	C/D <=> Cr. Share	-
Uttar Pradesh	C/D => Cr. Share	C/D => Cr. Share
West Bengal	-	-

Note: The => sign represent the unidirectional of causality, <=> represents bidirectional causality

The state is declining in both aspects. The case for Tamil Nadu is different. Its falling trend of credit deposit ratio is causing rising trend of credit share and at the same time the rising credit share is causing to falling credit deposit ratio. It may so happen that the state started its journey from a very high credit deposit ratio and as a result of natural law on diminishing productivity the ratio is falling but the credit share is rising because of rising economic activities and good perceptions of the bankers regarding the state. Causality is absent in Assam, Bihar, Gujarat, Haryana, Karnataka, Kerala, Maharashtra, Punjab, Rajasthan and West Bengal during 1972-1992. That means the majority of the states are with no such causal relation between the two variables.

The results of causality are to some extent different for the post reform period with half of the total numbers of states are producing any sort of direction of causality. The causality direction is running from credit deposit ratio to credit share in Assam, Haryana, Karnataka and Uttar Pradesh during post reform period (1993-2008). The results for relatively developed states Haryana and Karnataka are similar as their rising trends of credit deposit ratio are leading to rising trends of credit share but the difference of results with the relatively backward states like Assam and Uttar Pradesh that their rising trends of credit deposit ratio are leading to fall in credit share. Bi-directional causality is observed in Delhi, Gujarat, Kerala and Punjab during post reform period. Directional causality is absent in AP, Bihar, Maharashtra, MP, Orissa, Rajasthan, Tamil Nadu and West Bengal. Causality is absent in several states during both the pre-reform period and post reform era (viz, Bihar, Maharashtra, Rajasthan and West Bengal), but individually, credit deposit ratio and credit share follow AR (1) process. Hence, we have a mixed result of short run causality between

credit deposit ratio of the states in both the pre and post reform periods. One thing common in the short run results that whenever unidirectional causalities are present they are always running from credit deposit ratio to credit share, no reverse causation works. But for a long run period from 1972 to 2008 there are only three states namely, Orissa, Punjab and Tamil Nadu, for which the causality runs from credit share to credit deposit ratio (Table 4).

CONCLUSION

As our objective was to examine direction of causality between credit deposit ratio and credit share of the major Indian states for the period 1972-2008, we have observed, by applying standard tools of time series econometrics, that for the entire period of study there is missing of such causality in most of the states. But for short runs, with pre and post reform phases differently, we get the causality results for half of the states with the direction of causality runs from credit deposit ratio to credit share only. No reverse causation was found. At the same time there were bidirectional causalities in many cases. For the relatively backward states we get the result that rising trends of credit deposit ratio in both the pre and post reform phases have caused the falling trends of credit shares and for the relatively developed states rising trends of credit deposit ratio have caused rising trends in credit shares.

Future direction of research is to find out causal linkage between credit deposit ratio and other economic variables. Spatial analysis can be applied to find out causal direction between credit deposit ratio and credit share. This is our next research agenda.

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KEY TERMS AND DEFINITIONS

Banking and Finance: The banking and financial sectosr in India represent the institutions that play intermediatory role in economic func-

tioning. There are scheduled and non scheduled commercial banks operating in India under the Apex body of the Central Bank, The Reserve Bank of India. The financial sector includes all the sectors in the money market except the banking sector. The reform in these two sectors has been a greater part of the Indian liberalization policy.

Credit Deposit Ratio: It is the proportion of deposit used for lending purpose after keeping aside the amount of statutory reserves in line with the guideline of the central bank. It also shows the efficiency of the banks in using their funds for real sector investments.

Credit Share: It is the part of total credit generated in the total economy. In reference to our study on Indian states credit share of a state means the amount of credit generated by a particular state out of the total credit generated. It also shows the command of a state in the credit market.

Reform: The economic reform in India refers to ongoing economic liberalisation in India that started on 24 July 1991. In 1991, after India faced a balance of payments crisis, it had to pledge 20 tons of gold to Union Bank of Switzerland and 47 ton to Bank of England as part of a bailout deal with the International Monetary Fund (IMF). In addition, the IMF required India to undertake a series of structural economic reforms. As a result of this requirement, the government of P. V. Narasimha Rao and his finance minister Manmohan Singh (currently the Prime Minister of India) started breakthrough reforms, although they did not implement many of the reforms the IMF wanted. The new neo-liberal policies included opening for international trade and investment, deregulation, initiation of privatization, banking and financial sector, tax reforms, and inflation-controlling measures.

Unit Root, Causality and Cointegration: See the methodology section for detail.

ENDNOTES

1. As is well known, the *ECM* is a comprehensive linear regression equation specification which provides a description of the possible nature of interdependence of the short run movements of a pair of co-integrated variables keeping in view the fact that they bear a long run equilibrium relationship.
2. Note that here $y_{it} = \phi_0 + \phi_1 x_{it} + \varepsilon_{1it}$ and $x_{it} = \phi_0 + \phi_1 y_{it} + \varepsilon_{2it}$ are alternative representations of the (population) long run *equilibrium* relationship between y and x, where ε's are the stationary error terms. As y and x are cointegrated, by the definition of cointegration for some constants $\omega_0 + \omega_1 y_{it} + \omega_2 x_{it} = \varepsilon_{it}$, where ε_{it} is a stationary error term and $\omega = (\omega_0, \omega_1, \omega_2)$ is the non- normalized cointegrating vector. Thus, by normalizing ω one may write the long run equilibrium relationship for (y,x) in either form as shown above.
3. This is for the following reason. If, for example, $ECY_{it-1}>0$ for some $i,t,$ it means that the realized value of y_i exceeded the corresponding long run equilibrium level at $t-1$, given x_{it}. Now since y_i and x_i are cointegrated, once a positive deviation from the long run equilibrium level takes place, the actual value must try to move in the opposite direction in subsequent time points in an attempt to restore the long run equilibrium and hence the negative sign of η_{yx} and η_{xy}.

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Chapter 5
Production, Trade, Knowledge Economy, and ICTs in Arab Countries

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ABSTRACT

This chapter introduces, respectively, the issues related to production, trade with a focus on the degrees of concentration and diversification besides the relationships to innovation, and knowledge with a focus of information and communication technologies (ICTs). The link between innovation and the value added in diverse sectors of the overall Arab economies is then addressed and discussed. Links between ICTs and other sectors are also discussed for the development of Arab economies.

INTRODUCTION

This chapter introduces respectively the issues related to production, trade concentration and trade diversification as they have been experienced by Arab economies during the past periods. The relationships between production and trade to innovation and knowledge are assessed to identify the major directions of the needed changes. The link between innovation and the value added in diverse sectors of the overall Arab economies is then addressed and discussed. The role of ICTs in most sectors is analyzed in relation to the promotion of growth and development. As in series of reports and publications, the economies of the Arab world appear to be dominated by a limited set of goods and services with a recent trend attributed to ICTs. Such a limited portfolio generates often vulnerabilities to shocks and translates to the trading patterns of these countries because of the reduced diversification of production and trade. Institutional and technological innovations do provide opportunities for diversification opportunities through new competitive niches where production and trade could adjust to the knowledge flows and to the needs of international markets. Such a trend has been observed to be taking place in different Arab countries and mainly among

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those economies that are oil and gas based. These economies are now progressively involved in the sectors of financial services, banking, real estate and tourism, but the resilience of traditional sectors will not allow easily the required changes. Further inclusion and acceleration of access to knowledge through education, research, innovation with emphasis on ICTs are likely to identify new opportunities and markets with the creation of new enterprises in both old and new production and trading systems.

The present chapter is composed of two major parts. The first one deals with a descriptive analysis of production and trade. It then focuses on the trends characterizing trade diversification and concentration with the estimation of the relationships with the most important knowledge components. The second part focuses on the special sector of ICTs as a driver of important changes in the Arab economies.

PRODUCTION, TRADE, AND KNOWLEDGE ECONOMY IN ARAB COUNTRIES

This first section focuses on the on-going production and trading processes that have prevailed in Arab economies during the last years. Different economic issues related to production and trade are discussed in the respective parts shown in the following subsections.

Production

The Arab region has known a remarkable economic growth, with a growth in the creation of employment and the unemployment rate had decreased as emphasized in a report by the World Bank. (2007)

Between 2004 and 2007, the Arab region had seen an economic growth as stated by the report, indicating that high oil revenues coupled with the recovery in Europe, the growing vitality of the private sector and increased investment have provided the impetus for another year of economic performance chip.

The document notes that the region recorded in 2006 one of its strongest growth rate since the 70s. This expansion has been attributed to the continued strong expansion of resource-rich countries and importers of labor and improved results of resource-poor countries, noting that real GDP grew by 6.3 pc in 2006, against 4.6 pc in first four years of the decade.

According to the report, the GDP per capita increased on average by 4.2pc in the region in 2006, which is the highest level recorded in at least 20 years.

However, not all the countries can benefit, from that incredible expansion since the latest data about poverty are not available. It has been shown from the report that the increasing investment from the private sector, national and foreign, makes that private sector the main source for new opportunities of employment in the region.

The private sector will pursue its activities in a growing integration in the global markets, which will promote the creation of new jobs, as stated in the report. It also indicates that the integration in the global markets will require an improvement in the educational system so that workers will be prepared to create a more competitive environment and establish mechanisms for social protection.

In general, the Arab region has the possibility to benefit from that economic boom to develop their reform programs. Authors of the report explain that the prospects for maintaining or increasing current growth rates in the coming years will depend on progress on the front of structural reforms "far irregular" and the growing private sector.

In contrast to the strong regional growth, industrial production, which had increased by 4.1% in 2005, was down 0.4% in 2006, mainly due to capacity constraints faced by the production of hydrocarbons. Despite the decline in oil production and declining world oil prices, which reached a record $ 70 dollars per barrel in August 2006, revenues of oil exporting countries continued to

increase. Hydrocarbon revenues have increased by more than $ 75 billion from the level reached in 2005 to $ 510 billion. Surplus funds of oil exporters and new investment opportunities in the region (some of which result from the ongoing reforms) have propelled the flow of foreign direct investment (FDI) to the record level of more than $ 24 billion in 2006, as stated in the report.

After the 2008 global economic crisis, the world cannot afford any uncertainty, and the lingering effects of that crisis continue to negatively affect some of the world's biggest economies.

According to the organization of the petroleum exporting countries (OPEC), despite the economic uncertainty, data show long-term growth in energy consumption. In their World Oil Outlook, OPEC sees global energy demand increasing under all scenarios- with primary global energy demand to 2035 doubling in the Reference Case. Fossil fuels can be making up 82% of this by 2035, having fallen slightly from 87% today. This dominant growth is expected to be demand in non-OCED developing countries. In OPEC's Reference Case, the overall oil demand is going from 88 million barrels (mb)/day in 2011 to 93 mb/day by 2015-reaching around 110 mb/day by 2035.

One source of rising oil demand is growing domestic demand in the Arab region. Actually, some of the Arab countries have some of the fastest growing energy demand in the world. Domestic consumption of crude oil, which is primarily used for power and generating purposes, has increased in several countries. Obviously, these countries understand that with local energy consumption rising, they need to find ways to diversify and enlarge their energy supplies so that their oil exports are not negatively affected.

Some OPEC countries in Arab region are already exploring for more oil and gas. Others are raising some recent gas discoveries. However, if the problems of satisfying the domestic energy demand while keeping crude export levels if left without a solution that would seriously impact some Arab countries.

In general and as in Chauffour and Hoekman (2013), the Arab markets offer considerable untapped potential for intra-regional trade. To these authors, A necessary first step to conquer international markets is to open the domestic economy and to further to reduce barriers to trade. They observe that significant progress appear over the last two decades in many Arab countries with the lowering of import tariffs and other explicit trade restrictions.

Descriptive Statistics

The data represented in the table are extracted from UNCTAD database that shows how the production is progressing over the years in Arab countries. More precisely, it shows the data from 1970 to 2009, for the following countries: Algeria, Bahrain, Egypt, Iraq, Jordan, Kuwait, Lebanon, Libya, Mauritania, Morocco, Palestinian occupied territories, Oman, Qatar, Saudi Arabia, Syria, Tunis, United Arab Emirates, Yemen and League of Arab states. It also shows how the production in each sector (agriculture, industry, production of electricity, gas, and water, transport, hotels and restoration, construction) is progressing over the years.

The data represent the GDPs of Arab countries over the years, the value added per sector, from which we can calculate the share of GDP for each country. In order to analyze the data, we have to describe it by using descriptive statistics such as the mean and the standard deviation. The mean makes it easier to have an overall view of all the variables for each country. The standard deviation show how diversified is the production. A trend analysis is also be conducted to see how the dominant sectors of production are progressing over the years.

By using the means of GDPs of all the countries, we can see an overall progression through the years. However, there is a decrease in some periods. There is a small decrease from 1970 to 1975, than an observable decline from 1980 until 1985.

In order to study the production in each country, it is preferable to look at the three dominant sectors per country. As shown from this, for most countries, the main sectors are services, industry, and production of gas and electricity. Morocco has agriculture as one of the dominant sectors, in addition to services and industry, and Lebanon has fabrication, services and industry as the main sectors.

After selecting the economic sectors, a trend analysis is conducted for each country. However, since there are seventeen countries, only few are analyzed here. The countries are divided into categories to facilitate the analysis. Since there is a strong relationship between the production and the awareness of countries about Science and Technology, countries of the Arab region can be categorized based on that criterion.

As discussed earlier, there are three main categories of countries in the Arab region. The first category includes Algeria and Egypt, the second is formed of Morocco and Tunisia, and the last category is composed of Libya and Mauritania.

Trend Analysis

First Category: Algeria and Egypt

The respective trend coefficients for industry, gas and services are 991.75; 849.10 and 606.25.

For Algeria, the behavior of the value added of its dominant sectors is increasing throughout the years from 1970 to 2009. However, the increase is different in each sector.

The trend coefficients for services, industry and gas are respectively 1456.42; 938.13 and 832.01.

For Egypt, the increase over the years of the value added of the three sectors (services, industry, and Production of Gas) starts from 0. The increase differs from one sector to another.

Second Category: Morocco and Tunisia

The estimated trends for services, industry and for agriculture are respectively 808.47; 303.13 and 130.77. Morocco is different from the other countries in term of the dominant sectors as it has agriculture as an important sector of production. But, the three sectors have an increasing trend over the years.

Similarly, the trends estimated for services, industry and gas are respectively 381.90; 198.14 and 160.15, for Tunisia. There is also an increase in the value added of the three sectors over the years.

Third Category: Libya and Mauritania

The respective coefficients for services, industry and gas are 248.30; 220.36 and 174.99.

For Libya, the increase in the value added of services over the years is not that big since it goes from $2,000 to $12,000 approximately. For the two other sectors, there is also an ascending trend over the years.

Mauritania has exhibited trend coefficients that are 18.47; 12.62 and 9.58 respectively for services, industry and gas. For Mauritania, the value added in the three dominant sectors (industry, services, and production of gas) has an ascendant trend over the years, but the increase is smaller compared to other countries.

The three main dominant sectors, which have the highest share of GDP, are industry, services, and production of gas. Some exceptions like Morocco and Lebanon rely on agriculture and fabrication respectively instead of production of gas.

For all the countries, the trend of the value added of the dominant sectors is ascending over the 40 years.

Trade Concentration and Diversification

The following tables show respectively the major trends taking place respectively in trade concentration and diversification. When looking at concentration based on the number of commodities, the countries showing significant decreases are Egypt, Lebanon, Qatar, Tunisia, Yemen, Morocco,

Oman and Syria. Jordan, Sudan and Kuwait are showing increasing trends with all the remaining countries having no trends over the study period. These results are shown in Table 1.

When looking at trade diversification, Algeria, Egypt, Qatar, Tunisia, Yemen, Kuwait, Bahrain, Oman, Saudi Arabia, Syria and UAE exhibit a decreasing pattern. The other countries have a constant level of diversification. No country is showing increase in diversification. These results are shown in Table 2.

Table 1. Trade concentration

Country	Intercept	Coefficients	R^2
Algeria	0.529 (27.074)	0.005 (1.535)	0.207
Egypt	0.340 (10.187)	-0.015 (-2.682)	0.444
Jordan	0.133 (14.651)	0.003 (2.129)	0.335
Lebanon	0.117 (28.271)	-0.001 (-2.578)	0.424
Mauritania	0.510 (35.360)	-0.003 (-1.522)	0.204
Palestine	0.166 (15.312)	0.002 (1.117)	0.121
Qatar	0.601 (57.788)	-0.009 (-5.570)	0.775
Sudan	0.442 (10.308)	0.037 (5.107)	0.743
Tunisia	0.207 (74.984)	-0.005 (-10.794)	0.928
Yemen	0.865 (59.689)	-0.010 (-4.431)	0.685
Bahrain	0.410 (21.391)	-0.004 (-1.244)	0.146
Iraq	0.966 (161.118)	-0.0002 (-0.244)	0.006
Kuwait	0.608 (46.300)	0.010 (4.520)	0.694
Libya	0.804 (43.625)	0.001 (0.512)	0.028
Morocco	0.174 (40.124)	-0.001 (-2.633)	0.435
Oman	0.758 (24.197)	-0.022 (-4.200)	0.662
Saudi	0.713 (51.716)	0.003 (1.518)	0.203
Syria	0.629 (24.589)	-0.042 (-9.751)	0.913
UAE	0.499 (17.480)	-0.006 (-1.346)	0.167

Table 2. Trade diversification

Country	Intercept	Coefficients	R^2
Algeria	0.836 (118.794)	-0.005 (-4.792)	0.718
Egypt	0.699 (42.739)	-0.009 (-3.585)	0.588
Jordan	0.580 (32.505)	0.003 (1.079)	0.114
Lebanon	0.631 (92.808)	-0.001 (-1.001)	0.100
Mauritania	0.825 (51.054)	-0.003 (-1.169)	0.132
Palestine	0.603 (85.941)	0.002 (1.755)	0.254
Qatar	0.847 (110.151)	-0.006 (-5.211)	0.751
Sudan	0.824 (135.149)	-0.001 (-1.089)	0.116
Tunisia	0.661 (73.964)	-0.013 (-8.780)	0.895
Yemen	0.859 (212.839)	-0.009 (-13.247)	0.951
Bahrain	0.788 (122.718)	-0.009 (-8.521)	0.889
Iraq	0.817 (74.411)	0.002 (1.608)	0.223
Kuwait	0.850 (173.108)	-0.005 (-6.818)	0.837
Libya	0.821 (136.149)	-0.001 (-1.298)	0.157
Morocco	0.709 (62.165)	-0.003 (-1.664)	0.235
Oman	0.787 (64.143)	-0.008 (-3.878)	0.625
Saudi	0.833 (153.977)	-0.006 (-7.489)	0.861
Syria	0.786 (58.138)	-0.018 (-7.943)	0.875
UAE	0.662 (65.436)	-0.010 (-5.886)	0.793

The share of oil and gas in most of the Arab countries does still dominate in Arab countries. This share is represented in Table 3. This table shows the share of oil and natural gas in the selected countries' total commodity exports. The shares indicate that, except for Oman in the last decade, none of the oil abundant countries of the region have managed to increase the share of their non-oil exports. More detailed analysis is undertaken in the section dealing with energy. These results are confirmed by Hvidt (2013) who uses an empirical approach, to analyze past record and future trends of economic diversification efforts in six Gulf Cooperation Council countries. The study shows that past record of diversification has shown limited results. But, current diversification plans are likely to ensure in theory, the stability and the sustainability of income for the future. With governments leading these economies, diversification is supposed to strengthen the private sector under some economic reforms. But the author identifies constraints to diversification as related to the prospects of world economies and the structure of production and trade in each country and between the countries of the region. The author emphasizes the difficulties related to the implementation of efficient diversification policies in these countries.

Knowledge Production in Arab Countries

Compared to previous years, the Arab region has known an increase in its knowledge production from 1995. Although there is a lack of information about the outcomes of research and development

Table 3. Share of oil and natural gas in total commodity exports

	Algeria	Egypt	Jordan	Kuwait	Morocco	Oman	S. Arabia	Tunisia
1991	96.90	53.48	0.02	80.36	2.51	87.40	92.87	14.32
1992	96.04	43.45	0.09	94.53	3.15	83.74	87.01	15.10
1993	95.76	49.07	0.02	95.07	2.66	78.90	91.08	11.46
1994	96.15	38.17	0.10	93.87	2.08	76.48	90.07	9.48
1995	95.08	35.83	0.03	94.67	2.20	78.59	86.76	8.47
1996	92.80	46.25		95.22	1.63	80.42	88.57	10.51
1997	97.17	44.32	0.04	95.05	1.94	76.39		9.07
1998	97.01	28.53	0.07	89.13	1.46	68.05	84.27	6.44
1999	97.14	36.03	0.03	90.64	2.70	76.93	88.53	7.16
2000	98.08	40.93	0.04	93.29	3.66	82.49	91.45	12.09
2001	97.61	39.02	0.04	92.04	4.22	80.49	86.09	9.24
2002	96.84	32.55	0.01	91.20	3.64	77.25	88.05	9.34
2003	98.04	42.14	0.24	91.54	2.59	76.82	88.23	9.99
2004	98.14	41.69	1.13	93.03	4.49	81.56	87.85	9.58
2005	98.40	50.71	0.17		5.05	84.38	89.47	12.93
2006	98.05	55.10	0.83	94.98	3.76	82.95	89.16	12.98
2007	98.38	51.41	0.68	94.45	3.81	79.66	88.10	16.19
2008	98.14	43.13	0.12	94.60	4.19	77.46	89.52	17.31
2009	98.31		0.27		3.28	67.64	84.61	13.63

Source: Dogruel & Tekce, 2011 based on COMTRADE data

in that region since there are no comprehensive statistics on specialized sectors or research topics, certain outputs can be measured by the amount of scientific publications, patents, and inventions.

For the scientific research, when the number of scientific publications per million people is taken into consideration, Arab countries fall into the category of advanced developing countries, since it published 26 research papers in 1995. It is more significant when compared with the other developing countries such as Brazil (42), China (11), and India (19). On the other hand, this production is still far from the production levels of developed countries, such as Netherlands (1,252), or Switzerland (1,878). The Arab world has noticed a substantial increase in the last three decades of the 20th century. There was a clear increase in the number of papers published by Arab scholars from 465 papers in 1967 to 7,000 in 1995, which is approximately an increase of 10% per year. However, that increase was not as significant as the increase in some other developing countries such as Korea, Brazil, or China. In order to make a comparison with those countries, the rate of increase in published scientific paper per million people can be useful. For example, the number of scientific paper per one million in China in 1995 was 11 times what it was in 1981. In South Korea, it was 24 times greater. But for Arab countries, it was only 2.4 times greater; i.e. increasing from 11 papers per one million people in 1981 to 26 papers in 1995. Even though there is that increase in the number of publications in Arab countries, most of the papers are specialized in applied fields such as medicine, health, and agriculture. For the publications in basic sciences such as physics, chemistry, astronomy, and mathematics, it did not exceed 10% of the total research. Therefore, the Arabic research activity is said to be far from innovative. There is no research in advanced fields, such as information technology and molecular biology (Rashed, 2003).

In order to measure the quality of research, there is an indicator that accounts for the number of references included. As indicated in the First Arab Human Development Report in 2002, "only one paper each in Egypt, Saudi Arabia, Kuwait, and Algeria in 1987 was quoted more than 40 times, while in the United States 10,481 papers were quoted more than 40 times and in Switzerland 523 papers." (Rashed, 2003, p.70).

For the patents, which are also an indicator of measuring the knowledge production, in Arab countries, there is a weak research and development activity, which delay far behind of that of developed countries and other countries of the developing world as shown in Table 4.

In order to have a well-developed research and development activity, Arab countries need to produce knowledge workers. Such as industries, national scientific research and development activities need to have highly qualified graduates and researchers with enquiring and trained people and highly skilled minds. According to some statistics, there is a sustained increase in the number of female students. Those statistics indicate that there is a small number of graduates who opted to specialize in basic sciences, engineering, medicine and other scientific subjects. There is also a lack of training for skilled people because training in Arab countries depends generally on the supply rather than the demand, and the focus is in the quantity, not the quality.

Table 4. Number of patents registered in the United States from Arab and non-Arab countries from 1980 until 2000

Arab Countries		Non-Arab Countries	
Bahrain	6	Korea	16,328
Egypt	77	Israel	7,652
Jordan	15	Chile	147
Kuwait	52		
Oman	5		
Saudi Arabia	171		
Syria	10		
Yemen	2		

Source: Djeflat (March 1999) and Bizri (April 2013)

According to the Arab knowledge report 2009, Arab societies are in need to more nurturing institutions and some supportive policies to experience a significant increase in knowledge production and creation. According to the report that Arab societies have to make political, cultural, and intellectual reforms in addition to reform of media and information technologies if they want to make the knowledge production stronger.

It is also said that for a clear increase in the knowledge production, there should be a strong link between knowledge and freedom. Knowledge can be defined by freedom in both its enlightenment and developmental aspects. In order to enhance knowledge performances, there should be a freedom of expression, thought, and political participation.

The Arab knowledge report also shows that Arab countries have made a reasonable progress with regard to most ICT axes, especially where infrastructure is concerned. There was an improvement in technological abilities and performances that surpasses that observed in any other region of the world in 2008. Four Arab countries are members of the Gulf Cooperation Council (GCC). These countries are part of the fifty countries ready to invest in this area. However, there is a limitation in regards to quantity and quality because performance varies from one Arab state to another. In the Arab world, the use of Internet has noticeably proliferated in the last five years. However, the examination of the general Arab landscape shows that the digital divide remains. When conducting an investigation of Arab digital content, which is an indicator of investment and knowledge production activity in the Arab region, it has been shown that Arab countries and societies have fallen, according to most criteria if they are compared to other countries. The report explains how the Arabic knowledge will never pass an extremely low threshold if no steps are taken on various levels in the domain of technology policy and legislation, and if the issues related to Arabic language usage on the net are not settled.

Innovation in Production in the Arab Region

Arab countries, like the rest of the world and the Developing countries in particular, will soon face enhanced competition, vanishing trade barriers, more stringent intellectual property regimes and deeper concern for the environment, as said in a World Bank report (World Bank, 2011). Movements in these areas are expected to make serious challenges for fragile components in the socio-economic systems of the region. Science and Technology policies and strategies are still inadequate even if policy-makers have taken the measures to a large extent of these challenges. However, those are essential prerequisites to attain viable Science and Technology capabilities and innovative capacity.

There are of course some differences from one country of another in the Arab region, than it might seem because of resources endowment, history, political regimes etc. A more proactive role of the state would be its involvement in promoting scientific and technological innovation, a well-established market-driven competition, and a more efficient market in allocating resources enhanced with the supply of more and better information.

As emphasized by the World Bank a Knowledge-Based Economy (KBE) is defined as one where "knowledge is created, acquired, transmitted, and used more effectively by enterprises, organizations, individuals and communities for greater economic and social development" (World Bank, 2003, p.1). One if the most important elements is an efficient innovation system, which means that several institutions and competencies have to interact to assimilate the growing stock of global knowledge, in order to adapt it to local needs and use it to create new knowledge and technologies.

Policies and Strategies for National System of Innovation in the Arab Region

The integrated approach to the National System of Innovation (NSI) was discovered by Lundvall (1985) and revised in the nineties for LDC. Three main spheres should be included in the NSI: The productive sphere, the training and education sphere, and the research sphere. There must be a co-ordination between those three components so that the system can work efficiently. Since the NSI composes a central component in the process of capacity building, its initial Nation-State base has to be expanded because of the necessary relationship it mobilizes with foreign entities. In order to overcome market failures and optimal uses of externalities, the market should regulate largely the interaction between the components of the system. Social and political institutions and economic policies are the important factors that should be orchestrated by the State to have a homogeneous system.

Policy Options

The National System of Innovation (NSI) mainly depends on the extent to which Science and technology is made and efficiently implemented. Research and Development and innovation cannot rest on a vacuum. Since Arab countries are heterogeneous, they show different levels of awareness of the importance of Science and Technology for development. For instance, because training and education are found everywhere, Research and Development institutions start to rise in various fields such as health, agriculture, engineering in some countries but are absent in others. In this sense, there are three main categories of countries in the Arab region:

First Category: Algeria and Egypt

Those countries have made serious attempts to include Science and Technology into their economic development and have now in their record some non-negligible experience. This experience seems to have started in the seventies based on an S&T policy and NSI. After conducting a study by the Egyptian Ministry of Scientific Research, it has been found that there are several strengths of the Egyptian S&T systems: they have marvelous human resources with a large number of highly educated people and specialized personnel, a lot of R&D institutions in various disciplines, and many examples of success especially in agricultural research. The main driving vectors of this policy include: massive transfer of up to-date technologies from various advanced countries and substantial investments in education and training, and engagement in programs of scientific research.

Second Category: Morocco, Tunisia, Jordan, and Kuwait

This category is more oriented towards market-driven growth and the contribution of foreign capital to industrialization. Foreign firms made decisions, at a time when the industrial base of the country was being laid down. Even though those countries have tried to make their policies on their own by developing local industries of small and medium size type, there were not in charge of the S&T policy and the level of awareness of the fundamental role of S&T in development. Consequently, the main component to set up the basis for NSI was missing.

Third Category: Libya and Mauritania

Those countries do not have enough industrial bases and are small in terms of population and markets, so the S&T policy and its integration in the economic policy is not part of their priorities. Current infrastructure and potential are unlikely to provide the basis for an NSI.

Sector Studies

Some studies of the most innovative companies in Tunisia in various sectors on a relatively small sample indicate that R&D departments in several operations made the most successful experiments modifying the acquired technological products or process in order to improve their characteristics (80%), developing new products and commercializing them (80%), and developing new products without commercialization (60%).

Arab Countries and Alternative Energy Sources

According to an article published in June 15, 2010 by Arabic knowledge Wharton, in 2009, Saudi Arabia turned on the largest water desalination facility in the world. With a price tag of $3.4 billion, the Jubail II desalination plant produces 800,000 cubic meters of water daily. It was made the 28th desalination facility operating in the country by the plant's opening. Its output is the lifeblood for Saudi Arabia: Fully 70% of the freshwater used by Saudis is generated by the desalination facilities but this desalination is costly.

The Saudi government estimates that using all the desalination plants requires 1.5 million barrels of oil a day, since the process of turning seawater into tap water heavily depends on energy. Because of that, the oil-rich country is looking to another natural resource to fuel desalination: the desert sun. This is just one experiment in the region, where increased demand, rising oil prices and dwindling groundwater resources have made finding less costly and more efficient alternative energy sources a priority.

According to IDA, the International Desalination Association, the Middle East and Africa now accounts nearly half of the world's global desalination capacity, with Saudi Arabia and UAE (the Unites Arab Emirates) alone counting for approximately 30% of installed capacity. There was a desalination boom in the Arab region that was fueled by growing water demand and the availability of cheap energy. Desalination is an energy-intensive process, with energy accounting for up to 50% of production costs. However, countries that do not have access to cheap energy found it expensive. For the hydrocarbon-rich nations in the Middle East, desalination has been the obvious way to address their lack of fresh water.

TO WHAT EXTENT KNOWLEDGE ECONOMY VARIABLES COULD HAVE DRIVEN PRODUCTION

This is shown using regression analysis where GDP from different sectors is regressed on those related to others sectors to better capture how knowledge variables have been driving production. The data used are those from UNCTAD. The results are shown in Table 5.

Table 5 shows that innovation has statistically significant effects on most sectors except for services and that education has a negative impact on agriculture. The other results show how positive interdependencies exist between the existing sectors.

However, more knowledge needs to be further mobilized to ensure production and trading efficiency besides the sustainable competitiveness required. Information technologies are known to possess the properties for enhancing productivity, trade but also series of social services.

Based on the results, a specific focus is placed in the following section on the role of ICTs as a knowledge component that could have important impact on the Arab economies.

Table 5. Regression results

		Independent Variables								
Dependent Variable	**Constant**	**INN**	**CONS**	**EDU**	**TRANS**	**SER**	**GAS**	**IND**	**AGR**	**R^2**
GDP	1.554 (6.483)	0.168 (2.101)	0.857 (10.748)							0.876
AGR	0.743 (2.238)			-0.700 (-7.316)	1.020 (10.667)					0.839
IND	0.060 (0.625)			0.030 (1.311)		0.161 (4.291)	0.843 (23.912)			0.992
GAS	1.043 (1.554)	0.613 (3.961)							0.470 (3.033)	0.837
FAB	0.148 (0.289)	0.641 (5.009)							0.635 (4.961)	0.640
CONS	-0.034 (-0.080)	0.557 (4.952)							0.769 (6.801)	0.719
SER	0.430 (1.976)	0.415 (1.540)						0.489 (0.417)	0.466 (0.319)	0.930
TRANS	-1.046 (-3.349)	0.373 (3.966)						0.385 (3.883)	0.617 (7.153)	0.898

Variables: GDP: overall domestic product; AGR= agriculture value added; IND= Industry; GAS= Gas and oil; FAB= manufacturing; CON=Construction; SER=Services; TRANS=Transportation; INN=Innovation and EDU=Education.

Data Sources: UNCTAD, most recent data.

ROLES OF ICTs AND IMPACTS ON ENHANCING SOCIOECONOMIC PERFORMANCE IN THE ARAB REGION

Information and Communication Technology (ICTs) refers to series of technologies that allow communication along with the electronic acquisition, processing and broadcasting of information. ICTs have an impact on businesses in both developed and developing countries. New opportunities emerge from the use of ICTs such as the design and delivery of digital goods and margin and revenue increase by accessing foreign markets directly. In the pursuit of development, sectors interact and share knowledge and techniques. These interdependencies among sectors need to be coordinated in order to achieve better progress. For instance, the economic performance influences and is impacted by performances in health and education sectors. In addition, there are variations between countries and regions in benefiting from these interdependencies. Therefore, this paper focuses on the importance of coordinating ICTs to benefit from the variations by sector, country, and region (developed versus developing, especially MENA) in promoting development.

This collaboration has to do with the way ICTs can be helpful in education, health, social and economic performances and how they are used to coordinate interdependencies within and between these sectors. This paper explains how ICTs and related technologies have been means to improve the lives of people and compares between the era of limited ICTs access and the era of reduced digital divide and improved access to ICTs, including the enhancement of old functions and the creation of new ones such as e-commerce, e-health, e-education, e-tourism, e-finance and e-trade. Developed economies are assumed to benefit more from these ICTs than developing ones. It also seems that the MENA region has the potential of performing better.

Previous Contributions

Information and Communication Technology (ICT), through radio, television and print media, have been important in many developing countries. In recent years new ICTs, including Smartphones and Internet-associated applications have become accessible to larger populations worldwide. ICTs have been helping developing countries deal with different health, social and economic problems (Postnote, 2006). ICTs are assumed to have a potential role in eliminating extreme poverty, achieving universal compulsory education and gender equality and fighting against serious diseases, by enhancing information accessibility and allowing communication.

However, disparities between countries still exist and poor and rural populations often do not have access to new ICTs. According to Postnote (2006), OECD countries have the highest access to new ICTs, followed by South Asian and some African countries, including South Africa. Manochehri, Rajab and Rafi (2012) stated that ICTs have an important impact on businesses in developed and developing countries in terms of productivity and economic growth. Burke (2010) reported the existence of important benefits from having Websites, including the introduction of new customers and additional sales for firms. Other studies found that Arab countries still fall behind developed ones both in ICT spending (Nour, 2008) and in the lack of means needed to succeed in projects made to promote growth through IT transformation (El-Shenawy, 2010). In addition, Richardsson and Kraemmergaard (2006) identified five main areas of ICT applications to support enterprises and rural development, which include the economic development of products, community development, research and education, small and medium enterprises development and media networks. The effect of ICTs also differs inside regions. The diffusion of ICT in OECD countries currently differs considerably since some of them have invested more or have began investing in ICTs earlier than other countries (OECD, 2003). This investment refers to establishing the infrastructure or networks for the use of ICT and providing productive equipment and software to businesses (Richardsson and Kraemmergaard, 2006).

Piatkowski (2003) has already established the link between ICTs and company competitiveness. The author found that ICT platforms, including personal computers, mobiles and Internet, provide more visibility to businesses, offer more information to small enterprises, allow enterprises to overcome trade barriers and facilitate financial transactions. The private sector was encouraged to invest in an ICT infrastructure and use ICTs as a means of competitive advantage to conduct business. This can take the form of commercially driven connectivity, software, technology, e-commerce and online transactions (Clift, 2003).

Manochehri et al. (2012) established a positive link between ICT investments and labor productivity. They stated that the most important benefits of ICTs come from their effective use, especially in enterprises that are structured to use these technologies. The ICT revolution in the US has stimulated enterprise restructuring and has modified the terms of competition: US enterprises have become more efficient in getting value from their ICT activities, given that spending in the US has jumped to 5.4% in 2010 according to Pettey and Tudor (2011).

It has been reported that investment in basic telecommunications in Africa resulted in a positive impact on economic, political and institutional development. Shirazi (2008) has also established a link between ICTs (the Internet) and a rapid democratization in regions such as the Middle East. A recent example of such view has been witnessed recently through events such as the "Arab Spring" in Egypt, Libya, Syria, Tunisia, Yemen and other Middle Eastern countries.

Adewoye and Akanbi (2012) pointed out to problems that delay the development of the SMEs sector in Nigeria, including obsolete technologies

and machineries, lack of access to modern technology, lack or limited access to information on raw materials, management support and technical advisory services, financial problems and poor economic condition. Some of these problems can be resolved by applying ICTs to bring about sustainable economic development. According to Richardsson and Kraemmergaard (2006), Nigerian companies can use ICTs in online services for information, monitoring and consultation and transaction and processing (e-commerce).

Rallet and Torre (2000) found that there are factors affecting the diffusion of ICT. These factors include coordination mechanisms in innovative and research activities and the geographical proximity of economic agents to develop innovation activities. It has been reported that geographical proximity is beneficial if the nature of the activities is characterized by tacit knowledge. Thus, the less tacit knowledge is (later stages of the development process), the less the need for physical proximity. In addition, it is argued that ICTs can increase the possibilities of remote coordination since they are a means of turning tacit knowledge into codified knowledge.

Ssewanyana and Busler (2007) reported that the adoption and use of ICTs have an impact on business processes, even though disparities between developed and developing countries do exist. Internet usage in the developed world was 8 times that of developing countries in 2004 (ITU, 2011 and ITU, 2012). ICTs have transformed the way businesses are conducted by introducing the concept of "Networked economy" that links businesses with suppliers, internal manufacturing processes, shippers and customers in real-time. From a Ugandan case study, the adoption and usage of ICTs by enterprises in developing countries are said to follow the same pattern as the developed ones and only differ in the level of usage and adoption.

Methodology, Data, and Results

To assess the impacts of ICTs on economic and social performance data, some indicators were gathered especially from the World DataBank database (World Bank, 2012) and the International Telecommunications Union (ITU) database to try to link ICT variables with health, education and economic indicators. Linear regressions were conducted to identify links and relationships between these indicators. Only countries included in the Middle East and North Africa (MENA) region are considered in this study. These include Bahrain, Egypt, Iran, Iraq, Israel, Jordan, Kuwait, Lebanon, Libya, Morocco, Oman, Qatar, Syria, Tunisia, Turkey, United Arab Emirates and Yemen.

Among the ICT indicators used, there is the number of Internet users who are people with access to the worldwide network and the investment in telecoms with private participation (current US$) which is the value of telecom projects that have reached financial closure and directly or indirectly serve the public, including operation and management contracts with major capital expenditure, green-field projects and divestitures. There are also the ICT goods imports and exports, which include telecommunications, audio and video, computer and related equipment; electronic components; and other ICT goods where software is excluded. In addition, ICT service exports include computer and communications services (telecommunications and postal and courier services) and information services (computer data and news-related service transactions).

The health, education and economic data was respectively represented by the total health expenditure, the total life expectancy at birth, the adult total literacy rate (as % of people ages 15 and above), GDP (current $US) and GDP per Capita (current $US). The total health expenditure is the sum of public and private health expenditure. It

covers the provision of health services (preventive and curative), family planning activities, nutrition activities, and emergency aid designated for health but does not include provision of water and sanitation. Life expectancy at birth is the number of years a newborn infant would live if prevailing patterns of mortality at the time of its birth were to stay the same throughout its life. The adult literacy rate is the percentage of people ages 15 and above who can, with understanding, read and write a short, simple statement on their everyday life. GDP at purchasers' prices is the sum of gross value added by all resident producers in the economy plus any product taxes and minus any subsidies not included in the value of the products. Data are in current US dollars. GDP per capita is gross domestic product divided by mid-year population.

The results of the regression analyses conducted are introduced in Tables 6 and 7. Details about the variables are in Tables 8 through 11. Tables 12 through 15, show the outcomes of the regressions that are summarized.

Discussion

It has been indicated in the literature that the share of ICT in investment is a core indicator of ICT diffusion. From the previous results, it is observed that an increase in the economic performance, measured by GDP per Capita in the MENA region can lead to an increase in investment in telecoms at a decreasing rate. Indeed, previous studies have shown that higher levels of ICT investments do not necessarily lead to better business performance than lower levels.

The results also show a positive relationship between economic performance (GDP) and the number of Internet users. An increase in GDP can lead to an increase in the number of Internet users but at a decreasing rate. However, an increase in health expenditures per capita by one point of percentage can trigger a decrease in the natural logarithm of the number of Internet users by 0.57 points.

Other indicators tested during the empirical analysis did not show any impact on the investment in ICT, number of Internet users, ICT goods

Table 6. Internet users

Equation	R^2	Obs.
$\ln\left(InternetUsers2010\right) = \underset{(-0.928)}{-5.295} + \underset{(3.557)}{0.807}^{*} \ln\left(GDP2009\right)$	0.46	17
$\ln\left(InternetUsers2010\right) = \underset{(-1.432)}{-6.265} + \underset{(5.401)}{0.983}^{*} \ln\left(GDP2009\right) - \underset{(-3.376)}{0.567}^{*} \ln\left(HEPC2009\right)$	0.70	17

Table 7. Investment in telecoms

Equation	R^2	Obs.
$\ln\left(InvInTelecoms2010\right) = \underset{(-0.874)}{-1.127} + \underset{(0.770)}{0.447}^{*} \ln\left(HEPC2009\right) - \underset{(2.569)}{0.746}^{*} \ln\left(GDP2009\right)$	0.59	10
$\ln\left(InvInTelecoms2010\right) = \underset{(0.189)}{1.633} + \underset{(2.126)}{0.727}^{*} \ln\left(GDP_{PC}2009\right)$	0.39	9

Note: t-statistics are given under each estimated coefficient.

Table 8.

Country Name/2010	Internet Users	HEPC 2009	GDP pc 2009	GDP 2009	TLEB 2009
Bahrain	694009.25	770.623628	17608.8298	2.0595E+10	75.0238293
Egypt, Arab Rep.	21691776	113.620268	2370.71111	1.8898E+11	72.9752683
Iran, Islamic Rep.	9616571.9	287.147214	4525.94861	3.3101E+11	72.7518537
Iraq	791789.775	200.414688	2096.85105	6.5193E+10	68.4860488
Israel	4985164.8	2004.32232	26102.3506	1.9539E+11	81.504878
Jordan	2351146.26	373.287909	4242.1537	2.5092E+10	73.2896585
Kuwait	1046799.99	1578.75097	41364.6893	1.0946E+11	74.6047317
Lebanon	1310555.07	617.131462	8321.37074	3.4925E+10	72.4087561
Libya	889715.68	427.236419	9957.49041	6.236E+10	74.753122
Morocco	15656191.9	151.51309	2827.81855	9.0908E+10	71.8646341
Oman	1725109.7	520.379297	17280.0972	4.6866E+10	73.1246098
Qatar	1435175.09	1612.1451	61531.6921	9.8313E+10	78.0975854
Syrian Arab Republic	4224995.44	95.44027	2691.59766	5.3935E+10	75.702561
Tunisia	3856983.71	242.550288	4168.93675	4.3522E+10	74.6
Turkey	28969975.8	575.490023	8553.74145	6.1455E+11	73.6966585
United Arab Emirates	5859118.2	1704.05982	38959.8122	2.7033E+11	76.5736098
Yemen, Rep.	2970485.48	63.4003858	1077.24014	2.513E+10	65.0304634
Middle East & North Africa (all income levels)	96625274	306.340769	5823.36424	2.1861E+12	72.4873235
Middle East & North Africa (developing only)	69363777.2	189.290494	3268.28162	1.0642E+12	72.0012722
OECD members	844430192	4185.63766	33407.9107	4.1053E+13	79.3237783
World	2038644960	900.073245	8520.25178	5.8074E+13	69.6272321

for import, ICT goods for export or ICT service exports. These include the total adult literacy of ages 15 and above and life expectancy at birth. In addition, health expenditures per capita, GDP, GDP per capita and total life expectancy at birth did not seem to affect the ICT goods imports, ICT goods exports and ICT service exports.

CONCLUSION

The objective set for this chapter is to characterize the major trends related to production and trade besides their links to different components of the knowledge economy in the context of the Arab economies. Using descriptive methods and regression analysis, important results are attained. They concern the limited diversification of each of the Arab economies where most of the time few sectors form the basis of the economies. North African countries are mainly agricultural, natural resource and service based economies while Gulf countries are based mainly on oil and gas. This is directly expressed in their trading patterns with the rest of the world where concentration and limited diversification are also observed. These results say that the economic portfolio appears to be reduced in its composition implying that vulnerability to shocks is an element that needs to be considered.

Besides, the prior, a specific focus is placed on the role of one knowledge component that is information and communication technologies

Table 9.

Country Name/2010	Internet Users	HEPC 2009	GDP pc 2009	GDP 2009	TLEB 2009
Bahrain	13.4502406	6.64720009	9.77615575	23.7483093	4.31780579
Egypt, Arab Rep.	16.8924438	4.73286191	7.77094524	25.9649287	4.29012059
Iran, Islamic Rep.	16.0789984	5.65999502	8.41758247	26.5254294	4.28705439
Iraq	13.5820512	5.30038866	7.648192	24.9006133	4.22663006
Israel	15.421977	7.60306129	10.1697806	25.9982724	4.40066287
Jordan	14.6704135	5.92235	8.35282637	23.9458284	4.29441951
Kuwait	13.8612484	7.36438929	10.6301829	25.4188506	4.31220393
Lebanon	14.0859613	6.42508207	9.02658227	24.2764604	4.28232723
Libya	13.6986572	6.05733754	9.20608035	24.856197	4.31419098
Morocco	16.566377	5.02067202	7.94726086	25.2331183	4.27478427
Oman	14.3608012	6.25455796	9.75731067	24.5705596	4.29216497
Qatar	14.1767974	7.38532093	11.0273076	25.311424	4.35795914
Syrian Arab Republic	15.2565287	4.55850061	7.89789022	24.7110368	4.32681199
Tunisia	15.165396	5.49120906	8.33541631	24.4965331	4.31214051
Turkey	17.1817705	6.35522189	9.05412406	27.1441625	4.29995746
United Arab Emirates	15.5835097	7.44076882	10.5702859	26.3229275	4.3382525
Yemen, Rep.	14.904236	4.14946995	6.98215763	23.9473317	4.17485583
Middle East & North Africa (all income levels)	18.3863509	5.72469811	8.66963342	28.4131307	4.2834117
Middle East & North Africa (developing only)	18.0548753	5.24328284	8.09201963	27.6932757	4.27668379
OECD members	20.5541726	8.33941434	10.416548	31.3458743	4.37353794
World	21.4355512	6.80247614	9.05020117	31.6927407	4.24315576

Table 10.

Country Name/2010	Investment in Telecoms 2010	Health Exp PC 2009	GDP pc 2009	GDP 2009	Total Life Expectancy at Birth 2009
Egypt, Arab Rep.	2113000000	113.620268	2370.71111	1.8898E+11	72.9752683
Iran, Islamic Rep.	486000000	287.147214	4525.94861	3.3101E+11	72.7518537
Iraq	456000000	200.414688	2096.85105	6.5193E+10	68.4860488
Jordan	301000000	373.287909	4242.1537	2.5092E+10	73.2896585
Morocco	1124000000	151.51309	2827.81855	9.0908E+10	71.8646341
Syrian Arab Republic	65000000	95.44027	2691.59766	5.3935E+10	75.702561
Tunisia	966000000	242.550288	4168.93675	4.3522E+10	74.6
Turkey	1682980000	575.490023	8553.74145	6.1455E+11	73.6966585
Yemen, Rep.	59000000	63.4003858	1077.24014	2.513E+10	65.0304634
Middle East & North Africa (developing only)	5854000000	189.290494	3268.28162	1.0642E+12	72.0012722

Table 11.

Country Name/2010	Ln(Investment in Telecoms 2010)	Ln(Health Exp PC 2009)	Ln(GDP 2009)	Ln(GDP pc 2009)	Ln(Total Life Expectancy at Birth 2009)
Egypt, Arab Rep.	21.4713746	4.73286191	25.9649287	7.77094524	4.29012059
Iran, Islamic Rep.	20.0017192	5.65999502	26.5254294	8.41758247	4.28705439
Iraq	19.9380034	5.30038866	24.9006133	7.648192	4.22663006
Jordan	19.5226208	5.92235	23.9458284	8.35282637	4.29441951
Morocco	20.8401596	5.02067202	25.2331183	7.94726086	4.27478427
Syrian Arab Republic	17.9898978	4.55850061	24.7110368	7.89789022	4.32681199
Tunisia	20.6886744	5.49120906	24.4965331	8.33541631	4.31214051
Turkey	21.2438319	6.35522189	27.1441625	9.05412406	4.29995746
Yemen, Rep.	17.893048	4.14946995	23.9473317	6.98215763	4.17485583
Middle East & North Africa (developing only)	22.490391	5.24328284	27.6932757	8.09201963	4.27668379

Table 12.

DETAILED REPORT		**ANALYSIS OF VARIANCE**					
Statistical Regression			***Degree of Freedom***	***Sum of Squares***	***Mean Squares***	***F***	***Critical Value of F***
Coefficient of Multiple Determination	0.6764	**Regression**	1	10.072	10.072	12.653	0.0029
Coefficient of Determination R^2	0.4576	**Residues**	15	11.941	0.796		
Coefficient of Determination R^2	0.4214	**Total**	16	22.013			
Error-Type	0.8922						
Observations	17						

Ln(Internet Users 2010)						
	Coefficients	***Error-Type***	***Statistical t***	***Probability***	***Lower Limit for a Confidence Level = 95%***	***Upper Limit for a Confidence Level = 95%***
Constant	-5.295	5.7087	-0.928	0.3683	-17.46	6.8725
Ln(GDP 2009)	0.8072	0.2269	3.5571	0.0029	0.3235	1.2908

(ICTs). The analysis conducted in the second part of this chapter shows clearly how important improvements could be ICT based and how the different ICT components are enhancing the levels of production and services. This confirms again the roles of ICTs in enhancing not just the production and trading processes but also the other welfare components such as health and education. These effects are again translated into impacts on production and trade.

Table 13.

DETAILED REPORT		**ANALYSIS OF VARIANCE**					
Statistical Regression			***Degree of Freedom***	***Sum of Squares***	***Mean Squares***	***F***	***Critical Value of F***
Coefficient of Multiple Determination	0.8373	**Regression**	2	15.431	7.7157	16.413	0.0002
Coefficient de Determination R^2	0.701	**Residues**	14	6.5815	0.4701		
Coefficient de Determination R^2	0.6583	**Total**	16	22.013			
Error-Type	0.6856						
Observations	17						

Ln(Internet Users)						
	Coefficients	***Error-Type***	***Statistical t***	***Probability***	***Lower Limit for a Confidence Level = 95%***	***Upper Limit for a Confidence Level = 95%***
Constant	-6.295	4.397	-1.432	0.1742	-15.73	3.1359
Ln(GDP 2009)	0.9827	0.182	**5.4006**	9E-05	0.5925	1.373
Ln(HEPC 2009)	-0.567	0.1679	**-3.376**	0.0045	-0.927	-0.207

Table 14.

DETAILED REPORT		**ANALYSIS OF VARIANCE**					
Statistical Regression			***Degree of Freedom***	***Sum of Squares***	***Mean Squares***	***F***	***Critical Value of F***
Coefficient of Multiple Determination	0.76967	**Regression**	2	11.4764	5.73822	5.08658	0.04324
Coefficient de Determination R^2	0.59239	**Residues**	7	7.89678	1.12811		
Coefficient de Determination R^2	0.47593	**Total**	9	19.3732			
Error-Type	1.06213						
Observations	10						

Ln(Investment in Telecoms)						
	Coefficients	***Error-Type***	***Statistical t***	***Probability***	***Lower Limit for a Confidence Level = 95%***	***Upper Limit for a Confidence Level = 95%***
Constant	-1.1267	6.84712	-0.1646	0.87394	-17.318	15.0641
Ln(HEPC 2009)	0.44691	0.58076	0.76951	0.46676	-0.9264	1.82019
Ln(GDP 2009)	0.74604	0.29035	**2.56942**	0.03704	0.05946	1.43262

Table 15.

DETAILED REPORT		**ANALYSIS OF VARIANCE**					
Statistical Regression			***Degree of Freedom***	***Sum of Squares***	***Mean Squares***	***F***	***Critical Value of F***
Coefficient of Multiple Determination	0.62631	**Regression**	1	5.3289	5.3289	4.51818	0.07113
Coefficient of Determination R^2	0.39226	**Residues**	7	8.25606	1.17944		
Coefficient of Determination R^2	0.30545	**Total**	8	13.585			
Error-Type	1.08602						
Observations	9						

Ln(Investment in Telecoms)						
	Coefficients	***Error-Type***	***Statistical t***	***Probability***	***Lower Limit for a Confidence Level = 95%***	***Upper Limit for a Confidence Level = 95%***
Constant	1.63331	8.62684	0.18933	0.85521	-18.766	22.0325
Ln(GDP pc 2009)	0.72681	0.34193	**2.1256**	0.07113	-0.0817	1.53534

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KEY TERMS AND DEFINITIONS

Economic Sectors: Mainly traditional levels of aggregation used to show how each economy is producing and trading different goods and services.

Dominant Sectors: Those aggregates that ensure the highest economic outcomes as measured through different economic variables as they appear in the chapter.

ICTs: Information and Communication Technologies refer to the large array of means and technologies used in telecommunication, information, and media but that are increasingly mobilized in different economic and social sectors.

Production and Trading Systems: Used to express the major trends occurring in Arab countries where oil and gas play an important role in the trading patterns of some Middle Eastern countries.

Trade Concentration: In terms of the number of commodities and services, a measure of concentration refers to how trade is based on a small or larger number of goods and services. The concept and the measure of concentration are generally used to show how an economy could be vulnerable to international market shocks in commodities and services. An economy with a limited number of export goods is generally vulnerable to any sudden price decrease for these goods.

Trade Diversification: Represents and measures the level of multiplicity of commodities and services that are included in both imports and exports. By opposition to concentration, a larger diversification of trade is economically preferred.

Value Added per Sector: As a measure of production, this is used in the context of this chapter to better show the contribution of the most important sectors and aggregates in each economy.

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Chapter 6
The State-Based Factors Affecting Inward FDI Employment in the US

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ABSTRACT

The descriptive part of this research focuses on the latest trends in US inward Foreign Direct Investment (FDI) and describes the US inward FDI flows and stock as a percentage of Gross Domestic Product (GDP) and includes geographic and sectoral distribution of inward US FDI. The important part of US inward FDI profile relates to inward US FDI employment and inward US FDI financial flows, which include equity, reinvested earnings, and intercompany debt. The corporate players, Mergers and Acquisitions(M&A's) and green field investment are discussed briefly. The empirical part of this research investigates state-based factors affecting the inward FDI employment among 50 states of the United States and is based on data collected by the Commerce Department's Bureau of Economic Analysis (BEA). This study identifies several state-specific determinants of FDI employment. The results indicate that the major factors exerting positive impact on inward US FDI employment are: real wages, infrastructure, unionization level, educational attainment, FDI stock, and manufacturing density. In addition, the results show that gross state product growth rate, real per capita taxes has negative impact on FDI employment.

INTRODUCTION

Foreign direct investment (FDI) plays an extraordinary and growing role in the global business and represents an integral part of the US economy. The inward FDI constitutes important factor contributing to output growth and employment in the US economy. The United States continues to be the leading destination for foreign direct investment (FDI) and the leading investor in other economies. Kearney's index ranks World inward FDI and reveals FDI flows and the factors that drive corporate decisions to invest abroad. The major finding in A.T. Kearney's 2010 FDI report

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indicates that China and United States are the most attractive FDI locations in the world and have achieved unprecedented levels of investor confidence. The United States remains a strong FDI magnet in the World economy. Recently, China, India, and Brazil made the top spots of Kearney's FDI Confidence Index (Ries & Swenson, 1999)

Foreign companies and their US subsidiaries generate enormous economic benefits for the American economy and bring billions of investment dollars into the United States, create thousands of in- sourced American jobs, and highlight the importance of the US market for foreign companies. The state development agencies have an established framework of financial incentives to influence the final business location decision. Typical state inducements may include: low-interest loans, reduced income, sales, or property tax liability and grants for training or infrastructure improvement (Location USA, 2013).

BACKGROUND

Inward US FDI Stock and Flow

Inward foreign direct investment is an essential component of the US economy, contributing to production, exports and high-paying jobs for the country's workers. As the world's largest economy, the United States is well positioned to participate in the increasingly competitive international environment for FDI that has emerged as both advanced and developing economies have recognized the value of such investment. The US hosts the largest stock of IFDI among the world's economies, and continues to be at the top as a destination for inward FDI flows.

The country's IFDI stock grew from US$ 83 billion in 1980 to US$ 540 billion in 1990 (www.unctad.org/fdistatistics) to US$ 2,783 billion in 2000, and reached $3,509 billion in 2011 (Table 1). It exceeds by far the inward FDI stock of other large developed economies such as the United Kingdom (US$ 1,199 billion), Germany (US$ 714 billion) and the largest emerging market economy, China (US$ 712 billion) (Table 1).

The US continues to be the leading destination for FDI flows, with inflows reaching US$ 227 billion in 2011; in comparison, FDI flows that year to China were US$ 123 billion, to the United Kingdom, US$ 54 billion, and to Germany, US$ 40 billion (Table 2). Between 2000 and 2011, the US received the largest FDI inflows of any economy in the world. Between 2008 and 2009, during the recent financial and economic crisis, inflows decreased by 50%, from US$ 306 billion to US$ 153 billion, but grew again to US$ 197 billion in 2010 and further to US$ 227 billion in 2011.

Table 1. United States: Inward FDI stock, 2000-2011 (US$ billion)

Economy	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
United States	2,783	2,560	2,022	2,455	2,717	2,818	3,293	3,551	2,486	3,027	3,451	3,509
Comparator Economies												
United Kingdom	439	507	523	606	702	841	1,139	1,243	981	1,056	1,086	1199
Germany	272	272	298	395	512	476	591	695	668	677	674	714
China	193	203	217	228	245	272	293	327	378	473	579	711
Russia	32	53	71	97	122	180	266	491	216	382	423	457
Japan	50	50	78	90	97	101	108	133	203	200	215	226

Source: UNCTAD's FDI/TNC database, available at: www.unctad.org/fdistatistics.

Table 2. United States: Inward FDI flows, 2000-2011 (US$ billion)

Economy	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
United States	314	159	75	53	136	105	237	216	306	153	198	227
Comparator Economies												
China	41	47	53	54	61	72	73	84	108	95	115	124
United Kingdom	119	53	24	17	56	176	156	196	91	71	51	54
Germany	198	26	54	32	-10	47	56	80	4	38	47	40
Russia	3	3	3	8	15	13	30	55	75	36	41	53
Japan	8	6	9	6	8	3	-7	23	24	12	-1	-2

Source: UNCTAD's FDI/TNC database, available at: www.unctad.org/fdistatistics.

The flow of international capital supported the US economy in the 1980s and has been a key factor expanding economy. During the 1990s, the US experienced extraordinary inflow of FDI corresponding with exceptionally high output growth (Goss, Wingender and Torau, 2007).

The inward US FDI stock as a percentage of GDP climbed up to 6% during 1980's and up to 10% during 1990's reaching a peak of 27% in 2000 and 25% in 2007. US FDI stock shows cyclical character and declined significantly after 2002 and 2008 as a result of economic recessions (Figure 1). This relatively high percentage of the FDI stock in GDP indicates important role of the inward FDI in the US economy (Kornecki, 2010).

Inward US FDI Employment

The FDI stock and the FDI-related employment are widely used as a measure of inward FDI effectiveness (Bode and Nunnenkamp, 2007). The most of the foreign direct investment flows in the United States between 2000 -2011 entered the manufacturing industry. The FDI inflow in manufacturing industry reached on average, during analyzed period of time 36% of the total foreign flows, followed by finance 16%, wholesale trade 10%, depository institution 6% (Figure 2). More detailed employment data are included in Tables 3, 4 and 5.

Each state has adopted a unique strategy to attract FDI as they compete for foreign investors. The leading states in foreign direct investment

Figure 1. Inward FDI stock and flow as a percentage of GDP, 2000-2011
Source: UNCTAD's FDI/TNC database, available at: www.unctad.org/fdistatistics.

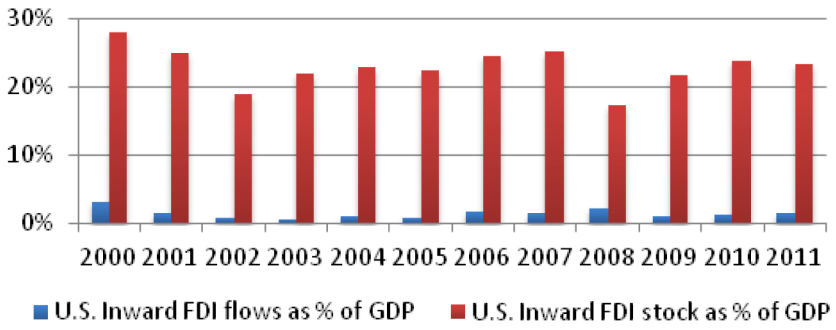


Figure 2. Sectoral distribution of US inward FDI flows in % (2000-2011, average)
Source: United States Department of Commerce, Bureau of Economic Analysis, FDI database, available at www.bea.gov/international

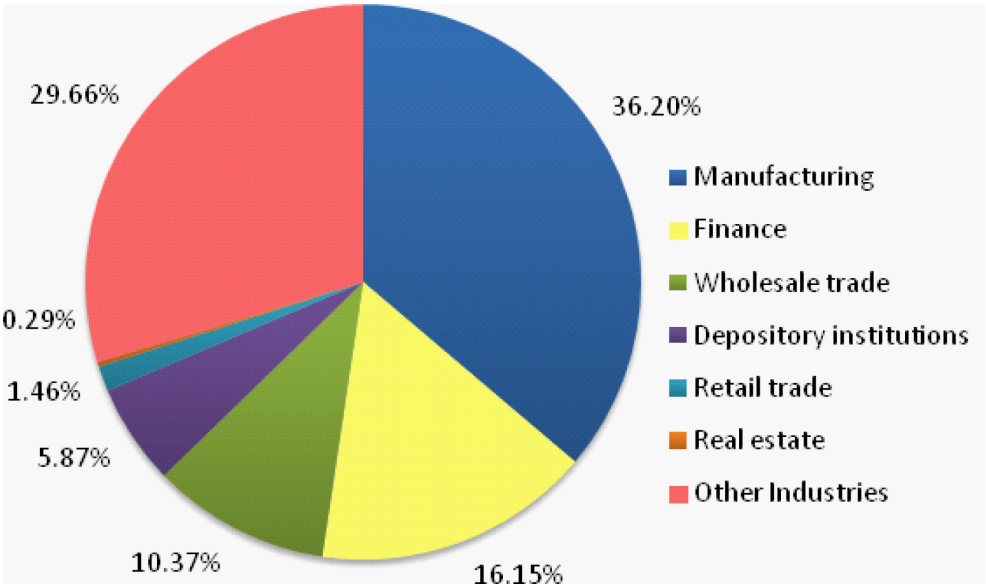


Table 3. Sectoral distribution of US inward FDI flows, 2000-2011 (thousands of employees)

All Industries Total	5,974
Manufacturing	2,277
Retail trade	665
Wholesale trade	591
Finance and insurance	340
Information	339
Professional, scientific, and technical services	217
Real estate and rental and leasing	44
Other industries	1,502

Source: United States Department of Commerce, Bureau of Economic Analysis, FDI database, available at www.bea.gov/international

employment, in manufacturing, are: California, Texas, Ohio, Pennsylvania, Illinois, North Carolina, New York, New Jersey. The southern US states has become more aggressive in recruiting foreign investment by providing incentives to attract investments and communicating the unique advantages they offer to foreign companies. Many southern states have been successful in improving their economies and providing new employment opportunities by offering the incentives attracting foreign capital (Borstorff, Collum and Newton, 2007).

Many foreign investors choose the southern part of the US as a desirable location for their FDI. Southern states invite large industrial employers in order to continue the evolution from an agricultural economy to a manufacturing economy. Tennessee, Alabama, Georgia, Kentucky, South Carolina and Texas have welcomed foreign automakers with numerous incentives. Currently, more than 300 foreign-based manufacturers from more than 30 nations operate in Alabama. Out of these foreign-based companies, three are major automobile manufacturers; Honda, Hyundai, and Mercedes (Borstorff, Collum and Newton, 2007).

The Financial Structure of the US Capital Inflows

Among the components of inward US FDI flows between 2000 and 2011 (equity investment, reinvested earnings, intra-company loans), equity

Table 4. United States inward FDI employment by sectors, 2000-2010 (thousands of employees)

Sector	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
All Industries Total	**6,525**	**6,268**	**5,925**	**5,713**	**5,617**	**5,666**	**5,803**	**6,089**	**6,325**	**5,979**	**5,802**
Manufacturing	2,705	2,531	2,372	2,242	2,133	2,115	2,166	2,215	2,294	2,162	2,110
Retail trade	667	755	678	674	695	643	633	562	658	677	670
Wholesale trade	564	588	547	556	579	591	629	678	626	576	564
Finance and insurance	300	323	284	275	267	265	286	431	491	408	407
Information	410	311	314	317	290	313	331	339	377	369	363
Professional, scientific, and technical services	154	194	171	180	193	213	219	259	265	271	263
Real estate and rental and leasing	47	44	36	39	59	53	46	40	40	40	41
Other industries	1,679	1,522	1,524	1,430	1,401	1,474	1,493	1,564	1,573	1,477	1,387

Source: United States Department of Commerce, Bureau of Economic Analysis, FDI database, available at www.bea.gov/international

Table 5. Inward US FDI employment by sectors, 2000-2010 (as % of total FDI employment)

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
All Industries Total	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**
Manufacturing	41.5%	40.4%	40.0%	39.2%	38.0%	37.3%	37.3%	36.4%	36.3%	36.2%	36.4%
Retail trade	10.2%	12.0%	11.4%	11.8%	12.4%	11.3%	10.9%	9.2%	10.4%	11.3%	11.5%
Wholesale trade	8.6%	9.4%	9.2%	9.7%	10.3%	10.4%	10.8%	11.1%	9.9%	9.6%	9.7%
Finance and insurance	4.6%	5.2%	4.8%	4.8%	4.8%	4.7%	4.9%	7.1%	7.8%	6.8%	7.0%
Information	6.3%	5.0%	5.3%	5.5%	5.2%	5.5%	5.7%	5.6%	6.0%	6.2%	6.3%
Professional, scientific, and technical services	2.4%	3.1%	2.9%	3.2%	3.4%	3.8%	3.8%	4.3%	4.2%	4.5%	4.5%
Real estate and rental and leasing	0.7%	0.7%	0.6%	0.7%	1.1%	0.9%	0.8%	0.7%	0.6%	0.7%	0.7%
Other industries	25.7%	24.3%	25.7%	25.0%	24.9%	26.0%	25.7%	25.7%	24.9%	24.7%	23.9%

Source: United States Department of Commerce, Bureau of Economic Analysis, FDI database, available at www.bea.gov/international

investment is the one that is related most directly to long-term international investment strategies and constitute 75% of capital inflows (Figure 4).

Based on Table 6, foreign direct investment financial flows were US$ 227 billion in 2011, up from US$ 198 billion in 2010 and consisted of US$ 93 billion in net equity investment, US$ 80 billion in reinvested earnings, and US$ 53 billion in net intercompany debt investment inflows. Net equity investment was the largest component in 2011, but it was lower than in 2010 (US$132 billion) and it was at its lowest level since 2005 (US$ 71 billion). Reinvested earnings increased in comparison with 2010 from US$ 60 billion to US$ 80 billion in 2011. Borrowing transactions between US affiliates and foreign parent groups increased the direct investment position by $53 billion in 2011 from $7 billion in 2010. The 2011 intercompany debt investment increase was the largest since 2006 (US$ 59 billion) (Barefoot & Ibarra, 2011).

Figure 3. FDI employment in manufacturing by the states (in thousands), 1980 – 2009
Source: Bureau of Economic Analysis, Comprehensive Financial and Operating Data Archive by Industry of Affiliate, (http://www.bea.gov/international/di1fdiop.htm) (Tables F7 & G7)

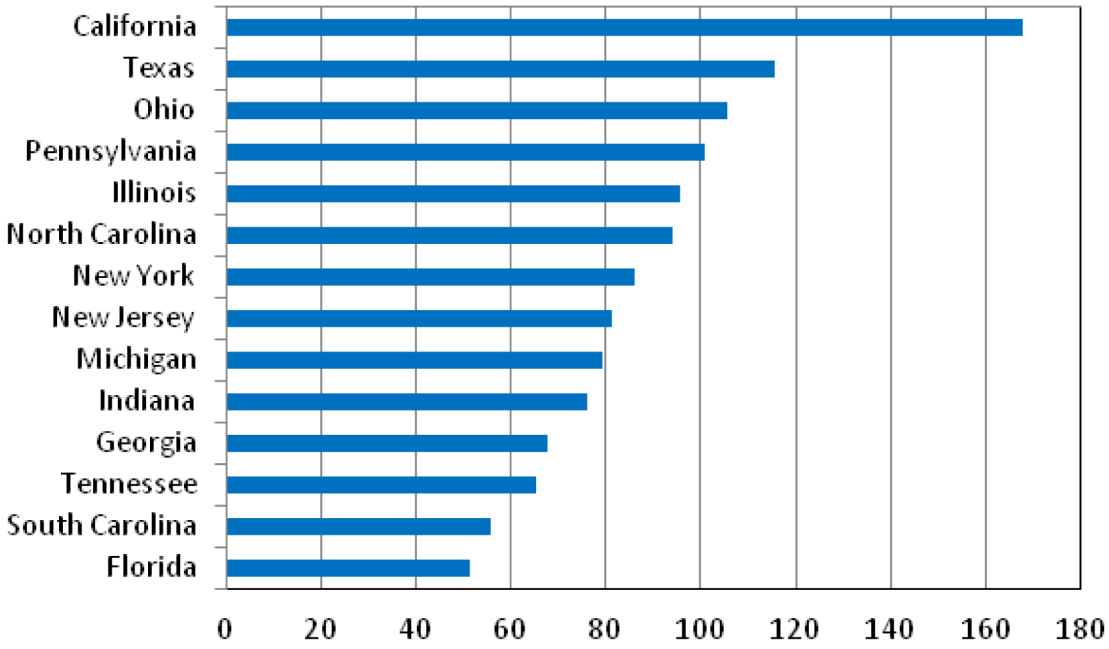
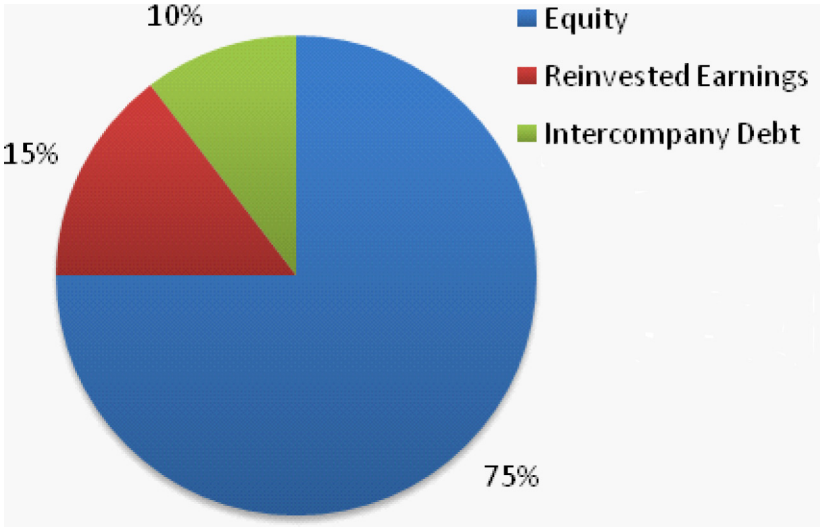


Figure 4. The structure of US FDI inflows by financial components in % (2000-2011, average)
Source: United States Department of Commerce, Bureau of Economic Analysis, FDI database, available at www.bea.gov/international



In 2010 and 2011 inward US FDI reinvested earnings (negative in 2002) increased respectively to 43% and 53% of generated FDI income coming back to pre- crises level (43% in 2006). Equity as a percentage of US FDI flows shows declining tendency since 2009 (Table 6).

Principal Foreign Affiliates in the United States

The list of principal foreign affiliates in the United States, ranked by revenue for 2010, was largely dominated by affiliates of European Multinational Enterprises (MNEs) (Table 7).

Shell Oil, the US affiliate of Royal Dutch Shell (Netherlands) topped the list, followed by BP America, an affiliate of British Petroleum (BP) (United Kingdom). Foreign affiliates in manufacturing featured prominently on the list. Included in the top twenty foreign affiliates by revenue were the affiliates of five automobile manufacturing firms: Toyota Motor, Honda Motor, and Nissan Motor from Japan, as well as Daimler and Volkswagen from Germany; US affiliates of foreign MNEs in electronic manufacturing, with established names like Siemens (Germany), Sony (Japan) and Samsung (Republic of Korea) were also among the top twenty, ranking 10th, 15th and 8th, respectively.

In the midst of the global recession, US FDI inflows and especially mergers and acquisitions (M&As) were particularly affected. Despite the reduction in FDI inflows, the US remains the largest host economy for FDI, and European MNEs and their affiliates continue to dominate FDI in that country. The bulk of M&A purchases by foreign firms during this time took place in financial services and largely involved commercial banks attempting to restructure balance sheets and mitigate losses. A number of greenfield investments were cancelled or postponed. The largest greenfield FDI projects between 2008 and 2010 were in energy and manufacturing. The dramatic surge in large greenfield investments in 2010 in manufacturing

Table 6. The structure of US FDI inflows by financial components (2000 -2011)

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
FDI Inflows	**314**	**159**	**75**	**53**	**136**	**105**	**237**	**216**	**306**	**153**	**198**	**227**
Equity	260	141	105	93	93	71	115	142	256	127	132	93
Reinvested Earnings	-8	-41	-8	4	39	34	63	43	35	15	60	80
Intercompany Debt	62	60	-23	-44	4	0.2	59	31	15	2	7	53
FDI Income	**48**	**4**	**32**	**61**	**88**	**110**	**145**	**121**	**126**	**98**	**138**	**152**
Reinvested Earnings as a % of FDI Income	-15.66%	-1061.54%	-24.77%	6.08%	44.82%	30.73%	43.51%	35.48%	28.16%	15.12%	43.13%	53.00%
Equity as a % of USFDI Flows	82.68%	88.62%	140.40%	176.23%	68.31%	67.33%	48.52%	65.88%	83.56%	82.88%	66.46%	41.06%

Source: United States Department of Commerce, Bureau of Economic Analysis, FDI database, available at www.bea.gov/international

Table 7. Principal foreign affiliates in the United States (ranked by revenue, 2010)

Rank 2010	Rank 2000	Foreign Investor	Home Economy	Name of Affiliate	Industry	Revenue (US $ Billion)
1	6	Royal Dutch Shell	Netherlands	Shell Oil	Oil	285.1
2	7	BP	U. K.	BP America	Oil	246.1
3	8	Toyota Motor	Japan	Toyota Motor North America	Automobile	204.2
4	20	AXA Group	France	AXA Group	Insurance	175.3
5	9	ING Group	Netherlands	ING America Insurance Holdings	Diversified finance	163.2
6	36	Volkswagen	Germany	Volkswagen of America	Automobile	146.2
7	38	Daimler AG	Germany	Daimler (US)	Automobile	109.7
8	890	Samsung	Korea	Samsung Electronics	Semiconductors and products	108.9
9	1	HSBC Holdings	U.K.	HSBC Bank USA	Banking	103.7
10	50	Siemens	Germany	Siemens	Electrical eng.& electronics	103.6
11	45	Nestle	Switzerland	Nestle USA	Food, nutrition, health, cosmetics	99.1
12	68	Honda Motor	Japan	Honda North America	Automobile	92.4
13	172	Deutsche Telekom	Germany	T Mobile	Telecom services	89.8
14	96	Nissan Motor	Japan	Nissan Motor (US)	Automobile	80.9
15	182	Sony	Japan	Sony Corporation of America	Consumer electronics, entertainment	77.7

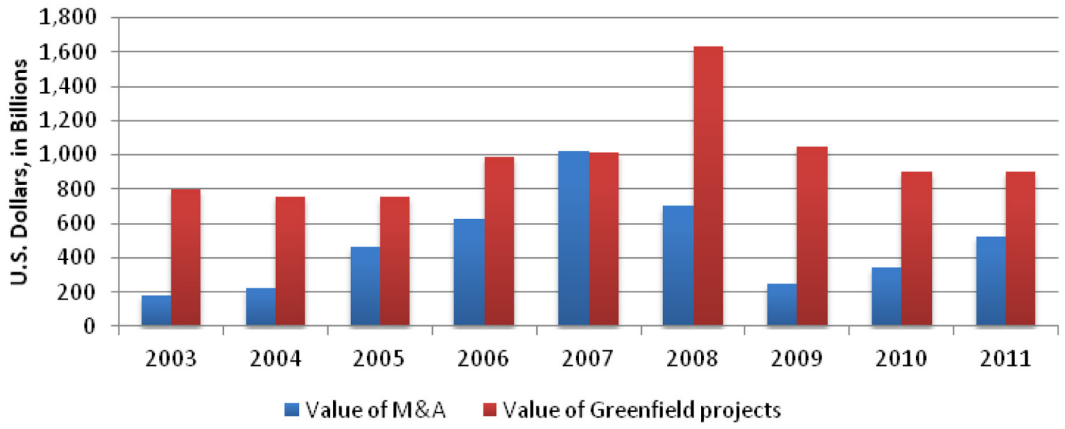
Source: Information compiled by the Organization for International Investment & RSM McGladrey, available from: http://www.ofii.org/resources.

and energy included investments valued at more than US$ 1.1 billion each by Iberdrola (Spain), Solar Millennium (Germany), Blue Chip Energy Gmbh. (Austria), and the Gestamp Group (Spain). The largest greenfield FDI project of 2010 was in the manufacturing sector, by Samsung of the Republic of Korea, with an investment of US$ 3.6 billion (Kornecki, 2013).

In 2008 and 2009, several foreign pharmaceutical companies undertook large multi-billion M&A deals in the United States. Swiss Roche Holding AG targeted Genentech Inc. (valued at US$ 46.7 billion), and InBevNV from Belgium targeted Anheuser-Busch in a deal valued at US$ 52.2 billion. During this period, the bulk of M&As by foreign MNEs in the United States occurred in the financial sector and, in particular, involved commercial banks, as part of the efforts to re-restructure balance sheets and prevent further systemic risk and liquidity crises set in motion by the multi-billion dollar fall of Lehman, prefaced just months earlier by that of Bear Stearns. In 2009, M&As involving US commercial banks continued, mainly by MNEs from home countries that had been relatively immune to the liquidity crisis, such as Canada and Singapore (Kornecki, 2013)

The largest cross-border acquisitions in 2011 were by Sanofi-Aventis (SA), a French biological products company, valued at US$ 21.2 billion, and one by BHP Billiton Ltd., a crude petroleum and

Figure 5. M&A and Greenfield projects comparison, 2003-2011 (USD billions)
Source: United States Department of Commerce, Bureau of Economic Analysis, FDI database, available at: www.bea.gov/international



natural gas company from Australia, valued at US$ 11.8 billion. In 2010, the largest cross-border acquisition in the United States was that by the German pharmaceutical company Merck KGaA (the world's largest maker of liquid crystal), of the US biotechnology equipment manufacturer Millipore Corp, valued at US$ 6.2 billion. The oil and gas industry continued to account for a significant portion of cross-border M&As in the United States in 2010 and 2011. M&A transac-

Table 8. Top ten M&A companies in the US (2011 million US$)

Year	Acquiring Company	Home Economy	Target Company	Target Industry	Shares Acquired (%)	Value (US$ Million)
2011	Sanofi-Aventis SA	France	Genzyme Corp	Biological products	100	21,230
2011	BHP Billiton Ltd	Australia	Petrohawk Energy Corp	Crude petroleum and natural gas	100	11,766
2011	Mitsubishi UFJ Finl Grp Inc	Japan	Morgan Stanley	Offices of bank holding companies	100	7,800
2011	Ensco PLC	United Kingdom	Pride International Inc	Drilling oil and gas wells	100	7,306
2011	Teva Pharmaceutical Industries	Israel	Cephalon Inc	Pharmaceutical preparations	100	6,311
2011	Toronto-Dominion Bank	Canada	Chrysler Financial Corp	Personal credit institutions	100	6,300
2011	BHP Billiton Ltd	Australia	Chesapeake Energy Corp.	Crude petroleum and natural gas	100	4,750
2011	Bank of Montreal	Canada	Marshall & Ilsley Corp.	National commercial banks	100	4,095
2011	ABB Ltd	Switzerland	Baldor Electric Co	Motors and generators	90	3,895
2011	Unilever PLC	United Kingdom	Alberto-Culver Co	Perfumes, cosmetics	100	3,842

Source: Thomson ONE Banker, Thomson Reuters (2011)

tions like Goldcorp's US$ 3.3 billion acquisition of Andean Resources Ltd. in 2010 formed part of a critically important growth strategy for metals and mining companies benefiting from higher metal prices (Kornecki, 2013).

MAIN FOCUS OF THE ARTICLE

This empirical research investigates state based factors affecting the inward FDI employment among fifty states of the United States, uses annual data for the period of time from 1997 to 2007 and identifies several state-specific determinants of FDI employment. It assumes that the major factors influencing inward US FDI employment in the US economy are: real wages, infrastructure, unionization level, educational attainment, FDI stock, manufacturing density, gross state product growth rate, real per capita taxes and share of scientists and engineers. Our findings indicate the importance of selected variables in evaluating the effects of FDI flow on state employment.

Literature Review and Hypotheses

The empirical literature related to the state based determinant of FDI employment in the US is limited. In evaluating the effects of FDI on the local economies, economists focus primarily on the performance of foreign-owned subsidiaries operating in the US It is already known that the establishment of a new foreign subsidiary or the expansion of an already existing one leads to higher employment and wages (Axarloglou, 2005). Reserchers identified link between job growth in the US economy during a period of increasing foreign direct investment flow. The economic impact on US employment due to FDI is evident, as are linkages among the various benefits due to the inward flow of FDI (Craig, 2008).

According to Axarloglou & Pournarakis in the last two decades, various US states offered strong economic incentives in an effort to attract FDI inflows, with the hope that FDI would stimulate local economies (Axarloglou & Pournarakis, 2005). Axarloglou, Casey and Han analyzed the effects of FDI inflows in local economies across US states. The empirical results point out that the US economy benefits from FDI inflows in manufacturing both in terms of employment and real wages. Overall, FDI inflows have a positive and in several cases statistically significant impact on local employment and wages. However, these effects vary across US states. In some states, such as California, Michigan, Ohio and Pennsylvania, FDI inflows appear to expand both employment and wages while in others, like Florida, Georgia and Virginia appear to depress both employment and wages. Finally, in several US states, such as in Connecticut, Delaware, Kentucky, and Louisiana, FDI inflows have mixed effects on local labor markets, with predominantly negative effects on local employment and expanding effects on local wages. There is evidence that these results are due to the industry composition of FDI inflows across states. FDI inflows in Printing and Publishing, Fabricated Metals, Industrial Machinery and Transportation Equipment have positive employment and wages effects, while FDI inflows in Furniture and Leather have negative effects (Axarloglou, Casey & Han, 2006).

The studies by Borstorff, Collum and Newton relate to FDI in the southern US, specifically automobile FDI in Alabama and describe state-specific features of southern states in recruiting foreign investment bringing the employment opportunities (Borstorff, Collum & Newton, 2007). Ajaga and Nunnen a analysis complements the regression analysis of Mullen and Williams and the Markov chain approach of Bode and Nunnenkamp and presents strong evidence of favorable FDI effects on output and employment at the level of US states (Ajaga & Nunnen, 2008).

Alfaro examined the effect of foreign direct investment on growth in the primary, manufacturing, and services sectors. Foreign direct investments in the primary sector, however, tend to have a negative

effect on growth, while investment in manufacturing a positive one. Evidence from the service sector is ambiguous (Alfaro, 2003). Blomstrom, Fors and Lipsey compared the relation between foreign affiliate production and parent employment in US manufacturing multinationals with that in Swedish firms. US multinationals allocated some of their more labor-intensive operations in developing countries, reducing the labor intensity in their home production. Swedish multinationals produce relatively little in developing countries and most of it in high-income countries, such as the United States and Europe associated with more employment, particularly blue-collar employment, in the parent companies (Blomstrom, Fors and Lipsey, 1997). Bode and Nunnenkamp investigated the effects of inward FDI on per-capita income and growth of the US states since the mid-1970s. This study analyzed the long-run relationships between inward FDI and economic outcomes in terms of value added and employment at the level of US states (Bode & Nunnenkamp, 2007). The study found that employment-intensive FDI, concentrated in richer states, has been conducive to income growth, while capital-intensive FDI, concentrated in poorer states, has not.

Methodology

Data Sources and Variables

In order to test the implications of our models, we collected a panel of aggregate data on foreign direct investment on all US states, excluding the District of Columbia. The entire data set includes 50 states for which foreign direct investment and all other relevant variables are reported over the 1997–2007 period.

In the United States, the Bureau of Economic Analysis (BEA) (BEA, 2013a), a section of the US Department of Commerce, is responsible for collecting economic data related to FDI flows. Monitoring this data is very helpful in trying to determine the impact of FDI on the overall economy, but is especially helpful in evaluating states and industry segments. The data on stock of FDI are from the US Department of Commerce, Bureau of Economic Analysis (BEA) (BEA 2013a),

The real per capita disposable income is measured as the nominal per capita disposable income deflated by the GDP deflator in constant (2000) US dollars. The real per capita taxes is measured by dividing the real state tax revenue by the state population. The nominal tax revenue for states are from various issues of the Annual Survey of State Government Finances (CENSUS 2013) published by the US Department of Commerce. The nominal tax revenue was deflated by the GDP deflator to derive the real state tax revenue. The data on state population are from the US Census Bureau (CENSUS 2013). The real per capita expenditure on education is measured by dividing the real state education expenditure by the state population. The nominal education expenditure for states are from various issues of the Annual Survey of State Government Finances (Census 2013) published by the US Department of Commerce. The nominal education expenditure was deflated by the GDP deflator to derive the real state education expenditure.

The share of scientists and engineers in the workforce, a proxy for labor quality, is collected from the National Science Foundation, Division of Science Resources Statistics, Science and Engineering Indicators 2010 (NSF 2013) The data on FDI related employment are collected from the Bureau of Economic Analysis while the data on state employment are collected from the US Department of Labor, Bureau of Labor Statistics (NSF, 2013). The information on real research and development expenditure is collected from the National Science Foundation, Division of Science Resources Statistics, Science and Engineering Indicators 2010 (NSF, 2013)

The data on the average wage and total state employment are collected from the US Department of Labor, Bureau of Labor Statistics. Following Coughlin, Terza, and Arromdee (1991),

the manufacturing density variable is measured as the manufacturing employment per square mile of state land excluding federal land. The data on manufacturing employment are collected from the US Department of Labor, Bureau of Labor Statistics (BLS, 2013)). The information on union membership is collected from http://www.unionstats.com/(Unionstats, 2013) maintained by Barry Hirsch (Georgia State University) and David Macpherson (Trinity University). The data on state unemployment rate are collected from the US Department of Labor, Bureau of Labor Statistics (BLS, 2013).

Model Specification

Drawing on the existing empirical literature in this area, we specify the following model:

$$FDIEMP = \beta_0 + \beta_1 EDU + \beta_2 RFDI + \beta_3 GDPGR + \beta_4 PCEXP + \beta_5 PCTAX + \beta_6 RWAGE + \beta_7 UNION + \beta_8 SAE + \beta_9 MANDEN + \beta_{10} RND + \beta_{11} HWY + \varepsilon \quad (1)$$

where:

FDIEMP: FDI Related Employment
EDU: Educational Attainment
RFDI: Real FDI Stock
GSPGR: Real GSP Growth Rate
PCEXP: Real Per Capita Exports
PCTAX: Real Per Capita Taxes
RWAGE: Real Wage
UNION: Union Membership (Share of Workers who are Members of Labor Unions)
SAE: Share of Scientists and Engineers in the Labor Force
MANDEN: Manufacturing Density
RND: Real Research and Development Expenditure
HWY: Highway Mileage

$FDIEMP_{it}$ represents FDI related employment in state i in year t; EDU_{it} is the real per capita expenditure on education in state i in year t; $RFDI_{it}$ represents real FDI Stock in state i in year t; $GSPGR_{it}$ stands for real gross state product growth rate in state i in year t; $PCEXP_{it}$ is real per capita exports in state i in year t; $PCTAX_{it}$ symbolizes real per capita taxes in state i in year t; $RWAGE_{it}$ is real wage in state i in year t; $UNION_{it}$ represents share of workers who are members of Labor Unions in state i in year t; SAE_{it} stands for share of scientists and engineers in the labor force in state i in year t; $MANDEN_{it}$ represents manufacturing density in state i in year t; RND_{it} relates to real research and development expenditure in state i in year t; HWY_{it} stands for highway mileage in state i in year t.

Our first variable, the real per capita expenditure on education is expected to have a positive effect on foreign direct investment employment. Therefore, we would expect that $\beta_1 > 0$. Our second variable, the real FDI stock is expected to have a positive effect on FDI employment. Therefore, we would expect that $\beta_2 > 0$. Our third variable the real gross state product growth rate is expected to have positive effect on FDI employment. Therefore, we would expect that $\beta_3 > 0$. The fourth variable the real per capita exports is expected to be positive. The fifth variable the real per capita state taxes usually deter FDI flows and, therefore, is expected to be negatively related to foreign direct investment employment; thus, we would expect that $\beta_5 < 0$. The sixth variable, real state per capita wages is a measure of market demand in a state and is expected to be positively related to foreign direct investment employment. Therefore, *a priori*, we would expect that $\beta_6 > 0$. The next variable, unionization of the workforce is expected to be related positively to foreign direct investment employment. Thus we would expect that $\beta_7 > 0$.

The eight variables, the share of scientists and engineers in the workforce, a proxy for labor quality is expected to have a positive effect on foreign direct investment employment. Therefore, we would expect that $\beta_8 > 0$. The manufacturing

density is expected to be related positively to foreign direct investment employment. Therefore, we would expect that $\beta_9 > 0$. As Coughlin, Terza, and Arromdee (1991) and Head, Ries and Swenson (1995, 1999) point out, manufacturing density could also be used as a proxy for agglomeration economies. States with higher densities of manufacturing activity is expected to attract more foreign direct investment because the foreign investors might be serving existing manufacturers. Our tenth variable, the real research and development expenditure is expected to have a positive effect on foreign direct investment employment. Therefore, we would expect that $\beta_{10} > 0$. Highway mileage is a indicator of infrastructure is expected to be positively correlated with foreign direct investment employment. Therefore, we would expect that $\beta_{11} > 0$.

Empirical Results

The results of our empirical analysis are presented in Table 9., in addition to the eleven independent variables included in Equation (1). All the variables presented in Table 9 are expressed in logarithm and the coefficient of each variable can be interpreted as elasticities. The results of the study imply that FDI employment in the US is strongly influenced by the state spending on education. The coefficient of this variable is positive and statistically significant at the 1% level of significance.

The real stock of FDI has a positive and statistically significant effect on FDI related employment. The results of the study suggest that FDI employment is strongly correlated with the real FDI stock in the US This could be due to the fact that the states with high level of FDI employment also have larger FDI stock. Real per capita exports have the positive sign and are statistically significant at the 1% level. Most of the time higher FDI stock and employment result in higher state exports.

Real GSP growth rate has the unexpected negative sign and it is statistically significant at the 1% level. It can be explained by the fact, that many foreign investors choose the southern part of the US as a desirable location for their FDI. The southern US states has become more aggressive in recruiting foreign investment by providing incentives to attract investments and communicating the unique advantages they offer to foreign companies. The real per capita taxes has the expected negative sign and it is statistically significant at 1% level. This finding is also consistent with the findings of previous studies. Real wages have the positive sign and it is statistically significant at 1% level. It is known that foreign companies investing in US not only provide jobs, but relatively high-paying jobs what constitutes important determinant of FDI employment. Unionization variable has an expected positive sign and it is statistically significant at the 1% level of significance. Sur-

Table 9. Determinants of FDI related employment in the United States, 1990-2007. Panel least squares estimates, dependent variable: FDI related employment.

Variable	Coefficient	t-Statistic
Constant	-248.2263***	-13.34
Education	1.6966***	9.08
Real FDI stock	1.8515***	9.04
Real GSP Growth Rate	-3.2924***	-16.23
Real Per Capita Exports	0.0603***	5.11
Real Per Capita Taxes	-0.0600***	-10.37
Real Wages	15.5267***	14.13
Unionization	2.5801***	7.79
Scientists and Engineers	-0.1157	-0.68
Manufacturing Density	0.0003	0.03
Real Research and Development Expenditure	0.0000	0.24
Highway Mileage	9.9975***	7.13
Adjusted R^2	0.8662	
Number of Periods	18	
Number of Cross-Sections	50	
Number of Observations	900	

Note: *** indicates the statistical significant at the 1% level.

prisingly, the share of scientists and engineers in the workforce has an unexpected negative sign. It can be related to the fact that the labor force is relatively more productive and skilled in urban than in rural areas. Manufacturing density variable has the expected positive sign. This variable is also expected to capture the agglomeration economies and we can guess that the more dense the manufacturing activity is in a given state, the more likely higher foreign direct investment employment will be. However, current results reveal that the Southeast region in the US stems from relatively high manufacturing density. Highway Mileage represents infrastructure level in the state and it is definitely positively correlated with the FDI employment at the 1% level of significance.

CONCLUSION

Inward FDI represents an integral part of the US economy. Most of the foreign investment in the United States comes from the European developed economies. These investments are predominately in the manufacturing sector and accounts for very high percentage of foreign direct investment in the United States. US affiliates of foreign companies in the manufacturing industry is the largest contributor of FDI employment in the US economy. In 2009, manufacturing employment accounted for 36.3 percent of total FDI employment in the United States. The next large industry outside the manufacturing for employment by US affiliates of foreign companies was retail trade. The retail trade industry accounted for 10.9% of total FDI employment followed by wholesale 9.7% along with finance and information consecutively accounting for 6.8% and 6.4% of total FDI employment. The leading states in foreign direct investment employment are California, Texas, Ohio, Pennsylvania, Illinois, North Carolina, New York, New Jersey. The southern US states have become more aggressive in recruiting foreign investment by providing incentives to attract investments.

This paper investigates locational determinants of the inward foreign direct investment (FDI) among fifty states of the United States. In order to test the implications of our models, we collected a panel of aggregate data on foreign direct investment on all US states, excluding the District of Columbia. The entire data set includes 50 states for which foreign direct investment and all other relevant variables are reported over the 1997–2007 period. US policymakers obviously expect FDI inflows to help improve income and employment prospects in the economy.

It is known that foreign companies investing in the United States not only provide jobs, but offer relatively high-paying jobs what constitutes important factor influencing to high FDI employment and contributing to employment in the US economy. Findings of our research show that real wages variable has the positive sign and it is statistically significant at 1% level. The next important factor the state highway mileage representing infrastructure is positively related to the FDI employment at the 1% level of significance. Among other findings, unionization variable, as expected is statistically significant at the 1% level of significance. It is known that the degree of unionization within US affiliates of foreign companies is relatively higher in comparison with domestic companies.

The real stock of FDI has a positive and statistically significant effect on FDI related employment. This could be due to the fact that the states with high level of FDI stocks also have larger related employment. The education has the expected positive sign and it is statistically significant at 1% level. It can be concluded, that for states to attract more investment is to spend more on educations and research and development activities. The real per capita taxes has the expected negative sign and it is statistically significant at 1% level. This finding is also consistent with the findings of previous studies. Given that the current results suggest that state government taxation negatively affect foreign direct investment, state governments

may consider providing more fiscal incentives to foreign investors in order to attract more foreign direct invest to their states.

Real state growth rate has the unexpected negative sign and it is statistically significant at the 1% level It can be explained by the fact, that many foreign investors choose the southern part of the US as a desirable location for their FDI. The southern US states has become more aggressive in recruiting foreign investment by providing incentives to attract investments and communicating the unique advantages they offer to foreign companies. It could be related to the fact that that employment-intensive FDI, concentrated in richer states, has been conducive to growth, while capital-intensive FDI, concentrated in poorer states, has not. Additionally, according to Alfaro foreign direct investments in the primary sector tend to have a negative effect on growth and employment, while investments in manufacturing tend to have a positive one, while the evidence from the service sector is ambiguous (Alfaro, 2003). Surprisingly, the share of scientists and engineers in the workforce has an unexpected negative sign. It can be related to the fact that the labor force is relatively more productive and skilled in urban than in rural areas.

FUTURE RESEARCH DIRECTIONS

Our findings indicate the importance of selected variables in evaluating the effects of FDI flow on US states employment. Also, they emphasize the need for US to selectively target FDI in specific states and industries and make a host government's aware of importance of promotional effort to attract foreign direct investment and stimulate employment and growth at the state level contributing to overall output growth and employment in the US economy. Encouraging more FDI and expanding the number of countries investing in the United States can lead potentially to higher employment and higher output growth.

The recent economic crises negatively impacted world FDI flows in 2008 and 2009 and opened a period of major uncertainty. IFDI flows into the United States fell in 2009 but rose in 2010 and 2011, recovering toward the pre-crisis level, but remaining well below their pre-crisis peak. The effectiveness of government policy responses at both the national and international levels in addressing the financial crisis and its economic aftermath will play a crucial role for creating favorable conditions for a continued recovery of FDI inflows into the United States. Public policies will obviously play a major role in the implementation of favorable conditions for such a recovery. Structural reforms aimed at ensuring more stability in the world financial system, a renewed commitment to an open environment for FDI and the implementation of policies aimed at favoring investment and innovation are key issues in this respect (*UNCTAD, 2009).*

Solutions and Recommendations

IFDI represents an integral part of the US economy, with its stock growing from US$ 83 billion in 1980 to US$ 3.5 trillion in 2011. The United States, which had earlier been primarily a home for multinational enterprises (MNEs) rather than a host for affiliates of foreign MNEs, has become a preferred host country for FDI since the 1980s. Foreign MNEs have contributed robust flows of FDI into diverse industries of the US economy, and total FDI inflows reached US$ 227 billion in 2011, equivalent to 15% of global inflows, the single largest share of any economy. US FDI flows, with a peak of US$ 314 billion in 2000 and another of US$ 306 billion in 2008, have been an important factor contributing to sustained economic growth in the United States.

The recent financial and economic crises negatively impacted FDI flows to the United States and opened a period of major uncertainty. The effectiveness of government policy responses at both the national and international levels in

addressing the financial crisis and its economic consequences will play a crucial role for creating favorable conditions for a rebound in FDI inflows.

Unlocking the full potential of the future global inward FDI developments for the United States, as elsewhere, will depend on wise policymaking and institution building by governments and international organizations.

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KEY TERMS AND DEFINITIONS

Foreign Direct Investment (FDI) Financial Structure: Equity capital, reinvested earnings, intercompany debts. Equity capital is the foreign direct investor's purchase of shares of an enterprise in a country other than its own. Reinvested earnings comprise the direct investor's share (in proportion to direct equity participation) of earnings not distributed as dividends by affiliates, or earnings not remitted to the direct investor. Such retained profits by affiliates are reinvested intercompany debts. Intra company loans or intra company debt transactions refer to short or long term borrowing and lending of funds between direct investors (parent enterprises) and affiliate enterprises.

Foreign Direct Investment (FDI) Flow: The FDI inflow measures the amount of FDI entering a country during a one year period. FDI refers to an investment made to acquire lasting interest in enterprises operating outside of the economy of the investor. The investor's purpose is to gain an effective voice in the management of the enterprise. FDI refers to an investment made to acquire lasting interest in enterprises operating outside of the economy of the investor. A threshold of 10 per cent of equity ownership qualifies an investor as a foreign direct investor, having an effective voice in the management of an enterprise FDI may be undertaken by individuals as well as business entities. *(*www.unctad.org/Templates/Page.asp?intItemID=3146&lang=1*).*

Foreign Direct Investment (FDI) Stock: The FDI stock represents the total amount of productive capacity owned by foreigners in the host country. FDI stock grows over time and includes all retained earnings of foreign-owned firms held in cash and investments.

Greenfield Investments: A form of foreign direct investment where a parent company starts a new venture in a foreign country by constructing new operational facilities from the ground up. In addition to building new facilities, most parent companies also create new long-term jobs in the foreign country by hiring new employees (http://en.wikipedia.org/wiki/Greenfield_project#Greenfield_investment.

Inward Foreign Direct Investment (IFDI): Inward operations refer to the activities of foreign affiliates in the host economy (business enterprises in which there is an FDI relationship in the host country) (http://unctad.org/en/Docs/wir2007p4_en.pdfI)

Mergers and Acquisitions (M&A): Refers to the consolidation of companies. A merger is a combination of two companies to form a new company, while an acquisition is the purchase of one company by another in which no new company is formed. Cross-border M&A statistics include mergers and acquisitions between foreign affiliates and firms located in the same host economy.

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APPENDIX: WEB SITES

- The 2012 A.T. Kearney FDI Confidence Index, (http://www.atkearney.com/index.php/Publications/foreign-direct-investment-confidence-index.html)
- National Science Foundation, Division of Science Resources Statistics, Science and Engineering Indicators, (http://www.nsf.gov/statistics/seind10/).
- The US Census Bureau, (http://www.census.gov).
- The US Department of Commerce, Bureau of Economic Analysis (BEA), (http://www.bea.gov).
- The US Department of Commerce, Bureau of Economic Analysis, FDI database, (www.bea.gov/international)
- The US Department of Commerce. Annual Survey of State Government Finances, (http://www.census.gov/govs/state/).
- The US Department of Labor, Bureau of Labor Statistics, (http://www.bls.gov)
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- Location USA- Area Development, (http://www.areadevelopment.com/LocationUSA/)
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Chapter 7
The Situation of Knowledge Economy in the Arab and EEE Regions

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ABSTRACT

This chapter introduces different knowledge components and indices and attempts to show their impacts on different economic and development indicators with focus on EEE and Arab economies. It uses mainly descriptive statistics and regression analysis to globally assess these performances. The sets of data used for EEE show already the data limitations faced by Arab economies.

INTRODUCTION

In a global world, it is rather straightforward to find similarities among regions located in different geographical areas or under different cultural regimes.

CEE: Central and Eastern Europe is a term describing former communist states in Europe, after the collapse of the Iron Curtain in 1989/90. In scholarly literature, the abbreviations CEE or CEEC or EEE are often used for this concept. In the sense of the current study, EEE includes all the Eastern bloc countries west of the post-World War II border with the former Soviet Union, the independent states in former Yugoslavia (which were not considered part of the Eastern bloc), and the three Baltic states – Estonia, Latvia, Lithuania – that chose not to join the CIS with the other 12 former republics of the USSR. The transition countries in Europe and Central Asia are classified today into two political-economic entities: CEE and CIS. The EEE countries are further subdivided by their accession status to the European Union (EU): the eight first-wave accession countries that joined the EU in May 2004 (Estonia, Latvia, Lithuania, Poland, Czech Republic, Slovakia, Hungary, and Slovenia) and the two second-wave accession countries that joined in January 2007 (Romania and Bulgaria). According to the World Bank, the transition is over for the 10 countries that joined the EU in 2004 and 2007.

MENA: Middle East and North Africa is a term describing the Arab countries from the Middle East and the northern part of Africa. According to the World Bank definition, MENA" is an

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economically diverse region that includes both the oil-rich economies in the Gulf and countries that are resource-scarce in relation to population, such as Egypt, Morocco, and Yemen." The Arab Region refers mainly to the following Arab countries: Algeria, Bahrain, Egypt, Iraq, Jordan, Kuwait, Lebanon, Libya, Morocco, Oman, Qatar, Saudi Arabia, Syria, Sudan, Tunisia, United Arab Emirates, West Bank/Gaza and Yemen.

LITERATURE REVIEW

EEE and Arab countries are almost at the same level of economic growth, according to the development pattern from Kharas (2010). The author of this study identifies four drivers of global economic growth:

- Technological advance of the global production frontier at the rate of 1.3 per cent per year.
- Catch-up technology in a group of fast growing converges who are in the midst of a process of shifting resources from low to higher productivity activities; the speed of catch-up depends on each country's income level relative to the US.
- Capital accumulation, derived by assuming each country maintains its investment rate at its historical average.
- Country specific demographic changes of the 15-64 age group, assuming constant labour force participation rates in each country.

In the past years, countries like Morocco, Algeria, Tunisia, Libya have become attractive for foreign investment. Until recently, multinational companies looked to the east, when they wanted to establish low-cost offshore production and other operations at the door of Europe. This has led to billions of dollars in investment in the former Soviet bloc countries like Poland, Slovakia, Romania and Bulgaria. However, as wages have risen in Eastern Europe, countries from the Arab region became more attractive.

While their appeal to potential investors may be similar, Eastern Europe and the Arab countries are totally different, both economically and socially.

Moreover, from a social point of view, the ex-communist states of central Europe can be a role model for nations in North Africa and the Middle East in their fight for democracy and freedom of expression.

In the following sections we will discuss the main aspects regarding the knowledge economy indicators for EEE countries, as a benchmark for Arab countries.

The Work Foundation Report *Defining the Knowledge Economy* reviewed the common definitions used. The knowledge economy has most commonly been defined in terms of technology and knowledge based industries reflecting R&D intensities, high ICT usage, and the deployment of large numbers of graduates and professional and associate professional workers. An industry-based definition is not entirely satisfactory because, the knowledge economy applies across all industries.

However, an industry-based approach has the advantage of being able to draw on official statistics based on internationally agreed definitions of knowledge-based industries. For this chapter, we have drawn on the definitions developed by Eurostat and the OECD (2003).

The Eurostat definition includes high to medium tech manufacturing and communications, financial, business services, health, and education. Eurostat also includes recreational, cultural, sporting services and some travel services (sea and air) that the OECD excludes (OECD, 2005b).

Eurostat also breaks the knowledge service sector down into four groups: high tech services (R&D and computing); financial services; market knowledge services (communications, travel and business services) and other knowledge services (health, education, and recreational and cultural services).

- **The OECD Definition:** "The knowledge based economy" is an expression coined to describe trends in advanced economies towards greater dependence on knowledge, information and high skill levels, and the increasing need for ready access to all of these by the business and public sectors.

1. DESCRIPTIVE FACTS REGARDING THE KNOWLEDGE ECONOMY INDICATORS

1.1. Trends

The current literature in business, academia and market analysis has identified the following trends and opportunities, that stakeholder never benefit from. Technology that facilitates the shift out of survival mode and enables businesses to focus on business expansion has become more important. Companies will seek to enhance existing customer relationships, improve business efficiencies, and grow revenue in the coming months as in Ndou (2004) but also in Gichoya (2005).

- For small businesses, this means increased use of collaborative tools, improved networking and implementing disaster recovery plans. Medium businesses, as well, are focused on more effective collaboration among employees. However, this will come in the form of more enterprise IT solutions such as Customer Relationship Management (CRM), Enterprise Resource Planning (ERP) and server virtualization.
- Substantiated marketing messages with more quantifiable information will be required to drive ICT purchases beyond basic break/fix purchases. Because of the economic downturn, business decision-makers (BDMs) are much more involved in the purchase process of ICT. Companies will require stronger justification for ICT purchases, and in a language, BDMs can directly translate into bottom line results. Phrases such as "save time" and "save money" will need to be heavily supported with hard numbers and proof of outcome.
- Cloud computing solutions (Morgan Stanley, 2011) will struggle to capitalize on the full market opportunity presented in the upcoming years. Adoption will continue to climb in the near future, but marketers will need to reduce confusion, misinformation and apprehension in order to convert interest into actual purchases.
- The next following years will continue to see accelerated adoption and mainstreaming of key technologies like Cloud computing and Virtualization, as cost savings, operational efficiency and IT disaster recovery are key business drivers. However, marketers will struggle to fully address the growing interest in specific software and virtual infrastructure solutions due to the amount of confusion in the value proposition and offerings that exist in the minds of ICT executives.
- Social media will move beyond its primary role as a promotional tool into the strategic role of business intelligence.

Businesses will continue to adopt digital marketing media to reach customers, and as usage of social media grows so will the advantages and opportunities for companies to capture valuable competitive feedback. Although the number of companies using social media as a source for business intelligence is small, it will grow significantly in the next few years as the value of the tool becomes more obvious.

In the next upcoming years, companies will continue to find new ways to gain visibility in day-to-day operations in a non-technical, non-IT assisted manner. Business intelligence (BI) has been traditionally under-utilized by companies compared with large enterprises, and with mas-

sive amounts of data assets lying around in these smaller companies, organizations are realizing that they can use existing data resources better to gain clear line of sight into their business and customers for timely decision-making. In order to focus more on business growth and results, and not just internal efficiency and cost control companies are now using BI tools. These trends are illustrated by the following facts.

1.1.1. Percentage of ICT Sector Value Added

For the EEE countries the percentage of ICT sector value added in the past ten years has almost the same tendency as the European Union as a whole, with an average of around 6% of GDP. Although the trend is positive, there is a clear downturn due the financial crisis period, most of the countries being affected by the economic recession.

O'Mahony, Timmer and Ark (2007) show that the potential for a recovery in productivity growth will to a large depend on the EU's capability to transform the economy towards an economic engine that makes more productive use of its resources with an intensive use of ICT investments in service industries. To this author, these trends appear to be the most successful avenues that could ensure a revival of the productivity in Europe.

1.1.2. Gross Domestic Expenditure on R&D

Consider the relative shares of the different sources of funds in R&D. More specifically the indicators provided are percentage of GERD (Gross domestic expenditure on R&D) financed respectively by industry, government, the higher education and the private non-profit sector (Table 1). The fifth source of funds shown, which also make the breakdown complete, is GERD financed from abroad. R&D is an activity where there are significant transfers of resources between units, organisations, sectors and countries. The importance of the source of funding has been recognized in one of the Barcelona targets of the Lisbon agenda where it is said that the appropriate split for R&D is 1/3 financed by public funds and 2/3 by private ones.

Table 1. Gross domestic expenditure on R&D(% on GDP)

Gross Domestic Expenditure on R&D (% on GDP)	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
EU-27	*1.86*	*1.87*	*1.88*	*1.87*	*1.83*	*1.83*	*1.85*	*1.85*	*1.92*	*2.01*	*2.00*
Bulgaria	0.51	0.46	0.48	0.48	0.49	0.46	0.46	0.45	0.47	0.53	*0.60*
Czech Republic	1.17	1.16	1.15	1.20	1.20	1.35	1.49	1.48	1.41	1.48	1.56
Estonia	0.60	0.70	0.72	0.77	0.85	0.93	1.13	1.08	1.28	1.43	*1.62*
Latvia	0.45	0.41	0.42	0.38	0.42	0.56	0.70	0.60	0.62	0.46	0.60
Lithuania	0.59	0.67	0.66	0.67	0.75	0.75	0.79	0.81	0.79	0.83	0.79
Hungary	0.81	0.93	1.00	0.94	0.88	0.94	1.01	0.98	1.00	1.17	1.16
Poland	0.64	0.62	0.56	0.54	0.56	0.57	0.56	0.57	0.60	0.68	0.74
Portugal	*0.73*	0.77	*0.73*	0.71	*0.75*	0.78	*0.99*	1.17	1.50	1.64	*1.59*
Romania	0.37	0.39	0.38	0.39	0.39	0.41	0.45	0.52	0.58	0.47	0.47
Slovenia	1.38	1.49	1.47	1.27	1.39	1.44	1.56	1.45	1.65	1.86	*2.11*
Slovakia	0.65	0.63	0.57	0.57	0.51	0.51	0.49	0.46	0.47	0.48	0.63

The empirical evidence identifies knowledge as an important source of economic growth (Acs, Audretsch, Braunerhjelm, & Carlsso, 2012) where the results of this study emphasize the importance of policies that not only promote R&D investments, but also take the role of spillover mechanism into account. Most countries followed a similar trend along the years.

Gross domestic expenditure on R&D for EEE countries is between 0.5% and 2% of GDP, for the period 2000-2009, and the data are similar to those from Arab countries. According to the latest data from World Bank (2005), the value of this indicator for Arab region is 0.85% of GDP, a value comparable to the EEE region.

1.1.3. Researchers

Researchers are professionals engaged in the conception or creation of new knowledge, products, processes, methods and systems, and in the management of the projects concerned. Head count (HC) data measure the total number of researchers who are mainly or partly employed on R&D.

The number of researchers has an upward trend in almost all the considered countries. The highest number is held by Poland, followed by Czech Republic, Hungary, Romania and Slovakia, only normal relative to the country population.

For the Arab countries, although there are data availability issues, the World Bank reports show also an upward trend in terms of number of researchers in the past decade.

1.1.4. Turnover from Innovation

This indicator is defined as the ratio of turnover from products new to the enterprise and new to the market as a % percentage of total turnovers. It is based on the Community innovation survey and covers at least all enterprises with 10 or more employees. An innovation is a new or significantly improved product (good or service) introduced to the market or the introduction within an enterprise of a new or significantly improved process.

A clear upward trend is presented only in Hungary and Portugal, while Slovakia presents a downward trend.

1.1.5. Venture Capital Investments

Venture capital investment is defined as private equity raised for investment in companies; management buyouts, management buying and venture purchase of quoted shares are excluded. Data are broken down into two investment stages: Early stage (seed and start-up) besides expansion and replacement (expansion and replacement capital).

1.1.6. High-Tech Exports as % of Exports

This indicator is calculated as share of exports of all high technology products of total exports. High Technology products are defined as the sum of the following products: Aerospace, Computers-office machines, Electronics-telecommunications, Pharmacy, Scientific instruments, Electrical machinery, Chemistry, Non-electrical machinery, Armament. The total exports for the EU do not include the intra-EU trade.

As it can be easily observed from the data, Hungary, Czech Republic and Estonia are on top of all EEE countries.

If we consider the values of this indicator, there is a similarity between the Arab World as a whole and EEE countries, but there is a significant difference between the EEE countries and Arab countries. Nour (2005) shows that Arab countries don't have enough financial and human resources to promote a development policy based on research and development, this fact being one of the causes of the lagged development.

1.1.7. Employment in High and Medium-High-Technology Manufacturing Sectors

The data shows per country the employment in high and medium-high technology manufacturing sectors as a share of total employment. Data source is the Community labour force survey (CLFS). The definition of high and medium-high technology manufacturing sectors is based on the OECD definition (itself based on the ratio of R&D expenditure to GDP).

Once again, a similar pattern of behaviour can be noticed for all EEE countries, less Slovakia.

For Arab countries, there is a persistent gap between the skills acquired at university and the requirements of business (O'Sullivan, Rey, & Mendizi, 2011). Enterprises often cite lack of suitable skills as an important constraint to hiring: according to the World Bank's Enterprise Surveys. Firms identify labour skill levels as a major constraint in Lebanon (38% of surveyed firms), Syria (36%), Jordan (33%), Mauritania and Egypt (31% in both countries).

1.1.8. Employment in Knowledge-Intensive Service Sectors

The data show per country, the employment in knowledge-intensive service sectors as a share of total employment. Data source is the Community labour force survey (CLFS). The definition of knowledge-intensive services including high-technology services used by Eurostat is based on a selection of relevant items of NACE Rev. 1 on 2-digit level and is oriented on the ratio of highly qualified working in these areas.

For all the countries in EEE region there is a positive trend in employment in knowledge intensive service sectors, as drivers for development.

As a comparison, in Arab countries the general rate of unemployment is high, and as the population increases, youth unemployment also continues to rise.

The Arab region has the highest rates of unemployment in the world and a growing deficit of knowledge in both new and traditional forms as claimed in several studies. These insist also on the unemployment rate ranges from 56% in Gaza to 15% in Oman, and the rate of unemployed youth as a percentage of the entire population sits between 39.5% in Morocco (1999) and 75.4% in Bahrain (1995). In Iran, youth account for 70% of a population of more than 66 million, but youth unemployment has other national and global impacts, notably increased violence, crime, drug use, poverty and political instability. In addition, the rapid rate of urbanisation in many Arab countries has increased levels of youth-specific unemployment, due to the lack of skills required in urban employment compared to that practiced in rural activities.

1.1.9. Human Resources in Science and Technology

Human resources in science and technology (HRST) are an important feature in the new paradigm of knowledge economy: as the investments in high-tech technologies increases, there is an increase in demand for skilled labour force. In Eurostat methodology this fact is measured by the percentage of the total labour force in the age group 25-64, that is classified as HRST, i.e. having either successfully completed an education at the third level in an S field of study or is employed in an occupation where such an education is normally required. HRST are measured mainly using the concepts and definitions laid down in the Canberra Manual, OECD, Paris, 1995.

The trend is increasing for all countries, because they had to adapt to e-governance requirements by the EU, before and after accession.

1.1.10. Doctorate Students in Science and Technology Fields

In the European Union, according to Eurostat definition, a key indicator for knowledge economy is the proportion of doctoral students in science and technology fields. The methodology takes into account the students participating in second stage of tertiary education in science and technology fields of study, as a percentage of the population 20-29 year old. This indicator includes the total number of students in tertiary programs which leads to an advanced research qualification (ISCED level 6), in the educational fields Science, Mathematics and Computing and Engineering, Manufacturing and Construction. The levels and fields of education and training used follow the 1997 version of the International Standard Classification of Education (ISCED97) and the Eurostat Manual of fields of education and training (1999).

For the period 2000-2009, all the countries in EEE region exhibit a significant increase in the number of students enrolled in doctoral programs in the field of science. For example, the proportion of doctorate students ranges between 0.1% in Bulgaria to 0.85% in Czech Republic.

For the Arab countries, there are no specific data available for this indicator, yet there are data regarding the proportion of student enrolled in tertiary education. From the point of view of this indicator, there is an increasing trend, from almost 20% in 1999 to 28% in 2009.

1.2. Production of Knowledge

Knowledge production is a complex and time-consuming process, since for knowledge to be produced someone must think of an idea and decide to pursue it further. Sometimes an idea takes years to germinate in a person's mind. The idea will require time to research and develop fully-regardless of whether it leads to scientific experimentation or research in a library.

In addition to the time needed to do research and produce new knowledge, a person must find the appropriate funding to pursue the research. Scientific research costs a considerable amount of money, and while research in the social sciences and humanities may cost less, both require investments of money and time.

Research is usually done by people associated with large institutions because of the time and resources needed to produce new knowledge. Most of the research is pursued by individuals who work for government agencies, universities, large non-profit organizations, or large corporations.

1.2.1. Information Produced by the Government

Government, governmental agencies and institutions are knowledge producers. Usually, they produce country official data. The official data can be found in yearbooks, statistical bulletins, newsletters and studies.

1.2.2. Information Produced by Academic Institutions

Universities and colleges are also major producers of knowledge. Faculty performs research in the sciences, humanities and social sciences, the so called scholarly research. The results of this research can sometimes be applied directly to practical and social problems and it sometimes benefits companies or public institutions. Much of the research and knowledge produced by scholars is used by other scholars to advance the state of knowledge in a specific field of study.

Research and knowledge generated by faculty at universities and colleges is most often published in the form of books and scholarly journals. One can locate this knowledge by searching library catalogues and scholarly journal indexes. To be published in a scholarly journal or book, researchers submit their findings to a publication's peer

review board. Faculty researchers try to match the content and style of their research to a particular journal's focus and audience. The article or book is then evaluated by a panel of experts in the field for the merit of its ideas, originality, and thoroughness in research, accuracy, and contribution to the body of knowledge in the discipline. The peer review board then makes a recommendation to accept or reject the work for publication. Often the peer review board makes suggestions for revisions or further clarification that may require rewriting and additional research.

The publication of an article or book encourages other scholars to evaluate the research to corroborate or dispute it. This exchange and debate of ideas and findings contributes to the production of the larger body of knowledge within a discipline.

The way academic disciplines structure knowledge affects searching. In order to effectively locate information, one must have an idea of how academic disciplines and libraries structure knowledge.

One way to assess the similarities between EEE and Arab countries from the point of view of scholarly research is to study the evolution of one indicator reported by the World Bank regarding the number of journal articles. Scientific and technical journal articles refer to the number of scientific and engineering articles published in the following fields: physics, biology, chemistry, mathematics, clinical medicine, biomedical research, engineering and technology, and earth and space sciences.

Taking into account the values of this indicator over time shows us that there is slightly the same pattern for EEE and Arab countries: the number of journal article published by researchers from those two regions was pretty much the same for the period 2000-2007(between10000 and 18000), and the trend is a positive one.

1.2.3. Information Produced in the Private Sector

The private sector (i.e. non-governmental) also produces information and knowledge. Commercial newspapers, magazine and book publishers, the film and television industry, corporate laboratories, business research firms, associations, advocacy groups, and think tanks, all gather data and produce information.

These publications take many forms: magazines, books, bulletins, conferences, pamphlets, videos, technical reports, and company annual reports are but a few. Some are intended for internal use within the organization and may not be available to the general public. Companies and laboratories often patent or trademark information as it is the result of their research. Patents and trademarks give the holder of the patent or trademark exclusive rights to the information.

When using any publication, it is important to know as much as possible about the organization, its goals and motives, and its reputation. Points of view, as well as goals and motives, *are* reflected in the information organizations produce.

How might the information from a business publication--primarily concerned with the research, development and promotion of a product--differ from that of a consumer advocacy group? Advocacy groups or organizations which are formed around particular issues, political or social agendas, have differing and sometimes conflicting perspectives of the same issue.

1.3. Technological Transfers

Technology transfer is the term used to describe the processes by which technological knowledge moves within or between organisations. International technology transfer refers to the way in which this occurs between countries.

The technological knowledge that is transferred can assume various forms: it can be embodied in goods (including physical goods, plant and animal organisms), services and people, and organisational arrangements, or codified in blueprints, designs, technical documents, and the content of innumerable types of training. Alternatively it can be communicated through flows of tacit knowledge – i.e. knowledge that has not been fully codified, and remains embodied in the skills of people.

All these forms of knowledge may vary in a further important way: at one end of the spectrum, the transfer involved can be concerned with the knowledge for using and operating technology. At the other end, it can be concerned with the knowledge necessary for changing technology and innovating. In between, transferred knowledge may involve the many different kinds of design and engineering knowledge required to replicate and modify technologies.

Moreover, in international technology transfer there is a distinction between horizontal and vertical transfers. Horizontal technology transfer consists of the movement of an established technology from one operational environment to another (for instance from one company to another). Vertical technology transfer, in contrast, refers to the transmission of new technologies from their generation during research and development activities in science and technology organisations, for instance, to application in the industrial and agricultural sectors.

1.3.1. Gaining Access to New Technologies

Technology transfer is an important means by which developing countries gain access to technologies that are new to them. For example, the acquisition of foreign technologies by East and Central European countries, coupled with domestic 'technological learning' – efforts to accumulate the capability to change technologies – have been key factors in their rapid technological and economic development, mainly after '89.

However, the ability of developing countries to use technology transfers to develop their domestic capabilities, allowing such countries to reap the social and economic benefits of existing technologies, has been mixed. There are wide variations between countries and between sectors within individual countries.

The disparities between – and within – developing countries in benefiting from technology transfer suggest that the relationship between technology transfer and the accumulation of domestic technological capability is far from straightforward. In other words, more technology transfer does not necessarily lead to more technological and economic development.

Main indicators that enable the assessment of knowledge transfers are: Technology Needs Assessment (TNA), number of people involved in joint R&D projects, inter-academia collaboration; unfortunately, reliable sources of information on these indicators could not be identified.

1.4. Trade in Knowledge Technologies

In 2005, according to statistics of International Monetary Fund (IMF), the output of the emerging countries exceeds half of the world's total output. As stated by the World Trade Organization (WTO), the liberalization in trade and investment regimes has played a central role in this expansion (WTO, 2003). Since neo-classical theory predicts that a higher rate of growth and wealth will result from a decrease in trade barriers and tariffs, openness implies higher productivity. The acknowledgement of international trade as one of the main channels of growth goes back to series of pioneering economists.

More recently, endogenous growth theory predicts that growth rates of countries are related through international trade linkages and associated

embodied and disembodied knowledge spillovers, i.e. knowledge externalities (Grossman & Helpman, 1991). Knowledge is inherently non-rival in its use, and hence its creation and diffusion are likely to lead spillovers and increasing returns. It is this non-rival property of knowledge that is at the heart of the theoretical models that predict endogenous growth from research and development (R&D) investments as in Romer (1990), in Grossman and Helpman (1991) but also in Howitt and Aghion (1998). In this context, the development of a country depends heavily on its knowledge capital, which in turn is determined by the rate of national innovation and international technology diffusion.

1.5. Patents and Other Intellectual Property Rights

Many academic papers enforce the idea that innovation is a key driver for economic growth. The creation, dissemination and application of knowledge have become a major engine of economic expansion, especially for developing countries.

Bilbao-Osorio and Rodríguez-Pose (2004), in the study regarding R&D in the European Union, show that results of R&D investment is positively associated with innovation, as a key factor for local and national development.

There are several statistical indicators describing the situation of innovation in EEE and Arab countries.

1.5.1. Patent Applications to the European Patent Office

Data refer to applications filed directly under the European Patent Convention or to applications filed under the Patent Co-operation Treaty and designated to the EPO (Euro-PCT). Patent applications are counted according to the year in which they were filed at the EPO and are broken down according to the International Patent Classification (IPC). They are also broken down according to the inventor's place of residence, using fractional counting if multiple inventors or IPC classes are provided to avoid double counting.

The most innovative country is Bulgaria, followed by Slovakia. A pertinent conclusion though can only be drawn after we correlate with the rate of success of the patent applications.

For the Arab countries, the data available through the World Bank are aggregated in an indicator pointing to the number of patent applications. These latter are filed through the Patent Cooperation Treaty procedure or with a national patent office for exclusive rights for an invention, a product or process that provides a new technical solution to a problem.

1.5.2. European High-Technology Patents

The data refer to the ratio of patent applications made directly to the European Patent Office (EPO) or via the Patent Cooperation Treaty and designating the EPO (Euro-PCT), in the field of high-technology patents per million inhabitants of a country. The definition of high-technology patents uses specific subclasses of the International Patent Classification (IPC) as defined in the trilateral statistical report of the EPO, JPO, and USPTO.

1.6. Education

Education has an important positive effect on economic growth, but economists are still working on further empirical hypotheses to be tested. Evidence shows with a high probability that more years of schooling lead to higher income. However, at the macroeconomic level, empirical evidence relating changes in education measures to economic growth has so far been ambiguous. In a report from International Institute for Applied Systems (2008), there is a strong evidence

of positive, statistically significant effects of education on a country's economic development proving that education is the necessary (although not always sufficient) precondition for long-term economic growth.

1.6.1. Students

A key indicator of educational system is the total number of individuals enrolled in tertiary education (including university and non-university studies) in the regular education system in each country. It corresponds to the target population for policy in higher education. It provides an indication of the number of people who had access to tertiary education and are expected to complete their studies, contributing to an increase of the educational attainment level of the population in the country in case they continue to live and work in the country at the end of their studies.

1.6.2. Spending on Human Resources

Generally, the public sector funds dedicated to education are reflected either by bearing directly the current and capital expenses of educational institutions (direct expenditure for educational institutions) or by supporting students and their families with scholarships and public loans as well as by transferring public subsidies for educational activities to private firms or non-profit organisations (transfers to private households and firms). Both types of transactions are reported as total public expenditure on education.

While the average public expenditure on education is 5% of GDP for European Union, there are countries like Bulgaria or Czech Republic, where for the last 10 years, the average public expenditure was less than 5% of GDP.

This situation is actually very similar to the Arab countries, where according to the latest World Bank data; the average public expenditure for education in 2008 was 4.7% of GDP.

1.6.3. Science and Technology Graduates

The indicator "Tertiary graduates in science and technology" includes new tertiary graduates in a calendar year from both public and private institutions completing graduate and post graduate studies compared to an age group that corresponds to the typical graduation age in most countries. It does not correspond to the number of graduates in these fields who are available in the labour market in this specific year. The levels and fields of education and training used follow the 1997 version of the International Standard Classification of Education (ISCED97) and the Eurostat Manual of fields of education and training (1999).

All countries from EEE region present an upward trend, following the trend present in the entire European Union.

1.6.4. Life-Long Learning

Operating successfully in the knowledge economy requires mastery of asset of knowledge and competencies. Three categories of competencies are key (OECD, 2005a):

- **Acting autonomously:** Building and exercising a sense of self, making choices and acting in the context of a larger picture, being oriented toward the future, being aware of the environment, understanding how one fits in, exercising one's rights and responsibilities, determining and executing a life plan, and planning and carrying out personal projects.
- **Using tools interactively:** Using tools as instruments for an active dialogue; being aware of and responding to the potential of new tools; and being able to use language, text, symbols, information and knowledge, and technology interactively to accomplish goals.

- **Functioning in socially heterogeneous groups:** Being able to interact effectively with other people, including those from different backgrounds; recognizing the social embeddedness of individuals; creating social capital; and being able to relate well to others, cooperate, and manage and resolve conflict.

In this context, one important aspect is the life-long learning process, as a key to developing personal competencies.

For EEE countries, the data related to life-long learning comes from the EU Labour Force Survey, as the percentage of the adult population aged 25 to 64 participating in education and training.

Life-long learning refers to individuals aged 25 to 64 who stated that they received education or training in the four weeks preceding the survey (numerator). The denominator consists of the total population of the same age group, excluding those who did not answer to the question 'participation to education and training'. The information collected relates to all education or training whether or not relevant to the respondent's current or possible future job.

There are significant differences among EEE countries from the point of view of life-long learning, Bulgaria and Romania having the lowest values for this indicator.

Few Arab countries have developed lifelong learning. Education systems in most Arab countries only allow limited opportunities for individuals to obtain more skills and acquire more knowledge after completing their formal degree or beginning to work. Lifelong learning is only articulated among national objectives in a handful of countries. Even then, the term "lifelong learning" is defined within the framework of formal education, and is linked to adult illiteracy, teacher training, or continuous education in the form of e-learning

1.7. Incubation

A modern "business incubator" is a combination of physical space and facilities, entrepreneurial ideas, and administrative and management support, all joined to nurture new companies in the critical early stages of development. More specifically, a typical business incubator is a building (or part of a building) in which space is provided for entrepreneurs who are forming new companies (a "new-venture" type), or else is intended to be a real-estate venture which will increase the value of the building used. The building usually includes a central office in which common services needed by all companies are provided, both logistical services and management assistance. The support services may be provided by government, industry, or one or more universities. This description is relatively conservative in some ways, since the explosion of investment in Internet firms ("dot-coms") has led to use of the term to include venture capital and other investment companies which buy or underwrite such Business Incubators for EEE new businesses without necessarily providing physical space or logistic support. In earlier years these would be termed "incubators without walls."

1.8. Links between Knowledge Variables and Development Variables

Three key variables serve as proxies for each Knowledge Economy pillar: Economic Incentive and Institutional Regime, Education, Innovation, and Information & Communications Technology (ICT).

Knowledge Index (KI) is the simple average of the normalized country scores on the key variables in three pillars – education, innovation and ICT. Knowledge Economy Index (KEI) measures performance on all four pillars.

The scorecards demonstrate comparative performance - the variables are normalized on a scale from 0 to 10 relevant to four possible comparison

groups – all countries, region and income groups (Table 2).

If a country performs worse over time on a certain normalized variable, this may be because it actually has lost ground in absolute terms, or improved slower than the comparative group (Table 3).

For the Arab countries, the most recent data about the Knowledge Economy Index shows the existence of a different pattern compared to the state of affairs in the EEE region (Table 4).

While in the EEE region, the countries have almost the same performances in terms of knowledge economy indicators, in the Arab countries the degree of homogeneity is significantly lower. Thus, a country like Israel is similar to Estonia, ranked on the first place in EEE region according to these indicators, while most of the Arab countries have very low values for knowledge economy variables.

One way to assess the relationship between the knowledge economy indicators and economic

Table 2. Knowledge economy variables for EEE region

Country	KEI	KI	Economic Incentive Regime	Innovation	Education	ICT
Estonia	8.40	8.26	8.81	7.75	8.60	8.44
Czech Republic	8.14	8.00	8.53	7.90	8.15	7.96
Hungary	8.02	7.93	8.28	8.15	8.42	7.23
Slovenia	8.01	7.91	8.31	8.50	7.42	7.80
Lithuania	7.80	7.68	8.15	6.82	8.64	7.59
Slovak Republic	7.64	7.46	8.17	7.30	7.42	7.68
Latvia	7.41	7.15	8.21	6.56	7.73	7.16
Poland	7.41	7.20	8.01	7.16	7.76	6.70
Romania	6.82	6.63	7.39	6.14	7.55	6.19
Bulgaria	6.80	6.61	7.35	6.94	6.25	6.66

Source: World Bank

Table 3. Knowledge economy index comparison group: All, the most recently calculated with reference year 1995

	KEI		Economic Incentive and Institutional Regime		Innovation		Education		ICT	
Country	**Recent**	**1995**	**Recent**	**1995**	**Recent**	**1995**	**Recent**	**1995**	**Recent**	**1995**
Estonia	8.40	7.94	8.81	8.29	7.75	6.65	8.60	8.53	8.44	8.30
Czech Republic	8.14	7.77	8.53	8.07	7.90	7.15	8.15	8.13	7.96	7.73
Hungary	8.02	7.50	8.28	6.84	8.15	7.71	8.42	7.91	7.23	7.55
Lithuania	7.80	6.59	8.15	7.14	6.82	5.29	8.64	7.24	7.59	6.67
Latvia	7.41	6.51	8.21	7.29	6.56	4.56	7.73	7.06	7.16	7.15
Poland	7.41	6.85	8.01	6.23	7.16	6.22	7.76	7.86	6.70	7.10
Bulgaria	6.80	6.81	7.35	5.76	6.94	7.17	6.25	7.27	6.66	7.04

Source: World Bank

Table 4. Knowledge economy variables for Arab region

Country	KEI	KI	Economic Incentive Regime	Innovation	Education	ICT
Israel	8.14	8.07	8.33	9.39	7.47	7.36
United Arab Emirates	6.94	7.09	6.5	6.6	5.8	8.88
Bahrain	6.9	6.98	6.69	4.61	6.78	9.54
Oman	6.14	5.87	6.96	5.88	5.23	6.49
Saudi Arabia	5.96	6.05	5.68	4.14	5.65	8.37
Qatar	5.84	5.5	6.87	6.42	3.41	6.65
Kuwait	5.33	5.15	5.86	5.22	3.7	6.53
Jordan	4.95	4.71	5.65	4.05	5.55	4.54
Tunisia	4.56	4.8	3.81	4.97	4.55	4.89
Lebanon	4.56	4.65	4.28	4.86	5.51	3.58
Algeria	3.79	4.28	2.33	3.54	5.27	4.04
Egypt, Arab Rep.	3.78	3.54	4.5	4.11	3.37	3.12
Morocco	3.61	3.25	4.66	3.67	2.07	4.02
Syrian Arab Republic	2.77	3.01	2.04	3.07	2.4	3.55
Yemen, Rep.	1.92	1.58	2.91	1.96	1.62	1.17

Source: World Bank

development is to build-up a panel data regression model, in order to explain real economic growth as a function of these knowledge related factors.

2. EMPIRICAL STUDY: THE IMPACT OF KNOWLEDGE ON THE ECONOMIC DEVELOPMENT

The relationship between the economic development and the knowledge related indicators have been emphasized in the papers of many authors.

Bandyopadhyay (2006) shows that knowledge is a key driver for economic development and growth and also there is an association between knowledge indicators and specific development indicators like corruption and economic inequality.

Eliasson (2000) emphasizes the role of knowledge in economic growth through competitive selection, as the investment in R&D could raise the competitive advantages of the companies and raise the opportunities in a competitive globalized market.

Hanushek and Woessmann (2008) showed that cognitive skills are related to economic growth with education playing a crucial role in economic development.

Bassanini, Scarpetta, and Visco (2010) point out that the contribution of the information and communication technology to output and productivity growth can accelerate productivity growth in the ICT-producing sectors themselves with an increase of their weight in the economy. They also contribute to capital deepening as driven by rapid investment in ICT equipment. The third effect mentioned by Bassanini et al. (2010) relates to ICT-using sectors do enhance their efficiency by harnessing new technology.

For our purposes, we have linked the knowledge related variables to GDP and economic growth for EEE and Arab countries.

2.1. Data and Methodology

In order to assess the impact of knowledge related variables to economic development (or economic

growth), we used data from the World Bank for the following countries:

- **EEE Countries:** Romania, Bulgaria, Czech Republic, Hungary, Poland, Estonia, Latvia, Lithuania
- **Arab Countries:** Algeria, Morocco, Egypt, Jordan, Saudi Arabia, Tunisia.

The following indicators were used in order to describe the knowledge in the analysed countries:

- **TE:** Enrolment in tertiary education(as a percentage of total enrolment).
- **PAT:** Patents applications by residents.
- **STJ:** Scientific and technical journal articles.
- **HTE:** High-tech exports as a percentage of total exports.
- **EDEXP:** Education expenditures as a percentage of GDP.

In order to insure comparability among countries, the following variables were normalized by dividing them to the number of population for each country in the sample:

- Patents applications by residents.
- Scientific and technical journal articles.

In addition, as a dependent variable, we used either real economic growth or real GDP per capita expressed in 2000 US$ at PPP standard.

Our data sample covers the time period 2000-2009, so the results are inconclusive in respect to the financial crisis.

As our database has both temporal and spatial variability, a panel data regression model was used in order to evaluate the impact of knowledge variables to output variables (real economic growth - EG or real GDP). In order to estimate such a model, we need to choose between the fixed or random effects formalizations.

The *Fixed Effects (FE) model* has the following expression:

$$y_{it} = (\alpha + u_i) + X_{it}^{'}\beta + \nu_{it} \quad (1)$$

where y_{it} is the dependent variable, X_{it} is a matrix of explanatory variables, $\nu_{it} \sim IID(0, \sigma_{\nu}^2)$.

The *Random Effects (RE) model* could be expressed as:

$$y_{it} = \alpha + X_{it}^{'}\beta + (u_i + \nu_{it}) \quad (2)$$

where y_{it} is the dependent variable, X_{it} is a matrix of explanatory variables and $\nu_{it} \sim IID(0, \sigma_{\nu}^2)$.

There are two major differences between the two models: in the *FE model* the intercept is varying across groups or time periods, while in the *RE model* the intercept is constant.

Also, the variance of residual term is constant for *FE model*, while in *RE model* this variance is not constant over time or across groups.

Hausman test is used in order to choose between fixed and random effects; in this approach, we are testing the null hypothesis that the intercepts are orthogonal to both explanatory variables and residual variable.

Let $\hat{\beta}_{FE}$ be the estimator for fixed effects model and let $\hat{\beta}_{RE}$ be the estimator for random effects model.

If the null hypothesis is true, then both $\hat{\beta}_{FE}$ and $\hat{\beta}_{RE}$ are consistent, but only $\hat{\beta}_{RE}$ is efficient; if the null hypothesis is rejected, then only $\hat{\beta}_{FE}$ is consistent.

The test statistic

$$HT=T$$
$$(\hat{\beta}_{RE} - \hat{\beta}_{FE})'[Var(\hat{\beta}_{RE}) - Var(\hat{\beta}_{FE})](\hat{\beta}_{RE} - \hat{\beta}_{FE})$$

follows a Chi-square distribution with $k = \dim(\hat{\beta}_{RE} - \hat{\beta}_{FE})$ degrees of freedom.

In the following only the relevant models (either *RE* or *FE*) are shown, according to *Hausman test.*

The panel data regression model was estimated separately for EEE and Arab countries, in order to have a comparable view of the results for the two blocks of countries.

The first model assumes that the economic growth is influenced by the knowledge variables

Model 1: $ln(EG_{it}) = \gamma_1 ln(TE_{it}) + \gamma_2 ln(PAT_{it}) + \gamma_3 ln(STJ_{it}) + \gamma_4 ln(HTE_{it}) + \alpha ln(EDEXP_{it}) + \beta + \eta_i + \delta_t + \varepsilon_{it}$

The second model investigate the impact of knowledge related variables on the real GDP.

Model 2: $ln(GDP_t) = \gamma_1 ln(TE_{it}) + \gamma_2 ln(PAT_{it}) + \gamma_3 ln(STJ_{it}) + \gamma_4 ln(HTE_{it}) + \alpha ln(EDEXP_{it}) + \beta + \eta_i + \delta_t + \varepsilon_{it}$

2.2. Results

In order to decide which estimates for the previous models are the most appropriate for our data, the Haussman test was used in order to test the null hypothesis of random effects. Since in all cases the null hypothesis is rejected at a significance level of 0.01, the best estimates are obtained if we consider that the models have fixed effects.

The explanatory power of the estimated models is very high, with high R square values.

These results are interesting with respect to the similarities and differences among EEE and Arab countries. In the past years, the countries from Central and Eastern Europe have experienced a high level of development, in all the areas of economy, and knowledge related factors are triggers for economic growth.

For Arab countries, the situation is slightly different in terms of economic development and improvement of educational system (Table 5).

Table 5. Panel data regression estimates

	EEE			Arab		
Variable	**Estimate**	**Standard Error**	**P-Value**	**Estimate**	**Standard Error**	**P-vaLue**
	Model with Economic Growth as Dependent Variable					
Intercept	-2.46	27.33	0.93	17.9	40.29	0.66
Expenditures on Education	-5.07	3.95	0.2	-2.27	22.57	0.92
Enrolment in Tertiary Education	6.87	3.78	0.07	5.57	11.39	0.63
High-Tech Exports	1.01	1.26	0.43	-0.34	0.82	0.68
Patents	-4.63	2.23	0.04	-2.27	1.78	0.22
Scientific and Technical Journals	-0.54	3.35	0.87	-5.39	3.14	0.1
R-Square	0.7969			0.5265		
	Model with GDP/Capita as Dependent Variable					
Intercept	21.63	0.88	<.0001	25.989	1.165	<.0001
Expenditures on Education	0.11	0.13	0.4	-0.3004	0.6526	0.6498
Enrolment in Tertiary Education	0.36	0.12	0	-0.5795	0.3293	0.0923
High-Tech Exports	0.11	0.04	0.01	0.02294	0.0238	0.3452
Patents	0.22	0.07	0	0.04817	0.0515	0.3594
Scientific and Technical Journals	-0.04	0.11	0.69	0.29646	0.0908	0.0035
R-Square	0.9947			0.9983		

The analysis of the estimates gives us some appropriate conclusions on the structural differences among EEE and Arab countries:

- For the model where the real economic growth is a dependent variable, the country in EEE exhibits a positive relationship between GDP growth and enrolment in tertiary education, although the significance level of this variable in around 0.07. For the Arab countries, there are no significant variables with impact on real economic growth.
- For the model where real GDP is the dependent variable, one can identify for EEE countries three main factors with positive and significant impact on GDP: enrolment in tertiary education, share of high-tech exports in GDP and the magnitude of patent applications.
- For Arab countries, the only significant factor for GDP is the number of scientific and technical journals.

CONCLUSION

In the past years, Arab countries are engaged in a serious effort to achieve a sustainable level of development, in both economic and socio-political areas. The experience from Central and East European countries, after 20 years from the breakthrough with the communist regime could be a good example to manage the transition phenomenon and to identify the key triggers of the development. However, although the geopolitical position (due to proximity to the decision centres of European Union) may favour the similarities, from many point of views, the actual situation could lead us to the conclusion of existence of some significant differences among EEE and Arab countries, both economically and socially.

From the economic development point of view, one can identify for EEE countries three main factors with positive and significant impact on GDP: enrolment in tertiary education, share of high-tech exports in GDP and the magnitude of patent applications.

For Arab countries, the only significant factor for GDP is the number of scientific and technical journals. These results are interesting with respect to the similarities and differences among EEE and Arab countries. In the past years, the countries from Central and Eastern Europe have experienced a high level of development, in all the areas of economy, and knowledge related factors are triggers for economic growth. The improvement of the education system and a significant boost in investments in R&D could raise the level of development in Arab countries and could reduce the competitiveness gap with the European Union.

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KEY TERMS AND DEFINITIONS

Catch-Up Technology: This is a term used when using benchmarks to compare countries in relation to technologies. But, technologies are now too diversified that sometimes, some of them can be used to catch-up their positioning and rankings in relation to some performance criteria. This term is used in the present chapter to refer to one important component of knowledge.

Creation of New Knowledge: The creation of new knowledge is based on research, and research and development, but also publications and means to diffuse the new know-how. The centers of creation normally include universities and research centers, but also enterprises. The actors and operators are mainly knowledge workers and researchers.

Digital Marketing: New marketing and communication processes that are devoted to providing new options to different possible clients and users. The trend of digital marketing is increasing, and more possibilities of access are being developed with the enhancement of new platforms and transactions.

Knowledge-Based Industries: Industries and economies where knowledge is the major driver and engine of ensuring performance. These industries require continuous updating and monitoring such that they keep up with progress in technologies and knowledge. This term is used in opposition to industries that have more inertia in adopting new knowledge and where a lag is observed in relation to their technologies.

Potential Investors: In the context of the present chapter, this refers to those who are attracted by an economy for which they have a high willingness to invest.

Role Model: EEE economies can serve as a role model for Arab countries as they are at different stages of their transition to more open and free economies.

Social Media: A growing field in the area of ICTs now used to characterize the positioning of countries and communities in the knowledge sphere.

Technological Advance: Technological progress as measured by different economic models but also used as ways of attaining the production frontier as state of the art in producing and providing commodities and services.

The Eurostat Definition: Includes high to medium tech manufacturing and communications, financial and business services, health, and education. Eurostat also includes recreational, cultural, sporting, and some travel services (sea and air) that the OECD excludes. Eurostat also breaks the knowledge service sector down into four groups: high tech services (R&D and computing), financial services, market knowledge services (communications, travel, and business services), and other knowledge services (health, education, and recreational and cultural services).

The OECD Definition: The knowledge-based economy is an expression coined to describe trends in advanced economies towards greater dependence on knowledge, information, and high skill levels, and the increasing need for ready access to all of these by the business and public sectors.

Virtual Infrastructure: All the physical and virtual equipment and routes that are devoted to supporting the provision of information and communication technologies and services.

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Chapter 8
Investment and Development Banks and Strategies in Turkey

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ABSTRACT

The World Bank is the most important financier for international investment. The bank opens credits mostly for investment projects in developing countries. Turkey has received various investment credits since its membership to the World Bank on March 11, 1947. The credits were used for economic and social domains. Turkey has also been granted credits from the European Investment Bank (EIB). The credits received are composed of micro credits that belong to Small and Medium Enterprises (SMEs). A regional development bank, Islamic Development Bank, has also received credits through Eximbank and Industrial Development Bank of Turkey (TSKB) to finance Turkish SMEs. This chapter deals with Turkish investment strategies in the framework of basic principles of investment – development banks.

INTRODUCTION

Following the Great Depression of 1929, banking and other financial services were separated from each other. However, the number of countries separating them is not that high. Investment banks have assumed key positions in the progress and growth of American economy. The best example would be the financing of the railroad construction in the country during 1700's and 1800's. Most of these banks were also dealing with deposit banking. Things changed after 1933, and banks were restrained from savings banking. Institutional and operational characteristics of investment banks vary across countries. While investment banks in industrialized countries target real sector and economic growth, those in developing countries need external sources due to insufficient capital. Therefore these banks primarily deal with economic development (Mishkin, 1992: 78-88; Mishkin, 2004: 330-337; Grinblatt and Titman, 2002: 4-22; Hubbard, 2002: 52-66; Peter and Marguis;

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2005: 45-72; Trescott, 1965: 88-102; Dornbusch and Fischer,1988: 12-26; Hubbard, 2002: 52-66; Ashcraft, A. B., & Schuermann, T., 2008; Smith & Watts, 1992; 263-292).

Turkey has been receiving investment credits since its membership to the World Bank on March 11, 1947. Turkey's share of capital in the World Bank is 832.8 million dollars. This number is equal to %0.53 of the total capital. As for the types of investment credits, they are "reorganization of Ministry of Health," "renewable energy project," "electricity distribution and rehabilitation project," "energy community of South East Europe," "Istanbul Seismic Risk Mitigation and Emergency Preparedness Project," series of "export finance intermediary loan," "small and medium enterprises loan," "restoring equitable growth and employment programmatic development policy loan."

Besides those stated above, Country Partnership Strategy for 2008-2011 enacted in February 2008 aimed "to help Turkey complete its harmonization process for EU membership, and bring steady growth, fair distribution of income, globally competitive power, and knowledge society. Thus, Turkey has received $4,969 billion credit from the World Bank to finance above mentioned projects; almost $5 billion. Moreover, Turkey has received more than $818 billion from the European Investment Bank to finance development projects. Part of this finance has been used in supporting investment plans of SMEs, eliminating economic and social inequalities between regions, supporting environmental protection and sustainable environmental policies, fight against the adverse effects of climate change, support for the initiatives of sustainable and safe energy, and support for the creation of the transportation, energy, and communication networks in the Union.

This paper primarily deals with the objectives and duties of certain investment banks worldwide and their relation with Turkey. In this vein, pre-Bretton Woods international monetary system is explained and monetary movements of the period are analyzed. Besides, The World Bank, which opens credits to worldwide investments are scrutinized. How the World Bank operates, credits (investment, adjustment, hybrid, and common loans) it has opened have been studied. Affiliates of the World Bank are also analyzed.

But this paper primarily deals with the banks opening investment credits to Turkey and their relation with the country. The paper evaluates the relationship between the World Bank and Turkey, Turkey's capital share in the World Bank, and the received investment credits. The paper also investigates Regional Development and Investment Banks such as European Investment Bank, Bank Asya, Islamic Development Bank, African Development Bank and their expectations.

THE WORLD BANK AND ITS STRATEGIES IN TURKEY

Turkey has become a member of the World Bank on March 11, 1947. Since its membership, Turkey has benefited from various credits of the World Bank. Depending of their capital share in the Bank, members have varying voting rates. Below in Table 1, capital shares and voting rates of ten member countries are listed. As one can see in the table, the biggest capital share and the voting rate belong to USA. Developed economies such as Japan, Germany, France, and UK follow USA. Turkey's share in World Bank's total capital amounts to % 0,53. This makes up $832.8 million (WB, 2010).

According to the regulations of the World Bank, a country's capital share is not parallel to the credit it can obtain. That said, it is directly linked to voting rate and thus, has effect on organization's decision making processes. In other words, voting rate is the basic means that countries can use to manipulate organization's decisions and actions. This fact has encouraged countries to become

Table 1. 10 biggest economies in terms of capital share in the World Bank and Turkey

	Capital (Million $)	Rate in Total Capital (%)	Vote Number	Rate in Total Votes (%)
USA	26.496,90	16,83	265.219	16,36
Japan	12.700,00	8,07	127.250	7,85
Germany	7.239,20	4,60	72.649	4,48
France	6.939,70	4,41	69.647	4,30
UK	6.939,70	4,41	69.647	4,30
China	4.479,90	2,85	45.049	2,78
Canada	4.479,50	2,84	45.045	2,78
India	4.479,50	2,84	45.045	2,78
Italy	4.479,50	2,84	45.045	2,78
Russia	4.479,50	2,84	45.045	2,78
Turkey	832,80	0,53	8.578	0,53

Source: WB, 2010

members with higher capital shares (Öztürk, 2006: 46-52). Turkey has benefited from World Bank credits in various projects. Some of these projects are as follows (WB, 2013)

- **Health Transition Project Adaptable Program Loan:** While only %24 of the poorest one-tenth of the total population was covered by health insurance, this number increased to %82 in 2008. Whereas the number of people registered to family medicine system in 15 pilot cities in 2003 was zero, the rate increased to %90 in 33 cities in 2009. While patient satisfaction rate for medical services in public hospitals was %38 in 2003, it increased to %67 in 2009. Social security system were centralized and transferred to the Ministry of Health. Now people can choose where to be treated.
- **Renewable Energy Project:** Renewable energy sources (hydro, geothermal, wind, landfill gas) that can produce yearly 3.810 GWh and 966 MW electricity, as well as reducing at least 1.7 million ton of greenhouse gas emission.
- **Electricity Distribution and Rehabilitation Project:** In the framework of the project, frequency of duration of power cuts that consumers suffered has decreased in eight targeted regional distribution company; on the other hand, collection of revenues in these eight regional distribution companies has also decreased.
- **Energy Community of South East Europe Project:** In 2006, a competitive electricity market of wholesale started operating. Whereas the rate of transmitted electricity (which means electricity sold on the market) was very low, it increased to %30 in 2009. While the number of system-related accidents was 21 in 2004, this number decreased to 19 in 2008.
- **Istanbul Seismic Risk Mitigation and Emergency Preparedness Project:** 418 public buildings were reinforced or re-built for earthquakes. 69 additional buildings (among which are hospitals) are being reinforced, and 110 schools are in tender processes for reinforcement. Reinforced and re-built schools host around 1 million students and 33,300 teachers. Hospitals

give services to more than 25,000 patients daily, and this number might triple in case of a disaster.

- **Export Finance Intermediary Loan:** Export rates of targeted companies averagely increased % 81. While the real rate of growth in these participant companies was %10.4 between 2005 and 2008, the rate for the companies compared was % 0. It is observed that participant companies are likely to develop new products (% 58 as opposed to % 29), improve environmental management (% 79 as opposed to % 47), accept new technologies to reduce costs (% 88 as opposed to % 61), export to new markets (% 69 as opposed to % 48) and extend their customer base (% 79 as opposed to % 58).
- **Small and Medium Enterprises (SMEs) Loan:** With a focus on underserved regions such as Eastern Anatolia and hinterlands, 500 companies are granted medium term financing throughout Turkey. Participant SMEs represent more than 20 sectors, including printing, plastics, tourism and food.
- **Restoring Equitable Growth and Employment Programmatic Development Policy Loan:** The peak point of the use of neutral intermediaries in crises has been more than $1 billion. The number of people who benefited from short term work subsidies was 40,000 in December 2009. While the amount of credits granted to SMEs was 83.9 billion TL in late 2009, this number increased to 103.6 billion TL in July 2010. The number of people participating İŞKUR's vocational training programs is expected to reach 300,000 in the two year period between 2009 and 2010.

Besides the projects listed above, Country Partnership Strategy for 2008-2011 enacted in February 2008 is based on the Ninth Development Plan which aims "to help Turkey complete its harmonization process for EU membership, and bring steady growth, fair distribution of income, globally competitive power, and knowledge society." This strategy was drawn up by government, businesses, and non-governmental groups. Country Partnership Agreement anticipates collaboration for development in three major fields: increasing Turkey's competitiveness and creating more and better job opportunities; reinforcing Turkey's health and social security systems; providing more efficient public services.

In Table 2, one can see the projects and areas where the credits from the World Bank were used. The credits Turkey has received from the World Bank for different projects amount to almost $5 billion.

REGIONAL DEVELOPMENT AND INVESTMENT BANKS

European Investment Bank (EIB) is EU's long term financing institution for public and private organizations to sustain their investments. Found in 1958, the bank belongs to EU member states. The bank has provided more than $818 billion to support project in EU member, candidate and partner states (EIB, 2011). The bank is a non-profit organization, primarily aiming to finance lasting projects(DEIK, 2011a).

Objectives and subsidy policies of European Investment Bank can be names as follows (EIB 2011): supporting investment plans of SMEs; eliminating economic and social inequalities between regions, supporting environmental protection and sustainable environmental policies, fight against the adverse effects of climate change, support for the initiatives of sustainable and safe energy, and support for the creation of the transportation, energy, and communication networks in the Union.

Apart from countries in the Union, the Bank supports various projects from more than 150

Table 2. World Bank's data on Turkey

Active Projects	Amount Million $
Energy	
Electricity Distribution and Rehabilitation Project	269,4
Energy Community of South East Europe (ECSEE)-APL#2	66
Energy Community of South East Europe (ECSEE)-APL#3	150
Energy Community of South East Europe (ECSEE)-APL#6	241
Gas Sector Development Project	325
Private Sector Renewable Energy and Energy Efficiency Project	500
Urban Development	
Istanbul Municipal Infrastructure Project	322,2
Istanbul Seismic Risk Mitigation and Emergency Preparedness Project	400
Land Registry and Cadastre Project	203
Municipal Services Project	275
Private and Sector Development	
Access to Finance for SMEs	696,9
Second Access to Finance for SMEs	500
Fourth Export Finance Intermediary Loan	600
Transportation	
Railways Restructuring Project	184,7
Education	
Secondary Education Project (SEP)	104
Health	
Health Transformation and Social Security Reform Project	75,1
Agriculture and Rural Development	
Avian Influenza and Human Pandemic Preparedness and Response Project	34,4
Environmental	
Anatolia Watershed Rehabilitation Project	15,7
Watershed Rehabilitation Project	7
Total	4969,4

Source: (WB, 2013)

countries. Financing mainly the projects inside the EU, the institution reserved % 88 of the total 72 billion euro of its funding sources for projects inside the EU during 2010 (EIB 2011).

Asian Development Bank (ADB) is an international financing institution that aims to increase life standards of its member developing countries and reduce poverty. Founded in 1966, the bank has 67 members. While 48 members are regional countries, 19 of them are at a distance. Asian Development Bank primarily supports projects of states, private sectors, non-governmental organizations, and development agencies. The strategy of the bank is based on real growth, environmentally sustainable growth, and ensuring regional integration (ADB, 2011).

Islamic Development Bank (IDB) was founded in 1974. The bank has 56 members. In accordance with Islamic philosophy and principles (sharia), the bank aims contributing to the economic development and social progress of member states and Muslim societies(IDB, 2011). The bank's functions are as follows: contributing to the capital of organizations or efficient projects in member countries, opening credits to public and private sectors projects, supporting progress in trade and technical collaboration, contributing to actions of development, doing research on how to conduct financial and banking activities in accordance with Islamic rules (IDB 2011). Types of financing that the Bank undertakes include loan without interest, participating equity capital, leasing, and dividend.

Areas of priority are as follows: humanitarian and agricultural development, food sufficiency, developing infrastructure, trade among members, development of private sector, Islamic economy, research, development and re-organization of banking and finance (Bacak, 2007: 75).

African Development Bank (AFDB) is a multilateral development bank. Founded in 1964, the

bank has 77 members. %53 of these members are African countries, %24 is from the Americas, Asia, and Europe. The Bank's primary target is to fight poverty, and to increase the economic and social welfare of the peoples. Besides these targets, the banks aims to improve regional welfare through technical support, participating in equity capital, and credits (DEIK, 2011b).

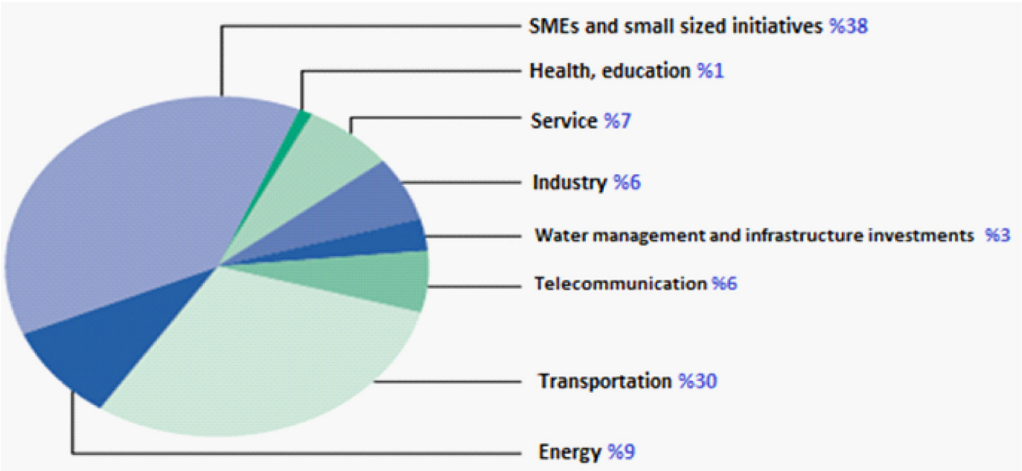
REGIONAL DEVELOPMENT AND TURKEY STRATEGIES OF INVESTMENT BANKS

Shareholding structure of The European Investment Fund is composed of European Investment Bank (EIB - % 61), European Commission (% 30) and 30 public and private organizations (% 9). Industrial Development Bank of Turkey (TSKB) is a shareholder of EIF since September 2006. EIB has actively contributed to the development of venture capital sector in Turkey during last three years. This was realized through investing 54 million EUR to independently managed funds, Actera Partners and Turkish Private Equity Funds II and implementing tailor-made program for Turkey, Istanbul Venture Capital Initiative (iVCi). iVCi is fully managed by the funds of European Investment Fund and mutual funds and allocated to Turkey. Last closing was on March 31, 2009 and worth 160 million EUR. Investors of iVCi are Small and Medium Enterprises Development Organization (KOSGEB), Technology Development Foundation of Turkey (TTGV), Development Bank of Turkey (TKB), GarantiBank, National Bank of Greece, and European Investment Fund (EIB 2011).

European Investment Bank has been active in Turkey since mid-1960. The amount of financing the Bank provided to this EU candidate country between 2001 and 2005 reached 3.1 billion EUR. This number also underlines commitment made for the country's economic development. Public and private members of the sector which benefited from EIB funds are foreign investors, central and regional administrations, regional banks and industrial organizations (DEIK, 2011a). During its activities in Turkey for more than 40 years, European Investment Bank has invested around 15 billion EUR to country's economy.

Sectors supported by European Development Bank (EIB 2011):

Figure 1. Distribution of credits according to sectors: 2005–2010
Source: EIB 2010



- Energy production, transportation, storing and distribution (renewable energies including electricity, petroleum, gas, wind and solar energy)
- Energy efficiency
- Industry
- Information technology and media
- Infrastructure (including municipal and environmental infrastructure)
- Manufacturing
- Research and Innovation
- Services
- Small and Medium Enterprises (SMEs)
- Tourism
- Telecommunication
- Transportation (including transportation infrastructure, railroad cars, buses, subways etc.)

As can be seen in Table 3, Turkey has received various credits from European Investment Bank; and the majority is for the development of SMEs. These credits are granted based on certain conditions and limits.

In July 2010, European Investment Bank launched Greater Anatolia Guarantee Facility (GAGF). This regional development enterprise targets SMEs and micro-enterprises in 43 cities in Turkey. GAGF project gathers two powerful projects of EIB Group which are long-term loans and sharing portfolio risk. It aims to create a credit volume around 500 million EUR for SMEs and micro-enterprises in the underdeveloped areas in Turkey covering a credit of 250 million EUR from EIB and a resource of 32 million EUR from EU's Instrument for Pre-Accession Assistance (IPA) (Bacak, 2007:6-28).

From 1976 to 1998, Islamic Development Bank financed projects and commerce worth $2.4 million in Turkey. In that period, the bank provided the second most credit opportunities to Turkey after Pakistan among its member countries. $1.7 million of those credits were allocated to finance import, while $184 million was allocated to finance export. One fourth of the whole credit was granted to finance projects in social and private sectors. In this period, the bank approved credits for infrastructure, industry, health, transportation, energy, education, agriculture and financial sectors. While all the credits in these areas were given to public sector, those regarding the trade were given to private sector(IKB 2011).

Since 2003, Islamic Development Bank opened credits to many public and private projects or trade financing. Recently, Islamic Development Bank extended its credit opportunities to SMEs. With the help of Participation Banks, they have opened $60 million credit in Turkey(IKB, 2011).

Islamic Development Bank generally grants investment credits to public sector, while they mostly grant financial loans to private sector for export. However, after 2008 economic crisis they have begun to open credits to SMEs in Turkey. The bank assures equal distribution of credits not

Table 3. Credits that European investment bank will grant to Turkey

	Who Can Apply	Credit Limit	Credit Rates	Terms
Energy and Environment II Credit.	Small and medium sized renewable energy facilities.	Should not exceed 25 million euro, maximum % 50 of investment costs will be financed.	Based on evaluation.	Based on evaluation.
Credit for Developing SMEs with Resources.	SMEs operating in industry and tourism with investment less than 25.000.000 Euro and employees fewer than 500.	Maximum 12.500.000 Euro.	Based on evaluation.	Based on evaluation.

Source: EIB 2011

Table 4. Credits given by Islamic development bank in Turkey

	Who Can Apply	Credit Limit	Credit Rates	Term
Investment Credit.	Investors with external loan prediction under Financing The Investment part on Investment Incentive Certificate.	Minimum $500.000, Maximum $10.000.000.	Credit can be granted for the %100 of the equipment costs.	Based on evaluation.
Import Financing Credit Intended for Export.	Using the imported products on credit in the production of export goods.	Between 100.000,- Euro and 2.000.000,- Euro.	While financing import transactions, a loan up to %80 of the import volume can be used.	Based on goods financing import and the terms of the credit.
Investment Credit.	Used in financing the investors buying domestic and imported machines-equipment and assembling costs of machines-equipments.	Minimum 35.000 Islamic Dinar (İD), maximum 3.500.000 İD (1 Islamic Dinar = 1 SDR).	Based on evaluation.	Terms up to 10 years and maximum a 3 year grace period.

Source: IDB 2010

through Eximbank or Turkish Industrial Development Bank, but through commercial banks. See Table 4 for the recently granted credits.

CONCLUSION

In Turkey's growth process, investment and development banks play an important part. By granting various resources, they have provided necessary finance for the real sector with the support of the World Bank, its affiliates and IMF.

Turkey has utilized the credits of the European Investment Bank. They provided 250 million EUR of resource credits and 32 million EUR of credit to be used in micro-credits for SMEs. Turkey has been granted various credits from Islamic Development Bank (a regional development bank) to finance SMEs, through Eximbank and Industrial Development Bank of Turkey. The minimum limit of investment credits is $500.000, while it is maximum $10.000.000. Credits worth 100.000 and 2.000.000 EUR were granted by the Islamic Development Bank as import financing loan intended for export. These loans and investment subsidies were used investors to buy new imported and domestic equipments.

Turkey has also utilized IMF loans. IMF is an association granting countries loans to meet the adverse balance of short term payments. Turkey has taken loans from IMF to meet the adverse balance of payments (Since most of the loans were used in financing investments, IMF categorized their loans as such). From 1961 to 2005, Turkey signed Stand-by agreements with IMF and received various loans. During this period, the biggest loan was taken in 1999; and in a 36-month period of Stand-by agreement, 15.038.40 million SDR was used from IMF resources. Finally, Turkey used 1.665.51 million SDR out of 6.662.04 million SDR in 2005, in accordance with the Stand-by agreement for a 36 month period. Since 2005, Turkey has not received any loans in the framework of Stand-by agreement with IMF. However, payments are still remitted.

As a result, one can see that Turkey has resources from international associations for investment and development, but for sustainable growth and development all the resources should be used properly, and based on efficiency. Another key topic for research can be the efficiency of resources, development and investments.

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KEY TERMS AND DEFINITIONS

African Development Bank (AFDB): A multilateral development bank. Founded in 1964, the bank has 77 members. %53 of these members are African countries, %24 is from the Americas, Asia, and Europe.

Asian Development Bank (ADB): An international financing institution that aims to increase life standards of its member developing countries and reduce poverty. Founded in 1966, the bank has 67 members. While 48 members are regional countries, 19 of them are at a distance.

Investment Bank: Is financial institution that assists individuals, corporations, and governments in raising capital by underwriting and/or acting as the client's agent in the issuance of securities.

Islamic Development Bank (IDB): Founded in 1974, the bank has 56 members. In accordance with Islamic philosophy and principles (sharia), the bank aims contributing to the economic development and social progress of member states and Muslim societies.

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Chapter 9
International Evidence on Financing of R&D

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ABSTRACT

This chapter examines the financing patterns of R&D expenditures using data from 38 countries for the period 1980-2006. The major hypothesis is that higher equity financing and higher past stock market valuation are associated with higher R&D expenditures. The evidence supports this hypothesis for firms, especially in market-based countries. The sensitivities of equity financing and internal funds are different between financially constrained and unconstrained firms. The results are robust when the effect of patent rights protection, which has also a nonlinear effect on R&D, is controlled.

INTRODUCTION

The survey by Levine (2005) indicates that there is a strong relationship between financial development and economic growth. Recently, some studies have investigated the relationship between finance, innovation, and growth to explain specific channels for how financing creates growth. These papers show that fluctuations in R&D expenditures of companies are associated with fluctuations in the availability of internal and external financial sources (Brown, et al., 2009; Martinsson, 2010). The evidence shown in these papers suggests that financing of innovation activities (mainly R&D expenditures) may be an important mediating variable explaining the finance-growth relationship. While Brown *et al*. (2009) test this relationship using a dataset consisting of 1,347 US companies, Martinsson (2010) uses data from 700 companies located in ten different European countries.[1] Understanding the finance-growth relationship better at a broader perspective therefore urges for more research on the relationship between finance and innovation.

In this chapter, we elaborate on previous research by looking into the financing of R&D expenditures from an international perspective. In particular, we analyze the relationship between corporate R&D expenditures and the availability of financial resources using a large dataset consisting of almost 49,000 firm/year observations in 38 countries for the period 1980-2006. We investigate patterns of finance from three different angles.

First, we examine the role of different sources of finance in covering R&D expenditures. We focus on internal capital (cash flows) and equity

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finance. With respect to internal capital, we take into account the possibility that the relationship between this type of capital and R&D expenditures may be non-linear, an issue that has been raised recently in the literature on explaining financing of investment decisions in general. According to this relationship, firm decreases their R&D at low level of cash flows and increases them at high level of cash flows. For a high level of R&D intensity, internal funds are not sufficient to cover all expenditures. The requirement of raising external financing opens the discussion of capital structure choice. There are several theories, such as pecking order and trade off theory dealing with market frictionless depending on information asymmetry, agency cost, or sources of capital to explain the proper debt-equity choice for financing of R&D investments. Since R&D expenditures indicate high growth opportunities with low liquidation value in the event of bankruptcy, equity finance can be considered as the optimal source for financing of R&D expenditures. With respect to equity capital, we investigate the role of using equity as such, as well as the extent to which firms issue new shares after periods when their shares are valued higher relative to their industry peers. Companies use this overvaluation for timing the market to issue new equity and, thus, temporarily reducing costs of capital. Both the issue of the non-linear relationship between internal capital and investment expenditures, as well as the market timing argument, have not been studied before in the context of financing R&D expenditures.

Second, when investigating financing patterns of R&D expenditures, we take into account firm-specific characteristics that may influence these patterns. In particular, we focus on whether or not firms are financially constrained (i.e. they have insufficient internal capital to finance their investment expenditures), because this may influence firms' behavior regarding the issuing of new shares in periods during which shares are considered as being overvalued. Previous studies have shown that this matters for explaining financing patterns of investment expenditures (Campello & Graham, 2007).

Third, we investigate whether and how the context of financial market development influences financing patterns of R&D expenditures. Our main premise to investigate this comes from the observation that R&D expenditures are constrained by access to finance and that these expenditures in most cases are financed either by internally available funds (i.e. cash flows) or by external equity. Yet, access to external finance may be conditional on contextual features such as the nature of national financial markets. As we will argue, access to external equity finance may be relatively easier in market-based financial systems, since equity markets are generally more developed. We are not aware of any study that looks into these issues using a large cross-country sample of firms.

This chapter provides evidence supporting a U-shaped relationship between cash flows and R&D expenditures. Increases in cash flows elicit greater expenditures at higher level of cash flows. For high level of R&D, increasing in R&D is only possible with an increase in internal funds because raising additional debt financing creates additional risk. However, when cash flows are negative or perhaps small, firms decrease R&D expenditures to be able to cover their financing costs.

The results of this chapter also show that firms with high level of R&D expenditures use more equity financing. The argument for this finding is that for these firms, increases in R&D expenditures will be viewed at some point as risky and firms will respond by using more equity. The evidence for market timing is clear; there is a positive relationship between industry-adjusted market to book ratio and R&D. The conjecture may be that for these firms high market value relative to their book value lower the cost of equity and some firms respond it by investing more.

The relationships between R&D expenditures and three factors; internal funds, equity financing, and past market valuation, appear to exist only for

firms that are 'high users' of R&D expenditures. The sensitivities of these variables are also different between financially constrained and unconstrained firms. While the sensitivity of internal funds is higher for financially unconstrained firms, the sensitivity of equity financing is higher for financially constrained firms. Both types of firms use market-timing opportunities similarly.

Regarding to comparison of market-based and bank-based countries, the data does not reveal similar evidence for firms in bank-based countries. This may be the result of closer firm-bank relationships in bank-based countries and favorable capital market conditions in market-based countries. Whereas firms have better access to external financing for the latter, banks continue to lend to firms in the first in spite of the riskier features of R&D investment being unpredictable, having lack of collateral value and high asymmetric information problem.

The remainder of this chapter is organized as follows. In the next section, we briefly discuss existing literature on the financing patterns of R&D and present my hypotheses related to the three different angles spelled out above. We proceed with the section for the methodology and the data, and then we discuss the outcomes of the empirical investigation regarding my hypotheses. In the last section, we provide conclusions of the chapter.

LITERATURE REVIEW AND HYPOTHESES DEVELOPMENT

Financing of R&D Expenditures

Internal Financing (Cash Flows)

In the absence of market imperfections, the level of internal capital (cash flows) should not influence investment decisions, as firms are able to obtain the necessary funds from the capital markets at a cost similar to that of the cost of internal capital to finance positive NPV projects. However, when firms face capital market imperfections due to various types of agency problems and information asymmetry, they may have no access to external capital (debt, equity), or, in case they have, they have to pay a premium for this type of capital relative to the cost of internal capital. Firms with favorable investment opportunities may then want to rely more on internal capital and/or reduce their cost of external capital. This phenomena is the fundamental of the Myers and Majluf's (1984) Pecking Order Theory, which argues that firms finance their financial needs first with internal sources of funds, then with debt, and finally with external equity. Empirical research has shown that internal capital is the most important source of finance for most firms (Mayer, 1988; Mayer & Sussman, 2004). Several studies also document that the level of internal capital is positively correlated with the firm's investment expenditures (see also, e.g., Fazzari, et al., 1988; Hoshi, Kashyap, & Sharfstein, 1991; Hubbard, Kashyap, & Whited, 1995; Hubbard, 1998; Stein, 2003). However, this result is contested by Kaplan and Zingales (1997) and Cleary (1999).

With respect to investment in R&D projects, the problem of asymmetric information between insiders and outside investors may be worse because of the potentially high sunk costs and high future returns this type of projects may generate, firms may be reluctant to reveal information to outside investors. Moreover, firms need to protect the knowledge related to these projects from their competitors. According to Bhagat and Welch (1995) and Bah and Dumontier (2001), since the asymmetric information problem is stronger for R&D investments, the association between internal capital and R&D projects may also be stronger than for other types of investments. According to pecking order hypothesis, R&D projects should be financed the most with internal funds. A few authors have shown empirically that there is a positive relationship between internal capital and R&D, using data from a sample of US firms (Hall, 1992; Himmelberg & Petersen, 1994), pointing at

the importance of asymmetric information problems related to R&D projects, making external investors reluctant to finance them.

The idea that internal capital and investment expenditures should be correlated positively has been recently contested by Cleary *et al*. (2007) who show both theoretically and empirically that the relationship between internal funds and investment is actually a U-shaped. Three key assumptions drive this result: external capital is costly, this cost is determined endogenously (i.e. higher cost for higher amounts of debt borrowed), and investment is scalable. The bottom-line of the model is the hypothesis that firms with large financial gaps find it feasible to finance large rather than small investments. We argue that U-shaped curve is even more relevant for R&D expenditures since the risk associated with R&D is higher and, in turn, the returns to R&D range from negative to a huge payoff. Assuming that internal funds are not sufficient to finance all investment's requirements, and then decreasing in cash flow will cause the firm to decrease its investments to avoid high new debt financing and high risk. R&D investment will probably be first investment item to be cut in such a situation due to its high-risk characteristic. On the other hand, at low or negative levels of internal cash flows investors are likely to be repaid a lesser amount since the firm may be unable to pay all of the promised payment. In this situation, increases in investments generate high revenues and, then, improves the firm's ability to pay its financing costs. Again, R&D would be a good candidate to generate huge cash flows to be able to pay the cost of external financing. The hypothesis we test for the relationship between internal financing and R&D expenditures is as follows:

H1: At high levels of internal funds R&D expenditures increase monotonically; at low levels of internal funds R&D expenditures decrease monotonically.

External Financing: Debt vs. Equity

The second aspect of the relationship between financing and R&D is whether firms use debt or equity as an external source of financing for their R&D expenditures. Core of this aspect is the company's capital structure. The literature for choice of capital as the mix of debt and equity starts with Modigliani and Miller (1958 and 1963) who examine the financing decision of a firm separately from its investment decision. There have been several other theories focusing on debt equity choice. The tradeoff theory arrives at an optimal capital structure by balancing the tax advantages with the agency and bankruptcy costs. Some others explain that leverage depends on market frictions, such as informational symmetries between insiders (managers) and outsiders (investors or lenders). These asymmetries cause some firms not reach to sufficient capital to fund all their good projects (financial constraints) due to agency costs (Jensen & Meckling, 1976; Jensen, 1986), signaling costs (Stiglitz & Weiss, 1981), and source of capital as a market friction recently examined by Faulkender and Petersen (2006), who find that firm with credit ratings as an indication of ability to access to debt market use significantly more debt.

The literature has examined the relationship between debt financing and R&D. Studies generally argue that debt financing is a sub-optimal alternative for R&D because in most cases R&D expenditures convert into firm-specific assets, which have a low liquidation value in the event of bankruptcy. Moreover, firms with high R&D expenditures have high growth opportunities, which mean that they may suffer from the underinvestment problem[2]. In this case, equity is most probably the optimal source for financing R&D expenditures. Among those, Bhagat and Welch (1995) show there is a negative relationship between the one-year lagged debt ratio and current-year R&D expenditures, using a sample of US firms. At the same time, however, they find

that this relation is positive for Japanese firms and not significant for Canadian, British, and European (Germany, France, and The Netherlands) firms. Hall (1992) also finds a negative relationship between the debt ratio and R&D expenditures for US firms. Bah and Dumontier (2001) find that R&D intensive firms have lower debt levels than non-R&D intensive firms, using data from a sample of firms in the US, UK, Japan, and Europe. Brown *et al*. (2009) observe a significant positive relationship between external equity and R&D expenditures for young high-tech companies, but not for mature high-tech firms in a sample of US companies. My second hypothesis, which is related to external financing especially for the role of equity, is as follows:

H2: R&D expenditures are positively associated with higher levels of equity financing.

The Role of Market Timing

The timing of issuing new shares may also matter for financing investment projects along with equity financing. In particular, companies may issue new shares when the market price of their shares is viewed as abnormally high, because this reduces the costs of equity. Graham and Harvey (2001) conduct a large-scale survey among American and Canadian executives. The results show that these executives confirm the importance of mispricing in decisions regarding new equity issuances. This behavior is more likely to occur if firms believe that the high stock price is a temporary phenomenon, which means they should take action as soon as possible. For example, Kim and Weisbach (2008), using an extensive dataset of 17,000 IPOs and nearly 13,000 seasoned equity offerings from companies in 38 countries during the period 1990-2003, find evidence that firms with high market-to-book ratios keep more of their equity offerings in cash than firms with low market-to-book ratios do. One reason for this behavior may be that these firms aim at taking advantage of the high abnormal stock valuation and stockpile the cash for future investments.

A number of papers find empirical support for the fact that companies take advantage of mispricing opportunities on their investment decisions. Barro (1990) using US and Canadian data, and Galeotti and Schiantarelli (1994), based on US firm-level data, show that lagged values of real stock market prices significantly influence investments even after controlling for Q and other cash flow variables. Baker *et al*. (2003) using a large sample of US firms covering the period 1980-1999, find evidence that investments of equity-dependent firms (i.e. firms that need equity capital to finance marginal investments), are more sensitive to stock prices than they are for non-equity dependent firms. Campello and Graham (2007), based on a sample of 1,943 US firms covering the 1971-2003 period, show that financially constrained so-called "non-tech" firms issue equity due to mispricing and subsequently some of it to invest, while the rest is saved in their cash accounts. This observation turns out not to be true for unconstrained "non-tech" or "tech" firms.

None of the above studies have explicitly looked at the extent to which companies take advantage of mispricing opportunities to finance R&D expenditures. We contribute to the literature by looking at this issue in this chapter by testing the following hypothesis.

H3: R&D expenditures are positively associated with higher past valuation of equity.

Financing of R&D and Firm Characteristics

Some of the above-discussed papers point out that financing patterns of investment may differ due to firm-specific characteristics. One important firm characteristic that has been discussed in some of these papers is whether or not firms are financially

constrained, i.e. whether or not they are unable to finance their investment projects from internal capital. As has been discussed in Campello and Graham (2007), financial constraints are important with respect to firms' need for external financing and/or the past valuation of their shares. Thus, when investigating financing patterns of R&D investment it is important to take into account whether or not firms are considered to be financially constrained, which we do in our analysis.

Another potentially important firm characteristic that may influence financing patterns of R&D expenditures is the extent to which firms make such expenditures. This may be particularly relevant for explaining debt versus equity financing of these expenditures. At low levels of these expenditures, the expectation would be that firms do not change their financing mix for small increases in R&D. On the other hand, the situation can be different for firms that expend considerable resources for R&D expenditures. This argument is consistent with Myers's (1984) relaxation of strict financing order in the case where firms have an abundance of future investment opportunities. At some point, additional resources devoted to finance R&D will be viewed as additional risk. Then the main question would be whether the firm makes up enough revenues or has enough cash flow to pay for the costs of additional resources. Lenders may view the additional expenditures as risky as well and either limit additional funds and/or charge more for these funds. Moreover, R&D expenditures convert into firm-specific assets, which have a low liquidation value in the event of bankruptcy. The prudent course of action may therefore be to use equity financing and, thus, avoid additional required payments. Therefore, in our analysis of financing patterns of R&D expenditures we take into account the firm-level size of these expenditures. Thus, with respect to the role of firm-specific characteristics and how they help explaining financing patterns of R&D expenditures, we test the following hypotheses:

H4: The positive associations between R&D expenditures and equity financing, and past valuation of equity are stronger for financially constrained firms.

H5: The positive associations between R&D expenditures and equity financing, and past valuation of equity are stronger for firms with high levels of these expenditures.

Financing of R&D and the National Context

Differences in financing patterns of R&D expenditures of companies may also occur because of differences in the national context. In particular, we focus on two specific elements of this context: the nature of national financial markets and patent rights protection.

In the literature, financial markets around the world have been characterized as market-based or bank-based. In market-based financial markets, stock markets play an important role in channeling sources to investment, whereas in bank-based markets, banks are the most important channel for financial intermediation (Demirguc-Kunt & Levine, 2001; Demirguc-Kunt & Maksimovic, 2002; Levine, 2002). The type of financial markets firms have to deal with may have consequences for the financing patterns of investment expenditures. In particular, in the context of R&D investments, the hypothesis that firms use more equity as opposed to debt financing for this type of project may be more valid in a market-based financial market than in a bank-based financial market. First, in bank-based financial markets, strong relationships between banks and firms reduce the agency problems of debt and asymmetric information. This means that in bank-based financial markets debt may be used relatively more for financing of R&D expenditures than in market-based financial markets. Second, in market-based financial markets firms have better access to equity, increasing the use of this type of external finance vis-à-vis debt finance.

The other important country specific factor is patent rights protection. Firms should conduct more R&D if they feel there is less chance that their R&D work will be stolen or imitated. The literature documents a strong relationship between patent rights protection scheme and R&D investment. Varsakelis (2001) finds that countries with strong patent protection invest more in R&D. Therefore, the analysis in this chapter controls the effect of patent rights. Ginarte and Park (1997) first constructed an index of patent rights protection for 1960–1990 for 110 countries, and then Park (2008) updated the index to 2005 and extended it to cover 122 countries.

The other possibility is to have a nonlinear effect of patent rights on R&D. Allred and Park (2007) find that there is a significant and negative effect on firm-level R&D for low level of patent rights and the positive and significant effect after some threshold level. While this evidence is relevant for developed countries, Allred and Park do not detect a significant effect of patent rights in developing countries. Summarizing the above discussion with respect to the role of the national context and how this helps explaining financing patterns of R&D expenditures, we test the following hypotheses:

H6: The positive association between R&D expenditures and higher levels of equity financing is stronger for firms in market-based economies as compared to bank-based economies.

H7: There is a nonlinear relationship between R&D expenditures and patent rights especially for firms in market-based economies as compared to bank-based economies.

METHOD AND DATA

The aim of this chapter is to examine the role of market timing and equity financing along with the other determinants of R&D expenditures using a large international sample of firms, which allows us first to examine the hypotheses in an international content with broader set of countries, and second to compare the US firms with firms operating in either market or bank-based countries. For the subsamples of countries, this chapter uses the classification of market and bank-based countries in studies by Demirguc-Kunt and Levine (2001) and Demirguc-Kunt and Maksimovic (2002).

Method

This chapter performs Ordinary Least Square (OLS) regression analysis with the country and year fixed effects. In order to investigate the hypotheses developed in the previous section, we use the following model with several modifications:

$$R\&D_{it} = a + b\ Cflow_{it-1} + c\ SqCflow_{it-1} + d\ Size_{it-1} + e\ EqFin_{it-1} + f\ AdjMtoB_{it-1} + g\ PRI + h\ SqPRI + j\ HTD + \sum Country + \sum Year + e_{it}$$

$R\&D_{it}$ is the dependent variable and R&D expenditures for firm i at time t. As consistent with Brown and Peterson (2009), we use total assets to scale R&D. This maintains a common scale factors for all other variables in my model.

The values of all other financial variables in the model refer to the end of the previous calendar year, time t-1. *CFlow* is cash flows scaled by total assets, which adds R&D expenses over a standard definition of cash flows as the sum of net income and depreciation. To examine whether there is a U-shaped relationship for R&D, we insert the square of the firm's cash flow (*SqCflow*) into the equation. According to hypothesis 1, we expect *Cflow* and *SqCflow* to have significantly negative and positive coefficients, respectively.

Size is the natural logarithm of total assets. Young and small firms are expected to have higher R&D intensity, and therefore, we expect this variable to have negative coefficient.

EqFin measures the effect of equity financing to test hypothesis 2. We use two proxies for this variable. The first proxy is an aggregate measure of

equity financing, which is the ratio of shareholders' equity to total assets (EqFin 1). The second proxy is an incremental measure of equity financing, which is the percentage of new equity financing and is measured by the ratio of new equity issued to the sum of new equity and new long-term debt issued (EqFin 2). The definitions of new equity and new debt are 'Net proceeds from the Sale/Issue of Common and Preferred,' and 'Long-Term Borrowings,' respectively. If our second hypothesis is true, we expect a significant and positive relationship between R&D and equity financing.

AdjMtoB is industry adjusted market to book ratio and is measured as the ratio of the sum of the market value of equity and book value of debt to the book value of total assets. For a better proxy of market timing, this variable is adjusted by the mean of firms' market to book ratio in the same two digit industry for a particular country. Industry benchmark includes all firms with or without available R&D expenditures in the same two-digit industry for a particular country. According to hypothesis 3, the expected coefficient of this variable is positive, and we expect to have this positive relationship for especially firms in market-based countries (hypothesis 6).

To test hypothesis 4, we run regressions for financially constrained and unconstrained firms' separately, and expect that the impacts of equity financing and mispricing are stronger for financial constrained firms. Fazzari *et al*. (1988) use dividend payout ratio for a proxy of financial constraints and find that firms with low-dividend payout ratios are more likely to face financial constraints. Since considerable amount of firms do not pay dividends for some years (zero dividend), we classify firms with no dividend payment as financially constrained and firms with dividend payment as financially unconstrained. This proxy is likely refers to both internal and external constraints. Firms may choose not to pay dividend because of lack of available cash for a particular period. A negative profitability that may indicate the lack of internally generated funds can cause this policy. In case of firms having positive profit and future growth potential, firms may decide not to pay dividend to increase the level of internal funds.

We use a dummy variable to classify firms into high and low R&D groups based on the median of the ratio of R&D expenditures to total assets and interact this variable with variables measuring equity financing and mispricing. To support our hypothesis 5, we expect to have significant and positive coefficients for those interaction variables.

PRI is patent rights index developed by Ginarte and Park (1997). The data for this index is available for the years 1980, 1985, 1990, 1995, 2000, and 2005. One could believe that as firms and countries do more R&D that might result in more protection as firms want their new inventions protected. This argument may imply that there is a direction of causation from more patent rights protection to more R&D. For five-year periods, such as from 1986 to 1990 or from 1991 to 1995, the analysis uses the property rights index in the beginning of this period, such as the index in 1985 or 1990. This reduces possible endogeneity issues between R&D and *PRI*. For a possible nonlinear relationship between PRI and R&D, the analysis also uses square of *PRI* (*SqPRI*). We expect significant associations between R&D and these variables, but particularly negative coefficient for *PRI* and positive coefficient for *SqPRI* for firms in market based countries.

HTD is a dummy variable to control R&D level for high tech industries and equal to 1 if a firm is in the following SIC codes 283 (drugs), 357 (office and computing equipment), 366 (communications equipment), 367 (electronic equipment), 382 (scientific instruments), 384 (medical instruments), and 737 (software) and 0 otherwise.

Data

Since the focus of the analysis is to investigate the level of R&D, the sample contains only firms having a positive value of R&D expenditures. Fi-

nancial data is collected from *Worlsdscope* from 1980 to 2006[3]. We eliminate financial firms and utilities in my chapter and, thus, avoid issues about regulatory influence on these firms. *Worldscope* data may contain errors, and thus all financial variables are winsorized at 0.01 and 0.99 to avoid that large outliers affect results.

We report summary statistics for the variables used in the analysis by country in Table 1, which presents the mean values of the variables for the US and the other countries on the basis of classifications as market and bank-based countries. The sample period varies for countries. The US sample contains as many observations as the total number of observations for firms in market and bank-based countries. Table 2 reports the correlations among the variables. The correlation coefficient between EqFin1 and EqFin2 is very high and significant with a p value (the numbers below the correlations are p values) lower than 1%, indicating that they measure the similar issue and therefore the analysis does not include these two variables together in a model. These two variables are also correlated negatively with size. This is consistent with the findings in the capital structure literature that small firms issue stocks (more dependent on equity financing) than large firms do. The analysis has models by having size and equity financing variables separately.

Table 1. Sample countries

Country	N	R&D	PRI	Cflow	Size	EqFin 1	EqFin 2	AdjMtoB
US	24383	0.092	4.780	0.101	5.098	0.580	0.618	-0.168
Australia	982	0.062	3.949	0.048	4.892	0.572	0.471	-0.032
Brazil	40	0.013	2.480	0.149	7.218	0.569	0.186	0.000
Canada	1290	0.095	4.293	0.065	4.887	0.620	0.680	-0.082
Chile	86	0.003	3.225	0.116	5.714	0.601	0.095	0.017
Denmark	214	0.079	4.411	0.179	5.641	0.556	0.292	-0.110
Honk Kong	287	0.021	3.770	0.074	4.686	0.607	0.433	-0.150
India	976	0.008	2.056	0.151	5.127	0.462	0.190	0.039
Malaysia	91	0.005	3.203	0.108	4.864	0.574	0.478	0.035
Netherlands	332	0.054	4.508	0.150	7.181	0.412	0.330	0.013
Philippines	33	0.019	3.380	0.133	3.866	0.658	0.308	0.065
Singapore	120	0.021	4.018	0.121	5.214	0.592	0.527	-0.064
South Africa	314	0.008	3.722	0.186	6.182	0.461	0.449	0.042
South Korea	2287	0.008	4.053	0.064	5.820	0.430	0.228	-0.056
Sweden	391	0.074	4.349	0.157	6.535	0.472	0.291	-0.102
Switzerland	538	0.054	4.186	0.138	6.374	0.446	0.365	-0.053
Turkey	86	0.008	3.132	0.205	5.176	0.505	0.314	0.036
UK	4026	0.058	4.456	0.130	5.129	0.492	0.587	-0.073
Market-based	12093	0.045	4.036	0.109	5.401	0.499	0.447	-0.053
Argentina	13	0.006	2.779	0.105	4.776	0.601	0.000	1.116
Austria	82	0.036	4.268	0.133	6.452	0.397	0.068	0.127
Belgium	74	0.046	4.581	0.151	7.231	0.424	0.260	-0.077

continued on following page

Table 1. Continued

Country	N	R&D	PRI	Cflow	Size	EqFin 1	EqFin 2	AdjMtoB
China	282	0.009	3.196	0.094	5.949	0.560	0.136	-0.157
Finland	297	0.045	4.340	0.157	6.637	0.435	0.267	0.002
France	654	0.051	4.473	0.126	6.912	0.401	0.297	-0.050
Germany	727	0.066	4.373	0.119	6.544	0.431	0.282	-0.045
Greece	15	0.003	4.078	0.166	6.509	0.413	0.159	-0.083
Hungary	11	0.022	4.125	0.183	5.513	0.683	0.333	0.102
Ireland	187	0.025	3.627	0.102	5.846	0.450	0.469	-0.066
Israel	157	0.082	3.888	0.131	5.426	0.571	0.551	0.092
Italy	315	0.036	4.256	0.100	7.319	0.316	0.151	-0.033
Japan	7050	0.023	4.555	0.087	6.931	0.452	0.141	-0.028
Luxembourg	11	0.001	4.028	0.096	7.345	0.430	0.667	-0.093
New Zealand	61	0.052	3.923	0.127	5.223	0.490	0.394	0.175
Norway	202	0.067	3.777	0.148	6.014	0.428	0.368	0.003
Pakistan	43	0.002	1.568	0.161	4.671	0.373	0.147	0.058
Poland	11	0.007	3.955	0.131	5.347	0.453	0.234	-0.078
Spain	38	0.031	4.236	0.159	6.748	0.381	0.108	-0.174
Taiwan	2118	0.023	3.273	0.113	5.778	0.581	0.165	-0.045
Bank-based	12348	0.029	4.220	0.101	6.616	0.469	0.183	-0.031

Table 2. Correlations

	R&D	PRI	Cflow	Size	EqFin 1	EqFin 2	AdjMtoB
R&D	1						
PRI	0.249	1					
	<.0001						
Cflow	-0.146	-0.060	1				
	<.0001	<.0001					
Size	-0.381	-0.086	0.202	1			
	<.0001	<.0001	<.0001				
EqFin 1	0.265	0.116	0.079	-0.376	1		
	<.0001	<.0001	<.0001	<.0001			
EqFin 2	0.374	0.247	-0.012	-0.381	0.485	1	
	<.0001	<.0001	0.0179	<.0001	<.0001		
AdjMtoB	0.149	-0.003	-0.001	-0.087	0.126	0.166	1
	<.0001	0.5504	0.8319	<.0001	<.0001	<.0001	

Table 3 examines a general overview of the data by classifying observations into three different time periods to explore if there are different patterns in the different time periods. The results indicate that R&D portion in total assets, EqFin1 and EqFin2 show increasing patterns from the first period (1981-1995) to the third period (2001-2006) for the US firms and firms in market-based countries. However, the patterns of the same variables (except EqFin1) for firms in bank-based countries are opposite. The means of AdjMtoB change from negative to positive for the US and market-based countries from the period 1981-1995 to the period 1996-2000 when there is an increasing pattern in the mean of R&D. It stays the same for firms in bank-based countries in these two periods. The means of AdjMtoB turn to negative in the period 2001-2006 for all groups of firms, but negative deviations are smaller than the first period for the US and market-based countries. Table 3 also covers the statistical comparisons for mean values of the variables among the US, market and bank-

Table 3. Summary statistics

	N	R&D	PRI	Cflow	Size	EqFin 1	EqFin 2	AdjMtoB
All	48824	0.065	4.454	0.103	5.557	0.532	0.479	-0.105
1980-1995	12121	0.051	4.341	0.141	5.780	0.503	0.450	-0.427
1996-2000	11985	0.073	4.450	0.115	5.373	0.530	0.492	0.162
2001-2006	24718	0.067	4.512	0.078	5.538	0.547	0.488	-0.078
US								
1980-1995	8392	0.060	4.600	0.145	5.500	0.539	0.487	-0.532
1996-2000	6669	0.105	4.875	0.110	4.775	0.592	0.624	0.199
2001-2006	9322	0.111	4.875	0.055	4.968	0.609	0.727	-0.106
Market								
1985-1995	2371	0.029	3.872	0.148	5.881	0.448	0.459	-0.370
1996-2000	3414	0.036	3.881	0.128	5.619	0.455	0.374	0.100
2001-2006	6308	0.057	4.181	0.083	5.108	0.543	0.484	-0.106
Bank								
1985-1995	1358	0.033	3.563	0.105	7.340	0.380	0.205	0.128
1996-2000	1902	0.028	3.979	0.108	7.028	0.449	0.174	0.144
2001-2006	9088	0.029	4.369	0.099	6.422	0.487	0.181	-0.091
US vs Market		0.047	0.744	-0.008	-0.303	0.081	0.171	-0.116
t statistics		(45)***	(106)***	(-3.8)***	(-13)***	(33)***	(31)***	(-6.1)***
US vs Bank		0.063	0.560	-0.000	-1.518	0.111	0.435	-0.137
t statistics		(67)***	(141)***	(-2.3)**	(-50)***	(48)***	(71)***	(-8.3)***
Market vs Bank		0.016	-0.184	0.008	-1.215	0.030	0.264	-0.022
t statistics		(18)***	(-21)***	(4.6)***	(-52)***	(1)***	(45)***	(-1.4)

The symbol *** denotes statistical significance at 1% level.

based countries. The test is the standard t test to compare means and the table presents t statistics in parentheses. There are significant differences in the mean values of the variables among these three subsamples. The US firms have the highest R&D followed by the other market-based countries and bank-based countries. The differences in R&D investments between the US and both market and bank-based countries are large. The mean value of R&D relative to total assets is 0.09 for the US, 0.05 for market and 0.03 for bank-based countries. The difference in R&D intensity is statically significant between market and bank-based countries as well according to the t-test. Interestingly, the mean value of PRI for market-based countries is lower than that of for bank-based countries. The mean value of this variable is again the highest for the US firms. The comparisons of these two variables have already shown the importance of separation of the US firms from market-based countries in the analysis. The mean of cash flows is the largest for market-based countries followed by firms in bank-based countries and the US firms. The sample from Worldscope for observations with available R&D covers larger firms in bank and market-based countries than in the US firms.

In terms of equity financing, the percentage of shareholders' equity in total assets (EqFin 1) is 0.58 for the US firms and 0.50 and 0.47 for firms in market and bank-based countries, respectively. The differences between pairs of subsamples are significantly different, showing that firms in market-based countries also use more equity financing than firms in bank-based countries as expected. The second proxy for equity financing is the percentage of new equity issued in total new financing as the total of equity and debt issued (EqFin2). The sample presents large significant differences between firms in the US, market-based countries and firms in bank-based countries as the mean values of this variables are 0.62, 0.45, and 0.18 for all three subsamples, respectively.

This chapter uses industry-adjusted market to book ratio (AdjMtoB) to measure the ability of firms for timing the market to increase their R&D investment in the next period because of mispricing opportunities. The ratios of the US firms deviate from their industry peers more than those for firms in market and bank-based countries. While the differences in means are statistically significant between the US and market-based and between the US and bank-based, there is no statistically significant difference in mean of AdjMtoB between market and bank-based countries[4].

REGRESSION ANALYSIS

Financing and Market Timing of R&D

This section reports the results from OLS regression analysis where the dependent variable is the ratio of R&D to total assets in year t with the country and time fixed effects (not reported to save space) by using entire sample in Table 4. The values of all other financial variables in the model refer to the end of the previous calendar year, time t-1. The coefficients for Cflow are negative in all models, but it shows a nonlinear influence when it is considered with square of this variable by controlling the effects of all other variables. Being consistent in all models, Cflow has negative and SqCflow has positive effect on R&D, both coefficients are statistically significant at 1% level. This evidence supports the first hypothesis stating that the effect of internal cash flows is the U-shaped.

Next, we investigate the influences of equity financing and market timing on R&D. The coefficients of EqFin1 (EqFin 2) and AdjMtoB are positive and significant at 1% level in all models where equity financing variables are inserted alone (not reported) or together with mispricing variable into the models[5]. EqFin 1 and EqFin 2 have very similar coefficients. This evidence supports the hypotheses 2 and 3, and indicates that as the percent of equity financing and industry adjusted market to book ratio increase so does R&D. Equity

Table 4. Financing and market timing of R&D

	(1)	(2)	(3)	(4)
Constant	-0.027	0.02	0.317	-1.453
	[0.008]***	[0.010]**	[2.140]	[1.573]
Cflow	-0.018	-0.021	-0.017	-0.02
	[0.004]***	[0.004]***	[0.004]***	[0.004]***
SqCflow	0.195	0.18	0.196	0.181
	[0.010]***	[0.011]***	[0.010]***	[0.011]***
Size	-0.009	-0.009	-0.009	-0.009
	[0.000]***	[0.000]***	[0.000]***	[0.000]***
EqFin 1	0.022		0.021	
	[0.002]***		[0.002]***	
EqFin 2		0.024		0.024
		[0.001]***		[0.001]***
AdjMtoB	0.004	0.003	0.004	0.003
	[0.000]***	[0.000]***	[0.000]***	[0.000]***
PRI	0.021	0.021	0.042	0.044
	[0.003]***	[0.004]***	[0.005]***	[0.006]***
SqPRI	-0.005	-0.005	-0.008	-0.009
	[0.001]***	[0.001]***	[0.001]***	[0.001]***
US*PRI			-0.168	0.597
			[0.899]	[0.663]
US*SqPRI			0.024	-0.058
			[0.094]	[0.070]
MWUS*PRI			-0.052	-0.053
			[0.006]***	[0.008]***
MWUS*SqPRI			0.01	0.01
			[0.001]***	[0.001]***
HTD	0.043	0.042	0.043	0.042
	[0.001]***	[0.001]***	[0.001]***	[0.001]***
Observations	48432	41593	48432	41593
Adj R-squared	0.34	0.35	0.34	0.35

Robust standard errors are in brackets. The symbols ***, **, and * denote statistical significance at 1%, 5%, and 10% levels, respectively.

financing seems well suited for R&D given its unpredictability, its lack of collateral value, and the fact that the asymmetric information problem is not easily resolved. High market valuation lowers the cost of equity and, thus, may encourage future R&D.

The results show that Patent Rights Protection Index (PRI) has also a nonlinear effect on R&D as consistent with the argument of Allred and Park (2007). However, the signs of PRI and SqPRI are not the same direction as Allred and Park (2007) suggested. PRI has significant and positive and

SqPRI has significant and negative effects on R&D. Allred and Park (2007) suggest that low level (high level) of patent rights should have negative (positive) effect for especially developed countries. Therefore, models 3 and 4 introduce interaction variables between PRI, SqPRI and the dummies for the US and Market-Based Countries Without the US (MWUS). The coefficients of interaction variables of MWUS*PRI and MWUS*SqPRI, which represent the effect patent rights protection in market-based countries, are negative and positive, respectively. This evidence is consistent with the results of Allred and Park (2007). Interestingly, the coefficients of PRI and SqPRI have the same signs (significant at 1% level) with previous models, indicating that the effect of patent rights protection is opposite in bank-based countries[6]. One possible explanation for this evidence would be that strong patent protection reduces competitive pressures to innovate for firms in bank-based countries. For firms in market-based countries, since develop a new technology and protect it are very expensive, firms may not want to carry this high cost if rights protection is not so strong. Benefits of high risky investments exceed costs after a certain level of protection.

Control variables Size and HTD are statistically significant in all models. Larger firms involve less R&D investment and there is a major difference in the level of expenditures between firms in high tech industries and firms in other industries.

Financial Constraints and High Level of R&D

This section examines the effects of internal funds, equity financing, and market timing on R&D by classifying firms as financially constrained and unconstrained, and as high R&D and low R&D firms. As discussed earlier, firms with no dividend payments are classified as financially constrained and firms with dividend payments as financially unconstrained. A dummy variable (High RD) subdivides the entire sample into high and low R&D groups based on whether each observation falls above or below the median of the ratio of R&D expenditures to total assets.

Table 5 presents the results for financially constrained and unconstrained firms with 2 models each. First model uses variable EqFin 1, and the other model uses EqFin 2. The last part of the table covers the results for the entire sample. For

Table 5. Financial constraints and high level of R&D

	Financially Constrained Firms		**Financially Unconstrained Firms**		**Entire Sample**	
	(1)	**(2)**	**(1)**	**(2)**	**(1)**	(2)
Constant	0.135	0.068	0.006	0.002	0.029	0.047
	[0.054]**	[0.019]***	[0.003]*	[0.004]	[0.006]***	[0.006]***
Cflow	0.077	0.064	-0.06	-0.045	0.059	0.048
	[0.005]***	[0.005]***	[0.011]***	[0.011]***	[0.003]***	[0.003]***
SqCflow	0.117	0.098	0.352	0.329	0.13	0.111
	[0.011]***	[0.012]***	[0.030]***	[0.032]***	[0.010]***	[0.010]***
Size	-0.012	-0.013	-0.002	-0.002	-0.008	-0.007
	[0.000]***	[0.000]***	[0.000]***	[0.000]***	[0.000]***	[0.000]***
EqFin 1	-0.048		-0.007		-0.037	
	[0.002]***		[0.001]***		[0.001]***	
EqFin 2		-0.018		-0.003		-0.014
		[0.001]***		[0.000]***		[0.000]***

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Table 5. Continued

	Financially Constrained Firms		Financially Unconstrained Firms		Entire Sample	
	(1)	**(2)**	**(1)**	**(2)**	**(1)**	(2)
AdjMtoB	-0.001	-0.002	-0.001	-0.001	-0.001	-0.001
	[0.000]***	[0.000]***	[0.000]***	[0.000]***	[0.000]***	[0.000]***
High RD Dummy	0.081	0.08	0.032	0.036	0.051	0.062
	[0.003]***	[0.002]***	[0.002]***	[0.002]***	[0.002]***	[0.001]***
High RD*Cflow	-0.112	-0.103	0.043	0.021	-0.119	-0.111
	[0.006]***	[0.006]***	[0.013]***	[0.014]	[0.005]***	[0.005]***
High RD*EqFin 1	0.067		0.014		0.072	
	[0.005]***		[0.004]***		[0.003]***	
High RD*EqFin 2		0.062		0.015		0.056
		[0.002]***		[0.001]***		[0.001]***
High RD*AdjMtoB	0.005	0.004	0.002	0.003	0.005	0.004
	[0.001]***	[0.001]***	[0.001]**	[0.001]***	[0.000]***	[0.000]***
PRI	-0.006	0.002	0.000	0.000	0.006	0.008
	[0.010]	[0.011]	[0.002]	[0.002]	[0.003]**	[0.003]**
SqPRI	-0.001	-0.002	0.000	0.000	-0.002	-0.002
	[0.002]	[0.002]	[0.000]	[0.000]	[0.001]***	[0.001]***
HTD	0.016	0.013	0.014	0.014	0.018	0.016
	[0.002]***	[0.002]***	[0.001]***	[0.001]***	[0.001]***	[0.001]***
Observations	20953	18718	27479	22875	48432	41593
Adj R-squared	0.36	0.36	0.56	0.55	0.45	0.46

Robust standard errors are in brackets. The symbols ***, **, and * denote statistical significance at 1%, 5%, and 10% levels, respectively.

financially constrained and unconstrained firms, the analysis first examines if the effects of all variables are the same between two sub groups. Then, the effect of high level of R&D is combined with the effect of financial constraints. Interaction variables between High R&D and Cflow, EqFin 1 and EqFin 2 are used to investigate this issue.

Comparison of model 1 between financially constrained and unconstrained firms shows that the sensitivity of internal funds is higher for financially unconstrained firms. Even though the estimated coefficients of Cflow are insignificant for both groups, the coefficient of SqCflow of constrained firms (0.117) is lower than that of unconstrained firms (0.352). Moreover, in unreported results, the sensitivity of equity financing for financially constrained firms (0.032 for EqFin 1 and 0.042 for EqFin 2,) is higher than that of financially unconstrained firms (-0.004 for EqFin 1 and 0.004 for EqFin 2). The coefficients of mispricing variable (AdjMtoB) are higher for financially constrained firms than financially unconstrained firms for whichever equity financing variable is used. These results indicate that firms with insufficient internal funds use more equity financing to increase their R&D investment a year after favorable market conditions.

We also investigate how the sensitivities occur in case of high R&D expenditures for both financially constrained and unconstrained firms. The coefficient of the interaction variable (HighRD*Cflow) is negative (-0.112in model 1

and -0.103 in model 2) for financially constrained firms. The combination of this interaction variable and Cflow itself indicate that the U-shaped effect of internal funds is only relevant for firms with high level of R&D expenditures if they are financially constrained. This is not true for financially unconstrained firms. The coefficients of the same interaction variables are positive (0.043 and 0.021).

The coefficients of the interaction variables between High RD and equity financing (High RD*EqFin 1 and High RD*Eq Fin 2) for financially constrained firms (0.067 and 0.062) are higher than those for financially unconstrained firms (0.014 and 0.015). The combinations of these coefficients with the coefficients of EqFin1 and EqFin 2 show that financially unconstrained firms with high level of R&D also finance their R&D investment by equity, but not as much as financially constrained firms do. This evidence indicates that the dividend payment is a proxy for both internal and external financial constraints. For financially unconstrained firms, it implies that they have sufficient internal funds to use in R&D investment (positive effect of internal funds), but have restrictions to raise external financing and therefore, they do not use new equity financing to finance their high level of R&D expenditures.

The interaction variables between High R&D and AdjMtoB for both financially constrained and unconstrained firms shows that both type of firms use market timing opportunities, as the coefficients of the interaction variable (High RD*AdjMtoB) are positive and significant.

The last part of Table 6 provides the results for the effects of internal funds, equity financing and mispricing for firms with high portion of R&D expenditures in total assets in the entire sample. Investigation of the three interaction variables, High RD*Cflow, High RD*EqFin 1 in model 1 (High RD*EqFin 2 in model 2), and High RD*AdjMtoB, shows that the U-shaped effect of

Table 6. The importance of economic system

	Entire Sample		**Financially Constrained Firms**		**Financially Unconstrained Firms**	
	(1)	**(2)**	**(1)**	**(2)**	**(1)**	(2)
Constant	-0.015	0.027	0.162	0.066	-0.036	-0.033
	[0.009]*	[0.007]***	[0.063]**	[0.019]***	[0.011]***	[0.006]***
Cflow	0.071	0.067	0.072	0.073	0.066	0.068
	[0.008]***	[0.009]***	[0.014]***	[0.015]***	[0.012]***	[0.012]***
SqCflow	0.191	0.173	0.163	0.139	0.465	0.450
	[0.010]***	[0.011]***	[0.012]***	[0.013]***	[0.034]***	[0.036]***
Size	-0.009	-0.009	-0.014	-0.014	-0.002	-0.002
	[0.000]***	[0.000]***	[0.000]***	[0.000]***	[0.000]***	[0.000]***
EqFin 1	-0.019		0.003		-0.016	
	[0.003]***		[0.008]		[0.002]***	
EqFin 2		-0.002		0.014		-0.004
		[0.001]		[0.005]***		[0.001]***
AdjMtoB	0.001	0.001	0.003	0.002	-0.004	-0.003
	[0.001]	[0.001]	[0.002]	[0.002]	[0.001]***	[0.001]***
US*Cflow	-0.089	-0.09	-0.08	-0.088	-0.055	-0.06
	[0.010]***	[0.010]***	[0.014]***	[0.016]***	[0.015]***	[0.015]***

continued on following page

Table 6. Continued

	Entire Sample		Financially Constrained Firms		Financially Unconstrained Firms	
	(1)	**(2)**	**(1)**	**(2)**	**(1)**	(2)
US*EqFin 1	0.048		0.022		0.020	
	[0.004]***		[0.009]**		[0.004]***	
US*EqFin 2		0.037		0.032		0.014
		[0.002]***		[0.005]***		[0.002]***
US*AdjMtoB	0.002	0.001	0.000	0.000	0.004	0.003
	[0.001]**	[0.001]	[0.002]	[0.003]	[0.001]***	[0.001]**
MWUS*Cflow	-0.112	-0.113	-0.053	-0.055	-0.109	-0.106
	[0.012]***	[0.012]***	[0.017]***	[0.019]***	[0.013]***	[0.015]***
MWUS*EqFin 1	0.054		0.068		0.013	
	[0.005]***		[0.012]***		[0.003]***	
MWUS*EqFin 2		0.018		0.022		0.006
		[0.002]***		[0.007]***		[0.001]***
MWUS*AdjMtoB	0.005	0.006	0.003	0.004	0.003	0.002
	[0.001]***	[0.001]***	[0.003]	[0.003]	[0.001]***	[0.001]*
PRI	0.019	0.02	0.007	0.003	0.006	0.007
	[0.003]***	[0.004]***	[0.010]	[0.012]	[0.002]**	[0.003]**
SqPRI	-0.005	-0.004	-0.003	-0.001	-0.001	-0.001
	[0.001]***	[0.001]***	[0.002]	[0.002]	[0.000]***	[0.001]***
HTD	0.043	0.041	0.044	0.039	0.028	0.028
	[0.001]***	[0.001]***	[0.002]***	[0.002]***	[0.001]***	[0.001]***
Observations	48432	41593	20953	18718	27479	22875
Adj R-squared	0.34	0.35	0.24	0.25	0.40	0.39

Robust standard errors are in brackets. The symbols ***, **, and * denote statistical significance at 1%, 5%, and 10% levels, respectively.

internal funds, higher R&D investment with more equity financing and high market valuation are relevant for firms with high R&D expenditures.

The Importance of Economic System

This section sheds light for the importance of economics system on the relationships between R&D expenditures and equity financing and market timing. The analysis examines the differences between firms in market-based and firms in bank-based countries by controlling the role of the US firms. To differentiate the effects of equity financing and mispricing on R&D, we create several interaction variables between these variables and the dummy variable representing the US firms and another dummy variable representing firms in Market-Based Countries Without US (MWUS). These variables also capture the role of bank-based system. If favorable market conditions, which provide firms better access to external financing in market-based countries, play important role in financing of R&D, then the coefficients of the interaction variables for market-based countries should be positive and significant. The previous section shows that the sensitivity of equity financing for financially constrained firms is higher than that for financially

unconstrained firms. In this section, we should also observe that the sensitivity of equity financing should be higher for financially constrained firms in market-based countries.

Table 6 presents the results for this analysis. First part of the table reports the results for the entire sample, and samples of financially constrained and unconstrained firms by using 2 models. Model 1 is for EqFin1 and Model 2 is for EqFin 2, respectively. The results for the entire sample show that the interaction variables between Cflow and the US and MWUS are negative and significant. The coefficient of Cflow, however, is positive and significant. Since the magnitude of the coefficient of interaction variables is bigger than that of the variable itself, the U-shaped effect of internal funds is relevant for firms in market-based countries. The coefficients of the interaction variables for both EqFin 1 and EqFin 2 with the US and MWUS are positive and significant as consistent with the expectations. The magnitudes of the coefficients of the interaction variables with MWUS are also higher than those of with the US firms. This evidence demonstrates that firms in market-based countries use more equity financing than firms in bank-based countries when they invest in R&D more, and this is not restricted only with the US firms. The coefficients of EqFin 1 variable are negative and significant, indicating that debt financing is more relevant for firms in bank-based countries. For mispricing opportunities, the results show that the coefficient of the interaction variables, MWUS*AdjMtoB, are positive and significant. While firms in market-based countries increase their R&D investment after high market valuation year, this is not true for firms in bank-based countries since the coefficients of AdjMtoB are not significant.

Table 6 also examines the role of the importance of economic system for financially constrained and unconstrained firms separately. The results show that, as expected, firms in market-based countries use more equity financing, but the sensitivity of equity financing is higher for financially constrained firms. The estimated coefficients of MWUS*EqFin 1 (MWUS*EqFin 1) are 0.068 (0.022) for financially constrained firms and 0.013 (0.006) for financially unconstrained firms. This evidence is not strongly relevant for the US firms. The coefficients of US*EqFin 1 are very similar between financially constrained (0.022) and unconstrained (0.020) firms. The coefficients of US*EqFin 2 are 0.032 and 0.014 for constrained and unconstrained firms, respectively. EqFin 1 and EqFin 2 represent financing of R&D for firms in bank-based countries. The coefficients of these variables are 0.003 (not significant) and 0.014 for financially constrained firms, and -0.016 and -0.004 for financially unconstrained firms. This evidence for bank-based countries indicates that financially constrained firms use equity financing, but financially unconstrained firms use mostly debt for the financing of R&D. Finally, the coefficients of the interaction variable representing mispricing opportunities in market-based countries (MWUS*AdjMtoB) are very similar for financially constrained and unconstrained firms.

CONCLUSION

This chapter examines the effects of the financing and past market valuation on R&D expenditures. The analysis also controls the effects of internal funds and patent rights protection. The data include observations from 38 countries for the period 1980-2006, and allow us to compare firms in market and bank-based countries by controlling the importance of the US firms. The results show that the US firms have the highest R&D, the percentage of shareholders' equity in total assets, and the percentage of new equity issued followed by the other market-based countries and bank-based countries.

We find that patent rights protection has a nonlinear effect on R&D intensity. Firms in market-based countries decrease R&D investment as protection index increases. High R&D is associated after a certain level of protection. The

effect of patent rights protection index is opposite for firms in bank-based countries.

The analysis supports a U-shaped effect of internal funds for firms in market-based countries. While the sensitivity of internal funds is higher for financially unconstrained firms, the U-shaped effect of internal funds is only relevant for firms with high level of R&D expenditures if they are financially constrained. An alternative and better way to estimate such an existing nonlinear relation would be to employ nonlinear algorithms, which we leave for further research.

Equity financing seems to be well suited for R&D investment. The sensitivity of equity financing is higher for financially constrained firms than that for financially unconstrained firms that have probably sufficient internal funds to use in R&D investment. When the sample covers firms with high level of R&D, financially unconstrained firms also finance their R&D investment by equity, but not as much as financially constrained firms do. The results show that this evidence, as expected, is relevant for firms in market-based countries. Firms in bank-based countries finance also their R&D with equity if they are financially constrained, but financially unconstrained firms use mostly debt for the financing of R&D.

High market valuation encourages future R&D due to low cost of equity. The analysis shows that both financially constrained and unconstrained firms use market-timing opportunities, especially in market-based countries. Firms in bank-based countries; however, there is no effect of past higher market valuation on R&D investment.

We believe that the findings of this chapter help policy makers from different economic systems understand the finance-growth relationship better. R&D expenditures reflect the effect of innovative activities on economic growth. Knowing the structures of the relationships between internal funds and sufficient external financing and R&D investments should lead to important policy implications in countries where the policy makers pursue higher economic growth.

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KEY TERMS AND DEFINITIONS

External Capital: Funds raised externally by issuing new debt or new equity to invest in capital investment projects.

Financial Constraint: Inability of firms to finance their investment projects by using solely internally generated funds.

Internal Capital: Readily available funds generated by firms from their past operational cash flows.

Market Timing: Managers take actions to get advantages of temporary higher market valuations, such as issuing new shares when past performance of their stocks is better relative to the market or their counterparts.

Pecking Order Theory: The theory for hierarchy in financing. Firms finance their financial needs first with internal cash flows, then with debt, and finally with external equity.

R&D: Research and development expenditure is type of investment on innovation activities to create new products, processes, or services.

Tradeoff Theory: Optimal capital structure is determined by balancing the tax advantages with the agency and bankruptcy costs.

Underinvestment: Managers may reject to invest in some of valuable projects with positive net present values because of agency problems of debt.

ENDNOTES

1 Brown *et al*. (2009) find significant effects of internal and external financing on R&D expenditures for young tech U.S. firms. This evidence is sufficient enough to explain the relationship between supply shifts in finance and a significant portion of the 1990s R&D boom and subsequent decline. Martinsson (2010) examines whether R&D spending in Europe in a similar way was sensitive to fluctuations in the supply of internal and external equity during the late 1990s and early 2000s and finds that market-based financial systems outperform the bank-based economies of Continental Europe for providing channel from financing to growth through innovation.

2 The underinvestment problem is introduced by Myers (1977) who argues that firms with rich growth options should either use short-term debt or reduce their long-term debt, while firms with a stable base of asset-in-place should opt for long-term debt. We argue that this discussion is relevant for regular investments and leads to a conclusion of equity financing being a proper choice for R&D because of its certain characteristics and empirical findings in the literature. We also readdress this issue in the next section as well.

3 Worldscope is a database provided by Thomson financial and contains information on financial data on the world's leading public and private companies.

4 This inexistence of statistical difference in the mean of AdjMtoB indicates that mispricing proxy is similar between two types of economic system. This does not mean that there is no significant difference in market valuation for firms' equity in those systems. Unreported results show that the mean of MtoB value is 2.19 for firms in market based countries and statistically significant from the mean value of MtoB, which is 1.40, for firms in bank-based countries.

5 The numbers of observations change across regression models and basically decrease with including equity financing and market timing variable based on availability of these variables.

6 Allred and Park (2007) provide a detail discussion for the several aspects of possible negative and positive effects of patent rights protection in developed and developing countries.

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Chapter 10
Factors Driving Value Creation in Online B2B Banking

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ABSTRACT

In today's highly competitive business environment, online business-to-business (B2B) banking services offer efficient, reliable, securable, and convenient financial services for customers. However, research has paid scant attention to quantifying the value of online B2B banking and identifying the factors that drive it from the employees' perspective. Hence, this study explores value creation in online B2B banking in terms of user satisfaction, individual impacts, and organizational impacts by incorporating technological, organizational, and environmental forces. The results based on a survey of 178 respondents collected from Taiwanese Small and Medium Enterprises (SMEs) strongly support the contention of the study that technological, organizational, and environmental forces really drive value creation in online B2B banking in terms of user satisfaction, individual impacts, and organizational impacts. These findings and the proposed research model may be helpful to managers when implementing online B2B banking, and valuable for researchers who are developing related theories.

INTRODUCTION

The emergence of the Internet as a global distribution channel, and more importantly, as a transborder, nomadic trading platform, has significantly altered the landscape of the banking sector (Lee, 2007b). The advent of the Internet has increasingly become a strategic weapon, revolutionizing the way businesses operate, deliver, and compete against each other (Alsajjan & Dennis, 2006; Chen, 2011; Seitz & Stickel, 1998). It has not only spurred the development of new business sectors, but also changed the business model of many existing industries. In the banking sector it has altered the competitive patterns of traditional banking while opening doors for innovation and new service opportunities in the corporate banking arena (Ruben, Llobet, & Fuentes, 2010). Online

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channels (e-channels) which provide alternatives for faster delivery of banking services to a wider scope of customers (Gunasekaran & Love, 1999) have gained increasing popularity in delivering banking services and dramatically changed the rules and operations of the banking industry. Online banking (e-banking) already has revolutionized relationships within organizations and between organizations and individuals (Salehi & Alipour, 2010).

The nature of opportunities and obstacles in e-banking at the business-to-customer (B2C) or individual level is different from B2B banking, as the bank-corporate customer relationship remains a key issue for competitive advantage in the market. It is crucial to design and quickly implement new banking services that are positively accepted (Berndt, Herbst, & Roux, 2005) without losing customers while developing and maintaining better relationships (González, Quesada, Picado, & Eckelman, 2004), especially for corporate customers since they are a major source of profits (Tyler & Stanley, 1999; Zins, 2007). The likelihood of obtaining fresh new insights is especially high in fields that remain largely unexplored in information systems theorizing (Kock, 2009). The conventional focus of online banking research is shifting from technological developments to customer behavior (Alsajjan & Dennis, 2006). At the same time, the extant literature on online B2B (e-B2B) banking is lacking. Given this background, this paper has three major purposes:

1. Identifying the drivers and inhibitors of B2B e-banking value for employees;
2. Determining an appropriateness of Technology-Organization-Environment (TOE) framework; and
3. Identifying the factors that form B2B banking value for firms from the employee perspective.

Hence, this research explores the technological, organizational, and environmental factors that drive value creation in online B2B banking. Managers and researchers may use our model and findings to better understand the factors that affect e-business success.

LITERATURE REVIEW

Taiwanese SMEs Firms

The number of Taiwan's SMEs totals 1,236,000, with an export value of NT$1.63 trillion (~US$49.3 billion), contributing 17% of Taiwan's overall exports (MOEA, 2011). Taiwan's SMEs have been the primary driver of the economic development of Taiwan over the past century (Tzeng, 2009). SMEs account for more than 97% of all firms in Taiwan, and are noted for their performance in international markets (Chiao & Yang, 2011). Taiwanese industrial structure is "unique and dichotomous," with most SMEs focusing on the international market while most large companies concentrate on the domestic market (Tzeng, 2009). Taiwan is moving towards a service sector economy where SMEs have active participation (Tzeng, 2009). Given the changes that are taking place in the business environment, there is a clear need for the Taiwan government to adjust and revise its SME guidance policy and development strategies in line with the new requirements of globalized logistics management and localization. Conceivably, national policy discussion on banking and finance would benefit institutions from an international perspective.

The Taiwanese government is promoting its global logistic strategy for economic development which stresses supply chain integration by bridging information flows among overseas enterprises, domestic large firms, and local SMEs. The Ministry of Economic Affairs (MOEA), Taiwan is fostering "industry clusters" by encouraging SMEs engaged in similar industry to locate their operations near one other to facilitate information exchange (Tzeng, 2009). Driven in large part by

Taiwan SMEs' aggressiveness to tap into overseas markets, banks operating there are targeting the SME sector in the near future. Such banks must develop international remittance services, more efficient corporate cash flow management, foreign currency transaction services, and international financial market information, to allow SMEs to monitor both domestic and offshore capital flows and to ensure normal profit stability for their businesses.

Ultimately, Taiwan has developed a unique context that possesses multifarious attributes such as high uncertainty avoidance, anxiety, insecurity, flexibility, a short-term focus and greater sensitivity, yet also a global reach (Ahlstrom, Chen, & Yeh, 2010). Though deeply ingrained, culture cannot be a standalone antecedent for the success of Taiwanese firms. Culture has influenced Taiwan's SME performance through organizational structure, formal institutions, and other variables (Ahlstrom et al., 2010; Chen, Weng, & Hsu, 2010). In practice, to meet the challenges of the highly competitive business environment, SMEs must aggressively adopt advanced information technology for survival (Chang, Hung, Yen, & Lee, 2010). For effective integration of the SME sector into e-banking systems, it is necessary for policy makers to recognize its unique characteristics.

E-Banking Background in Taiwan

In early 1990s, with the rapid growth of information technology (IT) and electronic services, banks began to offer Internet banking services (Jenkins, 2007). Beginning in 1997, Taiwan-based banks such as The Shanghai Commercial & Savings Bank aggressively promoted Internet banking services. In May 1999, Taiwan's Bureau of Monetary Affairs in the Ministry of Finance announced the Master Agreement of Personal Computer (PC) and Network Banking Services for commercial banks offering e-banking services, which governed how commercial banks could offer e-banking services such as fund transfers and account summaries (Shih & Fang, 2006). Taiwan's financial institutions were compelled to reintegrate in order to enhance service quality, operational efficiency, and competitiveness (Liu, 2010). There have been a series of innovative changes in online banking services since the growth of Internet-based services has changed the manner in which firms and consumers interact (Ho & Lin, 2010). Generally, using e-banking, firms can check account balances, transfer money, pay bills, collect receivables and ultimately reduce transaction costs and establish greater control over bank accounts (Riyadh, Akter, & Islam, 2009).

In Taiwan, current online banking services provide dedicated services to firms to ensure integration of internal resources and reduction of costs. Moreover, in recent years, new electronic banking modes have also been established in Taiwan. In June 2007, the mobile banking services were offered by the three major mobile service providers, Chunghwa Telecom, Far EasTone, and Taiwan Mobile, in partnership with 20 banks (Lin, 2011). According to the most recent statistics from the Taiwan Network Information Center (TWNIC) (2010), 77% of households in Taiwan have Internet access, and 69% of households have broadband access. Widespread access to the internet has led to great expansion of e-businesses. Since Taiwanese SMEs often confront international business, B2B e-banking is not only beneficial but necessary. Big companies, however, are likely to be more efficacious in executing e-businesses or less likely to experience failure in implementing B2B e-business than SMEs. Since SMEs still underexploit the potential of e-business technologies (Ang & Husian, 2012) such as e-banking, there appears to be a need to focus on the SME sector. With this in mind, SMEs were chosen as the target population in this study.

Due to slow adoption of e-banking services by SMEs, they have failed to exploit the value of e-banking (Riyadh et al., 2009), particularly in the B2B context. This is why B2B e-banking value assessment at the firm level is an important propo-

sition for managers. Employees play the important roles of communicators, producers, and users of business knowledge in organizations. Further, they initiate and actualize e-business practices in the firm (Uusi-Rauva & Nurkka, 2010). Dealing with B2B e-banking systems is likely to be a routine job of employees. Even though B2B e-banking is one of the most efficient methods of delivering banking services to SMEs, its value is often unclear to employees of SMEs. Thus, value assessment of online B2B banking from employees' perspective would be useful. Of course, understanding of employee value perceptions would be of interest to managers pursuing organizational alignment and formulating business strategies. Despite its importance, the employee perspective has been only lightly explored in the e-commerce literature. Consistent with previous studies (Mairesse & Greenan, 1999; Uusi-Rauva & Nurkka, 2010), the current study offers insights by concentrating on factors and inhibitors that shape B2B e-banking value from the perspective of employees at the firm-level. We believe that data collected from employees can effectively and substantially generate new insights at the firm level.

The Rational Use of TOE Framework

The TOE framework was developed by Tornatzky et al. (1990). It identifies three aspects of an enterprise's context that influence the process by which it adopts and implements a technological innovation: technological context, organizational context, and environmental context (Oliveira & Martins, 2011). But traditionally, researchers have assumed that for each specific technology or context that is being studied, there is a unique set of factors or measures. Thus, the TOE framework usually has a limited number of factors (Bakar et al., 2011). The traditional technological view is mainly focused on the content of the project or technology, while the organizational view includes the softer aspects related to the firm and the environmental view includes the influence of the environment (Bosch-Rekveldt, Jongkind, Mooi, Bakker, & Verbraeck, 2010). The TOE framework has been extensively used in technology adoption studies (Oliveira & Martins, 2011). In each of the empirical studies that test the TOE framework, researchers have used slightly different factors for the technological, organizational, and environmental contexts (Bakar et al., 2011). IS studies have used the TOE framework in different settings such as electronic data interchange, e-procurement adoption, e-commerce, e-business, and e-governance (Oliveira & Martins, 2011; Pudjianto, Zo, Ciganek, & Rho, 2011; Zhu, Kraemer, Xu, & Dederick, 2004), including e-banking (Riyadh et al., 2009), from the perspectives of the organization, external institutions, and the government (Boumediene & Kawalek, 2008; Pudjianto et al., 2011; Scupola, 2009). Recently, Polydorpoulou et al. (2011) deployed a TOE in a study of a port community system investigating employee perspectives on change.

Mixed model approaches have been extensively used by prior literature in technology adoption studies. The technology acceptance model (TAM), theory of planned behavior (TPB), innovation of diffusion (IDT), the resource-based view (RBV), and the Unified Theory of Acceptance and Use of Technology (UTAUT) are typical examples of such theoretical models (Boumediene & Kawalek, 2008). Using perceived usefulness and perceived ease of use as salient antecedents of intention to use makes TAM a partial adoption model at the individual level. However, in a firm level study where more comprehensive constructs are necessary, the TOE framework is more commonly used due to its comprehensiveness as it examines the technological, business, and environmental contexts (Riyadh et al., 2009). Due to the presence of the environmental context, the TOE framework is considered superior to other theories such as DOI, institutional intervention theory, and institutional theory, when used at the intra-firm level (Boumediene & Kawalek, 2008; Riyadh et al., 2009).

Online B2B banking generally consists of a significant number of complex operations and activities. Assessing how employees will perceive value and accept changes from B2B e-banking is among the main factors influencing the likelihood of adoption and implementation of B2B e-banking. Thus, a dedicated framework is necessary for determination of employee perspectives on the value of B2B banking services. The TOE framework is useful for this study because it not only has a solid theoretical basis and consistent empirical support but also the potential for application in the IS innovation domain (Oliveira & Martins, 2011). While a number of studies have focused on technology adoption using the TOE framework, several studies have directly examined how TOE factors affect the impact of an IS innovation on firm performance, explicitly investigating e-business value (Zhu et al., 2004), particularly the B2B aspect. Thus, this study uses TOE as a theoretical lens for assessing B2B e-banking value in terms of user satisfaction, individual impacts, and organizational impacts.

DEVELOPMENT OF RESEARCH FRAMEWORK AND HYPOTHESES

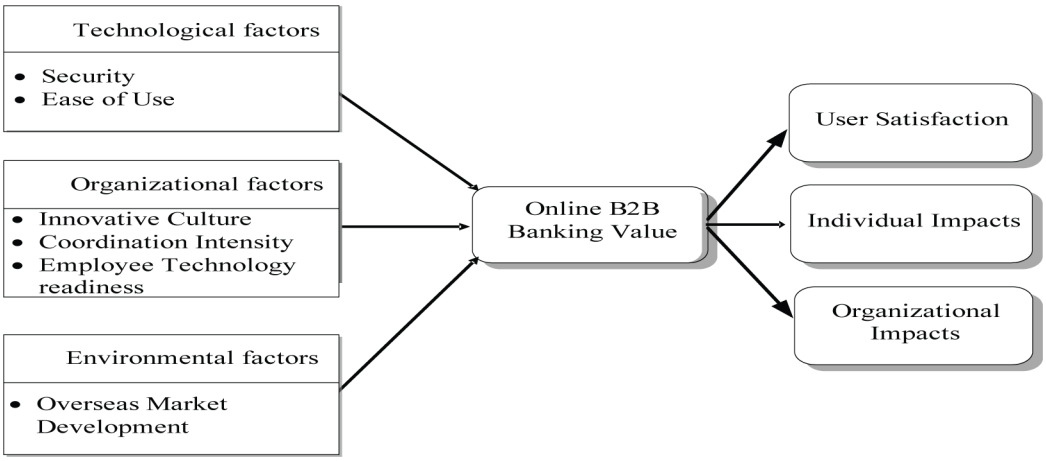
Technological Factors

While online banking features have made banking services convenient and available, the advancement of technology and the development of the Internet have also led to concerns for the security of customers' personal information and internet transactions (Bakar et al., 2011). Financial institutions have moved to protect the information transmitted and processed when banking online (Makowski, 2007). However, threats such as phishing and personal identify fraud are growing and making online banking vulnerable to unauthorized use (Bakar et al., 2011). Banks have no control over the systems used by their customers and thus cannot control risks caused by such systems. For this reason, the banks cannot assume liability for them. Moreover, laws related to security and privacy issues remained unclear, which affects whether online banking is perceived as trustworthy by its users (Chong, Ooi, Lin, & Tan, 2010). Customers consider security to be very important when making online transactions. In B2B e-markets, security is one of the most influential factors for firms (Zhao, Wang, & Huang, 2008). Previous research has also argued that security was a significant determinant of online banking (Yoon, 2010). Further, the e-commerce literature considers security a significant determinant of the perceived value of Internet technology (Yang & Peterson, 2004). If customers do not trust organizations within the context of the security provided, employees' perceptions of the value of doing business with such customers are likely to be weakened.

On the other hand, the Internet channel has been found to improve the efficiency of business transactions. It saves employee time and effort and reduces transaction costs. Ease of use of Internet transactions plays a pivotal role in customer satisfaction with online services (Yang & Peterson, 2004). Online B2B banking offers ease-of-use functions to firms in making transactions over Internet. Such a facility may be beneficial for firms in assessing international as well as domestic customers, ultimately increasing their market reach. Thus, they are likely to gain value from it. In particular, ease of use is an important antecedent to perceived value for new adoption (Ko, Kim, & Lee, 2009; Venkatesh, Ramesh, & Massey, 2003). Presently, in the B2B context online banking remains immature. Its value as experienced by employees is thus more likely to grow with increased ease of use of e-banking systems. Therefore, we hypothesize (Figure 1):

H1: The higher the degree of the system security, the greater will be the online B2B banking value;

Figure 1. Research framework



H2: The higher the ease of use in online banking system has, the greater will be the online B2B banking value.

Organizational Factors

Innovation is depicted as a cultural element of an organization which should be instilled by managers in order to communicate to employees the organization's mission, drive them to search for unique opportunities, ensure that those opportunities align with the organization's strategic direction, and both define the measurements needed to evaluate the success of such opportunities and continually reassess them so as to ensure that they remain relevant and beneficial (Isidre & Jeef, 2010). Innovation, by its nature, embraces change. However, embracing changes requires building a culture and associated organizational structures and processes that make innovation a daily way of life. Top management must address both the organizational- and individual-level risks associated with innovation (Coffman, 2011). The literature also supports the idea that innovative culture has a number of benefits for innovative performance, market orientation, and brand performance (O'Cass & Ngo, 2007), and enhance the innovative capability, quality, and efficiency of the firm (Miron, Erez, & Naveh, 2004). Further, an innovative culture facilitates senior management implementation of innovative strategies (Isidre & Jeef, 2010). Overall, it is one of the most important determinants of the organizational performance (O'Cass & Ngo, 2007). An innovation culture would thus be valuable for a firm implementing e-banking. Organizations having a history of continuous innovations are more likely to build an innovative culture (Coffman, 2011) and perceive and exploit the value of e-banking. While the idea of innovation culture is commonly applied to firms within high-technology industries (Isidre & Jeef, 2010), it may be useful in online banking as banks as well as their potential customers often have proved reluctant to innovate when adopting e-banking (Singer, Ross, & Avery, 2010).

Coordination refers to matching available development services, support, or resources with the real needs of recipients through interaction among stakeholders. In the present study, coordination refers to the synchronization of a financial institution and its customers. The degree of coordination of financial institutions with other financial as well as non-financial institutions has changed significantly. It is becoming more salient for them as vertically coordinated ties are reportedly more effective responses to the uncertainties in rapidly changing environments (Buvik & John, 1999). Due to feasibility of the supplementary communica-

tion modality facilitated by e-banking, traditional relationship banking is undergoing transformation. Bank regulators are concerned that fierce competition among financial institutions is conducive to the buildup of banking system vulnerabilities. Improved coordination is referred as improved compatibility (Economides & White, 1994) that offers e-banking value due to corporate transaction flexibility. Therefore, corporate coordination with the supply chain members, especially customers, is salient because it creates value (Xu, Sun, & Hua, 2010). Each firm's utility value is likely to increase as more firms opt for e-banking. The greater the coordination between the bank and firms, the greater the value of e-banking to the firms. Better coordination of a bank with firms is likely to deliver value to customers as well as employees by enhancing their operational performance.

Readiness is defined as an employee's beliefs, thoughts, and behaviors that accept the needs and capability of an organization. It is known as a cognitive precursor to behaviors of either resistance or support (Shah & Irani, 2009). E-readiness is the level of preparedness pertaining to the ability of being able to exploit Internet technology for economic purposes through the rapid adoption of e-business (Jutla, Bodorik, & Dhaliwal, 2002). The organizational context represents the factors internal to an organization. From the employee perspective, employee technology readiness is recognized as an organizational factors. Scupola (2009), using the TOE framework, treated "employee knowledge and attitude" as an organizational factor. The present study operationalizes employee knowledge and attitude as employee technology readiness. The attitude of employees towards technology, employee technological readiness, plays a significant role in organizational implementation of new technologies (Ho & Ko, 2008; Parasuraman, 2000). Employee readiness is an important and dominant factor for promoting effective and successful organizational change programs (Shah & Irani, 2009). Employees who are strong in both interpersonal skills and technology readiness are likely to be much more effective in tech-support roles (Jaafar, Aziz, Ramayah, & Saad, 2007). Employee misunderstandings of new technology can be very costly for business; not only in terms of time and money, but also in terms of customer relations and business reputation. Though, employee use of online content may lead to increased productivity for organizations, only when the integrity of information is maintained can employees make good decisions from the information aggregation (Jutla et al., 2002). Therefore, we hypothesize:

H3: The higher the innovative organizational culture of a firm, the greater the online B2B banking value;

H4: The higher the coordination intensity a firm has with banks, the greater its online B2B banking value;

H5: The higher the employee technology readiness of a firm, the greater its online B2B banking value.

Environmental Factors

The internet has accelerated the capability of firms to coordinate processes and personnel across organizational as well as geographic boundaries (Mithas & Whitaker, 2007). A firm can either grow by international market penetration of existing customers based in international markets, and/or the firm can develop completely new international markets with existing products. Both of these international market growth strategies are influenced by Internet (Mathews & Healy, 2006) and of course, online banking services. Firms engaging in international business can take advantage of differences in recession and growth in economic cycles around the world (Daniels & Radebaugh, 2001). However, Firms need adequate resources at their disposal in order to take advantage of an opportunity when it comes along. Firms can enter into foreign market to minimize competitive risks, perceived dependency on domestic market, and

to exploit market and investment opportunities abroad (Daniels & Radebaugh, 2001). The motivation is to create additional economic value through interaction patterns that take into account the trading partners' requirements and circumstances (Buvik & John, 1999). Therefore, we hypothesize:

H6: The greater the opportunity for overseas market development a firm has, the greater the online B2B banking value it experiences.

RESEARCH METHODOLOGY

A questionnaire containing 26 items about security, ease of use, innovative culture, coordination intensity, employee technology readiness, overseas market development, user satisfaction, individual impacts and organizational impacts was constructed. Each of the factors was measured with multiple items. All of these items were adapted from scholarly extant literature in order to measure factors. Four items for measuring security and ease of use, i.e., SEC1, SEC2, EOU1, EOU2 were adopted from Aladwani & Palvia (2002). Items for measuring employee technology readiness, i.e., ETR1 to ETR3 were adopted from Parasuraman (2000). Items used for measuring coordination intensity, CI1 to CI3, were obtained from previous research (Gatignon & Robertson, 1989). From Bock et al. (2005) we adopted five items, i.e., IC1 to IC5, for measuring innovative culture. For measuring individual impacts and organizational impacts, six items were adapted from prior inventories (DeLone & McLean, 2003), while two items measuring user satisfaction were taken from the inventory of Doll and Torkzadeh (1988). This study was conducted in Taiwan, thus scales were translated into Chinese language. For cross cultural validation, they were back-translated into English. Further, with the help of a bilingual assistant professor, comparison was made with original scales to ensure translation equivalence (Mullen, 1995). The items were presented using a five-point Likert-type scale on which 5 represents "strongly agree" and 1 represents "strongly disagree" and divided into two parts, demographic data and the main survey (see Table 1). Since the respondents of the study were employees, all items were phrased from the employee perspective.

A pilot study was carried out to validate the items in the questionnaire using five financial/accounting managers/officers of firms who have multidisciplinary experience of corporate e-banking services. Initially they were requested to fill out the questionnaire and critique it for readability and format. Semi-structured interviews were then carried out in order to understand underlying cues for further modification of the instrument. Finally, with the help of two professors from National Chung Hsing University (NCHU), the questionnaire was refined, leaving 31 items. A cross-industrial questionnaire survey of corporate e-banking services users was used for sample collection. We chose financial holding companies (FHCs) with well-established e-B2B banking infrastructure and applications as the sample base. Thus, Top-10 private financial holding companies who had implemented e-B2B banking applications were included, yielding a sample of 5 companies. Of these, FHC A (pseudo name was used in this study for confidentiality) was the only firm to agree to participate in the study after we called the firms to explain the research project and inquiring about their willingness to participate. FHC A, a top-6 private financial holdings company in Taiwan in terms of sales (CommonWealth magazine, 2012), has more than 50 billion in capital, over 4 thousand employees, and total assets over 1.0 trillion NTD (1USD= 29.9 NTD). FHC A offers diversified online B2B banking services such as accounting, loans, and foreign exchange/trading for its corporate customers, including venture capital, insurance brokerage, and financial security services. It also offers infrastructure that allows its corporate customers to build their e-brand image, while improving the depth and breadth of customer relationships. Next, we identified contact persons,

Table 1. Survey used to research the value of B2B banking in SMEs (1=strongly disagree/5=Strongly agree)

Security	SEC1	Online B2B banking provides highly-secured services.	12345
	SEC2	Online B2B banking protects information privacy.	12345
Ease of Use	EOU1	Online B2B banking is easy to use.	12345
	EOU2	Online B2B banking is fast to use.	12345
Coordination Intensity	CI1	Our correspondent banks are highly close with us.	12345
	CI2	Our correspondent banks promptly inform us when they offer new services.	12345
	CI3	Our correspondent banks visit us periodically for business.	12345
Innovative Culture	IC1	I often exchange ideas and opinions with colleagues and supervisors in an open-minded circumstance.	12345
	IC2	My company gives employees enormous job autonomy.	12345
	IC3	My company encourages employees express ideas and opinions.	12345
	IC4	My company encourages employees use new methods to perform tasks and jobs.	12345
	IC5	My company is glad to let employees learn from trial-and error.	12345
Employee Technology Readiness	ETR1	I like to use computers to complete my tasks and jobs.	12345
	ETR2	I find computers easy to use.	12345
	ETR3	I acquaint myself with computer skills.	12345
Overseas Market Development	OMD1	Due to the overseas markets, most products/services are sold overseas.	12345
	OMD2	Company establishes overseas plants, branches, or subsidiaries.	12345
	OMD3	Top managers must often go overseas to meet with international clients for business.	12345
User Satisfaction	US1	In sum, I am satisfied with online B2B banking.	12345
	US2	In sum, I think that online B2B banking is successful.	12345
Individual Impacts	II1	Online B2B banking saves my time on daily transactions.	12345
	II2	Online B2B banking improves my productivity.	12345
	II2	Online B2B banking saves my costs on searching information.	12345
Organizational Impacts	OI1	Online B2B banking enables my company respond quicker to transactions.	12345
	OI2	Online B2B banking enables my company enhance information accuracy and reliability.	12345
	OI3	Online B2B banking enables my company speed up transactions.	12345

in the position of financial managers, leaders, and supervisors, and senior specialists, at FHC A.

This study defines an SME as a firm established with under NTD 300 million in capital (Lee, 2007a). SMEs are also defined as companies with 500 or fewer workers, a definition popular in industrialized countries (Knight, 2001). Based on our definition, a sample pool of 350 potential SMEs was identified. With the assistance of contact persons at FHC A, we contacted these SMEs who have used e-B2B banking applications and inquired about their willingness to participate in the study after explaining the purpose of the research. Accompanied by contact persons at FHC A, we personally visited the financial managers of these SMEs and explained the questionnaires to them. Finally, 200 questionnaires were sent to corporate clients who were willing to join this research and distributed to those employees who work in the finance department. However, only 178 usable questionnaires were received. Table 2 indicates profile of samples.

Table 2. Profile of surveyed companies

		Number of Companies	Percent (%)
Sector	Manufacturing	66	37.1
	Construction	17	9.5
	Commerce	32	18.0
	Transportation	11	6.2
	Service	37	20.8
	Others	15	8.4
Number of Employees	5	14	7.9
	5-19	43	24.2
	20-49	38	21.3
	50-99	12	6.7
	100-500	71	39.9
Capital (NT$ Million)	<5	32	18.0
	5-29	61	34.3
	30-59	25	14.0
	60-99	5	2.8
	100-300	55	30.9
Number of Staff of Accounting/ Financial Division	<5	90	50.5
	6-9	32	18.0
	10-29	35	19.7
	>30	21	11.8
e-Banking Experience (years)	<1	43	24.2
	2-5	101	56.7
	6-10	21	11.8
	11-15	11	6.2
	>16	2	1.1
Service Application (Multiple Possible)	Bookkeeping	97	54.5
	Loan	51	28.7
	Factoring	34	19.1
	Searching	131	73.6
	Foreign exchange/trading	45	25.3

DATA ANALYSIS

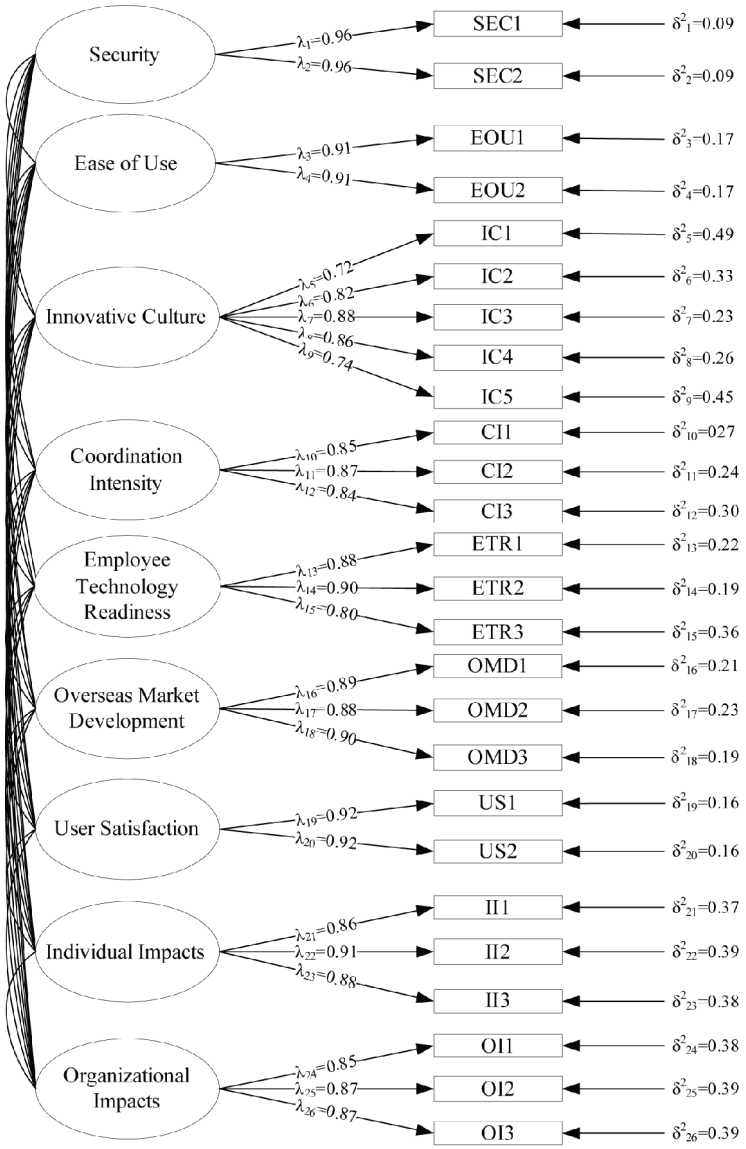
Partial least squares (PLS) approach was developed in the 1960's by Herman-Wold as an econometric technique. Basically, PLS is similar to regression analysis, but it is capable of latent variable modeling and offers causal modeling techniques that have made it possible for researchers to examine the theory and its measures simultaneously. Additionally, PLS is appropriately used under conditions of non-normality and small to medium sample sizes (Chin & Newsted, 1999). Hence, we use PLS to perform the data analysis. The computer program used for this analysis was the Smart PLS 2.0. The bootstrap re-sampling method with re-samples of 900 determined the significance of the paths within the structural model.

Reliability and Validity

First, construct reliability and validity were established using confirmatory factor analysis (CFA) (Figure 2). Convergent validity was evaluated for the research model according to criteria recommended by Fornell and Larcker (1981). These are: (1) Construct reliability in terms of composite reliability (CR), defined as the internal consistency of the indicators measuring a given factor exceeding 0.80, and (2) the average variance extracted (AVE) from each construct should exceed 0.50. AVE assesses the amount of variance that is captured by the underlying factor in relation to the amount of variance due to the measurement error. Based on the calculations (Table 3), the results show that the composite reliability of each factor is above recommended value, 0.7 (Hair, Anderson, Tatham, & Black, 1998). Further, it suggests acceptable reliability and good convergent validity.

The average variance extracted and shared variance (squared correlation coefficient between two constructs) are then employed to evaluate discriminant validity. To assess discriminant validity, Fornell and Larcker (1981) suggest that AVE must be greater than shared variance for all factors. Unlike the approach of Campbell and Fiske (1959), this criterion is associated with model parameters and recognizes that the measurement error can vary in magnitude across a set of methods (indicators of constructs). The results satisfy the requirement of

Figure 2. Confirmatory factor analysis (CFA)



All λ s significant at $P < 0.001$

Fornell and Larcker (1981), indicating good convergent and discriminant validity of the measurement.

Structural Equation Modeling

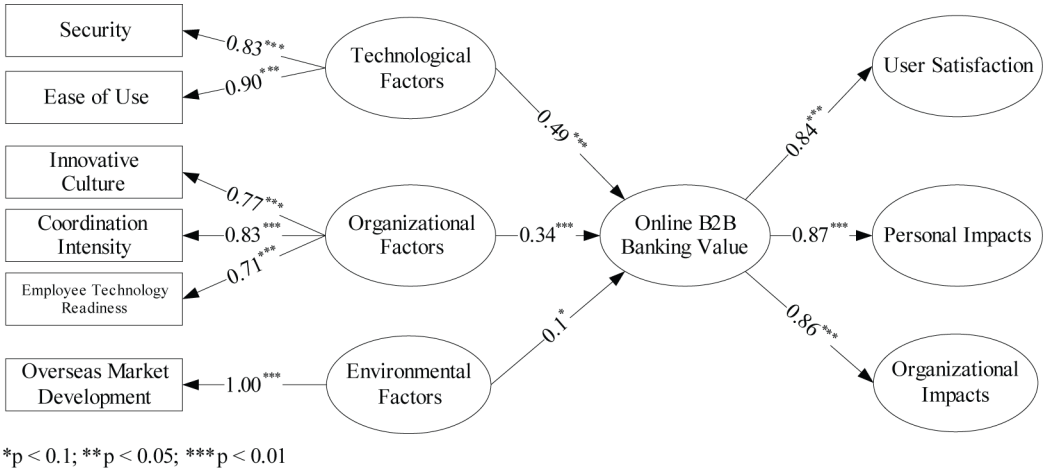
Figure 3 shows a graphical representation of the structural model. The path coefficients, *P*-values, *R*-square, and t-values were examined in the statistical model test in order to test hypotheses. The path coefficients are standardized regression coefficients and the *P*-values represent their respective significant level. *R*-square values refer to the total variance of dependent variable that can be explained by the path model. As shown, all coefficients are positive, indicating that as the value of independent latent variable increases, the value of the dependent latent variable also increases. Thus, as expected, these results support all hypotheses.

Table 3. Reliability, convergent validity, and discriminant validity

Construct	CR	AVE	Shared Variance								
			SEC	EOU	IC	CI	ETR	OMD	US	II	OI
SEC	0.95	0.91	(0.91)								
EOU	0.90	0.83	0.26	(0.83)							
IC	0.90	0.65	0.16	0.15	(0.65)						
CI	0.89	0.73	0.08	0.17	0.12	(0.73)					
ETR	0.90	0.75	0.14	0.24	0.19	0.13	(0.75)				
OMD	0.92	0.79	0.12	0.15	0.03	0.10	0.07	(0.79)			
US	0.91	0.84	0.34	0.43	0.17	0.22	0.20	0.18	(0.84)		
II	0.91	0.78	0.19	0.29	0.16	0.12	0.32	0.12	0.32	(0.78)	
OI	0.90	0.74	0.16	0.36	0.16	0.09	0.26	0.07	0.30	0.51	(0.74)

Notes: CR = composite reliability; AVE = average variance extracted (also in parentheses).

Figure 3. Model testing results



DISCUSSION AND FINDINGS

The goal of the study was identify critical precedents that form e-banking value and their impact using the TOE framework. Results of the study show that all technological, organizational, and environmental factors significantly contribute to e-banking value. The technological factor was found to be the most significant contributor to e-banking value as perceived by SME employees, followed respectively by organizational and environmental factors. E-banking value has a positive influence on individual impacts, organizational impacts, and user satisfaction. However, had approximately same impact.

E-banking is a high-risk area with a potential for substantial economic loss (Hertzum, Juul, Jørgensen, & Nørgaard, 2004). In the process of developing plans for implementation, an understanding of local interpretations of technology is fundamental, if the technology is going to be adopted and eventually institutionalized (Silva, 2011). E-banking is increasingly becoming a traditional banking channel, making technological

robustness a necessity for implementing e-banking. Perhaps this is why technology factors such as security and ease of use are most influential factors for the employees participating in this study. It should be noted that ease of use has been shown to be a stronger antecedent of technology adoption than security from the employee standpoint. This finding is consistent with studies that show that Chinese tend to have strong culturally specific design preferences for interfaces (or IT system) and therefore have higher perception of ease of use (Evers & Day, 1997). Employees in SMEs generally lack the capability to handle cyber threats. Thus, the dedicated security services offered by the financial institutions are valuable for them. Smoother human-computer interactions with interfaces that emphasize learnability, operability, and understandability increase the value of online systems to SMEs when making online transactions. This finding is compatible with the literature indicating that both security and ease of use are contribute to e-business value (Nurse & Sinclair, 2010). In Taiwan, ease of use is the most prominent precedent amongst technology and organizational factors from the employee standpoint. This indicates that ease of use directly influences employee anticipated online banking value. However, offering ease of use and security at the same time generates conflicts (Hertzum et al., 2004) for service providers.

Organizational factors had the second highest influence on B2B e-banking value. Specifically, innovative culture and employee technology readiness were significant but most the salient organizational factor in the Taiwan context was coordination intensity, which perhaps implies dependency of SMEs on banking finance to undertake projects. Implementing online banking and providing customized services to the diversified customers cannot be done with a rigid organizational culture. With an innovative organizational culture, firms can visualize changing business requirements and customer needs. The literature also suggests that in creating continuous and sustained value creation, firms must devise and implement an innovation culture which allows them to build the capabilities necessary to compete successfully both now and in the future (Isidre & Jeef, 2010; Voelpel, Leibold, & Streb, 2005). As information and communication technologies advance, e-banking services are expected to be more innovative, involving the entire organization. Additionally, employee technology readiness facilitates value for SMEs in making e-banking more resilient as a part of long term strategy. Being actual implementers, employees are responsible for realizing e-banking value. Hence, employee technology readiness to implement e-banking technology and further innovations stimulates a fertile environment. The literature supports the notion that concerted effort and e-readiness action from top management, other managers, and employees enables firms to minimize financial losses and optimize business practices in responding to changing business environments (Jutla et al., 2002). Coordination being the most significant organizational factor shows that Taiwanese SMEs are dependent on financial institutions that are normally highly risk averse. Research has found that SMEs that are dependent on banks when developing their international business relationships tend to have previously depended on the bank when conducting business (Lindstrand & Lindbergh, 2011). Coordination with financial institutions is advantageous for SMEs for satisfying business processes with supply chain members and also exploiting economic benefits. However, banks do not participate in SME business networks when SMEs are internationalizing (Lindstrand & Lindbergh, 2011). Understanding and processing of transactional requirements with multiple customers would call for intensive effort on the part of employees of SMEs. Therefore, a better level of co-ordination with financial institutions is necessary to a firm for pursing business operations. Our finding is consistent with the literature on supply chain management (Buvik & John, 1999; Zirpoli & Camuffo, 2009).

The government's R&D and technology policies encourage and support innovation among all firms, especially SMEs, and can help countries remain competitive in a global market. In the absence of robust policy overseas market development has the least significant impact, meaning that firms are still appraising e-banking technology for overseas market development. This may indicate that government policies are yet not completely congruent with SME needs. It also shows SMEs are likely to experience high economic risks, scarce financial resources, and difficulty accessing market information and markets when going abroad (Demirbas, 2011). Research shows that overseas market development plays only a partial and controversial role when creating e-business value since some SMEs use the Internet as efficient conduit for international market growth (Mathews & Healy, 2006), while others SMEs do not. As competition in the international market increases, domestic competition decreases and the number of firms competing domestically decreases. In Taiwan where domestic market is small and there is a large number of SMEs (Chiao & Yang, 2011), performance in the international market matters. Of course, such performance is vital for the survival of the firm.

While using e-banking, firms may have unpleasant experiences that eventually reduce user satisfaction. However, the present study finds that user satisfaction is a significant contributor to B2B e-banking value as defined by employees. This shows that Taiwanese employees appreciate the value received from e-banking as they are experiencing its perceived benefits. Our finding is consistent with the literature regarding e-commerce which finds that e-business value is more important than user satisfaction (González et al., 2004).

Our study further shows a significant effect of e-banking value on individual impacts. It shows that technology standards and systems used in e-banking appear to prominently influence employee job characteristics such as organizational commitments, essential functions, satisfaction and performance with an increase in job comfort level. By the same token, e-banking value had a significant influence on organizational impacts. Firms appreciate the value of e-banking since it offers concrete benefits such as market expansion and reduced operating costs. The organizational management and IS literature, which acknowledges substantial influences of technology on employees as well as the organization, corroborates our findings (Chen, 2011; Raphael & Zott, 2001; Venkatesh, Davis, & Morris, 2007).

CONCLUSION

Managerial and Academic Implications

A clear understanding of the technological, organizational, and environmental factors and impacts of e-banking value can provide firms with the opportunity to understand their own business process characteristics. Employees of such firms could then benefit from the systematic efforts of managers. As Internet technologies diffuse and become necessities, these organizational and industry-specific capabilities become even more critical (Zhu et al., 2004), meaning that managerial leadership is indispensible. Technology factors, as the most significant factors, require greater attention from managers. Both security and ease of use are vital for customers, but their simultaneous attainment may be difficult. When firms may not have the resources for implementing secure internet services, ties with financial institutions may insure better security services. Financial institutions should thus pay close attention to ease of use when designing and maintaining their websites.

Ideas of security and ease of use differ across countries. Thus, respective online banking related innovative dispositions would differ. Inter-organi-

zational and intra-organizational business process must be synergized by understanding cognitive, affective, and cultural/socio-demographic antecedents for supporting global business processes. Overall, managers need to strike a balance between Taiwanese business practices and the foreign contexts in which they operate.

Changes in the ICT can influence employee perceptions of the technology. Managers should focus on developing an environment that can handle the changes induced by IT and to build innovative capability. Top management must be actively involved in generating an innovative culture. It can retain a constant focus on innovation management, encourage employee creativity, and actively monitor the organization's progress in order to ensure a culture conducive to the constant generation of valuable innovations (Isidre & Jeef, 2010). Cultivating an innovative culture enables an organization to outperform and also plays a very important role in determining the level of market orientation of an organization (O'Cass & Ngo, 2007). In-depth understanding complexity of the technology is a mandate for managers. Managers would be well-advised to be aware of the technology readiness of employees and adjust the training schedule and management activities to optimize business processes. However, simply providing employees with IT and standardized training may not be sufficient to gain the full benefit of the investment (Walczuch, Lemmink, & Streukens, 2007). When implementing online B2B banking, technology centric inputs themselves might not be enough for employees to perform well. Affective as well as political support from management is also required. Due to the perceived security requirement involved in online B2B banking, despite the presence of electronic channels, virtual or face-to-face relationship building is important (Mathews & Healy, 2006). Managers must put effort into reconciling strategic inter-firm alliances as a part of organizational strategy. Owing to the lack of property rights and unstable institutional environments, firms may strengthen informal ties and pool resources to achieve scale and scope economies that are unavailable otherwise (Mesquita & Lazzarini, 2008), especially in Asia (Mathews & Healy, 2006). Managers using e-banking must determine how to establish and manage strategic coordination with other financial and non-financial firms to enhance collective efficiency. However, the degree of coordination must be known. For smoother and more reliable transactions, managers should choose an appropriate online bank/banking service, since its reach matters when considering overseas market expansion. Firms need to develop trust and reputation for their websites through affiliates and virtual networks (Mathews & Healy, 2006) when expanding abroad.

When assessing the impact of values, risk weighing is also necessary (Day & Crask, 2000). Managers are responsible for identifying customizations that will increase the value of e-banking and thus, user satisfaction. The implementation and organization of accelerating capability approach (Al-Jaded & Molina, 2005) is a value creation strategy that firms can adopt for user satisfaction. Further, firms may consider strategic agreements with banks in order to offer new service avenues to strengthen competitive position. Since personality influences technology use, managers should be aware of managing relationships when initiating new technology (Walczuch et al., 2007) such as e-banking. Firms may turn the positive impact of online B2B banking value into building competencies, but inter-organizational as well as intra-organizational trust development is necessary. Managers have to ensure both strategic and functional fit, so that they can achieve alignment of business and IT infrastructure and strategy to maximize IT investment and performance (Papp, 2004). Strategic recruiting and retaining marketers and managers with meaningful prior computing experience (Stone, Good, & Lori, 2007) may thus be required.

Limitations and Future Research

There are several limitations of this study. First, the present study focuses primarily on cognitive factors. Affective factors were not considered in study, but future research may explore theme. Second, we fails to shed light on cultural context where it was conducted, including such aspects language barriers and trust building through relationships (Mathews & Healy, 2006). Future research should explore these elements. Third, in addition to using only 178 samples, all were from Taiwan, limiting generalizibility. Future research could use larger sample sizes collected in other countries. Fourth, multidimensional constructs were used in the TOE framework in order to make it more comprehensive. However, this results in a loss of precision. Future studies can adopt a more focused approach.

Future research may examine other issues for online B2B banking services, such as trust. Trust is a critical issue in satisfaction and usage, but trust comes primarily from interpersonal relationships in Taiwan, so one theme that needs investigation is how web-based service channels could make contact with interpersonal services. Further research should explore the influence of usage with online B2B banking services in the wider domains of the corporate customer interaction with the bank. Acquiring the benefits from usage of online B2B banking services might be conducive to creating better relationships between the bank and the corporate customer, or may result in higher switching costs. Through these, online B2B banking may be able to indirectly create greater customer loyalty, critical in intensely competitive banking industry. Our results also demonstrate that a great deal of work is necessary to fully comprehend the potential of online banking. Numerous tasks remain to be conducted to robustly comprehend the corporate customer response to online B2B banking service channels.

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Chapter 11
Overview of Mobile Payment: Technologies and Security

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ABSTRACT

According to the Mobile Payment Forum, mobile payments are the transactions with a monetary value that is conducted through a mobile telecommunications network through diverse mobile users devices, such as cellular telephones, smart phones or PDAs, and mobile terminals. Mobile payment is a transfer of funds in return for goods or services in which a mobile device is functionally involved in executing and confirming payment. The payer can be standing at a POS or be interacting with a merchant located somewhere else. Mobile payment systems enable customers to purchase and pay for goods or services via mobile phones. Here, each mobile phone is used as the personal payment tool in connection with the remote sales. Payments can take place far away from both the recipient and the bank. This chapter gives an overview of mobile payments.

INTRODUCTION

The growth in wireless technology increases the number of mobile device users and gives pace to the rapid development of e-commerce conducted with these devices. The new type of e-commerce transactions, conducted through mobile devices using wireless telecommunications network and other wired e-commerce technologies, is called mobile commerce, increasingly known as mobile e-commerce or m-commerce. Mobile commerce enables a new mode of information exchange and purchases, and it presents an unexplored domain. To customers, it represents convenience; merchants associate it with a huge earning potential; service providers view it as a large unexplored market; governments look it as a viable and highly productive connection with their constituents. In short, mobile commerce promises many more alluring market opportunities than traditional e-commerce. M-Commerce is an area arising from the combination of electronic commerce with emerging mobile and pervasive computing technology.

The most important application of mobile Commerce is Mobile payments. These services makes a mobile device to act as a business tool replacing bank, ATM, and credit cards by letting a user conduct financial transactions with mobile money. A mobile user attempts to purchase goods

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or services from a business or service provider, which then contacts a trusted third party, the wireless service provider, or a financial institution to authenticate the user and amount of purchase. Once approved, a mobile payment can be made and the purchase is completed. The corresponding funds can then be withdrawn from user's m-wallet, charged to user's phone bill, or subtracted from user's bank account. Alternatively, the user could pay using mobile money provided to him by another user or a third party mobile money provider. Mobile money can be moved freely among users either by using a local area wireless network or by using the wireless service provider's network. Several groups are working on mobile payments, including PayCircle that is established by HP, Lucent, Oracle, Sun, and Siemens. Mobile financial transactions require a strong level of security support. Although, security features have been added in mobile middleware such as WAP for financial applications, wireless PKI (Public Key Infrastructure), a system to manage keys and certificates, is used to authenticate and obtain digital signatures from mobile users. The payment system is an application responsible for increase in competitive advantage in organizations. Researchers are interestingly working in the area of mobile payments as it is multidisciplinary in nature and works in collaboration with different areas like telecommunications, wireless networking, mobile computing and security.

1. BACKGROUND

Chen et al. (2010) described a mobile payment system for merchant micropayments that can be built on existing GSM and NFC architecture components. The author's proposal leverages the SIM's authentication and identification capabilities and used cryptographic primitives, which simplifies integration into the current mobile infrastructure. The use of NFC for short range communication allows for possible integration with existing Point -Of-Sale (POS) equipment and the payment process from the customer and merchant's perspective remains unchanged. Liu et al. (2010) proposed a trust model to protect the user's security. The billing or trust operator works as an agent to provide a trust authentication for all the service providers. The services are classified by sensitive calculations. With this value, the user's trustiness for corresponding service can be obtained. For, decision, three ranks: high, medium and low. The trust region tells the customer with his calculated trust value, which rank he has got and which authentication methods should be used for access. Authentication history and penalty are also involved with reasons. Yang et al. (2010) gives a general framework of online mobile payment and presents a new mobile payment pattern which advocates stratified extension and cascading agent based on stable and credible platform group. It also proposes a cross-bank unified payment platform to solve the difficulties of connection to banks. As a result, the authors got the regular effective and monitoring payment process which is of great manoeuvrability. The mobile payment process will be more reasonable and the transaction will be more secure. This framework was given to solve the problem of mobile applications that are difficult to be connected with the banks. Asghar et al. (2010) have surveyed five different models in the field of mobile payment in their research; then they were compared with MCDM evaluation methods applications. To implement a mobile payment service, there are many actors involved such as bank, operator and service provider. As an effective interaction role and in order to optimize efficient parameters for implementing a mobile payment solution a suitable business model is necessary. Since one of the most effective parameter to select an appropriate business model is the banks/operators structure of every country, the proposed business model is localized based on the Iranian banks/operators' framework. The results of MCDM method indicate that the collaboration model is the most suitable mobile payment busi-

ness model in Iran. Olsen et al. (2011) proposed a design of e-wallets. Interviews and formative usability evaluations have provided data for the construction of first a conceptual model in the form of low fidelity mock-ups. Chandrahas et al. (2011) focussed on some design considerations for Mobile Payment Architecture. For widespread adoption, interoperability is a key concern. The design of this architecture requires the user to know only the beneficiary's mobile number in order to initiate a mobile payment. This is restrictive in the sense that only one bank account can be linked to a mobile number. To enhance flexibility it would be desirable, especially for merchants, to be able to link multiple bank accounts to a single phone number. The authors proposed an alternate and enhanced design that allows the flexibility to link multiple bank accounts while also allowing the transactions to be conducted with just the mobile number. Evaluated and compared these two designs on various criteria. The details of implementation issues, advantages and limitations are also presented. The analysis is a step towards the evaluation process of various design choices for mobile payment architectures.

Researchers are continuously working in the field of mobile payments in order to increase the competitive advantage for the organisations and from user's perspective as well.

2. PAYMENT SYSTEMS

According to the Mobile Payment Forum the mobile payments are the transactions with a monetary value that is conducted through a mobile telecommunications network through diverse mobile users devices, such as cellular telephones, smart phones or PDA's and mobile terminals. Mobile payment is a transfer of funds in return for goods or services in which a mobile device is functionally involved in executing and confirming payment. The payer can be standing at a POS or be interacting with a merchant located somewhere else. Mobile Payment is a major component of m- commerce and is defined as a process of two parties exchanging financial value using a mobile device in return for goods or services.

Mobile payment systems enables customers to purchase and pay for goods or services via mobile phones. Here, each mobile phone is used as the personal payment tool in connection with the remote sales. A phone card-based payment system has the advantage over the traditional card-based payment in that the mobile phone replaces both the physical card and the card terminal as well. Payments can take place anywhere far away from both the recipient and the bank. The basics and example of phone-based payment systems are described in Innopay, Mobile Payments.

Traditionally, in the real world, the most popular modes of payments are cash, cheques, debit cards and credit cards. With the possibilities created by the Internet, a new generation of payments appeared, such as electronic payments, digital payments and virtual payments. Now, with the growing penetration of the mobile phone and the development of m-commerce, the mobile payment will become an uncontested mode for paying goods.

Consumers can use a mobile device to pay for goods and services, transportation-related items, any merchandise in a physical merchant location. For Goods and Services such as music, videos, ringtones, online game subscriptions, wallpapers, and other digital goods. For Transportation-related items such as bus, subway, or train fares and parking at meters.

Doing financial transactions with mobile phones eliminates the need for auxiliary payment instruments (like POS devices), while using security features of the SIM card (as a smart card) yield to a great level of security and dependability. A mobile payment service comprises of all technologies that are offered to user as well as all tasks that the payment service provider(s) perform to commit payment transactions.

2.1. Classification of Mobile Payments

Mobile payment methods currently in use or under trial may be classified according to the basis of payment. A payment transaction has been identified on the basis of multiple dimensions. A distinction between the different types of payments is on the basis of location, time, size and medium. Mobile payments are typically differentiated by technology, transaction size, location (remote or proximity), and funding mechanism.

On the basis of location payments are classified in two types:

- Remote mobile payments
- Proximity mobile payments

On the basis of Technology:

- SMS, a mobile browser, or a mobile application
- Bar codes or a contactless interface to chip-enabled payment technology, such as NFC-enabled mobile phones, contactless stickers, tags

On the basis of size the payments are classified into two types:

- Micro payments
- Macro payments

On the basis of funding mechanism the payments are categorised into following types:

- Account Based
- Real time
- Pre paid
- Post paid
- Smart card Based
- Credit card Based
- M POS
- Mobile wallets
- P2P Payments

2.1.1. Location-Based Payments

Remote mobile payments and proximity mobile payments are distinguished by the location of the mobile handset in relation to the merchant's POS, as well as by payment account information and the payment acceptance device or service. A remote mobile payment is a payment in which the payer does not interact directly with the merchant's physical POS system (for example, transferring funds through a mobile phone application to a merchant's PayPal account). A proximity payment is a payment in which the mobile phone interacts in some way with a physical POS device to transfer the consumer's payment information and perform the transaction.

2.1.1.1. Remote Mobile Payment

Remote mobile payments may use a variety of mobile phone data channels to initiate a transaction. Most mobile phones are equipped with functionality that can enable remote mobile payments. Remote mobile payments makes purchases from a Web merchant with mobile phone, paying a merchant who does not have traditional acceptance capabilities for physical goods, or paying a merchant for a purchase of digital goods. Remote mobile payments may be implemented using the existing financial payments infrastructure (e.g., for payment at a Web merchant) or using a closed loop mobile payments system.

A remote mobile payment process is as follows:

- The consumer and merchant set up an account with a trusted third party or MPSP.
- When a transaction is initiated, a SMS message is sent to the MPSP. Authentication can be secret passwords, validation of handset hardware information, or verification of other sender personal information.

- After the transaction request is received and authenticated, the MPSP transfers funds from the consumer's account into the merchant's account and notifies the merchant that the funds have been transferred.
- In a closed loop system, the merchant may then move the funds into a standard bank account.

Remote mobile payments are ideal for use in markets that require person-to-person payments and for under-banked consumers and merchants who are not part of the normal POS acquirer payment process, such as flea market vendors and seasonal outside vendors.

2.1.1.2. Proximity Mobile Payments

Proximity mobile payments leverage the financial industry's payment infrastructure. An NFC-enabled phone is provisioned with a version of the payment application (i.e., credit or debit card) issued by the consumer's financial institution. The application and payment account information are encrypted and loaded into a secure area in the phone. The phone uses the built-in NFC technology to communicate with the merchant's contactless payment-capable POS system, similar to the contactless payment cards and devices in use today. The payment and settlement processes are the same processes used when the consumer pays with a traditional contactless or magnetic stripe credit or debit payment card. Proximity mobile payments can be made at both attended POS locations (such as stores) and unattended locations (such as vending machines) that use the existing merchant payments infrastructure. To pay, the consumer simply brings the phone to within a few inches of a contactless payment capable POS system and the transaction occurs. The process is the same as that used by the contactless credit and debit cards currently being deployed in the United States.

The most obvious differences between proximity and remote mobile payments are speed, convenience, and the fact that NFC payments use the existing financial payments processing infrastructure. There is no need to set up payment processes or accounts with a third party, and the proximity mobile payment data is linked directly to a payment card issued to the consumer by a trusted financial institution.

2.1.2. Technology

Mobile payments use different technologies to perform a transaction. Remote payments typically rely on text messaging (SMS), a mobile browser, or a mobile application. Proximity payments rely on either bar codes or a contactless interface to chip-enabled payment technology, such as NFC-enabled mobile phones, contactless stickers, tags, or fobs.

2.1.3. Transaction Size

Transaction size affects the choice of mobile payment technology and approach. Mobile payments typically fit into one of two transaction size categories. Micropayments (less than $10-$25) are typical for paying for ring tones, music, parking, transit, coffee, and items in convenience stores. Micropayments' (over $25) are typical for all other transactions, such as person-to-person domestic and international remittances, charitable donations, Web site purchases, bill payment and retail POS.

2.1.3.1. Micro Payments

Remote mobile micropayments enable purchases of mobile content and services such as news, games, tickets, and location-based services. Mobile micropayments also provide a potential payment method for e-commerce. In Finland, Helsinki City Transport offers a mobile subway and tram

ticket, an example of a successful mobile payment service. Customers can order a one hour SMS ticket via their mobile phones by sending a SMS message to a service number. Mobile micropayments at unmanned POS include applications such as purchase of soft drinks or items from vending machines, and payments on self-service stations, for example paying for gas without cash at hand. Mobile micropayments at manned POS include small purchases at shops, kiosks, and fast food restaurants. The manned POS mobile payments are often more convenient in the purchase situations. Micropayments generally represent a payment which is below 10 Euros and is usually supported by cash or debit cards. Merchants accept credit card transactions for small amounts because of transaction fees. Consequently, mobile payments are an attractive substitute for this type of transaction, especially since most current mobile purchases are news alerts, logos and ringtones. However, most companies promoting micropayments failed because the margins on small value payments are notoriously low, and sufficient economies of scale are extremely difficult to attain.

Micro payments are provided by mobile operators, with payment being made mostly via premium SMS/WAP using mobile operators' billing infrastructures. Such micro-payments have proved to be an extremely lucrative source of revenue. Since payment amounts are low and the merchant's fee for mobile content relatively high, mobile operators have accepted the payment risk, based on their basic authentication of the user and their billing systems, without any collaboration with the banks for online authorisation.

2.1.3.2. Macro Payments

Mobile macro payments can be used to pay for larger purchases both electronically (e-commerce, mobile ticketing, gaming) and on manned and unmanned POS (restaurants, retail shopping, and so forth). Mobile macro payments face more competition from well-established traditional payment instruments. However, solutions developed for user authentication in macro payments provide possibilities for a variety of different services such as passage control, digital signatures, and mobile government services. There are different research and telecom organisations that are developing a mobile authentication service based on a WPKI solution. Mobile authentication can be used for m-government services and digital signatures both on Internet and mobile networks.

Macro payments are logically every payment above 10 Euros and represent a real challenge for mobile payments. They need stronger security mechanisms because of the large amount of money involved and the greater possibility of fraud.

For remote macro payments, the mobile is linked to a payment card (credit/debit card) or an account (bank account and/or store account) through an activation/enrolment process and is used afterwards as an authenticator of remotely-stored information. There are various opportunities for mobile remote macro payments.

1. **Topping-Up a Mobile Pre-Paid Account:** This is done with the help of handset. Customers do not need any more to go to the shop to purchase a voucher. For mobile operators, this is a far less expensive topping up method than scratch cards and represents huge cost savings.
2. **Mobile Shopping:** Here the mobile phone is used as a shopping and payment channel. Shopping channels are based on IVR, SMS or WAP/iMODE. Access to the mobile store can be facilitated by tag reading, whereby the user swipes the mobile phone across a tag that links them to a website to purchase a product.

There are two kinds of tag:

3. **Bar Code Tag:** The user scans the bar-code near his favourite product in a magazine, using his mobile phone embedded camera.

He is then redirected to the related product on the merchant's WAP site, where he can get more information on it and purchase it.

4. **NFC Tag:** The same principle as the bar code tag, but the NFC tag is read by the NFC-enabled mobile phone. Ticketing applications in which dematerialised tickets are ordered, paid for and delivered on the mobile.
5. **Bill Payment:** SMS bill delivery and payment is already being used by some mobile operators and utility companies.
6. **Internet Shopping:** Here a user authenticates their transaction with their mobile handset rather than having to enter their credit card details. There is a still a significant number of consumers that do not feel comfortable entering credit cards details online, for whom mobile authentication could be an acceptable alternative The mobile device are also used as an authentication method for 3D-secure card payments online. In this case, the user still enters their card details through the Internet and validates the transaction on their mobile phone
7. **P2P (Person to Person):** It refers to payment between two persons through their GSM. The success of P2P on the Internet is largely driven by online auctions.
8. **M- POS:** It refers to a specific case of P2P in which the mobile payment service is marketed to professionals and to low-segment mobile merchants without point-of-sale (POS) payment terminals, for which mobile payment could prove a cheaper alternative to electronic payment. The merchant initiates the transaction via a SIM toolkit menu entry in his mobile device, entering the amount due and the customer's phone or reference number. The customer then receives a signature request on his mobile handset and validates it by entering his PIN. Both receive a confirmation of the transaction via SMS. Transactions are performed directly by debiting the customer's bank card and crediting the merchant account. The payment costs including communication costs are billed by the telecom operators using the SMS premium infrastructure.
9. **International Fund Transfer for Migrant Communities:** Another potentially promising application for P2P mobile payment services is the capability to send money abroad.

The international fund transfers via mobile phone represent the Mobile Money Transfer mechanism endorsed by the GSM Association and MasterCard that leads to a faster development of operator driven mobile fund transfer systems worldwide. An additional new opportunity for mobile operators is to bring financial services to developing countries, where the number of 'unbanked' (or under banked') people with mobile phones is much higher than the banked population. Vodafone's M-PESA in Kenya is a good example of those emerging opportunities, enabling mobile subscribers to deposit or withdraw cash at a branch of the mobile operator, top-up their prepaid account and transfer money to another customer using their mobile phone.

2.1.4. Funding Mechanism

Mobile payments rely on multiple funding mechanisms. Transactions can be included on a telephone bill or funded by a prepaid account associated with the phone (typically used for text-message-based payments). Alternatively, cash can be loaded into a virtual account at an agent location that is then used for payment. This is the alternate way to maintain an account for each consumer in the form of electronic tokens. Here, consumers typically need to convert actual currency to their electronic equivalent, i.e. tokens. Another source of funds is a traditional bank account or credit, debit, or prepaid card, accessed through a virtual wallet (a wallet that is accessed using the mobile phone's

browser or a mobile application). The wallet may provide access to one or more of the above funding sources, which are loaded into the wallet.

2.1.4.1. Account-Based Payment Systems

In account-based payment systems, each customer is associated with a specific account maintained by the TTP like a bank. Every consumer is associated with a specific account maintained by an Internet Payment Provider. There are three kinds of transactions in Account based Payment Systems (Real time-Cash, Prepaid transactions-Debit, Post-paid transactions-Credit):

1. **Real-Time (Cash):** Payment methods that adopt the real-time or "cash" like payment schedule involve some form of electronic currency that is exchanged during a transaction. Examples of real-time payment methods are e-Cash and beenz.
2. **Pre-Paid:** In pre-paid transactions, this account will be directly linked to the consumer's savings account. The consumer maintains a positive balance of this account which is debited when a pre-paid transaction is processed. This is the most common charging method for MNO's as well as third-party service providers in order to be able to evaluate only that the user is capable of paying. The prepaid user is a significant part of the current MNO customer base.
3. **Post-Paid:** If post-paid transactions are supported, the charges from a transaction are accrued in the consumer's account. The consumer is then periodically billed and pays for the balance of the account to the TTP. This is the most common method used in e-/m-commerce transactions today. Examples are:
    a. **Phone-Bill Based:** This is the charge method most commonly used by mobile network operators, and it is an internal charging method.
    b. **Account-Based (Bank/Credit Card):** This method is used by banks, which a priori have an account of the user, or the credit card industry.

2.1.4.2. Smart Card Payment Systems

A smart card, chip card, or ICC is any pocket-sized card with embedded integrated circuits. Smart cards are made of plastic, generally polyvinyl chloride, but sometimes polycarbonate. Smart cards can provide identification, authentication, data storage and application processing. Smart cards may provide strong security authentication for single sign-on within large organizations. Payment systems use a smart card, an embedded microcircuit, which contains memory and a microprocessor together with an operating system for memory control. These smart cards can be used for electronic identification, electronic signature, encryption, payment, and data storage.

Smart cards serve as credit or ATM cards, fuel cards, mobile phone SIMs, authorization cards for pay television, household utility pre-payment cards, high-security identification and access-control cards, and public transport and public phone payment cards. Smart cards may also be used as electronic wallets. The smart card chip can be "loaded" with funds to pay parking meters and vending machines or at various merchants. Cryptographic protocols protect the exchange of money between the smart card and the accepting machine. No connection to the issuing bank is necessary, so the holder of the card can use it even if not the owner.

These are the best known payment cards (classic plastic card):

- **Visa:** Visa Contactless, PayWave.
- **MasterCard:** PayPass Magstripe, PayPass Mchip
- **American Express**: ExpressPay.

Smart cards are of two types: Contact smart cards and Contactless smart cards.

1. **Contact Smart Cards:** Contact smart cards have a contact area of approximately 1 square centimetre, comprising several gold-plated contact pads. These pads provide electrical connectivity when inserted into a reader, which is used as a communications medium between the smart card and a host (e.g., a computer, a point of sale terminal) or a mobile telephone. Cards do not contain batteries; power is supplied by the card reader. The ISO/IEC 7810 and ISO/IEC 7816 series of standards define physical shape and characteristics, electrical connector positions and shapes, electrical characteristics, communications protocols, including commands sent to and responses from the card and the basic functionality of the smart card. Communication protocols for contact smart cards include T=0 (character-level transmission protocol, defined in ISO/IEC 7816-3) and T=1 (block-level transmission protocol, defined in ISO/IEC 7816-3).
2. **Contact-Less Smart Cards:** A contactless smart card is any pocket-sized card with embedded integrated circuits that can process and store data, and communicate with a terminal via radio waves. Memory cards contain non-volatile memory storage components, and perhaps some specific security logic. Contactless smart cards contain a re-writeable smart card microchip that can be transcribed via radio waves. These cards require only proximity to an antenna to communicate. They are often used for quick or hands-free transactions such as paying for public transportation without removing the card from a wallet. Like smart cards with contacts, contactless cards do not have an internal power source. Instead, they use an inductor to capture some of the incident radio-frequency interrogation signal, rectify it, and use it to power the card's electronics. The standard for contactless interface is defined in ISO/IEC 14443-4.

The first contactless smart card in production use for fare payment was the Octopus card. A major application of this technology has been contactless payment credit and debit cards. Some major examples include are ExpressPay from American Express, PayPass from MasterCard and PayWave from Visa.

2.1.4.3. Credit Card Mobile Payment Systems

This type of mobile payment systems allow customers to make payments on mobile devices using their credit cards. These payment systems are developed based on the existing credit card-based financial infrastructure by adding wireless payment capability for consumers on mobile devices. A credit card is a payment card issued to users as a system of payment. It allows the cardholder to pay for goods and services based on the holder's promise to pay for them. The issuer of the card creates a revolving account and grants a line of credit to the consumer (or the user) from which the user can borrow money for payment to a merchant or as a cash advance to the user. Credit cards allow the consumers a continuing balance of debt, subject to interest being charged. The credit cards conform to the ISO/IEC 7810 ID-1 standard. Credit cards have an embossed bank card number complying with the ISO/IEC 7812 numbering standard. The existing SET secure protocol, developed by Visa and MasterCard for secure transfer of credit card transactions, has been extended and known as 3D SET to support mobile payment for mobile device users.

2.1.4.4. Mobile POS Payment

Mobile POS payment system enables customers to purchase products on vending machines (or in retail stores) with mobile phones. Two popular

types of mobile POS systems are: automated point-of-sale payments, and attended point-of-sale payments. The first type is frequently used over ATM machines, retail vending machines, parking meters or toll collectors, and ticket machines to allow mobile users to purchase goods (such as snacks, parking permits, and movie tickets) through mobile devices. The other type of Mobile POS systems is useful for shop counters and taxis. They allow mobile users to make payments using mobile devices with the assistance from a service party, such as a taxi driver, or a counter clerk etc. A typical example of mobile POS payment system is Ultra's M-Pay.

2.1.4.5. Mobile Wallets

Mobile wallets are the most popular type of mobile payment option for transactions. Like e-wallets, they allow a user to store the billing and shopping information that the user can recall with one-click while shopping using a mobile device. The primary types of mobile wallet schemes in the market are client wallet and hosted wallet.

1. **Client Wallets:** These are stored on a user's device in the form of a SIM Application Toolkit card that resides in a mobile phone. Since the wallet is based on hardware, it is difficult to update, and potentially the user's sensitive financial information is compromised if the device is lost or stolen.
2. **Hosted Wallets:** These are the digital wallets hosted on a server. This gives the service provider much greater control over the functionality it delivers and the security of the data and transactions. Hosted wallets can be self- hosted wallets or third party hosted wallets.

In addition, server based mobile e-wallets using SET technology are already being used, providing secure transaction capability for merchants and cardholders.

2.1.4.6. P2P Mobile Payment

P2P payment allows individuals to pay one another through a third party. P2P payment services, which are offered by many banks and third parties, can also allow business owners to transfer money to a customer or supplier account (and vice versa) using an e-mail address or mobile phone number. Users can conduct transactions using funds from a bank, credit, debit or prepaid account, or the payment can be funded through the mobile phone bill. PayPal is the leader in the P2P category, with the largest global Internet-based payment network. PayPal offers a mobile phone app that allows consumers to send and request money using an e-mail address or phone number and a service based on SMS. PayPal has a P2P payments solution for Android NFC phones that allows money to be transferred by tapping two NFC phones together.

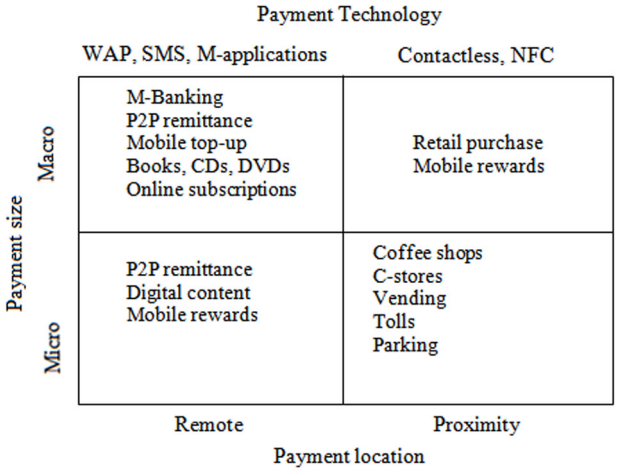
Other examples of P2P mobile payment solutions include the following (Figure 1):

- In 2010, Visa announced a new P2P payment service that gives its U.S. customers the ability to receive and send money from their Visa accounts. Visa's service includes a partnership with CashEdge and Fiserv; two P2P financial transaction companies that now have access to VisaNet, the company's payment processing network.
- MasterCard MoneySend uses the mobile browser, SMS, or a mobile app to enable customers to transfer money from person to person using a mobile phone.
- ZashPay, a service provided by Fiserv, offers a public Web site that allows people to transfer money using e-mail addresses or mobile phone numbers. The banks involved determine the sender's fee.

2.2. Mobile Payments Stakeholders

Mobile payments implementations are still in their infancy, with business models still being

Figure 1. Mobile payment overview



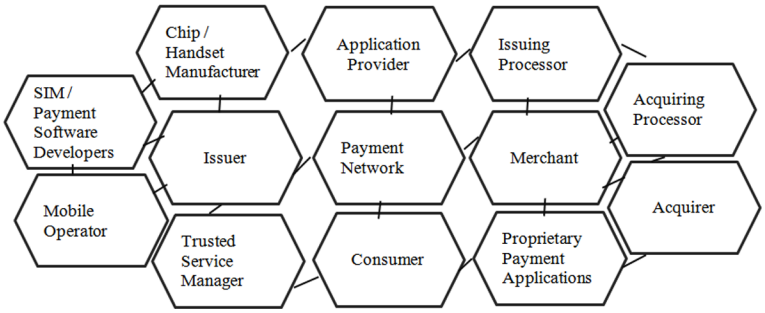
defined and tested through numerous pilots in the market. The business case mobile payment is complicated especially in proximity payments. There are concerns about the rate at which both consumers and merchants adopt payment type. However, the fundamental barrier to widespread adoption of mobile payments is the requirement that multiple players cooperate. Many of these players claim both a relationship with the customer and a share of transaction revenue. During the next several years, thousands more merchants in the United States are expected to be able to accept contactless payments. However, certain critical requirements must be met by all stakeholders before high volumes of consumers can actually start using mobile phones for payment especially at a physical POS.

There are a wide variety of stakeholders in a mobile payments system (Figure 2). Depending on the implementation scenario, stakeholders change and additional stakeholders with varying degrees of involvement may also be involved.

Stakeholders may include:

1. **Consumers:** The stakeholders who use the mobile payment devices for conducting mobile payment transaction.
2. **Issuers:** The stakeholders who issue mobile payment capabilities and support easy management of mobile payments.
3. **Merchants:** The stakeholders who accept mobile payments whether contactless or contacted payments.

Figure 2. Mobile payment stakeholders



4. **Acquirers:** The trusted third parties who support mobile payments.
5. **Mobile Operators:** The stakeholders who ensure a supply of mobile phones with NFC technology and support payment services on their networks for proximity payments.
6. **Payment Networks:** The stakeholders who set standards and promote acceptance by all parties throughout the network.
7. **Chip and Handset Manufacturers:** The stakeholders who support branded financial applications.
8. **SIM/Payment Software Developers:** The stakeholders who develop and support branded financial applications for chip and handset manufacturers.
9. **Trusted Service Manager:** The stakeholders including OTA personalization bureaus who provision the payment application to the memory of the phone.
10. **Issuing and Acquiring Payment Processors:** The stakeholders who process payments acting on behalf of acquiring and issuing banks and who are involved in almost every case.
11. **Proprietary Payment Application Providers:** The stakeholders who offer payment applications for specific services (for example, transit agencies' fare payment systems).
12. **Specialty Application Providers:** The stakeholders who can add additional value to proximity mobile payments (e.g., PayPal enabling person-to-person payments).

2.3. Mobile Payment Business Models

There are four potential mobile payments business model scenarios. These models are used by different stake holders, depending on their needs and value propositions. They are described as follows:

2.3.1. Operator-Centric Model

In this model, the mobile operator acts independently to deploy mobile payment applications to NFC-enabled mobile devices (Figure 3). The mobile operator loads the mobile payment application on its customer's NFC mobile devices. The customer may prepay, or the operator may add charges to the customer's existing wireless bill. This acts in two ways.

Operator provides the merchant with a wireless POS system.

- Operator enables the proximity payment application on the merchant's NFC mobile device.
- Operator enables the proximity payment application on the merchant's NFC mobile device.

2.3.2. Bank-Centric Model

A bank deploys mobile payment applications or devices to customers and ensures merchants have the required point-of-sale (POS) acceptance capability (Figure 4). Payments are processed over the existing financial networks with credits and debits to the appropriate accounts. An issuing bank owns the relationship with the customer and is responsible for getting the payment token. In this case an NFC-enabled phone is given to customers in the same way as bank cards are distributed. The responsibility of the bank for this role could vary. At one extreme the bank could actually give (or sell) its clients a fully-featured NFC phone, while at the other extreme the bank could simply provision an existing NFC phone with a suitable payment application. The merchant relationship is owned by the acquiring bank. In many cases the acquirer provides the merchant with the appropriate acceptance device for the Point -Of-Sale.

Figure 3. Operator centric model

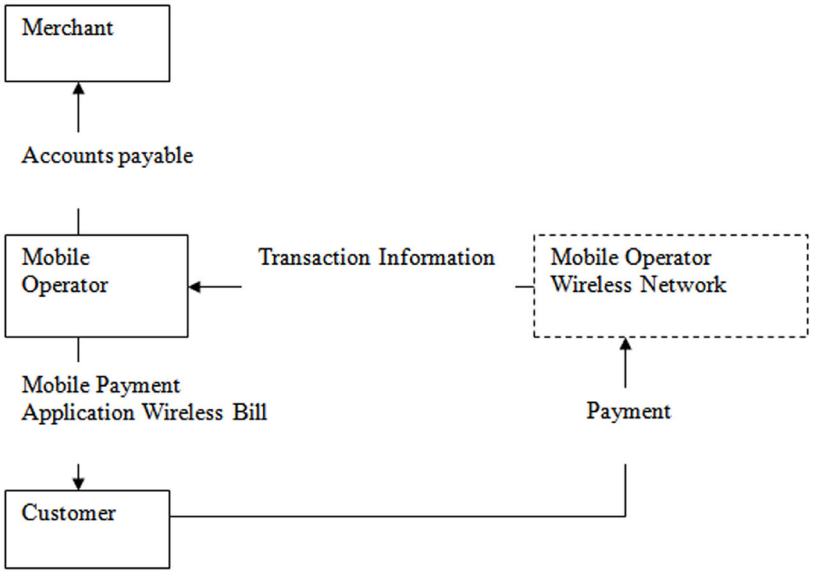
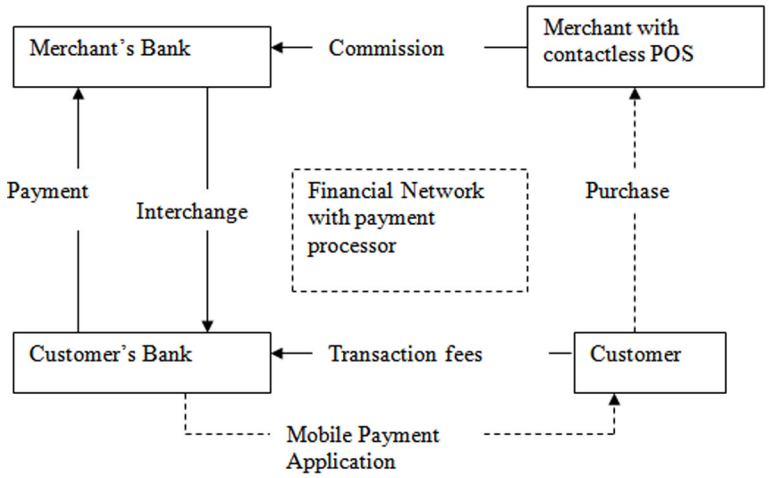


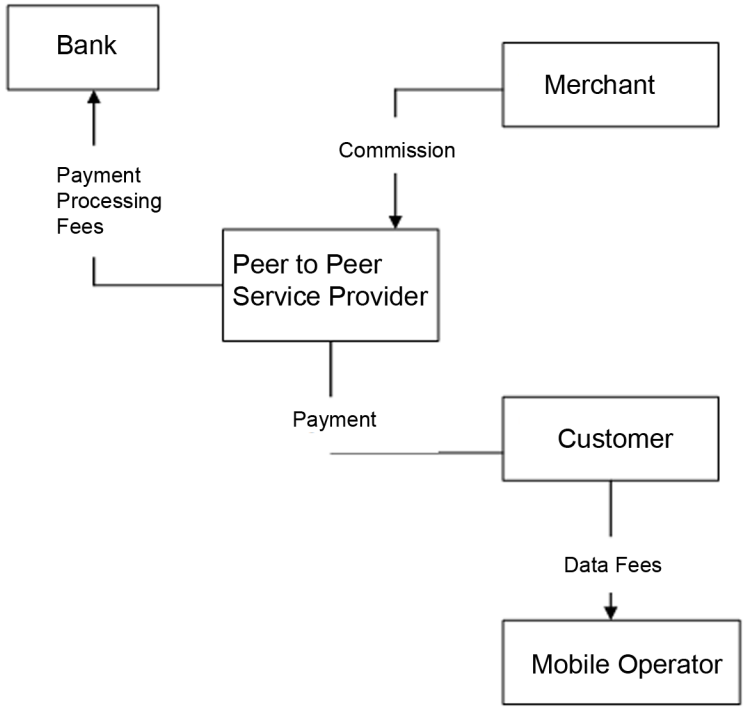
Figure 4. Bank centric model



2.3.3. Peer-to-Peer Model

The Peer-to-Peer Model is an innovation created by payments industries who are trying to find ways to process payments without using existing wire transfer and bank card processing networks (Figure 5). The ability to send money from one person to another, even across great distances, has existed for many years through providers such as Western Union. While the Internet has made this service even more convenient, the high fees associated with the transfers can make them cost prohibitive and not for every-day use. Internet bill payment services provided by most banks have made remote payments to merchants convenient, but cannot be used for real-time purchases. Mobile phones with Peer-to-Peer capabilities overcome these obstacles. An independent peer-to-peer

Figure 5. Peer-to-peer model



service provider provides secure mobile payments between customers or between customers and merchants. This entire process can have following scenarios:

Scenario 1: Provider deploys contactless cards/ devices to customers and POS equipment to merchants in a closed loop model.

Scenario 2: Provider deploys a mobile payment application for the NFC-enabled mobile device.

Scenario 3: Peer-to-Peer service provider uses an existing online application (e.g., PayPal Mobile). No POS equipment is required.

2.3.4. Collaboration Model

This model involves collaboration among banks, mobile operators and other actors in the mobile payments value chain (Figure 6). This also includes a potential trusted third party that manages the deployment of mobile applications. Payments in this model are processed over the existing financial networks with credits and debits to the appropriate accounts.

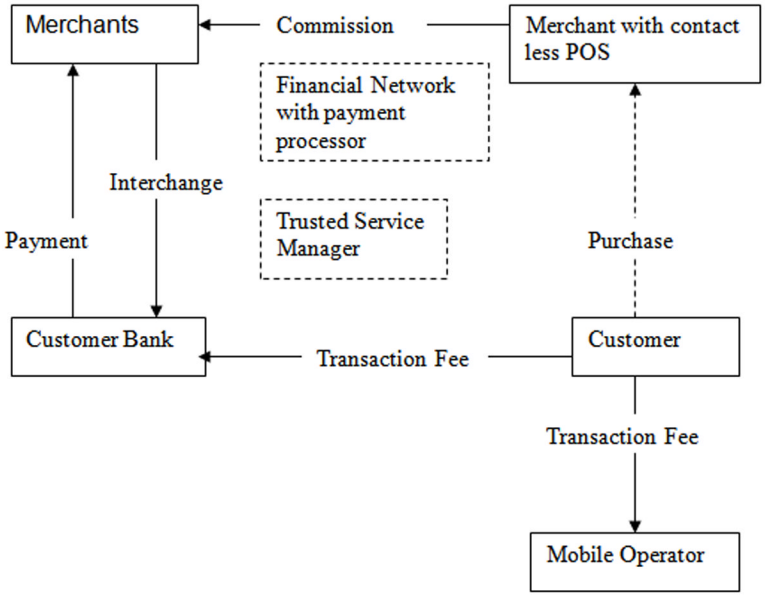
This model includes two possible scenarios:

Scenario 1: A mobile operator partners with one bank to offer a bank-specific mobile payments service.

Scenario 2: Industry associations representing mobile operators and financial institutions negotiate and set standards for applications that reside on secure elements in mobile devices, allowing multiple card types from different banks to be used.

In the above mentioned cases, NFC-enabled mobile devices and compatible POS devices are deployed that meet the standards set by the partner bank or industry associations. Potential sources of revenue include merchant commissions,

Figure 6. Collaboration model

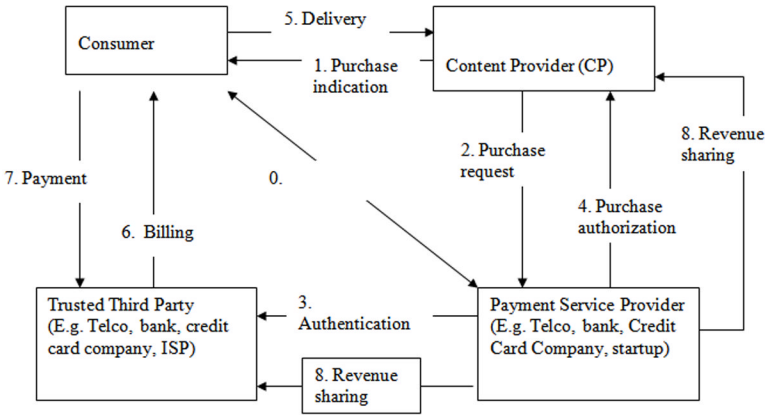


merchant and consumer trans-action fees, new customer acquisition fees, and marketing fees. The amount paid and collected by each actor is the source of considerable contention. Generally it is expected that merchant fees are split between banks, mobile operators, and perhaps third-party TSMs. Comparable models exist in the credit card industry for customer acquisition and marketing fees between partners.

3. MOBILE PAYMENT PROCESS

Payment transaction process in a mobile environment is similar to typical payment card transaction (Figure 7). The only difference is that the transport of payment details involves wireless service provider. WAP/HTML based browser protocol might be used or payment details might be used or payment details might be transported using technologies such as Bluetooth and infrared.

Figure 7. Payment process



Mobile payment process is explained in the following paragraphs.

3.1. Registration

Customer opens an account with payment service provider for payment service through a particular payment method. During this phase the PSP requires confirmation from the TTP that handles the relationship with the customer. This phase can be seamless for the consumer according to the functional choices made by the TTP and the PSP.

3.2. Transaction

It is accompanied by the four steps.

- Customer indicates the desire to purchase a content using a mobile phone.
- Content provider forwards the request to the payment service provider.
- Payment Service Provider then requests the TTP for the authentication and authorization.
- Payment Service Provider informs content provider about the status of the authentication and authorization. If customer is successfully authenticated and authorised, content provider will deliver the purchased content.

3.3. Payment Settlement

It can take place during real time prepaid or postpaid mode. A real time payment method involves the exchange of some form of electronic currency, e.g. payment settlement directly through a bank account. In a prepaid type of settlement customers pay in advance using smart cards or electronic wallets. In the post paid mode, the payment service provider sends billing information to the TTP. The TTP sends the bill to the customer receives the money back and then sends the revenue to the payment service provider. The PSP is then responsible for computing the revenues of each entity and distributing the funds accordingly.

4. SET

SET stands for Secure Electronic Transactions and is a proposed standard for performing credit card transactions over the Internet. SET, is an open network payment-card protocol. It is primarily designed to enable the user to securely employ their credit card payment infrastructure on the open network, such as the Internet. It is developed jointly by Visa and MasterCard, with technical assistance from various Internet, information systems, and cryptology companies such as IBM, Microsoft, Netscape, RSA, and VeriSign.(VeriSign is the world's largest Internet trust services provider, which has taken over the Cyber Cash's Internet payments business.) With these names behind it, in the future SET may very well become the dominant method for paying by credit card over the Internet.

4.1. Features of SET

- Provide confidentiality of payment information and enable confidentiality of order information that is transmitted along with the payment information.
- Ensure the integrity of all transmitted data.
- Provide authentication that a cardholder is a legitimate user of a branded payment card account.
- Provide authentication that a merchant can accept branded payment card transactions through its relationship with an acquiring financial institution.
- Ensure the use of the best security practices and system design techniques to protect all legitimate parties in an electronic commerce transaction.

- Create a protocol that neither depends on transport security mechanisms nor prevents their use.
- Facilitate and encourage interoperability among software and network providers.

4.2. SET Security

SET is a very comprehensive security protocol, which utilizes cryptography to provide confidentiality of information, ensure payment integrity, and enable identity authentication.

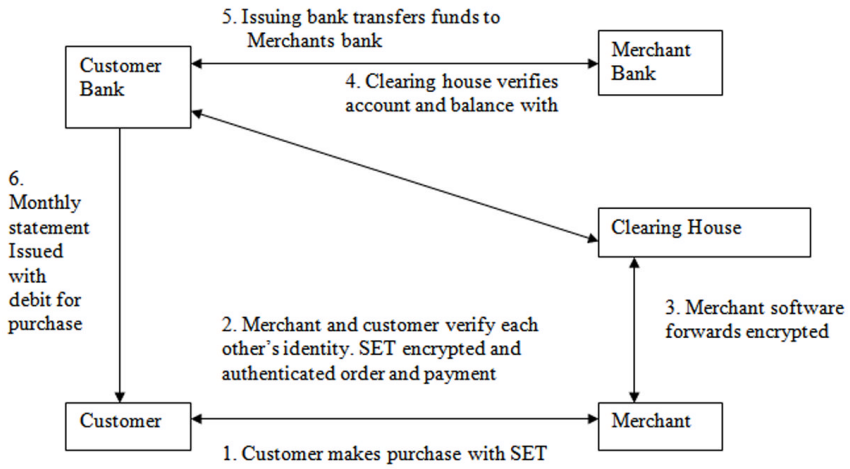
For authentication purposes, cardholders, merchants, and acquirers are issued digital certificates by their sponsoring organizations. It relies on cryptography and digital certificate to ensure message confidentiality and security. Digital envelop is widely used in this protocol. Message data is encrypted using a randomly generated key that is further encrypted using the recipient's public key. This is referred to as the "digital envelope" of the message and is sent to the recipient with the encrypted message. The recipient decrypts the digital envelope using a private key and then uses the symmetric key to unlock the original message. Digital certificates are also called electronic credentials or digital IDs, are digital documents attesting to the binding of a public key to an individual or entity. Both cardholders and merchants have to register with a CA before they can engage in transactions. The cardholder thereby obtains electronic credentials to prove that he is trustworthy. The merchant similarly registers and obtains credentials. These credentials do not contain sensitive details such as credit card numbers. Later, when the customer wants to make purchases, he and the merchant exchange their credentials. If both parties are satisfied then they can proceed with the transaction. Credentials must be renewed every few years, and presumably are not available to known fraudsters.

SET uses both methods in its encryption process. The secret-key cryptography used in SET is the well-known Data Encryption Standard, which is used by financial institutions to encrypt PINs. And the public-key cryptography used in SET is RSA.

4.3. SET Process

The SET protocol utilizes cryptography to provide confidentiality of information, ensure payment integrity, and enable identity authentication (Figure 8). For authentication purposes, cardholders, merchants, and acquirers will be issued digital certificates by their sponsoring organizations. It

Figure 8. A SET payment transaction



also use dual signature that hides the customer's credit card information from merchants, and also hides the order information to banks, to protect privacy.

- Before the parties perform a successful SET payment, they must do some steps:

The consumer obtains a credit card account from the bank, which supports the SET payment.

- The consumer receives a certificate from the cardholder certificate authority.
- The merchants obtain their own certificates, and the merchant also needs a copy of the payment gateway's public-key certificate.

To effect a successful SET payment, a cardholder invokes software on his device that initiates the following sequence:

1. The cardholder clicks the SET Paying Button after he/she chooses the items and determines the prices.
2. The merchant responses the order information along with a copy of its certificate, so that the consumer can ensure that the merchant is a valid seller;
3. After the verification, the cardholder sends the order and the payment information to the merchant, together with a copy of his/her certificate. The order information confirms the purchased items and the payment information contains the account details. The payment information is encrypted by the public-key certificate of the payment gateway, so that the merchant can't read it. The consumer's certificate enables the merchant to verify the buyer.
4. The merchant forwards the payment information to the payment-processing organization (the payment gateway or acquirer), requesting the authorization that the consumer's credit is sufficient for this purchase.
5. The authorization is handled by the payment-processing organization using existing financial networks;
6. The merchant receives the authorization result;
7. The merchant sends the cardholder confirmation that the payment has been accepted;
8. After collecting some authorization response, the merchant sends a settlement request to the payment-processing organization;
9. The clearing and settlement is processed by the payment-processing organization just as the normal payment card transaction.
10. The merchant receives confirmation that the transaction has been finished.

4.4. Entities Involved in SET

There are mainly five entities involved in SET.

1. **SET Payment Gateway:** The payment gateway is the bridge between SET and the existing payment network. The payment gateway translates SET messages for the existing payment system to complete an electronic transaction.
2. **SET Merchant Point of Sale Server:** A merchant offers goods or services for sale in the Internet and accepts electronic credit card payments. Merchant that accepts payment cards must have a relationship with an acquirer. The merchant Point of Sale Server provides an interface between the cardholder and the acquirer payment gateway.
3. **Cardholder and Electronic Wallet:** Cardholder is an authorized holder of a payment card supported and issued by an issuing bank. Cardholders use electronic wallets to store digital representations of credit cards and make purchases with them. SET ensures that the interactions the cardholder has with

a merchant keep the payment card account information confidential.

4. **Acquiring Bank:** An acquirer is the financial institution that establishes an account with a merchant and processes payment card authorizations and payments.
5. **Issuing Bank:** The issuing bank establishes an account for a cardholder and issues the payment card to the cardholder. The issuer guarantees payment for authorized transactions using the payment card.

4.5. Disadvantages of SET

SET is a protocol that is not completely secure in user authentication. SSL-based methods are ignoring essential security necessities. Some disadvantages of SET are:

- SET is designed for wired networks and does not meet all the challenges of wireless network.
- As the SET protocol was designed to maintain the traditional flow of payment data Customer Agent to Merchant Agent to Merchant's Bank. There is a need of an end-to-end security mechanism.
- The third element is the direction of the transaction flow. In SET, transactions are carried out between the Customer Agent and the Merchant. So it is vulnerable to various attacks like merchant can modify transactions data by altering the balance.
- Transaction flow is from Customer to Merchant so all the details of users credit cards/debit cards must flow via merchant's side. It increases the user's risk, since data can be copied and used later to access customer account without authorization.
- There is no notification to the Customer from the customer's Bank after the successful transfer. The user has to check his/her balance after logging on bank website again.
- SET is only for card based (credit or debit) transactions. Account based transactions are not included in SET.

5. SECURITY REQUIREMENTS FOR MOBILE PAYMENTS

For the utilization of Internet and mobile communications there is a requirement for security services to provide communications integrity and privacy. Mobile communications is the capacity and capability to perform transactions at any time irrespective of geographical locations. All mobile subscribers use mobile devices to access all these resources. Mobile payment transactions are carried out with the help of mobile devices. A common feature of these devices is that they are small and portable. At every stage they require security services. There are different securities which provide the completeness of information. General requirements for mobile transactions are to provide Integrity, Confidentiality, Non repudiation, Authentication, Authorization. In addition to these mobile transactions are confronted additional security issues in its implementation. Such problems are Hostility, Information Security and Vulnerability. These are described as under:

- Authentication
- Authorization
- Confidentiality
- Integrity
- Non-repudiation
- Hostility
- Information Security
- Vulnerability

5.1. Authentication

According to the Federal Information Processing Standards, authentication verifies "the identity of a user, process, or device, often as a prerequisite allowing access to resources in an information

system." Authentication is a simple process where the user enters a set of credentials to the system. If the credentials match the existing set in the system, then the user is given authorization otherwise, not. The purpose of authentication is to verify the specific set of information presented which represents that the request is authentic from a specified entity. This is important, for verifying the identity of an entity which is basis for all the rights and privileges granted to the entity. Whether the presenting entity is the computer program or a user makes no difference to the authentication process.

Authentication is the assurance that the communicating person is the one who it claims it to be. A system authenticates the user to determine if the user is authorised to perform any electronic transaction or access the system.

To perform any electronic transaction the authentication process begins with the request. The client requests for the services which require authentication. The service providers asks for the unique token which acts as a means of providing authentication to the user and which proves the identity of the user. This unique token binds a user's identity together with a secret and is given to user during registration. When the user presents his unique token during authentication the authenticating party verifies user's identity since unique token is unique to everybody.

Token can be classified as:

- Something you know i.e. Passwords.
- Something you have i.e. Hardware Tokens.
- Something you are i.e. Biometrics.

Today, these methods are called the three factors of authentication. ISC2 also adds a fourth category called someplace you are, which is based on your location and typically uses GPS (global positioning system).

Authentications such as fixed passwords are considered to be weak authentication process and single factor authentication, which is based on something you know. It is prone to many attacks like eavesdropping, dictionary attack, and replay attack. Strong authentication schemes rely on more than one factor that means it combines the use of something you know (passwords) with something you have (hardware devices). Authentication strategies can be divided into single-factor authentication and multi-factor authentication.

5.1.1. Single Factor Authentication (SFA)

Single-factor authentication is the traditional security process that requires a user name and password before granting access to the user.

SFA security relies on the diligence of the user, who should take additional precautions - for example, creating a strong password and ensuring that no one can access it. For applications that require greater security, it may be advisable to implement more complex systems, such as multifactor authentication.

5.1.1.1. Passwords

Most commonly, computers use passwords, the "something you know" factor, for basic authentication. The most common way to maintain security is the use of passwords and usernames. This is the weak authentication mechanism which can be broken down by eavesdropping on the network connection or by sloppy handling of the users. Since more and more services are available on Internet, and many of these services require authentication mechanisms. It is difficult to manage different combinations of keys acting as username and password.

Passwords are the simplest authentication model to implement, and that is why password models are so common. Unfortunately, password models are also the weakest authentication model because passwords are guessed or stolen relatively easily. It can also make any password model vulnerable. Even if passwords are made complex

by adding special characters to it, these measures can force users to write passwords down, which limits the value of the password because it can be more easily stolen.

Four types of attack on the passwords:

- **Dictionary Attack:** Simply use different dictionary files to crack passwords.
- **Permutation of Words and Numbers:** For each word from a dictionary file, permute with 0, 1, 2 and 3 digit(s) to construct possible password candidates. Also make common number substitutions, such a 1 for I, 5 for S etc. 3.
- **User Information Attack:** Use user information collected from password files, e.g., user id, user full name, initial substring of name, to crack passwords.
- **Brute Force Attack:** We made this attack on any passwords that were only 6 characters long.

5.1.1.2. Hardware Tokens

Some authentication systems commonly use tokens, which is any device or object that can authenticate a user. Common examples include physical keys, proximity cards, credit cards, or ATM cards. Tokens are good because they're simple. Physical keys, for example, are widely supported and cheap to produce and use. In computer authentication, cryptographic keys may be used, particularly in remote protocols such as SSH (secure shell). The advantage of cryptographic keys for remote protocols is that they may not only be used for user authentication, but also for message authentication and encryption of data in transit. Tokens have their own weaknesses, however. Because tokens are simple and cheap to produce, they are also simple and cheap to reproduce. This makes them vulnerable to being counterfeiting. Also, because they are typically a physical object or device, they can be stolen more easily than passwords. For this reason, tokens are typically used with another method, such as a PIN code, to reduce their usefulness if stolen.

5.1.1.3. Software Tokens

Software tokens are similar to hardware tokens. It is software implementations of hardware tokens. Software tokens run on the PC or on a separate multi-purpose device but hardware tokens are stored on an external device away from the PC. Software tokens support authentication of both parties and protect the used communication channel to transmit data for authentication. The disadvantage of software tokens is that it can be copied easily without the knowledge of the user.

5.1.1.4. Biometrics

Biometrics is automatic methodologies which use to identify a person on the basis of some biological or behavioural characteristic. Many biological characteristics, such as fingerprints, DNA (deoxyribonucleic acid) information etc. and behavioural characteristics, such as voice patterns, signature are distinctive to each person. Hence, biometrics is more capable and more reliable in distinguishing different individuals than any other techniques based on an ID document or a password. A biometric system is a pattern-recognition system that makes personal identification possible.

Biometric systems come in many varieties, with each variety measuring a physical characteristic found to be relatively unique to a specific individual, within a reasonable scale of individuals. A user enrols in a biometric system by providing a sample of the physical characteristic measured by the system. The system then converts this "analog" characteristic into digital form to create a template. The template is then stored on a central authentication server. The user authenticates to the system by providing a fresh sample of the characteristic to the system, which then compares the digitized fresh sample to the stored template. If the two digitized samples are similar within certain tolerances, the user is accepted.

Biometric approaches are divided into two categories: physiological and behavioural. Physiological biometric is based on bodily characteristics, such as fingerprints, iris scanning and facial recognition. Behavioural biometric is based on the way people do things, such as keystroke dynamics, mouse movement and speech recognition.

The different types of biometric technologies are as follows:

- **Facial Recognition** is the technology that identifies people from still or video photograph images of their faces.
- **Fingerprint Identification** is the technology that make authentication through fingerprint. A fingerprint is the pattern of ridges and furrows on the surface of a fingertip. No two persons have exactly the same arrangement of patterns, and the patterns of any one individual remain unchanged throughout life.
- **Retinal Pattern Recognition** is the technology to authenticate people through scanning their eyes. The retina is the innermost layer of the eye. The pattern formed by veins beneath the surface of the retina is unique to each individual.
- **Iris-Based Identification** is the technology that makes Iris-Based Identification is the technology that make authentication through iris scanning. The iris is the coloured part of the eye. It lies at the front of the eye, surrounding the pupil.
- **Signature Recognition** system is based that each person has a unique style of handwriting. This system can identify different individual through their signature characteristics. Voice Recognition and speaker recognition technology is a kind of biometric technology that through using a microphone to record the voice of a person and based on different voice and speech to identify different individual Voice Recognition and speaker recognition technology is a kind of biometric technology that through using a microphone to record the voice of a person and based on different voice and speech to identify different individual.
- **Voice Recognition or Speaker Recognition** is a technology through which voice of a person is recorded. The biometric technology uses the acoustic features of speech that have been found to differ between individuals. These acoustic patterns reflect both anatomy (i.e. shape and size of throat and mouth) and learned behavioural patterns (i.e. voice pitch, speaking style).

5.1.2. Multi Factor Authentication (MFA)

Multi-factor authentication is a method of user identification that combines a number of single factor authentications. It is used for priority customer information and high-risk financial transactions. The strength of an authentication mechanism can be judged on how many things it depends on. Using two types of the same factor is not multi-factor authentication. For example, a password and personal information are both what you know, so using them together would still be single-factor authentication. The strength of authentication keys can vary even within a factor category. Mother's maiden name, a four-digit code and a random eight-character alphanumeric password are all examples of authentication keys based on what you know, but they each provide different protection against discovery attacks. Consequently, the security of the authentication process is affected by the actual solution used. However, it is generally held that multi-factor authentication improves security. Multi-factor authentication is either two-factor or three-factor.

- **Two-Factor Authentication:** This uses two of the three factors of authentication. Accessing your account through an ATM is based on two factors of authentication:

the PIN (something you know) and the ATM card (something you have).

- **Three-Factor Authentication:** This uses all three of the factors of authentication. For example, to access a secure site you might need to pass a guard who checks your face against a stored image (something you are), swipe an access card (something you have), and enter a four-digit code (something you know).

5.1.2.1. One Time Password (OTP)

One-time passwords are passwords that are only valid for a single or small number of transactions. This contrasts with conventional passwords which are valid for many transactions as users are reluctant to voluntarily change passwords frequently. Since OTP's are only valid for a limited number of uses, an attacker has a smaller window of time to gain access to resources guarded by such a password because any previously stolen passwords will likely have become invalid. As with traditional passwords, one-time passwords are vulnerable to man-in-the-middle attacks. By observing the OTP before it is successfully received by the authenticator, an attacker has a valid password. Because of this undesirable property, both OTP's and conventional passwords must travel securely. Typically, the one-time password is generated by a hardware device that the person desiring to be authenticated carries to promote use across many physically distant domains. The hardware implements an algorithm that generates passwords in a specific manner that the authenticator knows. The hardware device will often display the password on a small screen for a user to type into the authenticator. In this hardware based approach, if the hardware or computer that generates the passwords were stolen, the thief would be able to authenticate himself just by reading the numbers on the display. Because of this reason, one-time passwords are often one part of a multi-factor authentication (MFA) system where two or more independent factors of authentication are used to identify a user.

Algorithms generating temporary passwords can be time-based or mathematical-based. Time-based algorithms generate passwords that are valid for a set period of time before automatically updated by the algorithm (often a hardware device). Technically, a one-time is a misnomer as a password can be used multiple times as long as it is within one time period. A hardware device of this type typically always displays a password, and the password is constantly changing. The length of time that an OTP is valid is an important security parameter in these schemes because one password is valid until the time period expires and then updated. If a password is infrequently updated, an attacker has a longer window for exploitation. As the period length grows, the security of OTP's approaches that of conventional passwords. For example, an eavesdropper could capture the OTP that has just been generated as it travels across a network. Once captured, the attacker has the entire lifetime of the password for unauthorized access. SecurID is a proprietary commercial system by RSA Security that uses hardware devices to generate passwords that change every thirty or sixty seconds.

5.1.3. Authorization

Authorization is the process by which it is determined if a person has right or permission to conduct a particular action. It is the mechanism by which a system determines what level of access a particular authenticated user should have to secure resources controlled by the system. Authorization information, for example, an access-control list, is stored and managed by the service. Internet services evolve rapidly and thus the set of potential actions and the users who may request them are not known in advance; this implies that authorization information is created, stored, and managed in a dynamic, distributed fashion. Users are often expected to gather credentials needed to authorize

an action and present them along with the request. Because these credentials are not always under the control of the service that makes the authorization decision, there is a danger that they could be altered or stolen. Thus, a public-key signature is must to be part of the authorization framework.

In traditional authentication and access control, the notion of identity plays an important role. In a traditional system, an identity often means an existing user account. User accounts are established with the system prior to the issue of any request. Earlier PKI proposals try to establish a similar global "user account" system that gives a unique name to every entity in the system and then binds each public key to a globally unique "identity." In Internet applications, the very notion of identity becomes problematic.

The term identity originally meant sameness or oneness. When we meet a previously unknown person for the first time, we cannot really identify that person with anything. In a scenario in which an authorizer and a requester have no prior relationship, knowing the requester's name or identity may not help the authorizer make a decision. The real property one needs for identity is that one can verify that a request or a credential is issued by a particular identity and that one can link the particular identity to its credentials.

5.1.4. Confidentiality

Confidentiality means preserving authorized restrictions on information access and disclosure. It includes means for protecting personal privacy and proprietary information. A loss of confidentiality is the unauthorized disclosure of information.

Confidentiality is defined as the property that ensures that information is not made available or disclosed to unauthorized users. Confidentiality mechanisms are intended to prevent information dissemination to users who are not authorized to receive it.

A confidentiality mechanism may prevent access to the information or may conceal or alter the information to all but those who have privileges.

Confidentiality of information can be determined by its impact level i.e. low, moderate, or high. It indicates the potential harm that could result to the subject individuals and/or the organization were inappropriately accessed, used, or disclosed.

Confidentiality of transmission can be protected by encrypting the communications or by encrypting the information before it is transmitted.

5.1.5. Integrity

Integrity is defined as the property that information is not altered or destroyed by unauthorised user. It is defined as precise, accurate, unmodified, and consistent. Precise means modified only in acceptable ways. Accurate means modified only by authorized people. To unmodify means to modify only by authorized processes. Consistent means meaningful and correct. Integrity policies seek to prevent accidental or malicious destruction of information. Traditionally, information integrity has been supported by security models based on access control mechanisms. These mechanisms mainly provide the authorization component of integrity requirements.

There are two categories that prevent the integrity threat.

- Preventing access to information through secure channels and routing control i.e. access control and stored data respectively.
- Detecting unauthorised modification by cryptography and digital signatures.

Electronic solutions are based on hash-algorithms, MAC (Message Authentication Codes) values and digital signatures.

5.1.6. Non Repudiation

It refers to illegal denial of request. Non-repudiation makes it impossible for someone to deny that he or she carried out a particular action. For example, a credit card purchase in which the bill of sale is signed by the cardholder is an example of a non-repudiable transaction. Neither the seller nor the buyer can deny that the transaction took place. A service that is used to provide assurance of the integrity and origin of data in such a way that the integrity and origin can be verified and validated by a third party as having originated from a specific entity in possession of the private key.

A contract is usually accepted by signing it. Every party gets its own copy of the contract. If the content becomes disputable, nobody can deny that the contract was signed since everybody has an identical copy (this assumes, of course, that the authenticity of the signatures can be verified). In distributing computing non-repudiation means that the sender should not be able to deny later that he has sent a message or that the receiver cannot deny that he has received the message. Typically, in electronic commerce, a client should not be able to deny that he has ordered a product. In telecommunication services, a client should not be able to deny that he has ordered to use a service like video-on-demand or to use network resources to make a phone call. There is no particular threat against non-repudiation apart from denial. In the computer world, non-repudiation is carried out with digital signatures conceptually similar to ones in the real world.

5.1.7. Hostility

It is the trustworthiness of users, customers, merchants and other players in mobile environment. The systems should provide enough stored information to detect the fraudulent later. Since we cannot assume that all participants in mobile transactions are honest, the mobile commerce system should provide enough mediated and stored information so that dishonest merchants, customers or other players can be found later with all aspects and is a general requirement for electronic transactions.

5.1.8. Information Security

In mobile transactions the information is transformed over wireless access network and is thus receivable by external parties more easily than wire line network. Information security prevents the external people to listen in or change the message content without it to be noticed by parties. The general way to maintain information security is encryption technology and Public Key Infrastructure. (PKI)

5.1.9. Vulnerability

Vulnerability is a flaw or weakness in a system's design, implementation or operation that could be exploited to violate the system's security. Security vulnerability is not a risk, a threat, or an attack. Vulnerabilities can be of four types.

- Threat Model vulnerabilities originate from the difficulty to fore see future threats (e.g. Signalling System).
- Design & Specification vulnerabilities come from errors or oversights in the design of the protocol that make it inherently vulnerable (e.g. Wi-Fi).
- Implementation vulnerabilities are vulnerabilities that are introduced by errors in a protocol implementation.
- Operation and Configuration vulnerabilities originate from improper usage of options in implementations. Not enforcing use of encryption in a Wi-Fi network, or selection of a weak stream cipher by the network administrator.

According to X.800, a security threat is a potential violation of security, which can be active (when the state of a system can be changed), or passive (unauthorized disclosure of information without changing the state of the system). A security risk originates when security vulnerability is combined with a security threat.

5.2. Security Attacks

An attacker might want to gain access to an electronic message for numerous reasons:

Gaining unauthorised access to information in order to violate someone's privacy, impersonating user in order to shift the responsibility or originate a fraudulent activity are some of the reasons an attacker might want to access the information. There are four general categories of attacks on a transmitted message apart from a normal transaction flow.

- Interruption
- Interception
- Modification
- Fabrication

In general, there is a flow of information from a source to a destination. In normal message flow, the information passes from source to destination without any hindrance (Figure 9).

5.2.1. Interruption

Interruption is the action of preventing a message from reaching its intended recipient (Figure 10).

It can also occur when an ass asset of the system is destroyed or becomes unavailable. This is an attack on availability. This attack can easily be detected by single party or both the parties. Some examples of this type are as under:

- Destruction of hardware.
- Physical damage to communication links.
- Introduction of Noise.
- Removal of routing.
- Disabling of file or a program
- DoS attack.

5.2.1.1. Mitigate the Attack

- Use Firewalls - Firewalls have simple rules such as to allow or deny protocols, ports or IP addresses. Modern stateful firewalls like Check Point FW1 NGX and Cisco PIX

Figure 9. Normal flow

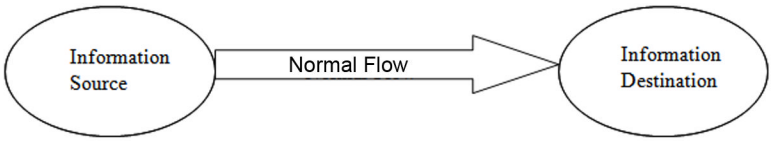
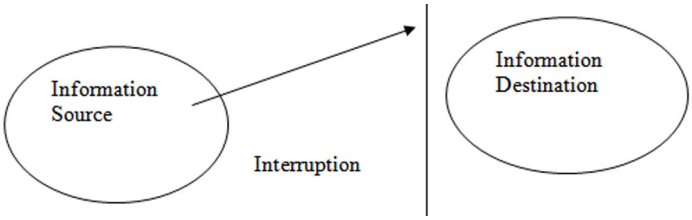


Figure 10. Interruption of a message



have a built-in capability to differentiate good traffic from DoS attack traffic.
- Keeping backups of system configuration data properly.
- Replication

5.2.2. Interception

Interception is where an unauthorised party gains access to information (Figure 11). This is an attack on confidentiality. The unauthorised party might be a person, program, or a computing system. A loss due to this kind of attack might be noticed quickly, but the interceptor might leave no trace by which the interception can be detected. This attack cannot be avoided in wireless communications. Some examples of this type are as under:

- Wiretapping to capture data in a network.
- Illicit copying of files.
- Eavesdropping.
- Link monitoring.
- Packet capturing.
- System Compromisation.

5.2.2.1. Mitigate the Attack

Using Encryption - SSL, VPN, 3DES, BPI+ are deployed to encrypt the flow of information from source to destination so that if someone is able to snoop in on the flow of traffic, all the person will see is ciphered text.

- **Traffic Padding:** It is a function that produces cipher text output continuously, even in the absence of plain text. A continuous random data stream is generated. When plaintext is available, it is encrypted and transmitted. When input plaintext is not present, the random data are encrypted and transmitted. This makes it impossible for an attacker to distinguish between tree data flow and noise and therefore impossible to deduce the amount of traffic.

5.2.3. Modification

Modification is where an unauthorised party not only gains access to an asset, but tampers with it (Figure 12). This is an attack on the integrity of the message. It can be detected if proper measures are taken. Some examples of this type are as under:

- Changing of values in a database for personal gain.
- Altering of a program.
- Modifying the contents of the message transmitted on a network.
- Making use of delays in communications.

5.2.3.1. Mitigate the Attack

- Introduction of intrusion detection systems (IDS) which could look for different signatures which represent an attack.

Figure 11. Interception of a message

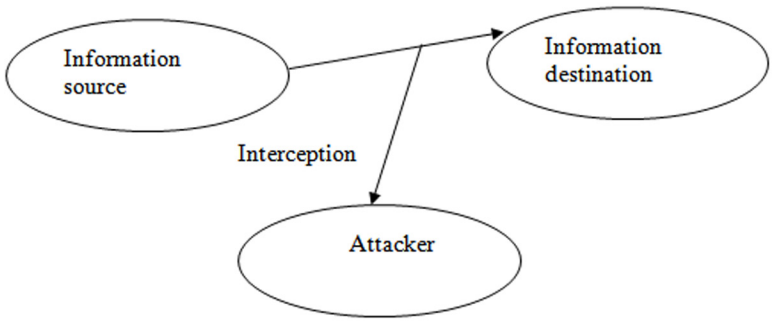
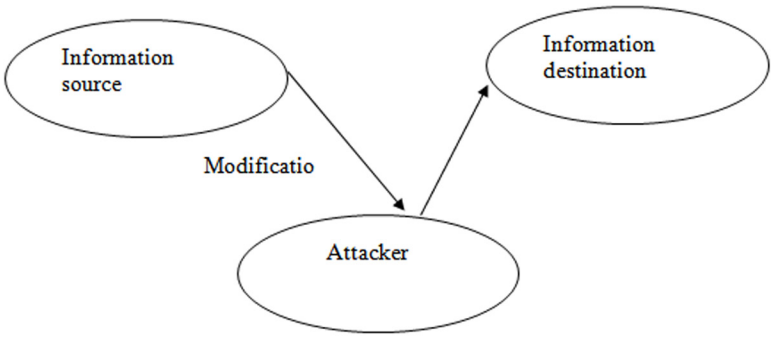


Figure 12. Modification of message



- Using Encryption mechanisms.
- Traffic padding.
- Keeping backups.
- Use messaging techniques such as checksums, sequence numbers, digests, and authentication codes.

5.2.4. Fabrication

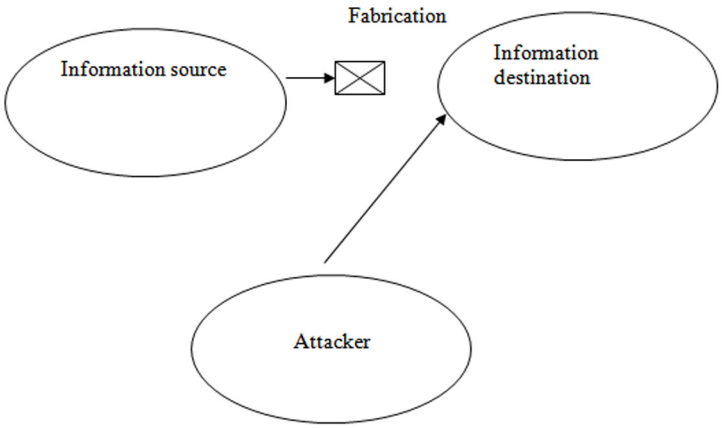
Fabrication occurs when an unauthorised party inserts counterfeit objects into the computing system (Figure 13). This is an attack on the authenticity of the message. These insertions can sometimes be detected as forgeries, but if done skilfully they are virtually indistinguishable from the real thing. It also relates to non-repudiation. Some examples of this type are as under:

- Adding additional records to an existing file or a database.
- Insertion of spurious information into the network communication systems.

5.2.4.1. Mitigate the Attack

- Use of Authentication and authorization mechanisms
- Using Firewalls
- Use Digital Signatures - Digital signature scheme is a mathematical scheme for demonstrating the authenticity of a digital message or document.

Figure 13. Fabrication of a message



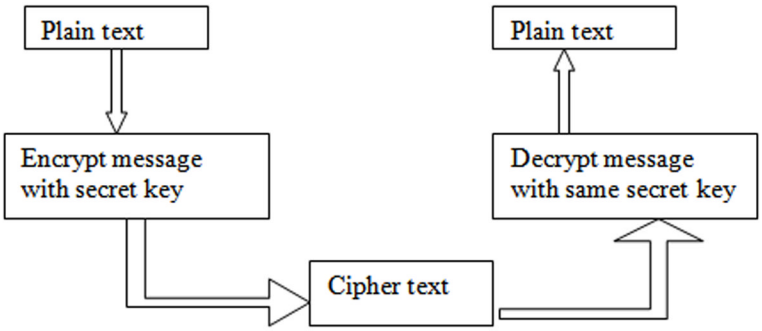
5.3. Security Mechanisms (Cryptography Overview)

Cryptography is the science of encryption and decryption. Modern encryption also includes the concept of a key, which is used by an algorithm to encrypt or decrypt a message. Security in cryptography comes from both the algorithm and the key. If the algorithm allows easy attacks, the system will be weak. A system is secure if it is computationally infeasible to recover the key or the plaintext from the cipher text. As time progresses, processes that were computationally infeasible become feasible with increased computing power. Some cryptographic algorithms may therefore become outdated extremely quickly. A cryptosystem consists of an algorithm that is used to secure communications and the keys that are used for encryption and decryption. All plaintexts and cipher text belong also to the cryptosystem. A cryptographic algorithm is a mathematical function that is used for encryption and decryption. A synonym for cryptographic algorithm is a cipher. A key is a series of data, a string of numbers and/or characters. It has a certain length, which is usually given in bits. Typically, a key length can range from 56 bits up to several kilo bytes. It can be stored in a file or in a chip. A key can be sent to somebody through the network. A key can have a lifetime depending of the cryptosystem and the agreement for the use of the key. The main threat against the concept of key is the brute force attack i.e. trying all possible keys.

5.3.1. Symmetric Encryption

Symmetric encryption (or private-key encryption) uses the same key to encrypt and decrypt a message (Figure 14). The length of the key is exponentially proportional to the strength of the encryption. Symmetric encryption usually uses short keys (less or equal to 128 bits). To ensure the best security, the key should be as random as possible. A totally random key that is only used once is the ideal form of symmetric encryption, and such a scheme is called a One-Time Pad. The common standard for symmetric encryption is DES (Data Encryption Standard) which uses a 56-bit key. It is being phased out in favour of AES (Advanced Encryption Standard) recently defined by the NIST (National Institute of Standards and Technology). DES security can be expanded through the repeated encryption of a message with two or three different keys. This process is called Triple DES. Symmetric encryption provides confidentiality. The strength of such ciphers cannot generally be proved mathematically. They make use of a few cryptographic functions (permutation, substitution, XOR, addition and multiplication modulo a number) that are combined together to form the

Figure 14. (Symmetric) secret key encryption [359]



algorithm. Private-key cryptosystems enable to cipher roughly around 1000 times faster than the public-key ones. There are numerous symmetric algorithms. The main standard algorithms are DES, 3-DES, Blowfish, IDEA, CAST and AES.

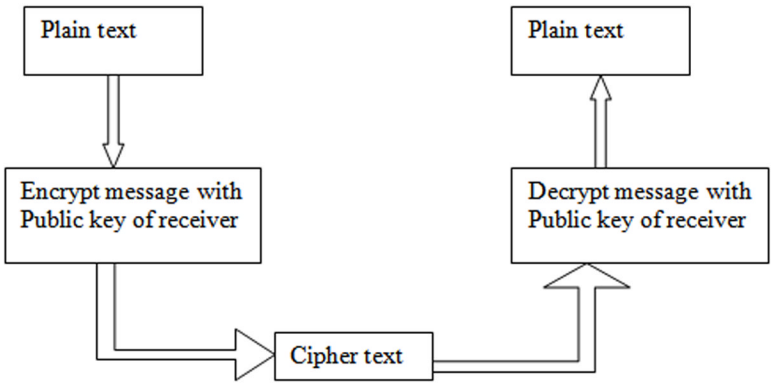
The main problem with Symmetric-key cryptography is that the sender and receiver have to share the same secret key. If they are in separate physical locations, they must trust a courier, or a phone system, or some other transmission medium to protect the secret key. Anyone who overhears or intercepts the secret key in transition can read, modify, or falsify messages encrypted with that key. Key management is in charge of the generation, transmission and storage of keys. Because all keys in a Symmetric-key cryptography algorithm must be kept secret, it is essential to also provide secure key management for a Symmetric-key cryptography approach.

5.3.2. Asymmetric Encryption

Asymmetric (or public-key) encryption uses two different keys during the encryption and decryption processes (Figure 15). The keys have certain mathematical qualities, which allow one key to be used to decrypt what the other key has encrypted. The keys have to be large enough in order to prevent one key being calculated from the other key. Because of these factors one key can be publicly distributed (the public key usually noted KU).

Alice knowing Bob's public key can send an encrypted message to the Bob who owns the private key (usually noted KR). In this use, asymmetric encryption provides confidentiality. If Bob encrypts a message with his private key, asymmetric encryption provides both authentication and confidentiality. Public keys are made available to applications, hosts and services. The public key authenticity can be certified by a Certificate Authority in order for a community of users to trust that a public key really belongs to a principal. Another approach is to keep public keys in a public repository managed by a trusted party or to let each user decide the keys he trusts. A private key belongs to an entity and is never revealed to anyone. It is used by the entity to decrypt incoming messages that are encrypted with the principal's public key. It is also used to sign an outgoing message sent by the principal to anyone else. This provides non-repudiation and authentication, as anyone can use the principal's public key to verify the signature, to be sure that the message originated from that principal. Public key technology is commonly used to secure short messages or very important messages where real-

Figure 15. (Asymmetric) public key encryption



time encryption and decryption is not an issue. The main public-key algorithm standards are RSA (Rivest-Shamir-Adelman) and ECC (Elliptic Curve Cryptography).

5.3.3. Key Escrow and Perfect Forward Secrecy

A key escrow system uses public key cryptography to encrypt and decrypt messages. The difference between the standard public key implementation and a key escrow system is that with key escrow, copies of the private key are split into pieces and stored by a trusted third party. In the case of the Clipper Chip an 80-bit key was to be split into two 40-bit keys that were to be stored with two independent agencies. The benefit of a key escrow system is that if the private key is ever lost, it can be recovered from the independent agencies. The down side of this mechanism, from the perspective of privacy advocates that the government can also recover the private keys with a justice court order. The fact that key recovery encryption technology, has kept it one of the most hotly debated subjects in the cryptography field today. Perfect forward secrecy (PFS) in a key establishment protocol is the condition in which the compromise of a session key or long-term private key after a given session does not cause the compromise of any earlier session.

5.3.4. Hash Functions

Hash functions are employed in conjunction with Public-key cryptography algorithms to produce digital signatures. When implementing a digital signature, it is unusual to encrypt a whole message for security and performance reasons. A hash function works on a message with an arbitrary length, and returns a fixed-size hash value. This hash value is sometimes called message digest or digital fingerprint. The ideal cryptography hash function should be simple to calculate the message digest for any given message. It should be computationally impractical to find a message with a given message digest, computationally impractical to alter a message without modifying its message digest, and it should be computationally impractical to find two different messages with the same message digest.

Hash functions are widely used currently. The message digest can be used in creating digital signature schemes. For security and performance reasons, most digital signature algorithms specify only to sign the digest of the message, not the entire message. In addition, a hash function can be used to control the integrity of a message. Determining whether any changes have been made to a message (or a file), for example, can be accomplished by comparing message digests calculated before, and after, transmission or any other event. A widespread hashing algorithm is called MD5 (Message Digest version 5). It generates a 128-bit (16-byte) hash, and is considered reasonably secure. Other common used standard algorithms are SHA-1 and RIPEMD-160 (20-byte output). An added digest (or hash-value) provides integrity. The Secure Hash Algorithm (SHA) is the most widely used hash function. It was developed by NIST and its revised version is generally called SHA-1 or Secure Hash Standard in the standards document. SHA-1 is the most established of the SHA hash functions, and has been employed in widely used security applications and protocols. SHA-1 calculates a condensed representation of a message. When a message of any length < 264 bits is input, the SHA-1 produces a 160-bit message digest.

5.3.5. Digital Signature

Digital signature is a combination of several of the above technologies (public key and hash algorithms). A digital signature is the digest of a document encrypted with a private key. A digital signature is not only used to protect data integrity but also used to achieve authentication and non-repudiation. A digital signature mechanism can

be employed to authenticate the identity of the sender of a message, and sometimes to ensure that the original content of the message that has been sent is unchanged. Digital signatures can protect the two parties against each other, because there is no complete trust between sender and receiver.

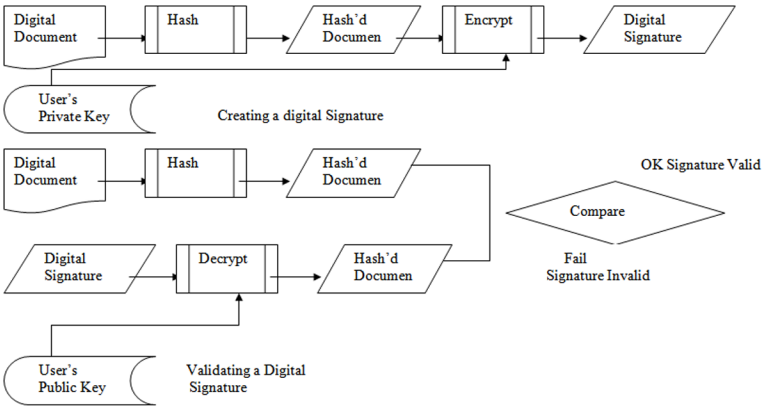
A digital signature includes three process steps: a key generation process, a signature signing process, and a signature verifying process (Figure 16).

A conventional signature is included in the document; it is a part of the document. Whenever we write a check, the signature is on the check; it is not a Separate document. But when we sign the document digitally, we send a signature as a separate document. The sender sends two documents: the message and the signature. The receiver also receives two documents but he verifies the signature. If the signature is proven the message is kept otherwise it is rejected. Digital signatures like physical signatures, can verify that a specific user affixed their signature to a document and they can also verify that the document is the same as when the user affixed the digital signature. Digital signature systems (DSS) use public key cryptography methods to create digital signatures. The integrity of the digital signature is tied to the security of the user's private key. As long as the user's private key is secure, then only the user can affix their digital signature to a document. Digital signature can be represented as a secure base in applications of mobile environment or mobile communications because it provides authentication, data integrity and non-repudiation cryptographic services. The digital signatures can be classified into two general categories: message digest based schemes and recovery based schemes. In message digest based digital signature scheme, the original message is first mapped to a checksum by a one way function then this checksum is used to generate digital signature. The checksum used here is to provide data integrity. In message recovery based scheme, the receiver can recover the original message from the received signature.

6. FUTURE RESEARCH DIRECTIONS

Further work could be done to add and use wireless protocols to increase the speed of the transactions and to further improve the security aspect at transport layer and network layer in addition to the usability. It would be very interesting to add extra hardware on mobile phones for easy installation of new technologies in mobile payments. Clearly wireless networks and mobile device technologies are still in rapid development. The growth of 3G/4G network technology and the Smartphone brings more and more opportunities

Figure 16. Creating and validating a digital signature



to mobile applications. The applications can be implemented in financial sector not only by the traditional commercial banks but by Internet payment agents, for example, PayPal.

7. CONCLUSION

The goal of this chapter is to research the area of mobile payment and to understand the concepts and emerging technologies that can benefit the mobile payments with respect mobile payment usability and security. This topic covers full mobility, telephony, financial interaction and security on the Internet. Mobile payments are the killer application of mobile commerce. As an important application it converges with different actors or players like Mobile network operator, Mobile telecommunications, Payment service providers and handset manufacturers. A mobile payment also acts as an important financial application and is attracting wide attention from researchers, developers, bankers, merchandisers and clients.

However, it has not yet become a mainstream approach for making payments. Non-secured mobile payments are simply not acceptable.

Although the technologies in the development of mobile payments have improved and are experiencing a significant development, mobile devices and wireless networks are still "resource-limited" compared to PCs and fixed-line network? The difficulty in building mobile payment systems lies in how to provide payment transactions with security and practicality.

The contribution of this chapter is as follows: The security mechanism is understood thoroughly and is concluded that these systems provide security at transaction, network level and application level. The Payment Systems developed should provide the security at each and every level to improve the customer satisfaction as well as value chain of an organization.

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APPENDIX

List of Acronyms

A3: Authentication Algorithm
A5: Ciphering Algorithm
A8: Ciphering Key generating Algorithm
ADSL: Asymmetric Digital Subscriber Line
AES: Advanced Encryption Standard
AFIS: Automated Fingerprint Identification System
AMPS: Advanced Mobile Phone System
API: Application Programming Interface
ATM: Automated Teller Machine
AuC: Authentication Centre
CA: Certificate Authority
CDMA: Code Division Multiple Access
COMP-128: Hash Function
CPU: Central Processing Unit
DES: Data Encryption Standard
DSA: Digital Signature Authority
DSS: Digital Signature Systems
ECC: Elliptic Curve Cryptography.
ECMA: European Association for Standardizing Information and Communication Systems.
EMV: Electronic Master Visa
ICCID: Security Authentication and Ciphering Information
IES: Integrated Encryption Scheme
IMT-Advanced: International Mobile Telecommunications Advanced
ISO: International Standard Organization
ITU-R: International Telecommunication Union Radio communication sector
IVR: Interactive Voice Response
MAC: Message Authentication Code
M-Commerce: Mobile Commerce
MD5: Message Digest
ME: Mobile Equipment
MEID: Mobile Equipment Identifier
MIDP: Mobile Information Device Profile
MIM: Mobile Inventory Management
MIMO: Multiple Input Multiple Output
MITM: Man in the Middle Attack
MMS: Multimedia Messaging Services
MNO: Mobile Network Operator
MPN: Mobile Phone Network
MPSP: Mobile Payment Service Provider

MSC: Mobile Switching Centre
MSISDN: Mobile Station ISDN number
MSRN: Mobile Station Roaming Number
OMA: Open Mobile Alliance
OTA: Over the Air
P2P: Peer to Peer
PAN: Personal Area Network
PCMCIA: Personal Computer Memory Card International Association
PDA: Personal Digital Assistant
PIN: Personal Identification Number
PIN: Personal Identification Number
PKI: Public key Infrastructure
PLMN: Public Land Mobile Network
PLS: Product Location and Search
POS: Point Of Sale
POTS: Plain Old Telephone Service
PSM: Proactive Service Management
PSP: Payment Service Provider
PSTN: Public Switched Telephone Network
PT2MP: Point-to-Multipoint
PTP: Point-to-Point
PUK: Personal Unblocking Code
RAN: Radio Access Network
RAND: Random number
RC5: Ron's Code encryption algorithm
RFID: Radio Frequency Identification
RSA: Rivest-Shamir-Adelman
SE: Secure Element
SET: Secure Electronic Transactions
SHA-1: Secure Hash Algorithm ver.1.0
SIM: Subscriber Identity Module
SMS-G: SMS Gateway
SRES: Signed Response
SSH: Secure Shell Network Protocol for Secure Data Communication
SSL: Secure Socket Layer Protocol
SWP: Single Wire Protocol

Chapter 12
Liquidity Management in the Large Value Payment Systems: Need for an Agent-Based Model's Complex Approach

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ABSTRACT

With the advent of Large Value Interbank Fund Transfer Systems operating on an RTGS basis, the bank liquidity management problem has become a crucial issue in payment system analysis for its interrelations with the key monetary policy variables, namely, the short-term interbank interest rate. The analysis of the RTGS system is far from being a trivial task due–mostly–to the complexity and the endogeneity. These stem from the multiplicity of heterogeneous participants (complexity) usually joining a system, whose decisions produce a spillover effect on the rest of the system, which prevents any participant from solving its liquidity demand problem in isolation (endogeneity). Agent Based Models seem to present a few advantages in analysing the payment system in comparison to microfounded ones, as well as to standard simulations: behavioural rules can be assigned to a multiplicity of banks defining the lending or borrowing timing as well as the liquidity sources. Therefore, Agent Based Modelling seems to represent an additional instrument by which to analyse the connection between the payment system and the functioning of one of the most important liquidity sources, the interbank money market.

1. INTRODUCTION

According to a consolidated definition, "a payment system consists of a set of instruments, banking procedures and, typically, interbank funds transfer systems that ensure the circulation of money among the economic agents" (Bank for International Settlement, 2001).

Banks lie at the heart of the payment system allowing economic agents to deliver funds to their counterparties either through bilateral arrangements (i.e. correspondent banking) or through mul-

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tilateral arrangements, the Interbank Fund Transfer Systems (IFTSs). IFTSs are formal arrangements among banks (but also comprising other eligible participants) and a settlement agent who holds settlement account on behalf of participants and provides them with the settlement asset need to comply with their reciprocal obligations. Due to their systemic importance, large value IFTSs are mainly managed by central banks, which allow participants to use cash deposited at their reserve accounts to fund their payment obligations. With a view to reducing systemic risk, central banks have been progressively adopting Real Time Gross Settlement (RTGS) systems where each payment instruction is settled individually on gross basis as soon as it enters the system, provided that the sender bank has sufficient liquidity on its account. RTGS systems, while virtually eliminating credit risk, impose participants to bear a significant liquidity cost, since they need to maintain adequate settlement asset in their accounts in order to process smoothly their payment instructions without any significant delay[2]. Besides the balance held at their reserve accounts, banks may rely on other liquidity sources: they can condition the submission of outgoing payment to incoming payments from their counterparties; they can access the daylight credit usually granted from the central bank; they can also borrow and lend funds on the money market to manage mismatching between the incoming and outgoing payments. Thus in a RTGS environment, payment activity is likely to generate demand and supply of settlement asset by banks to both satisfy their intraday payment needs and meet the desired end-of day balance within the planned minimum reserve fulfillment path. This renders RTGS systems and money markets intertwined with relevant implications for the conduct of the monetary policy: lack of liquidity in RTGS systems may give rise to an excess of demand in the money market either pushing the interest rates up or increase their volatility; on the other hand, weaknesses in the money market due to an increase of either credit risk or risk aversion may prevent bank from submitting their outgoing payments.

Investigating how the RTGS participants choose their liquidity mix represent a key issue for central banking, which–so far–has been basically investigated through the standard tools available at policy makers and academics: neoclassical theoretical models and simulations tools.

As shown below in detail, these approaches have been proven to offer useful insights on the functioning of RTGS systems, but they do not seem fully able to cope with all the difficulties, which emerge when studying the behaviour of banks in a RTGS large value payment system: in particular, the neoclassical theoretical models face difficulties in dealing with the fact that: 1) payment flows in RTGS systems do not follow any nice distribution from the exponential family but complex dynamics for which is difficult to derive analytical solutions; 2) the spillover effects each bank's decision produces on the rest of the system which prevent any system participant from solving its liquidity demand problem in isolation; 3) the incentives for banks to choose their liquidity mix (e.g. pay early versus late) are heavily influenced by the system design which has become increasingly complex due to the introduction of sophisticated liquidity saving features; 4) the players are affected by a high degree of heterogeneity.

On the other hand, the empirical literature based on simulation tools has not properly addressed the endogeneity issues, which arise in this context, where banks change their behaviour according to the evolution of the underlying environment.

Against this background, the toolkit available at policymakers and academics for analysing the functioning of RTGS systems needs to be enhanced: as we are going to show throughout this chapter, Agent Based Modelling represents an alternative approach, which appears to be very attractive. In fact, Agent Based Modelling makes it possible to represent each economic agent, i.e. each individual element of the system by way of a set of micro-level rules governing its behaviour both

in isolation and in interaction with other agents, which evolve in parallel allowing the emergence of credible macro-level dynamics under minimal assumptions on individual behaviour and without the need to optimise any utility function.

The rest of the chapter is organised as follows: the next section presents a brief review of the literature on large-value payments system spotting how the introduction of RTGS system has made more complex the task of academics and policy makers and calling for the application of Agent Based Modeling as a way to overcome the weaknesses of the standard analytical tools. Section 3 reviews a selection of the main existing contributions dealing with RTGS systems relying on Agent Based Model. The following paragraph puts forward some ideas to improve the reviewed ABM analysis of RTGS systems and, finally, the last section offers concluding remarks.

2. A GLANCE AT LARGE VALUE PAYMENT SYSTEM LITERATURE

Endogeneity, complex interactions, agent multiplicity, and heterogeneity have not always been a matter of concern in the analysis of large value payment systems.

In fact, the literature on large value payments systems has naturally changed its focus in accordance with the innovations undertaken by central banks aimed at promoting the usage of central bank money as a safe settlement asset and limiting the size of systemic risk stemming from the settlement of interbank obligations.

Until the eighties, Deferred Netting Settlement (DNS) systems represented the standard for large value payment systems in all but one the advanced financial systems. In these systems, usually operating on a multilateral netting fashion, banks grant each other intraday implicit credit by exchanging payment instructions throughout the operational day and paying (or receiving) at the end of the day an amount of central bank money equal to the net debit (credit) stemming from the payments due to, and to be received from, all the other banks participating in the system.

In a DNS system, the liquidity management problem of a bank treasurer is almost simple: it has to borrow or lend in the money market the amount of deposits needed to meet its desired end-of-day level of balances, taking into account the daily cumulative net inflows stemming from its payment obligations. Angelini (2000) builds a model calibrated on the Italian interbank market and on the SIPS, the netting large-value operating payment system operating at the time the paper was written, where the optimal the intraday behavior on the money market depends on the information available from two key stochastic variables: the desired end-of-day clearing balance and a short-term interest rate, typically the overnight rate.

The model by Angelini confirms how the intraday liquidity management is a minor issue in a DNS system: banks rely on the screen-based information on incoming payments provided by the operator of the netting system only to have an informed guess on their end-of-day balances.

On the other hand, the issue of endogeneity is not problematic neither when investigating the systemic risk typically associated to large value DNS systems (Humphrey, 1996). In fact, in such systems, the failure of one participant to meet its net obligations at the end of the day is routinely resolved through a procedure called unwinding. In an unwinding, all the transactions of the defaulter are excluded from the calculus of the net balances, which are recalculated taking into account only the transactions of the non-defaulting bank. The revised balances may differ greatly from those expected by banks in absence of defaults and may cause other banks failing to meet their new payment obligations. Should this be the case, the unwinding procedure is reiterated until all the survivor banks are able to pay their net balances. Multiple defaults may emerge before this occurs: the domino effect triggered by the first default materializes systemic risk into systemic crisis.

Analyzing systemic risk in netting systems does not require making behavioral assumptions and therefore, is an easier task than dealing with Real Time Gross Settlement (RTGS) systems: analytical solutions are easy to derive, and relatively simple models are able to give insight on the impact of a participant default by simply removing from the system all the payment instructions involving that agent as sender or receiver. Subsequent defaults take places for those participants whose revised multilateral net debit position exceeds or equals their available capital[3].

When in the late eighties' majority of central banks started to promote the migration of the large value payment system from DNS systems towards the alternative settlement modality, the RTGS system, with a view to reducing the high level of systemic risk entailed in the DNS systems, the task of policy makers and academics interested in the large value payment system has become more and more complex.

Systems operating in an RTGS fashion settle each payment continuously in real-time, individually, without netting debits against credits (i.e. on a gross basis), as soon as it enters, by transferring central bank money from the payer account, provided that it has sufficient liquidity on its settlement accounts, to the payee account. When a sending bank does not have sufficient covering balances, the payment instruction is typically queued and resubmitted by the system each time the liquidity on the payer account is replenished.

Compared to DNS systems, the RTGS mode eliminates virtually the credit risk by providing payment finality throughout the course of the day, but makes the system liquidity greedy, as banks need to maintain sufficient liquidity throughout the operational day in order to settle immediately their payment obligations.

This statement holds particularly true if we take in mind that the intraday liquidity needs, which arise from the time mismatching between incoming and outgoing payments, are usually a multiple of the end-of-day liquidity needs, which in turn are typically limited in size, as banks tend to smooth their end-of-day balances throughout a reserve maintenance period.

To meet their intraday settlement obligations, participants in an RTGS system have at their disposal four possible alternative sources of funds: (a) cash balances maintained on account with the central bank, (b) credit facilities granted by the central bank, (c) incoming transfers from other banks, and (d) deposits borrowed from other banks through the money markets.

While cash balances are usually related to reserve requirements that are imposed for monetary policy purposes and do not entail any additional cost directly addressable to the functioning of the payment systems, the other three sources entail different costs which banks try to minimize by choosing the best mix between the cost of settling customer obligations and their own proprietary operations.

Daylight credit lines by central banks are granted on either an uncollateralized or a fully collateralized basis, being the cost an explicit fee or the opportunity cost of conferring collateral, respectively. Incoming transfers from the counterparties may involve a settlement delay cost, in terms of either explicit fees to be paid to their customers or reputation cost.

Finally, the cost of borrowing from other banks through the interbank money markets is usually the overnight rate traded in the unsecured market, as there are no intraday money markets in place.

The reliance of RTGS systems on money market as a funding source creates a close relationship between the monetary policy key variables and the liquidity management carried out by banks in an RTGS environment, as also confirmed by a number of empirical contributions pointing out how the behavior of commercial banks in the money market depends, inter alia, on the intraday liquidity needs they face to settle payment in RTGS system.

Among these contributions, Ashcraft and Duffie (2007) find a significant relationship be-

tween the probability to act in the overnight money market and the liquidity balances held by banks, showing that that participants whose balances at a certain point in time of a particular business day are higher than those held at the same time in the past are more likely to be a lender to their counterparties; conversely, lower than average balances increases the individual probability of being a borrower.

Klee (2007) analyses the effect of operational outages in the Fedwire system on the deviation of the federal fund rate (i.e. the overnight rate negotiated in the market by banks) from the policy rate, the FOMC target rate; the author finds that operational outages involving large participants in terms of volume submitted to the system and the time of the operational day the outages occur are positively related to deviations from the policy rate. She motivated these findings arguing that an operational outage is a source of uncertainty about end-of-day balances: banks not receiving funds from the counterparty hit by operational strains fear they will not achieve their desired levels of overnight balances at the end of the day, forcing them to buy and lend funds in the market.

This short–perhaps–not exhaustive selection of empirical evidence confirms the central role of the liquidity management analyses for both the smooth functioning of the payment systems–to which the central bank are interested in their oversight role–and the volatility and level of the interest rate negotiated on the money market, which represents the variable directly targeted by central bank when conducting the monetary policy.

Against this background, it is apparent that, with the advent of RTGS era, policy makers and academics start to face a more complex problem, on the one hand they need to study how the system design and the cost of the four liquidity sources affect the behavior of participants and system performance; on the other hand, they need to quantify the right level of liquidity a payment system must maintain to allow its smooth functioning and an avoid adverse affect on the short-term interest rate. To tackle these issues, researchers have been relying on using two different approaches: microfounded models and simulations.

Among microfounded models, Angelini (1998), starting from the literature on precautionary demand for reserves, builds a game theoretical model and analyses the incentive mechanism operating in a RTGS environment and its impact on the behavior of key monetary policy variables, such as overnight interest rate and reserves. He shows that if daylight credit is costly, then banks will optimally postpone their outgoing payments until the perceived marginal cost of delaying equals the marginal cost of daylight liquidity. While such a strategy reduces the expected cost of processing payments for the payer bank, it also tends to increase it for the payee banks. As each bank has an incentive to postpone its outgoing payments, the liquidity redistribution mechanism may be hampered and this can potentially cause a system gridlock. In order to avoid ex-ante such an outcome, daylight credit at cheap conditions has to be granted.

Bech and Garrat (2002) confirm Angelini findings relying on a Bayesian game, in which each bank has private knowledge about its own payment requests. They study the incentive mechanism related to various intraday credit policies of the central bank and show that in some circumstances, it may be socially efficient for banks to delay payments.

These theoretical findings are empirically confirmed by McAndrews and Rajan (2000), McAndrews and Potter (2002), and Armantier et al. (2008): using data from the US RTGS system FEDWIRE, they all show that the pattern of payments made over that (RTGS) system peaks in the late afternoon as participants condition their outgoing payments to the incoming funds arriving from the other participants.

The microfounded models, à la Angelini, have been proven effective in giving insights on the policies a central bank should follow when granting intraday credit and may suggest how to

design the system in order avoid that banks pursue opportunistic behaviors, hampering the liquidity recycling in the system (i.e. setting throughput guidelines, which require participants to submit a certain share of their outgoing payment before pre-specified cut-off times).

However, such theoretical models may not offer an adequate guidance in other real-life problems, e.g. in quantifying the amount of liquidity participants should have at their disposals to submit their outgoing payments without any undue delay or the additional liquidity needs faced by system participants in case a disruption occurs at a participant level as the simplifying assumptions currently imposed[4] make these models struggle to cope with the complexity stemming from the high number of heterogeneous players (i.e. the number of participants), the huge quantity of payment transactions processed, the plethora of parameters describing the participants' behavior which makes analytical solutions impracticable when dealing with real data set.

In fact, even structural models describing optimal behavior can–at the state of the art–hardly be calibrated and adapted to such environments. Moreover, as time goes by, the RTGS systems have evolved from the original plain vanilla RTGS system (McAndrews & Trundles, 2001), having been enriched more and more with liquidity saving features (queuing mechanisms, optimizations' algorithms, bilateral limits, reservations' facilities), which add degrees of complexity to the system, influence the participants behavior and make the system more and more difficult to be replicated with stylized neoclassical or game theoretical set-ups.

To overcome these drawbacks, researchers and policymakers have turned their attention to simulation tools able to mimic existing or fictitious payment arrangements and, if fed with real data set, replicate closely the settlement process of an actual business day in the life of a payment system. By modifying the input dataset–e.g. by removing the outgoing transactions from a participant, which is simulated to fail–or the system design, it is possible to build counterfactual scenarios and evaluate policy decisions.

The most popular tool is by far the Bank of Finland Payment System Simulator Bof-PSS2[5], which can to replicate a wide variety of large value payment systems, functioning either alone or in connections with other (ancillary) systems.

The availability of the Bof-PSS2–which was adopted by 80 users among central banks, academics, and clearing organizations as of August, 2010 (Hellqvist, 2010)–has given rise to a flourishing of studies aimed, inter alia, at quantifying the effect of different liquidity levels on the system performance (Leinonen & Soramaki, 1999; Hejimans, 2009) or of operational outages occurring at a participants level (Bedford, 2004; Glaser & Haene, 2007).

It is apparent that the main drawback of this strand of literature based on the BoF-PSS2 is that every action the participants undertake in a simulation exercise is exogenously determined ex-ante, before the start of the simulated operational day[6]. This means that, when an event, like a default, is simulated to occur, the artificial participants do not adjust their behavior according to the new scenario: in other words, these studies fall generally under the Lucas critique argument[7].

3. SIMULATING PAYMENT SYSTEMS BY AGENT BASED MODELING

A promising way to introduce endogeneity in payment system analysis and at the same time to reproduce the complexity that microfounded models are not able to tackle is by employing Agent Based Models (ABM). In fact, Agent Based Modeling allows for the presence of multiple agents, to whom behavioural rules are assigned. These decisional rules can determine behaviours both in isolation as well as in interaction with other agents; they can depend either on agent's characteristics and being periodically activated or on the prevailing

market conditions and being triggered according to the evolution of some market variables (e.g., the imbalance on the own cash account, the interest rate dynamic, and so on). The interactions of different agents determine the market conditions, which in turn will affect the subsequent behaviour of the agents. In applying ABM to the payment system, it is possible to assign behavioural rules also in the field of liquidity management, defining the way agents choose liquidity sources as well as the lending or borrowing timing and conditions. Agent Based Models allow therefore to endogenise the liquidity issue in simulations.

Although the ABM literature dealing with the payment systems is still scarce, the few contributions produced so far show that there are several fields where ABM may prove to be able to be a useful simulation tool for payment system analysis, which allows for an endogenous liquidity management[8].

First, ABM may be used in payment system analysis to deepen the understanding of the funding strategies in an RTGS system as well as well as to evaluate the system's efficiency: Galbiati and Soramaki (2011) analyse the trade off that treasurers face whenever the alternation of in- and outflows makes their cash balances insufficient to settle immediately the due amounts[9]. Banks have to choose between borrowing liquidity or queuing payments, waiting for incoming funds. In both cases, agents bear costs: if they borrow money, they have to pay interests on their loan, if they delay payments, they have to face indirect delay costs arising from the loss of reputation or explicit penalties applied by their counterparties. Since the delay of a participant may cause a liquidity problem of its counterparty, simulations allow to discover the interactions of such individualist strategies that are strictly interconnected one to another. Agent Based Modeling allows in this case to endow participants with behavioural rules that determine their choice between turning to an external liquidity provision or queuing and waiting for internal liquidity to arrive.

The simulations rely on a cost function, which provides the overall cost borne by the bank for each level of externally borrowed liquidity. It is assumed that the participant can opt only once a day for external liquidity, namely at the beginning of the day, so that before the onset of the settlement process, it has to decide how much funds it wants to raise. The overall bank's cost is, therefore, given by the penalties for delays as well as by the cost of raising external liquidity at the beginning of the day. Rather than taking each day as a separate experience, a repeated game is introduced in which the daily initial level of liquidity chosen by each bank depends on its expectations of the others market participants' choice (fictitious play).

The authors find out that for intermediate levels of unit delay costs, the aggregate external liquidity level in equilibrium is lower than the optimal one. The inefficiency of the system results from its comparison with a social optimal equilibrium, where agents minimise the total social costs of all market participants instead of their own one. An inefficient level of liquidity absorption seems to be caused by relative low delay cost per each unit of liquidity in comparison to the cost of external liquidity, which fosters free-riding and determines a suboptimal funding of external liquidity.

For those critical levels of unit delay costs the authors investigate whether in a smaller and simpler network, greater efficiency can be expected. A proportional increase of system's size (total value of payments) and complexity (number of participants) determines an efficiency reduction: it is speculated that since the internal liquidity sources are more variable and therefore, less reliable, agents recur to higher levels of external liquidity per payment. A decrease in the number of participants, while keeping the system's size constant, would increase the efficiency even more, since the liquidity provision would benefit from 'liquidity pooling' effects.

Secondly, ABM can be employed to draw lessons to shape the design of Large Value Payment System. ABM can, in fact, facilitate the evaluation

of the either new policies' or functioning rules' effects that directly involve or have impacts on the participants' endogenous funding decisions, since it allows to assess their impact on the functioning of the system and on the participant's behaviour. The policy maker can therefore test second round effects, which might arise from market participants' behaviours interaction and which otherwise might be difficult to gauge in advance.

The ABM usage for such purpose is exploited by Markose et al. (2011), who uses an Agent Based Model to evaluate the introduction of a policy rule that allows banks to borrow uncollateralized funds, against the payment of interests, from the Central Bank at any time during the day. Since this work investigates the impact in terms of liquidity circulation of different policy rules, the paper can be collocated in the stream of the "policy oriented" contributions.

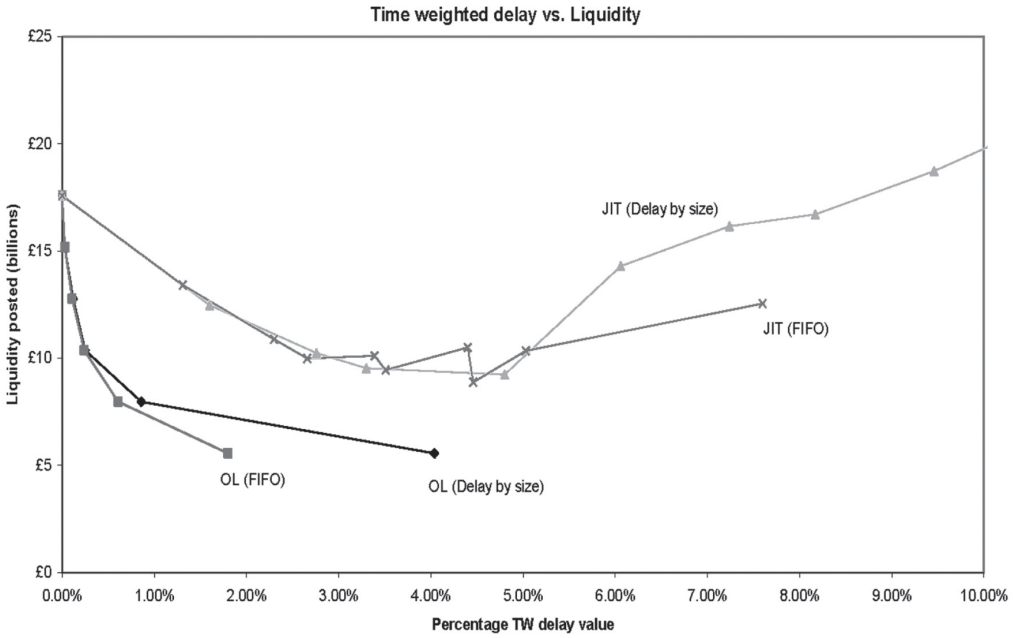
Two alternative frameworks are simulated: in the first group of simulations, falling into the so-called "opening liquidity" framework, banks can withdraw collateralised liquidity from the Central Bank only at the beginning of the day; in the second group, "the just-in-time liquidity" set up, banks can borrow uncollateralized funds at any time during the day according to their needs, against the payment of interests. No repeated game is foreseen; each day represents a separate simulation with new exogenously set opening liquidity level or new parameters of the intraday borrowing cost function. Each of the two alternative systems has their own behavioural rules, which are kept constant across simulations. More specifically, the banks' decision regarding the starting liquidity level to be pledged in the morning is not modeled and different initial values for opening balances on each independent one-day simulation are set exogenously; behavioural rules are introduced to define the trade-off between queuing a payment and requiring intraday extra external liquidity. Banks' optimal delay is determined by minimising this total cost. For the sake of simplicity, the decision rule between delaying or raising funds does not take the possibility into account to reuse incoming payments to settle queued payments and reduce delays, so that the banks' choice is a gross rather than a net liquidity decision.

Comparing the two frameworks for the same amount of external liquidity, the "opening liquidity" system appears more liquidity efficient than the "just-in-time liquidity" one, since the cumulated percentage of settled payments' value for each given time during the day is higher when liquidity is borrowed intraday according to the banks' needs[10]. This result might be addressed to the fact that in the second framework, banks borrow more money than effectively needed, since the incoming payments are not netted (see Figure 1).

Furthermore, within each of the two frameworks ("opening liquidity" and "just-in-time liquidity"), the performance of the system is tested for two queue processing rules: a FIFO approach (first in first out) minimising the value of delayed payments and a size priority criterion (first the smallest) minimising their volume. Gridlock effects are proven to be more likely to occur in the second case.

A third rational for Agent Based Modelling in payment systems lies in the field financial stability assessment. Since the outburst of the 2007 financial crisis, and even more after the Lehman's collapse, policy makers have devoted more and more attention to financial stability issues. The interdependences between intermediaries have been clearly recognised as a contagion channel and, therefore, as a main source of systemic risk. In particular, systemically important participants and market infrastructures have been indicated as the connection point of several flows in the economy and consequently as particularly exposed to systemic risk. Policy makers around the world have been reinforcing macroprudential supervision and market infrastructure oversight with the aim to keep the level of systemic risk under control in order to take preventive interventions whenever potential risk materialises.

Figure 1. Trade off between liquidity posted and time weighted delays (2011 Bank of England)



Large value payment systems–which link together intermediaries, infrastructures, and post-trading platforms–represent one of the most critical market infrastructure since possible delays or settlement failures from one or more participants can have a snowball effect due to the strict interdependencies within its participants.

As mentioned in the previous paragraph, a large body of literature using simulation has emerged to assess the resiliency of the system in case of shocks that affect the available liquidity of payment system participants.

In these stress testing exercises, payments executed from a bank hit by an either financial default or an operational outage, are simply dropped. To introduce a participant reaction, it is usually assumed that after a given time, the other banks become aware of the difficulties of the defaulted participant and stop sending payments: the incoming payments of the defaulted bank from any other market participant are therefore deleted as well. However, the residual liquidity flows, between banks that have not been affected by the outage, are kept unchanged. Even those banks, that would have received incoming payments from the defaulted participant, are not supposed to change their payment behaviour towards the rest of the market, which is a rather restrictive and counterintuitive assumption.

This kind of stress testing is a sort static simulations of defaults and does not capture the impact of critical events like a bank's default on the behaviour of other market participants. In this vein, it could be speculated that the effects captured by these simulation are biased, since they omit to consider "by side" effects of the event, incurring in the risk of overestimating the resiliency of the payment system under assessment.

Agent Based Modeling may be used to take into account that, in case a market participant defaults, the behaviour of the other banks could be affected since they do not receive incoming payments that in the actual world they would have received and that contributed to fund their outgoing payments. In the absence of such incoming payments, banks would have been likely to change their behavioural

strategies, modeled in terms of cost functions and trade-offs between raising liquidity and delaying payments.

For example, Arciero et al. (2009) use an ABM to execute a simulation of a default, in a model that takes both the payment system and a stylised money market into account. They simulate a direct-debit based system with very few market players, in which each participant is endowed with daily initial cash and collateral balances. The model is calibrated with BI-REL's data, the Italian gross settlement system in 2007: the five banks of the model are generated by collapsing a higher number of participants. The initial cash balances stem directly from the opening balances held at the RTGS system, while the opening collateral balances are estimated starting from the maximum collateral pledged at the central bank for intraday credit purposes. Payments between banks are generated for each participant through three random draws from a uniform distribution: the first determining whether a payment is executed or not, the second its exact quantity and the third one the receiver.

The behavioural rule of any agent requires him to compute the expected end-of-day balance at each tick of an internal clock of the model, i.e. the liquidity that the participant expects to hold at the closing of the trading day on the own cash account. It includes: 1) the initial liquidity level; 2) all the in- and outflows already settled; 3) all the pending in- and outgoing payments.

If the value of a due obligation is higher than the actual balances, so that it cannot be immediately settled, the agent can pledge collateral at the Central Bank to receive intraday credit as long as it has enough collateral. After having consumed its whole collateral endowment and provided that the outgoing payment value is higher than the current and expected end-of-day balances, the bank turns to the money market in order to raise the missing funds. The matching of opposite intents on the money market is only quantity-based: in case the expected liquidity of a randomly selected market participant is equal or higher than the requested deposit, the money market deal is executed; otherwise, the payment transaction is delayed and the deposit request is turned to a further randomly chosen bank. After a specific number of bounces, the payment is considered unsettled and is removed from the expected end-of-day balance. If the value of the due payment is higher than the current balances but lower than the expected end-of-day liquidity, the payment will be delayed and queued, waiting for new incoming funds to replenish the expected liquidity. The payment will be automatically re-submitted to settlement process in the following tick, when the current cash balance may have varied for effect of incoming payments: if liquidity is now available, the delayed payment will be automatically settled.

A default is introduced by simply letting a bank switch from this normal operational behaviour to inactivity. At the beginning, other market participants are not aware of the event: they continue sending payments to the defaulted bank and including the future incoming payments from that bank in their liquidity expectations. After a certain amount of time, namely half an hour, the participants gain knowledge of the failure, stop sending payments to that participant and update their end-of-day balance eliminating the pending payments from the defaulted agent. Since the end-of-day balance affects the behaviour of a participant towards any market participant, the default of a bank that causes a readjustment of the expected end-of-day balance has also effects on the behaviours towards the rest of the market.

The authors find out that immediately after the default the expected end-of-day balances of other market participants are inflated by the pending inflows, which are expected to come from the defaulted bank. To face the own outgoing payments, after having used the whole endowment of collateral to get intraday credit from the Central Bank, money market activity is enhanced. Delays on the expected incoming payments from the defaulted

bank start cumulating, up to the moment in which, through a random process, the other agents start becoming aware of the default. Pending inflows are switched to defaulted credits and eliminated from the expected end-of-day balances.

Interestingly in the simulations, an intervention from a lender of last resort is needed to help survived market participants to overcome the stress conditions and the losses, avoiding consequential defaults in a contagion whirl. A possible explanation for inability of the system to return automatically to an equilibrium without external interventions is that the number of agents in the simulated model is very restricted; since so that the relative importance of a single bank is on average 20% of the whole payments, the failure of one of them would therefore imply the default of a relatively high percentage of payments, which would be hard to overcome by the remaining banks.

4. AGENT BASED MODELING IN MARKETS AND PAYMENT SYSTEMS: WHICH WAY FORWARD?

The three contributions on ABM reviewed in the past paragraph witness the huge potentialities of this approach, but are still affected by weaknesses limiting their usage on a more practical ground. In the following, some hints are discussed on how the models could be extended.

The interesting efficiency exercise of Galbiati and Soramaki could be extended by allowing market participants to recur to external liquidity more than once per day, relying on sources that are available at any time during the operational day. Among the possible options, the authors could choose either the Central Bank's intraday credit or the mobilisation of reserves. Switching from an intraday to an overnight horizon, they could explore the possibility to commute intraday credit into standing facilities or to turn to the interbank money market. Especially, the linkage with an interbank market would introduce the concept of liquidity circulation, so that the model could be successfully used to assess the system's redistribution efficiency. In this way, the simulated system could be less isolated from the rest of the liquidity sources that are at banks disposal.

Additional developments of the paper could be also imagined with a view to shed further light on the two main results: 1) the lower efficiency of the individualistic approach to liquidity towards the minimisation of the total social liquidity costs; 2) the reduction of efficiency which takes place when increasing the size and the number of participants of the Payment System.

Referring to the first outcome, given the progressive increase of settled flows in LVPS, it would be interesting to test whether and to what extent an increasing number of payments worsens the outcome of individualistic behaviours in comparison to the social optimal equilibrium. The model could contribute in case any policy maker should be intended to calibrate the exact level of incentives to be introduced in Payment Systems to stimulate participants to manage liquidity according to a collective rather than an individualistic optimisation function.

Since the reduction of the number of participants to a Payment System, while keeping the total turnover unchanged might be due to an increase in the tiering of the system, namely to the decision of some banks not access the LVPS directly but indirectly through a direct participant who acts as the agent, the model could also be interestingly extended in order to include this second kind of indirect participants. In this way, it would be possible to test if the "liquidity pooling" effect of the second result of the paper still holds or whether the tiering introduces some new aggregate effects.

Extensions of the Markose et al. model could be imagined in several directions. A first stream of development could lie in switching from a gross to a net liquidity regime: the decision rule between delaying or raising funds should take the possibility into account to reuse incoming payments to settle queued payments and reduce delays. This would

depart from the simple rule of thumb by which the optimal delay is fixed, which currently relies only on the liquidity available at the moment the payment comes due: even if it is not the optimal rule "since none will be optimal in general," as the authors state, it would be a more realistic assumption. The optimal time of delay modeled in the JIT set up could be reliant not only on the available liquidity at the moment when an obligation comes due, but also on the value of the expected flows given by the sum of the expected incoming payments and the future outgoing payments. This would make each participant's decision reliant on the behaviour of other banks, possibly yielding interesting aggregate outcomes.

Secondly, besides testing different levels of initial liquidity values in the OL framework, a decision rule for the opening liquidity could be modeled; as recognised by the authors, interesting input could be provided by introducing a learning process so that at the beginning of each simulation the external liquidity level is determined relying on the daily experience of the previous days. For example, the decision could be function not only of the expected liquidity at the end of the day, namely balances B_t plus expected incoming payments I_t^{exp} excluding the outgoing payments O_t but also of the delay costs of the previous day d_{t-1} and the opportunity costs of having posted collateral at the Central Bank c_{t-1}: Recursively d_{t-1} and c_{t-1} will embed the experience gained from the beginning of the simulation to the day *t-1*. Since the incoming payments will be the result of other participants' behaviour, this extension of the model would produce an environment in which the synergic interactions of individual strategies might be fully appraised.

However, this kind of modeling would still imply a one-day horizon, so that each new day is an independent experiment in which the agent can profit from the experience gained in the previous games but which isn't affected from the result of the previous day's behaviour. A third kind of extension of the Markose et al. model could be therefore, the introduction of a multi-period framework, namely the possibility to follow the interaction of the agents for several days. This could allow to determine a repeated game in which the players base their daily operating rule on the equilibrium outcome of the previous day. For example, the account balance of liquidity available at the beginning of each day could be made equal to the previous end-of-day balance: the new experiment will inherit not only the experience gained from the previous days but also their effects.

In addition, the Arciero et al. model needs to be extended in several directions, in order to represent a more realistic framework[11].

First of all, this model should be "credit based" which is the standard for RTGS systems. Moreover, it should allow for a higher number of agents to interact, as if it happens in the payment systems of developed countries. With a more realistic number of agents, for example calibrated on real Payment Systems data, the default of one of them might be differently absorbed by the other market participants than in the previous stylised version and the system might be able to reach a new equilibrium without the need of a lender of last resort.

Secondly, the model should allow simulating the payment system over a longer period of days. When dealing with a multiple daytime horizon, it must be taken into account that over the so called maintenance period banks have to fulfill a Minimum Reserve Requirement (MRR). Central Banks require namely that market participants possess on the own account a certain amount of money at the end of the days of that period. According to the monetary policy implementation framework, banks can be required to hold minimum reserves on a daily basis or on average: in the last case, they are allowed to mobilise funds according to their needs and convenience, as long as they compensate by maintaining enough excess reserves on their account at the end of the subsequent days. In a multi period model, the decision to raise or lend funds in the money market will therefore not

only be triggered by the bank expectations on its liquidity, but also by the fact that each bank has to be compliant with the MRR.

To this aim, a possible option, empirically founded (Cassola, 2008) is to imagine that end-of-day reserves have to fall within thresholds that allow him to be compliant with the MRR at the end of the period along a linear fulfillment path. These thresholds can be modeled as function of both the number of days to the end of the maintenance period, since it can be expected that banks will be more focused on the requirement's fulfillment the more the end of the maintenance period approaches, and the previous days' end-of-day balance pattern.

Formula 1: Condition at which a net deposit is traded

$$D_{dt} \Leftrightarrow B_{dt} + \sum_{j=t+1}^{T} E(I_{dj}) - \sum_{j=t+1}^{T} E(O_{dj}) \notin \left[T_{low}(D-d), T_{up}(D-d)\right]$$

where D_{dt} is the net deposit traded at day d at the time interval t; I_{dt} is the incoming payment at day d at the time interval t; O_{dt} is the outgoing payment at day d at the time interval t; B_{dt} is the account balance at day d at the time interval t; $T_{low}(D\text{-}d)$ is the lower threshold bound depending on the remaining $D\text{-}d$ days to the end of the maintenance period; and $T_{up}(D\text{-}d)$ is the upper threshold bound depending on the remaining $D\text{-}d$ days to the end of the maintenance period.

We can hypothetically split the maintenance period into two parts: a first one during which we can assume that banks do not care much about the MRR and a second one when the market participants have to explicitly target a desired level of end-of day balance that allows them to be compliant. During this second subperiod the more the end of the maintenance period approaches the more banks can tolerate smaller and smaller deviations from their own target level;

$$\left|T_d^{low} - Tar_d\right| = f(D-d),$$

as well as

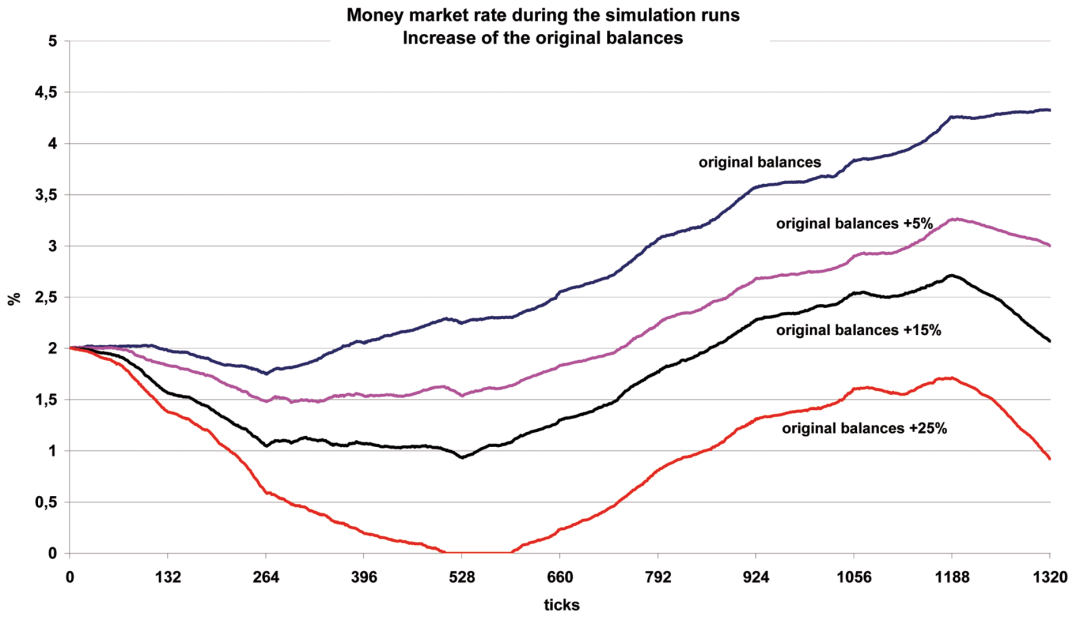
$$\left|T_d^{up} - Tar_d\right| = f\left(D-d\right),$$

where Tar_d is the desired end-of-day balance that allows, given the previous days' end-of-day balances to meet at the end of the maintenance period the average reserve requirement).

Third, the possibility to recur to the money market in case of lack or excess of funds has to be more extensively developed. The marginal role that has been attributed to the market in the first version of the model, to which banks turn only after having exhausted their collateral endowment to be pledged at the Central Bank, seems to be limiting. First, it does not consider banks' opportunity costs linked to the fact that these securities are not invested. Furthermore, it may be speculated that in a world where all agents believe that the Central Bank has injected all the liquidity needed by the system to clear and where the money market efficiently redistributes the liquidity across agents, the priority attributed from banks to liquidity sources is inverted: they first rely on the money market and only residually on Central Banks' facilities (see Figure 2).

Fourth, a simple money market microstructure needs to be introduced. The counterparty search process used in the old version of the model that sequentially evaluates the liquidity position of randomly selected banks and that rejects the proposal after a limited number of failures, could determine a suboptimal liquidity distribution mechanism. In fact, a proposal may be rejected also in the presence of one or more banks that would be interested in such a proposal, because the two willing have not been matched by the random selection mechanism. Money market transactions should be therefore concluded on an electronic trading platform[12], on which all trading proposals are contemporaneously exposed. A realistic

Figure 2. Interest rate dynamics for a quantity based price rule (Arciero et al., 2010)



matching mechanism should be based not only on the quantity but also on the interest rate, otherwise the simulated interest rate time series will follow a random walk, being driven by innovations in payment arrivals, which are stochastic in nature, while the actual interest rate series are usually stationary (see Arciero, et al., 2010).

In this way, on the one hand, the matching likelihood decreases, since the success of the search depends on the joint probability of matching the quantity and the rate; on the other hand, the contemporaneous presence on the screen of all the liquidity imbalances in the system, facilitates the matching of opposite needs by reducing the searching costs and allows competition between banks with the same need (lack or excess of liquidity).

The agents' proposals exposed on the money market cannot be left unchanged since the end of the operational day: more realistically, the banks check periodically whether their proposals need to be revised in terms of quantity and/or of rate. On the one hand, an unexpected incoming payment or the need to delay an outgoing payment might induce them to vary the asked or offered quantity. On the other hand, the flow of time makes the liquidity need more compelling as the risk of not reaching the targeted end-of-day balance increases: the bank will revise the proposed rate, making it more convenient for a potential counterparty and thereby increasing the probability of matching.

As a consequence the interest rate will fluctuate around the policy rate according to the temporary imbalance in the aggregate liquidity need of the system[13]. Depending on such fluctuations, banks could decide to post additional proposals on the market even if their expected end-of-day balance is close enough to the target value that allows the MRR compliance. In this case, the access to the money market is justified by convenience reasons: positive spreads on the key policy rate will stimulate lenders to look for potential profits; negative ones will induce borrowers to anticipate higher reserve levels to reduce future borrowing costs. The deviations from the policy rate are in this way neutralised, thus granting a mean reverting process for the interest rate.

The money market could be furthermore enriched with credit risk issues: a bank specific

random spread could be applied on the rate of each proposal to borrow money, which would reflect different levels of individual creditworthiness. The model could be also expanded to include exchanges, which last longer than overnight, providing in this way a money market interest rate yield curve.

Finally, the central bank as monetary policy authority could be introduced: as a consequence the fixing of the interest rate policy level and the execution of monetary policy operations should be modeled. Interest rate expectations and market risk premia should affect the banks' behavioural rules. The model could be hypothetically expanded to embrace at the limit the whole economy. However, a delicate equilibrium line has to be set down after which any benefit deriving from an increase in realism is outweighted by the disadvantages of enhancing the complexity of the model.

5. CONCLUSION

Which is the optimal solution in the trade-off between realism and complexity in an Agent Based Model? Answering this question seems to become more and more important since Agent Based Models may become a standard tool for Central Banks to understand complex interactions of market participants and of several events from perspectives other than those offered by the mainstream tools. This has become evident in the wake of the crisis, in which Central Banks sought for further methods, besides the classic economic research tools, to understand the rapidly changing environment and to calibrate their interventions in the market anticipating the possible impacts. Network topology is one example of a new interesting tool recently added to policy makers' toolbox to tackle the crisis (Haldane, 2009). In the same way, Agent Based Modeling in the field of the payment system and money market seems a promising possible complementary tool which should allow Central Bankers to take heterogeneous behaviours into consideration.

Under these conditions, new application fields could be imagined for Agent Based Modeling, which could be addressed in the future to Central Banking issues. ABM could, for instance, be used to assess the effectiveness and the risks of the unconventional measures introduced from central banks as a response to the crisis (e.g. BoE's and FED's quantitative easing, ECB's Securities Market Program, and so on). It could be also applied to evaluate the impacts and the second round effects of new regulations, which are currently discussed on both sides of the Atlantic (e.g. the new EU regulation, the Dodd-Frank Act) and fostered by all international fora (FSRB, G20, and so one). Among these cases, ABM seems to be potentially fruitful in assessing the possible impact of banks delaying payments in response to the introduction of regulatory requirements, as e.g. those recently introduced by the UK Financial Services Authority, which require banks to calibrate their liquid asset buffers to meet the intraday liquidity needs (Ball, et al., 2011). Finally, simulating the interactions of market participants' behaviours could be helpful, for example, to deepen the debate on the mandatory use of central counterparty for OTC derivatives transactions, on the new regulation of rating agencies as well as on the impact of short selling restrictions. In this sense, Agent Based Modeling seems to have a brilliant future as support for policy makers and regulators, to evaluate proposals that could shape not only the payment system and the money market but the whole financial system of tomorrow.

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ENDNOTES

[1] The opinions expressed herein are those of authors and do not commit the Banca d'Italia.

[2] Some RTGS systems provide participants with queue management facilities which resubmit automatically payment without coverage every time an increase in the debited settlement account occurs (see BIS, 1997).

[3] These kinds of simulation exercises have been carried out with reference to DNS system operating in several countries: see e.g. Humphrey (1986), Angelini, Maresca, and Russo (1995), Kuussaari (1996), and on the Finnish interbank payment system, McAndrews and Wasilew (1995), Bech, et al. (2002).

[4] To come back to the Angelini model: 1) the restriction only two banks and two periods (morning and afternoon); 2) the absence of reserve requirements and transaction costs related to borrowing or lending; 3) the risk of neutrality of agents.

[5] The Financial Network Analyzer (FNA) developed by K. Soramaki is another example of payment system simulator.

[6] It should be noted that, in principle, the BoF-PSS2 can be enriched with behavioral functions, but this requires developing additional routines to be performed separately.

[7] An elegant but not definitive attempt to introduce behavioral reactions in a model simulating outages at participant level is carried out by Ledrut (2007), who assumes that banks stop sending payment to the hit participant when their exposure breach a pre-determined threshold.

[8] Besides the cases discussed in this chapter other contributions are provided by Galbiati and Soramaki (2010) and Beyeler et al. (2007).

[9] The authors assume that outgoing payments stem from liabilities, which are negotiated in other departments in the bank and afterwards sent to the treasury for immediate settlement.

[10] Two settlement methods for the queued payments are tested both in the "opening liquidity" as well as in the "just-in-time" set up: first in first out criteria and a priority based on the size of the queued outflows. The first one appears to be the most efficient.

[11] The discussed model extension is forthcoming by Arciero, D'Aurizio, Ilardi, Picillo, and Terna.

[12] A possible reference for an electronic platform for money market exchanges is the e-MID market: managed by an Italian company, e-MID SIM; this platform allows European banks to exchange deposits in euro from overnight to twelve months, by posting transparently on the screen their intention to buy or sell liquidity.

[13] Without modeling the Central Bank and its monetary policy decisions, the system that can be simulated is similar to a framework in which the Central Bank has committed to keep rates unchanged so that the banks do not have interest rate expectations. The interest rate will, therefore, be expected to follow a mean-reverting process centred in the policy rate.

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Chapter 13
Financial Distress and Bankruptcy Costs

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ABSTRACT

Since the crisis of the 1930s and the early work of writers such as Fitzpatrick (1932), the problem of failure has become a field of investigation and research in its own right. According to Franks and Sussman (2005), a firm is defined as being in distress once the local branch or regional credit manager decides to transfer a status report to the monitoring unit of economic enterprises or responsible financial diagnosis. Such decisions may occur, especially for SMEs, in the case of violations of certain terms (non-payment of interest exceeding the overdraft limit...) or following a poor assessment of the future of the firm by directors of credit (by reference to indicators such as high debt and low profitability). The objective of this chapter suggests analyzing the processes of the financial distress of companies and their impact.

INTRODUCTION

Like all crises, business failure is perceived as a problem only by those who are directly or indirectly the victims and must bear the consequences. The failure is not the exclusive domain of small and medium companies, it can affect all, regardless of their size, even those that are publicly traded.

The risk assessment of business failure has long been a central concern of researchers and professionals in this field. Failure situations affect the existence of a company and are a very high cost to banks in case of partial or complete loss of funds lent, and also a major risk to other creditors, who, as a result, can fail too. In its common and legal sense, the failure covers a range of situations that contribute to the disappearance of the company mainly because of serious financial problems that lead to insolvency. Blazy and Al (1993) define the failure as "the situation from which a rehabilitation proceeding is opened against a business." Liang and Al (2003), Hol and Al (2002) suggest that failure is a situation where the cash flows generated by the companies fail to meet their obligations to their financial and non-financial partners. Sharabany (2004) believes that there's failure in all three cases: the activity of the company is discontinuous: either this activity does not generate adequate returns, or is the subject of a judicial declaration of insolvency. Pompe and Bilderbeek (2004) Pindado and Rodrigues (2001), Atiya (2001) and Varetto (1998) argue that the

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notion of failure is normally related to credit risk, since it is the banks who say that a company is insolvent when they refuse to lend them money.

Due to the fact that it involves several scientific disciplines, business failure has long been analyzed indirectly without creating a real current of homogeneous theoretical and empirical thinking, resulting in a specialised literature that makes of failure a fully fledged research topic.

The identification of the root causes of failure is not obvious. It is always difficult to exclusively list the factors causing the failure. The causes are numerous, and their conjunction endangers the survival of the company. The importance of this phenomenon and its impact on the overall economy, lead to a desire to know the causes and origins to explain them and be accordingly able to take preventive measures.

A variety of causes have been presented in various works. However, the majority of them agrees that two broad categories of factors can be identified:

- Microeconomic causes are endogenous causes. They represent a specific internal risk, and are rooted in the core functions of the business, mainly the production, the marketing or the organization.
- Macroeconomic causes are exogenous factors which are, in some cases, the major causes of business failure. Since the eighties, it was found that regardless of financial ratios, there are other economic variables related to the economic environment and whose relevance is unquestionable in the explanation of the phenomenon of failure and the determination of its causes.

As a first step, we will conduct an analysis of the process of financial distress of companies to better understand the path of failure under the financial, economic and legal perspectives. Then, we will examine the costs of the financial distress and their impact on companies.

THE PROCESSES OF THE FAILLURE

Historically, the failure problems have attracted the attention of both economists and lawyers because they are a key social issue. They therefore try to delimit the scope involving the concept of failure to give it a clear definition. However the variety of situations related to the application of this phenomenon has made the task difficult.

It is only with the crisis of the 1930s and the early works of authors such as Fitzpatrick (1932) that the problem of failure has become a fully fledged field of research. Like any other phenomenon, the failure was analyzed in different ways and by different disciplines. The most significant contributions came from legal, economic, financial, strategic, organizational and managerial sciences (Guilhot, 2000).

Definition and Cycle of the Financial Distress

Wruck (1990) defines financial distress as a situation where cash flows are insufficient to cover current obligations. These obligations may include payables, expenses of litigation or interest payments. According to Baldwin and Scott (1983), when the situation of a company deteriorates to the point where it can not meet its financial constraints, the company enters into a state of financial distress. These same authors assert that this is the result of a poor economy, a decline in their performance and low quality of their managements. Modigliani and Miller (1959) showed that only efficient firms, effective and efficient, are ready to support a relatively large debt because they are able to meet their obligations without problems. Jensen (1986) argues that debt acts as a disciplinary mechanism on the leaders and has a positive impact on business performance. According to Finet (2001), the granting of debt results from the difficulties experienced by the company. It becomes part of the weakening of its operating performance, its capital as well as its

reputation. Opter and Titman (1994) argue that the debt is a factor of financial distress that may endanger the survival of the company. John (1993) considers that the financial distress results from poor synchronization between the cash availability and contractual obligations during a given period. In other words, it is the inability/impossibility to meet the current liabilities with the available assets. The risk of insolvency as well as the breach of any contractual clauses are signal of financial distress (Chou et al., 2010).

Confusion arises when the term "insolvency" is used as a synonym for "financial distress." Insolvency can be interpreted as relating to the assets or cash, but the two are often confused. For example, *Webster's New World Dictionary* defines insolvency as first, unable to pay all debts and then, as the inability to pay debts that are due. The structural insolvency, or asset base, occurs when the value of a company's assets is less than the value of its debts implying negative equity.

Operational insolvency, or base flow, occurs when the company has inadequate cash flow to cover contractually required payments.

Flow-based insolvency gives creditors the right to require the restructuring because their contract with the company was not respected.

In such a situation, creditors are not supported by shareholders since their rights to equity are still preserved. When the value of a firm increases dramatically, shareholders reap the benefits.

According to Franks and Sussman (2005), a firm is defined as being in distress when its local bank branch or regional credit manager decides to transfer a status report to the monitoring unit of economic firms or to the person in charge of financial diagnosis. Such decisions may be triggered, especially for SMEs, in the case of violations of some terms (non payment of interest, exceeding the overdraft limit,...), or due to improper assessment of the future of the firm by credit managers (by reference to indicators such as high debt and low profitability...).

Bankruptcy and liquidation are also used as synonyms for the financial distress. Wruck (1990), considers bankruptcy as the legally adopted process to cancel and rewrite contracts. Liquidation refers it to the sale of assets of the firm and the distribution of income to the beneficiary or beneficiaries.

DEFINITION OF THE CONCEPT OF FAILURE

During these last years, the annual flow of failures of companies did not stop growing and this trend becomes more marked during the periods of crisis. The economic bankruptcy is the state which characterizes a company the financial performance of which is lesser than that of his main competitors (Ooghe and Van Wymeersch, 1986). Bescos (1987) defines the SME's in trouble as a company where shows itself a maladjustment in front of the economic environment. For Gresse (1994), the economic failure shows itself by a negative added value. Koeing (1985) proposes a definition which bases on the couple profitability, liquidity.

Cata and Zerbib (1979), speaks about the failure of the company by referring to a legal, economic and financial approach. According to these two authors, the legal failure concerns as a rule an action of deposit of the balance sheet bound to a situation of insolvency. The economic failure refers to the absence of profitability and efficiency of the production apparatus. Finally, the financial distress is bound to cash flow problems and of incapacity of refund of the debts. For Derni and Grucifix (1992), the company is threatened from the moment the profitability becomes insufficient because she does not any more allow to pay stockholders' equity at the current rates on the market. The company finds no more solution to manage its debt, what is translated by incidents of payment (Gresse, 1994). Zopounidis (1995), show that there is no only definition of the failure. It is thus necessary to give a wider definition, in-

cluding qualitative variables in the analysis of the financial distress (Sun and Li, 2009). The taking into consideration of these qualitative variables in esteemed by the financial variables will offer a more rational and more global frame of analysis for the forecast of the failure.

The Financial Failure

From a financial point of view, a company is considered as failing if it meets cash flow problems and if it is incapable to meet its commitments. Malecot (1981), respect that the financial failure intervenes when the exploitation cannot face any more the current liabilities by means of its available asset. If the profitability is insufficient, the exploitation of the company is threatened, because she cannot pay any more stockholders' equity at the current rates on the market. In these conditions, it will be less easy for the firm to get itself new stockholders' equity because she is not capable of paying them. She will have to request then a new credit line to assure continuation of her activity.

This appeal to outside heads, will pull additional financial charges which them will contribute to damage his financial results. Also, the company can know problems of liquidity in the case or its availability of the operation is not enough to cover all spending (Ball and al., 2010).

According to Ooghe and Van Wymeersh (1990), the insufficiency of the added value and the excessive weight of the loads of structure are at the origin of the lack of profitability of the company. She finds no more solution to pay its debt, what is translated by incidents of payment. According to Derni and Crucifix (1992), the financial activity of the firm becomes insufficient because she cannot assure any more stockholders' equity the current rates on the market; confronted with such a situation the company does not any more manage to be self-financed because it is not any more capable of attracting new financiers.

The Economic Failure

For Zopounidis (1995), the economic failure refers to the absence of profitability and efficiency of the production apparatus and to the deterioration of the connection: company-products-market and by the non-contribution of the company to the reduction of the social problems such as the unemployment or an incapacity to improve the standard of living of each or the purchasing power. According to Crucifix and Derni (1995), the company carries out its economic objective when it realizes a sufficient profitability and liquidity.

The threat of exclusion from the firm of his market is conversely proportional in the powers of his ruling market or developing in the sectors to which the company belongs ." According to Gresse (1994), the economic failure of the company is a negative added value; this value constitutes an indicator of performance brought by the use of the factors of production. In such a situation the firm uses more resources than it produces it and is not any more capable of assuring the market price all the factors of production which contribute to the realization of its economic activity.

Van Wymeersch (1996), respect that in economy of the market, the remuneration offered by the firm to each of the elements of production must be sufficient to assure the continuity and the quality. According to Quintart (2001), "a positive added value represents a surplus of the production with regard to the intermediate consumption. Theoretically, this surplus is not significant because it is advisable to put in perspective her: the crucial question is to know if the added value is sufficient to pay the factors of production as far as they are productive and used advisedly ." Ooghe and Van Wymeersch (1996), asserts that the notion of the ailing firm is defined as the one who does not any more manage to assure in a continue way her economic objectives, considering the social constraints and considering the environment

The Legal Failure

On this plan, two ideas are to be retained. Indeed, since the roman law, the rights of the bankruptcies are collective, general and public procedures having for object to eliminate the company or to allow its recovery, what establishes their first aspect, the being second that at the origin of these procedures, there is an insolvency of a debtor who shows himself by the suspension of payments, because he is in the incapacity to face the immediately due liabilities with his available asset.

On the legal plan, the suspension of payments means that a debtor does not settle when due, of the debt become due. A single incident of payment would be enough, from the point of view of the principles, to create the generative fact of the failure. Effectively, companies can be in the impossibility to honor their obligations, because of an insufficient finance, of difficulties of obtaining of credits or still an unfavorable economic situation, even if this situation is only.

COSTS OF THE FINANCIAL DISTRESS

The costs of the financial distress and the legal proceedings under the code of the bankruptcy are important. For SME, the costs involved in the reorganization can often exceed the value of the firm, which explains the dissolution of this one. These costs were recognized as an important determiner of the evaluation of the debt of a company and the structure of its capital. Haugen and Senbet (1978), was the first ones to support the hypothesis that the costs of the financial distress should not be significant because the pretenders should be capable of being in negotiations outside of the court without affecting the value of the underlying company. A firm in distress meets three difficulties: first of all it loses the right to make certain decisions without legal approval. For example, a firm which is of the American code of the bankruptcy (more exactly the Chapter 11), cannot spend some money or sell assets without approval of the Court. Then, the financial distress can reduce the demand for the product of the firm and increase its production costs. What will have an incidence on its market share. Thirdly, finally, the managers lose a considerable time to solve the financial distress.

Direct Costs

The direct costs of the financial distress are easier to measure. They include the legal, administrative and consultative fees paid by the company. The direct costs are essential for the companies which restructure their debts or those who go bankrupt. Numerous scientific studies tried to measure the direct costs of the bankruptcy. Altman (1984), White (1983) and Weiss (1990), assert that these direct costs represent approximately 3% of the market value of the company. In its study, Warner (1977), shows that the clear amount of these costs was equal, on average, to 1% of the market value of the firm seven years before the failure and became a more and more raised percentage as the bankruptcy approached (for example, 2,5% of the value of the firm three years before the failure). Lubben (2000), respect that to them only, the average legal expenses amount to 1,5% of the total assets of companies bankruptcies. For the firms which liquidate at the end of the process of bankruptcy, Ang, Chua and McConnell (1982), assert that the direct costs represent 7,5%, some value liquidated by the company.

Real Costs Supported Directly by the Firm

They are all the spending of remuneration and fees of the external and internal services mobilized for realizing tasks of evaluation and judgment.

Fees of the Professionals

Generally, the failing firms resort to the services of the external professionals, in particular, the judicial experts, the chartered accountants and the listeners, the bankers' investors, auctioneers and consultants. These fees are a function of the task to be made and of the complexity of the situation of the firm in trouble.

Weiss (1990) studied the direct costs for 37 situations of bankruptcy of the NYSE (New York Stock Exchange) and the AMEX (American Stock Exchange) followed over the period from November, 1979 till December, 1986. He observed that these costs of bankruptcy are of the order of 3,1% of the book value of the debts and the market value of the actions(shares), a fiscal year before the period of bankruptcy. The results are similar to Altman (1984) and Warner (1977) over the previous periods.

Indeed, Warner estimated the costs of bankruptcy of the order of 4%, of the market value one year before the bankruptcy for a sample of 11 firms of the sector of railroads. Altman estimated costs of the order of 4,3% for a sample of 11 firms of the sector of iron paths and 7 industrial firms. A more recent study, by Betker (1997), noticed that the direct costs are of the order of 3,93%. Gilson and al. (1990), present a revealing of the direct costs of the private agreements. With a sample of 18 restructurings of debts, these authors show that the median of the direct costs of restructuring of the debt is 0,32%, the total of assets at the end of exercise.

Mobilization of the Staff

The process of resolution of the problems of bankruptcy requires not only the mobilization of the leaders in terms of time and energy, but also the implication of all the staff. Indeed, the firm owes make forehead for the problems generated by the bankruptcy, negotiate with his creditors to be able to develop a plan of reorganization, and to cooperate in communicator the necessary information asked by the external professionals. All these tasks force the firm to keep its daily activity.

The internal costs launched during the process of resolution of the problems of bankruptcy, are implicit and difficult to estimate. The interaction between the staff of the bankrupt firm and the external professionals, implies an additional effort spread by the first part.

Real Costs Supported Directly by the Creditors of the Firm

Firms in situation of bankruptcy incur costs which are actually born by their creditors. So the shareholders, the bondholders, the bankers, the suppliers, the State, the retired people and the active employees, are forced to undergo the additional costs resulting from the common situation of the firm.

Fees of the Professionals

The individual creditors, can support additional costs in the sense where they are going to delegate experts either to compose a legal advice separated to estimate and bound their legal positions in assets and liabilities of the failing firm. In several cases, the creditors are in front of certain complexities, they are going to ask a legal assistance or same to commit their own experts or bankers investors to represent them in the committees of the creditors and estimate their heritages.

Mobilization of the Staff

Several creditors commit their staff and other resources in the evaluation of their interests. A big part of their spending is bound to the external professionals, but the definitive decisions belong to them generally. For example, they have to sell or keep their parts? Do they have to vote for a rescue plan or for a plan of reorganization? Mostly, the creditors and especially the members

of a minority party prefer to pursue the process of the bankruptcy. On the other hand, the majority creditors prefer to realize the alternative which satisfies their personal micro-economic interests, given that they committed additional costs.

After all, the management systems of the failing firms try to set up plans which allow protecting their jobs and the revenue streams of their creditors. Several of them prefer considerable changes in management systems considered initially less effective. The commercial, in particular the suppliers, prefer to protect their customer portfolio. As far as some groups defend their interests, other groups should support additional costs to maintain their relative positions. These additional resources are often directed to check the managers (Branch, 2002).

Reduction of the Commercial Efficiency

The creditors become more demanding when they notice that their debtor passes of a healthy situation in a situation of distress. This financial vulnerability is translated by two categories of loss:

- Their parts and profits tend to decrease in connection with the decreasing value of the firm.
- Their performances tend to degrade, in the presence of a loss of commercial efficiency of the firm further to a doubt on the growth potential of the exploitation.

Low liquidity of financial assets: listed securities will become less liquid on the stock market and will more be explained to a slump in prices, which are translated by additional risks stemming from the degradation of the price ranges of the titles. Several firms in distress opt by the securitization of their claims or sign framework agreements with the companies of factoring.

Social climate: in several cases, the financial distress or the premature bankruptcy, lead to claiming of the creditors which can activate conflicts, because of the differences of interest which set them. The process of resolution of the problems is disrupted by the heterogeneous character of the interests of each, the degree of satisfaction, reactions and interpretations but also by the payability of the debts, what generates costs of opportunities. So, when the company meets money troubles, the employees know that the guarantee of their jobs is not any more insured. He thus becomes very difficult for the company to keep and to incite his employees to stay and not to fetch a new safer employment.

They will thus be tried to fetch a safer employment and to leave the company, which it, will have difficulty in inciting them to stay and to keep them. In the companies the activity of which depends on the human resources of certain employees, their departure can succeed to put the company to state of transfer of payment.

Losses of the Failing Firm Being Translated by Earnings for the Benefit of other Entities

The loss of performance for firms in distress can create opportunities for the competitors. So the losses of the bankrupt firm can be compensated, even partially, with gains for the benefit of other economic entities. These costs can take varied forms.

Loss of Market Shares

The disturbances caused by the bankruptcy will have generally effects opposite to the capacity of the firm to maintain and to increase its market share. Indeed, she begins by losing her brand image, her employees are less reassured and she becomes less capable of honoring her commitments. The financial distress affects its capacity to negotiate more favorable prices for the inputs as well as the terms of credit. Worried about the capacity of the failing firm, the suppliers often

require a risk premium through higher price, or from lower-quality services. Besides, it is more difficult to negotiate favorable terms, prices and services, if the suppliers consider that their relation with the company is from now on of the short term and that the other entities of the market become prospects. This reality returns the other creditors less inclined to matter on the promises of the concerned company. So the skill of the bankrupt firm to develop stretchable business relationships will be more difficult. The market share is translated by an earnings for the benefit of one or several other economic entities, given that they share initially the totality of the profit of market. However, market shares lost in a parallel to the other market shares which increase, (Chang and Mc Donald, on 1996), cannot have the same amplitudes to balance itself. When financial difficulties make pressing, the company can be obliged in an asset disposal, to arrange sufficient liquid assets in the payment of the creditors. It is frequent that the compulsory sales of assets do not allow the company to sell to the market price. Pulvino (1998), showed in its study that airline companies in situation of suspension of payments which sold planes gave up them to a lower price from 15 to 40% at the price which would have obtained a healthy company.

Concentration on the Short Term

Because of their state of bankruptcy, firms cannot argue any more about the long term. They have to confine themselves to a short-term horizon. They need to keep funds to avoid any shortage on the long term and to bring to a successful conclusion their projects. A firm in situation of bankruptcy has no motivation to pursue opportunities on the long term which require financing and who are brought themselves to change immediately the horizons of reflection. They have to apply very high rates of updating for their future income.

Firms in situation of bankruptcy will always need, and under pressure of the creditors, to liquidate assets, (Shleifer and Vishny, 1992). These assets will generally have to be sold to market prices. The buyer is of this fact capable of exploiting the financial distress of the seller to negotiate assets at attractive prices. Moreover the more a firm is failing, the more it will be brought to liquidate assets to take funds, knowing that it focuses on the short term.

Firms in situation of bankruptcy, have to liquidate their assets, under the pressure of the creditors, (Shleifer and Vishny, 1992). These assets would as a rule be sold to the market price, but the buyers are going to tend to exploit the financial distress of the seller to negotiate the prices in the reduction. In fact, the more a firm is failing, the more it is led to liquidate assets to get itself funds essential to its survival, and it focuses of this fact on the short term.

As far as certain assets are less liquid, the failing firm has to support additional transaction costs, (Kim, 1996). Altman (1984), tried to estimate the indirect costs, by basing itself on the losses not anticipated for three years before the bankruptcy. His analysis implies indirect costs of 4,5%, for the commercial firms and 10,5% for the firms of the branch of industry. Wruck (1990), criticized the methodology of Altman of the fact that it is impossible to assert if the loss is caused in fact by the financial distress or if it is the financial distress which is the consequence of the loss. In another study of the indirect costs, to Opt and Titman (1994), showed that the firms of the extreme decile of debts incur 26% losses that the firms of the lowest decile of debts will have. The market value of their actions falls correlatively. The considerable positions which occupy the costs of the situation of failure, in particular for the common exploitation and for the processes of decision-making, imposes on any firm to be thought of developing a kind of dashboard to anticipate the situations of bankruptcy.

Indirect Costs

Contrary to the direct costs, the indirect costs are not observable and are thus difficult to specify and to measure empirically. However, the researchers developed various approaches used to analyze the likely scale of these costs. At first, it is difficult to distinguish if the bad performance of a company is caused by the indirect costs, or by the same factors which led her to a situation of financial distress. These studies thus tried to determine if the performance of the company reflects the costs of financial distress, the costs of the economic distress, or the interaction both. Altman (1984) was the first one to supply a methodology to measure the indirect costs of the bankruptcy. He notices that the average of the indirect costs is equal to 10,50% of the total value of the firm. The combination of both costs is estimated at 16,70% what is not unimportant with regard to the value of the firm. On the basis of valuable changes of the company in the course of time, the financial distress is considered from 10 to 20% of the value of the company. Andrade and Kaplan (1998), examines the qualitative aspects of behavior of companies. A great majority of firms are obliged to reduce their capital expenditures, to delay the restructuring, or to file for bankruptcy in a way which seems expensive.

CONCLUSION

Throughout this chapter, we tried to approach the notion of failure of the financial, economic and legal point of view, then from the point of view of the costs of the financial distress. These costs can be direct or indirect, in who are included the fees of lawyers, accountants, councilors and other experts to whom the company has to resort. One of the repercussions of this work would be to study the plan of reorganization requiring the taking into consideration of several determining factors of financial and managerial nature as well as the forecast of variables susceptible to lead to the success of the discussions with the stakeholders.

Also, it would be important to give a perspective on the procedure of liquidation and on the costs which it generates to be able to choose between plan of reorganization and procedure of liquidation.

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KEY TERMS AND DEFINITIONS

American Stock Exchange (AMEX): The second-largest stock exchange in the U.S.

Bankrupt: Firm, or corporation that has been declared insolvent.

Cash Flow: A measure of a company's financial health.

Cost: The total money, time and resources associated with a purchase or activity.

Financial Distress: Tight cash situation in which a business, household, or individual cannot pay the owed amounts on the due date.

New York Stock Exchange (NYSE): The largest stock exchange in the U.S.

Profitability: The ability to earn a profit.

Risk: The quantifiable likelihood of loss or less-than-expected returns.

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Chapter 14
IT Security Governance in E-Banking

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ABSTRACT

Most industries have been influenced in different ways by e-commerce, and the banking industry is no exception. Particularly, banks are embracing electronic banking (e-banking) as a service to reach a wider market share, increase customer satisfaction and lower operational costs. This increased supply and demand in e-banking services has caused not only opportunities but also risks. The need to manage and regulate those risks calls for a sound Information Technology Security Governance (ITSG) program as means to deliver value business and mitigate Information Technology (IT) risks. In this regard, the chapter's objectives are to explore, evaluate, and compare the current status and characteristics of Information Security Governance (ISG) approaches for e-banking. Therefore, the authors focus on an analysis of reputed best standards, guidelines on governance, risk management methods, and internal controls currently used for e-banking as means to research which satisfies best ISG objectives. Results show that banks should not be restricted to currently used approaches to ISG for e-banking but should take into consideration benefits and shortcomings other approaches possess. In this regard, the authors propose an ITSG framework for e-banking as a continuous process for assuring ISG objectives. They also highlight the importance of consistent measurement of metrics of ITSG performance with the aid of security content automation protocol.

INTRODUCTION

Since the beginning of modern network technology, especially the Internet, financial institutions have renovated their communication and business infrastructure in order to take benefit of advances in technology. It is evident that electronic banking (e-banking) has contributed substantially to the success and profitability of many banks (Kondabagil, 2007). Nevertheless, the parallel

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expansion of digital attacks has made stakeholders lose confidence on e-banking operations (Gikandi and Bloor, 2010).

The evolution of e-banking has moved banking services from back-end applications to customer-centric network ends. Particularly, the open networked environment provides instant global access to information products and services so now the consumer can access the bank to conduct financial services instantly. Common e-banking services include but are not limited to financial information news, ATM (Automated Teller Machine) locators, insurance, credit cards, cash management, funds transfer, investment services and others (Baten and Kamil, 2010).

With society's dependence on technology the risks as well as the failures to assure information has increased in a high rate. Particularly, the total amount of security breach and computer viruses cost globally $1.6 trillion a year and 39,363 human years of productivity for financial institutions (Symantec, 2010). Another incident in 2007 accused three cyber thieves for stealing $450.000 from the City National Bank in North Carolina (Vijayan, 2010) when recently in New Jersey, an attempt to steal information from more than 500.000 bank accounts got a bank employee arrested (MSNBC, 2010).

Banks ability to take advantage of the proliferation of technology often depends on open, accessible, available, and secure network services. Financial institutions depend on human notions such as customer trust, confidence, and satisfaction that appear to be the key indicators correlated to the growth of a business. As a result, retaining a good reputation for safeguarding information will increase market share and profit. In this respect, there is typically nothing that causes customer dissatisfaction more that compromised accounts or stolen identities, all purviews of security (Tan et al., 2010). For this reason and because banks should mitigate the information technology (IT) risks to an acceptable level, the concept of Information Technology Security Governance (ITSG) concept is tested as the main objective of this chapter under the prism of e-banking.

Particularly, we stress the importance for a financial institution to have a much more sophisticated and structured approach to ITSG as part of a wider Risk Management approach. In this regard, we focus on strengthening the relationship between Risk Management methods and ISG frameworks to approach the objectives of Security Governance in e-banking. Therefore, our main research objectives are to:

1. Empirically examine congruent terminology, role and implementation of ITSG in e-banking.
2. Research on e-banking risks with emphasis on outsourcing risk because it causes and affects other e-banking risks.
3. Focus on an overview of reputed approaches to ISG to meet the specific needs of e-banking systems.
4. Propose an ITSG framework for e-banking helping small banks achieve higher business value.

Just as new trends in information security (IS) require consistent measurement of metrics, we also consider how ITSG performance in e-banking can be measured. We summarize the chapter by supporting the argument that "*Security is a management problem, not a technical problem*" (Brotby, 2009, pp.15) especially in e-banking due to the interaction nature. This chapter is organized into ten sections. This section introduces the reader with the evolution of e-banking and main research concerns. Section two portrays the literature review of ITSG and e-banking in general and emphasizes on congruent terminology. Section three discusses the objectives of Information Security Governance (ISG) and most reputed approaches. Section four describes the role of ITSG in e-banking and proposes an ITSG framework as a basis for banks wishing to govern information security in the e-banking domain. Section five describes

and summarizes most common e-banking risks and section six describes why outsourcing risk is considered the most critical e-banking risk among others. Section seven describes the main concepts around Risk Management in e-banking and section eight compares the most reputed ISG frameworks in the banking industry. In section nine we describe emerging trends in measuring ITSG performance such as the Security Content Automation Protocol (SCAP). In section ten we summarize the findings of the chapter and propose future research.

Research Contribution: We focus on the rising demand of electronic banking to highlight how a sound Information Technology Security Governance program can actually add business value and mitigate IT-related risks. In this respect, we a) analyze and compare approaches not only to standard ISG objectives but also to other related IS criteria as means to discover which one best fits the e-banking environment and b) propose an ITSG framework as a continuous process for assuring ISG objectives. Results show that each approach/method has its own benefits and shortcomings. Moreover, following recent trends in measuring security we exemplify how to measure ITSG performance in e-banking in a consistent and automated manner with the aid of Security Content Automation Protocol.

BACKGROUND

We emphasize from the very beginning that it is important to use the terminology accurately because our words define our understanding. Therefore, before describing in detail the role of ITSG in e-banking, we need at least a literature review over e-banking and ITSG as separate contexts.

Fundamentally, banking services has evolved in a service of "anytime/anywhere/anyhow" (Chen, 2009) and the term e-banking is used to describe banking applications, including products and services, with the use of technology. Specifically, the proliferation of Internet technology has led the development of new products such as aggregation of services, bill presentment and personalized financial services. Today the competition in the banking sector is determined by the success of a bank to adopt and deliver innovative products and services that meet the changing needs of a customer (Daniel, 1999). In this respect most banks has some type of Web presence however this is restricted primarily for marketing purposes (Ho Bruce and Wu, 2009). However, e-banking can offer much more than a static banking presence online. Specifically, e-banking has the potential to:

- Eliminate physical or geographical boundaries, enabling a wider market share.
- Use a variety of devices (e.g. phone, personal computer) for instant admission to banking services without the expenses of facilities or labor.
- Satisfy consumer demands via mass-customization and self-service.
- Lower operational, transaction and production costs via the use of technology.
- Showcase community activities and attractions offering multilingual sites.
- Build public relations and reputation by supporting social welfare and local needs.
- Provide effortless (all time) accessibility for disabled people.

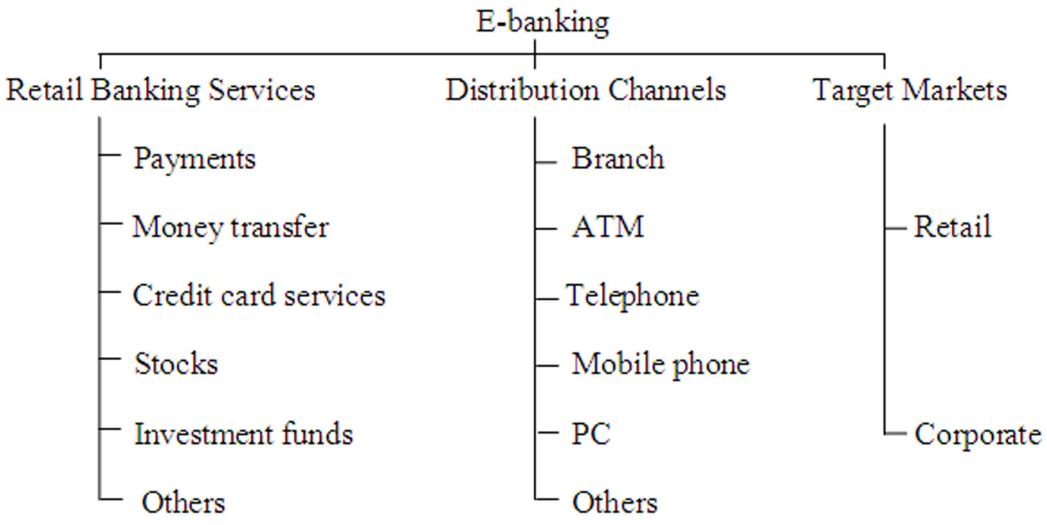
While there are various definitions in the literature about e-banking (Insley et al., 2003; Kolondisky et al., 2004; Shah and Clarke, 2009; Angelakopoulos and Mihiotis, 2011) we conclude that e-banking is an umbrella term including all possible transactions of a bank which are performed with the use of electronic means, mainly through the Internet but also via VPNs (Virtual Private Networks), Intranet, Extranet, phone and mobile phone and other devices such as ATMs, and these transactions do not require the customer to visit a bank branch. According to (Akinci et al., 2004; Aggelis, 2005) there are a number of retail

banking services, distribution channels and target markets included in an e-banking environment (see Figure 1) but three major types of e-banking distinguish depending on the channel by which the transactions are performed: 1. Internet banking, 2. Phone banking, 3. Mobile banking.

1. Internet banking (or web banking), as its name implies, is operated mainly through the Internet. The customer of the bank must have access to a personal computer and to the network of the bank. Usually, due to the increased security requirements regarding e-transactions, banks must ensure that e-banking customers' records remain safe under all conditions. In this regard, banks use security tools such as tokens, specialized software, digital signatures and other security defenses to protect the security requirements (confidentiality, integrity, availability) of the assets supporting e-banking.
2. Phone banking services are processed via a phone device that is not mobile. This service is divided (Aggelis, 2005) into two categories a) manually via real-person contact and b) automatically through IVR (Interactive Voice Response) systems where the customer responds to voice messages.
3. Mobile banking (m-banking) is a relative new channel which has not reached as much a penetration rate in usage as it should have. The main reasons are lack in security and marketing strategy. M-banking is performed thought the installation of specialized software program in the user's mobile device and precautions for safeguarding security such as the usual change of the password are essential.

According to (Nsouli and Schaechter, 2002), e-banking is considered an electronic financial service that belongs to the wider e-commerce area. E-commerce is conceived as a broad term that includes all business through the use of electronic networks. E-commerce is divided in two broad categories namely a) e-finance, a term which includes financial services via e-channels and b) e-money, a term that includes all the mechanisms for stored value or pre-paid payment. The main difference between e-money and e-banking is that

Figure 1. Retail banking services and distribution channels
Source: Adopted from Akinci et al., 2004



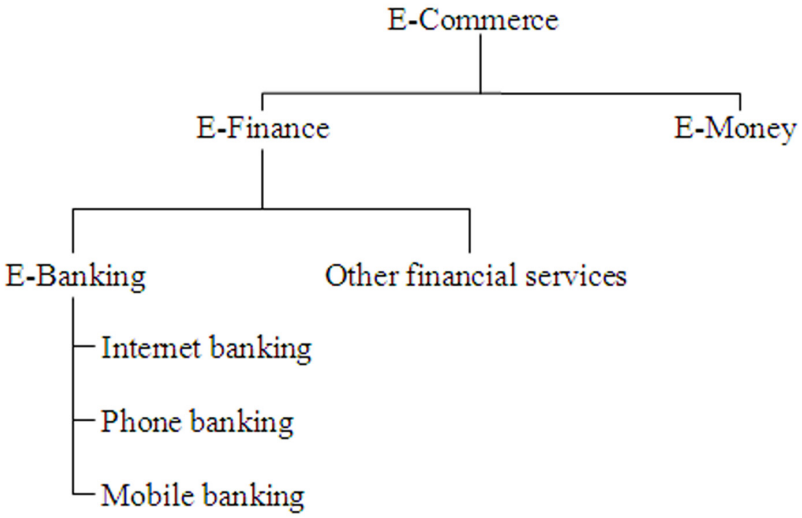
the former balances are not kept in financial accounts within banks but are rather seen as digital money or cash. Direct deposit and electronic funds transfer (EFT) are usual examples of e-money. E-finance includes e-banking and other financial services and products such as insurance and online brokering. Figure 2 summarizes this notion.

E-banking cannot operate without the aid of technology and specifically the Internet. Therefore, the role of technology in supporting the e-banking function has become increasingly complex. In this respect, IT operations have become highly dynamic and usually include distributed environments, integrated applications, telecommunication options, Internet connectivity, different computer operating platforms as well as increased reliance on third parties (e.g. vendors, partners) for delivering e-banking solutions (Rao et al, 2007). For this reason, IT security can no longer be regarded as a purely technical issue since it involves different stakeholders with different security behavior (e.g. investors, employees, society) and unfortunately, security is rarely at the forefront of stakeholders concerns, with the exception to comply with standards and/or legal requirements (Mellado et al., 2010). Particularly, IT security is a subset of information security (IS), a concept which has become an integral part of daily life and banks need to ensure that their information as well as the delivery of services are adequately secured (Saint-Gemain, 2005). For this reason, the purpose is to set the "desired state" of security to achieve the Information Security Governance (ISG) objectives for e-banking (Kondabagil, 2007; Solms and von Solms, 2009) namely:

1. Strategic alignment.
2. Risk management.
3. Business process assurance/convergence.
4. Value delivery.
5. Resource management.
6. Performance measurement.

It is time to describe the ITSG concept, a term which derives from the ITG (Information Technology Governance) term with an emphasis on the technological factor. In trace of its roots, Rastogi and Von Solms (2006) use a number of references such as Weill and Woodham (2002, p. 4) to define IT Governance as: ''specifying the

Figure 2. Position of e-banking in relation to e-commerce
Source: Adopted from Nsouli and Schaechter, 2002



decision rights and accountability framework to encourage desirable behavior in the use of IT," moreover, Van Grembergen (2002, p. 1) defines IT Governance as: "the organizational capacity exercised by the Board, executive management and IT management to control the formulation and implementation of IT strategy and in this way ensuring the fusion of business and IT."

There is a variety of definitions in the literature about the role of ITSG in general, however, most academicians and practitioners have lack of consensus in the definition and adherence of this term and some others use the term ISG to describe both the technological aspect in an institution (Monks and Minow, 2004; Kritzinger and von Solms, 2006; Rao et al., 2007). Moulton and Cole (2003) defined ITSG as the establishment and maintenance of the control environment to manage the risks relating to the confidentiality, integrity and availability of information and its supporting processes and systems. The IT Governance Institute (2006) supports that ITSG is compliment to ISG and is the set of responsibilities various stakeholders possess with the goal of providing strategic direction, ensuring that risks and resources are managed efficiently. In addition, Rastogi and Von Solms (2006) describe ITSG as a decision-making process including protection of stakeholder value and the most valuable assets of a financial institution. This definition matches well with this chapter's work since the objective is to examine how an ITSG program can benefit an e-banking system. To make this definition more accurate in the context of e-banking, we extend the aforementioned description and clarify the role of ITSG in e-banking as a "cognitive process that adds value to the business and IT infrastructure resulting in a set of actions among several stakeholders towards managing e-banking risks."

It is argued that the assurance of protecting information in financial services should not become an "one-man responsibility" but should be treated as a government issue (Abu Masa, 2010). For this reason, the term "Corporate Governance" (CG) is used to specify the relationships between, and the distribution of rights, information and responsibilities among, the four main groups of participants in a corporate body naming

1. Board of directors,
2. Managers,
3. Employees, and
4. Various stakeholders.

CG can also be defined as the system by which business operations are directed and controlled (Biri and Tentra, 2004). According to the same author, examples of international best practices for CG are: The King 2 Report and The Organization for Economic Co-operation and Development (OECD) Principles of CG. A highly related term that compliments and consists an integral part of ITSG, and thereby ISG, is the enterprise governance (EG) concept. According to IFAC (2004) EG is a more generic term, closely related to corporate governance (CG), referring to the organizational structures and processes that aim to ensure the organization's business objectives and IT sustains and delivers business value to the financial institution and stakeholders.

Moreover, relevant aspects of ISG include accountability to stakeholders, compliance with legal requirements, setting clear security policies, spreading security awareness and education, defining roles and responsibilities, contingency planning and instituting best practice standards (Monks and Minow, 2004). In other words, the scope of ISG is to describe the rules and procedures for making decisions regarding corporate affairs and the structure through which the corporate objectives are set. Moreover, it aims to fulfill the security objectives (confidentiality, availability and integrity), monitor corporate performance against those objectives and communicate it to the stakeholders (Long et al., 2008). However, there are sound examples that ISG has failed to live up to expectations due to high visibility failures such as Enron, Tyco, WorldCom, and Arthur Andersen

(Ralph Spencer Pool, 2005). For this reason, the need for ITSG has become apparent in an attempt to support ISG achieve its role. At its core, ITSG is concerned with two things namely delivery of value to the business and mitigation of IT risks (Moreira et al., 2008). A comprehensive definition of ITSG (Solms and von Solms, 2009) is as an integral part of enterprise (corporate) governance consisting of the leadership and organizational structures that ensure the organization's IT infrastructure sustains and extends the organization's strategies and objectives.

From a theoretical perspective ITSG is compliment to ISG, which is a subset of CG, but these two terms are not congruent. Particularly, ITSG focuses on the application of technology to business and how and to what degree this application provides value to the business. In practice, this concept reflects more the arguments of the technology itself (e.g. computer failures, technology obsolescence) rather than of the information itself. But because the primary purpose of any governance program within a financial institution is to hold management accountable for the assurance of information therefore, it must also assure the protection and ethical use of the information assets (Poore, 2005).

In literature there are attempts to build holistic ISG frameworks in order to simplify the variety of components and bring together the existing approaches such as (Tan et al., 2010, Trompeter and Eloff, 2001; Tudor, 2000). In this regard, wishing to further clarify the meaning of congruent terms such as CG, ITSG, ITG and ISG we use the framework as depicted in Da Veiga and Eloff (2007) (Figure 3) because it represents ISG based on four approaches namely, a) ISO 17799 (2005), b) PROTECT, c) the Capability Maturity Model, and the d) Information Security Architecture (ISA). The authors see ISG as a triangle pyramid (see Figure 3) shape consisting of three layers with distinct components.

INFORMATION SECURITY GOVERNANCE OBJECTIVES

According to literature (Moreira et al., 2008; Solms and von Solms, 2009) an effective ISG program, has six objectives summarized in the next bullets:

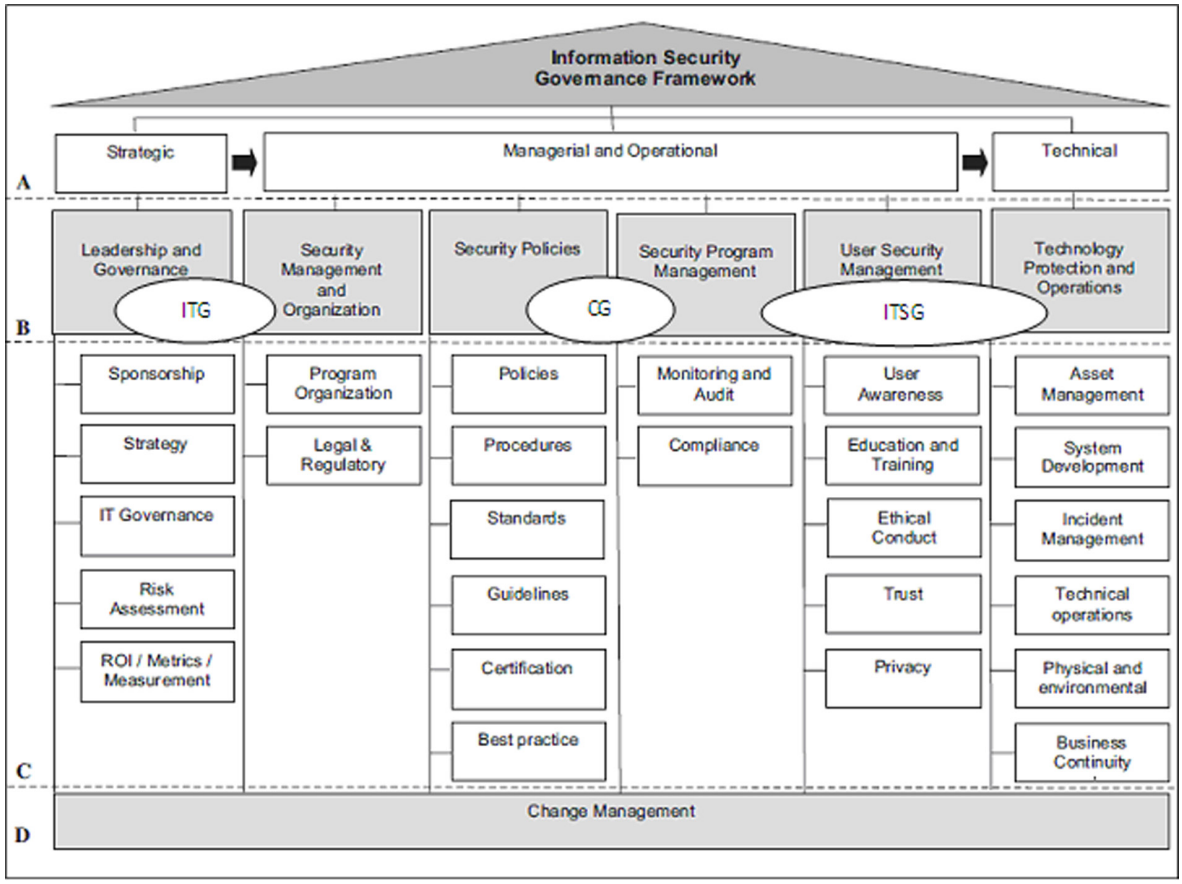
- **Strategic Alignment:** Aligning security activities with business strategy to support organizational objectives.
- **Risk Management:** Actions to manage risks to an acceptable level.
- **Business Process Assurance/ Convergence:** Integrating all relevant assurance processes to maximize the effectiveness and efficiency of security activities.
- **Value Delivery:** Optimizing investments in support of business objectives.
- **Resource Management:** Using organizational resources efficiently and effectively.
- **Performance Measurement:** Monitoring and reporting on security processes.

In this section, we will consider the most reputed methods used to describe the ISG objectives. Therefore, in our quest for which approach can "better" define objectives for ITSG, there are a number of approaches (Table 3) available to help define a desired state of ISG. Here "better" means "in a more holistic way." Reputed approaches to ISG objectives described in (Da Veiga and Eloff, 2007; Brotby, 2009; Koons and Minoli, 2010) are summarized.

Table 3. Security content application protocol (SCAP) components

Vulnerabilities (CVE)
Configurations (CCE)
Platforms (CPE)
Vulnerability Scoring System (CVSS)
Checklist Language (XCCDF)
Assessment Language (OVAL)

Figure 3. Information security governance framework
Source: Adopted from Da Veiga and Eloff, 2007



Sherwood Applied Business Security Architecture (SABSA)

Given the increasing complexity that surrounds the e-banking environment, the variety of cyber risks, the increasing regulatory pressures, and the ever more problematic security administration, one solution calls for the function of a "security architecture" as a tool of modern business capable to provide a framework within which complexity can be managed successfully. Particularly, it can offer simplicity and clarity through layering and modularization of business functions. Therefore, it is concerned with what the institution wants to achieve along with the environmental factors that will influence those achievements. A sound example of a "security architecture" is the Sherwood Applied Business Security Architecture (SABSA), which has been developed to address issues such as the design, management, implementation, and monitoring of business activities against security incidents. The approach is a framework that is compatible with and can utilize other IT Governance frameworks such as CobiT as well as ITIL and ISO/IEC 27001. The SABSA Model comprises of six layers each layer representing the view of a different player in the process of specifying, designing, constructing, and using business systems such as the Contextual Security Architecture - The Business View and the Conceptual Security Architecture - The Architect's View. The "security architecture" concept is closely

related to the "enterprise architecture" concept that typically provides a layered organized view of the IT assets. Such models include the Zachman Framework for Enterprise Architectures, The Open Group Architecture Framework (TOGAF) and the Federal Enterprise Architecture (FEA).

CobiT

CobiT (Control Objectives for Information and Related Technology) is an IT governance framework that allows managers to bridge the gap between control requirements, technical issues, and business risks as defined by the IT Governance Institute (ITGI, 2007). CobiT is developed by the Information Systems Audit and Control Association (ISACA) and enables policy development and good practice for IT control (Heschl, 2004). CobiT 4.0 was released in November 2005, CobiT 4.1 in 2007 and CobiT 5 is the latest strategic improvement towards enterprise governance of IT and address governance and management of information and related technology to achieve the business objectives of stakeholders. CobiT defines 34 high level control objectives under four domains namely

1. Plan and organize
2. Acquire and implement
3. Deliver and support
4. Monitor and evaluate.

CobiT also aims to fulfill the COSO requirements for the IT control environment. CobiT also supports Risk Management principles from ISO 27002, specifically, in the "PO 9 Control Objective" CobiT focuses on the assessment of risk for the scope to reduce them to an acceptable level. This framework can be used in ensuring proper control and governance over information and the systems that create, store, manipulate, and retrieve it. CobiT 4.1 is organized with 34 IT processes, giving a complete picture of how to control, manage, and measure each process. CobiT is, therefore, clear on the aspect of monitoring and ensuring compliance as part of ISG. CobiT appeals to different users namely from Executive management (to obtain value from IT investments and balance risk and control investment), to auditors (to validate their opinions and provide advice to management on internal controls). In particular, high level processes such as ME 1 and ME 4 and DS 5 are referring to Monitoring, Surveillance and Evaluating respectively.

The Capability Maturity Model (CMM)

This model is used to measure two things: The maturity of processes (specific functions) that produce products (e.g., identified vulnerabilities, countermeasures, and threats) and the level of compliance as a process with respect to the IATRP (InfoSec Assurance Training and Rating Program) methodology. In other words, a CMM is a measurement of the level of assurance that an organization can perform a process consistently. In this respect, a CMM identifies nine process areas related to performing information security assurance services. For each of the nine process areas, the CMM defines six levels of process maturity from Level 0 to Level 5. The higher the maturity levels, the more likely the process will be performed consistently.

ISO/IEC 27001:2005 and ISO/IEC 27002:2005

These are ISO standards suited to develop a management approach. Both using the ISMS processes and control objectives in ISO 27001; and the code of practice and controls in ISO 27002, these standards can support useful governance guidance and can be effectively used to establish the current state of security for an organization. Specifically, the ISO 27001 was published in October 2005 and as a standard defines the requirements for ISMS. An ISMS is a management system for dealing with IS risk exposures namely,

a framework of policies, procedures, physical, legal, and technical security controls forming part of the organization's overall Risk Management processes. ISO 27001 incorporates Deming's Plan-Do-Check-Act (PDCA) cycle have to be continually reviewed and adjusted to incorporate changes in the security threats, vulnerabilities and impacts of information security failures. The organization who adapts ISO 27001 can receive certification by an accredited certification body. ISO 27002 (aka ISO 17799) is used to describe two distinct documents: ISO 27002, which is a set of security controls (a code of practice), and ISO 27001 (formerly BS7799-2), which is a standard ''specification'' for an Information Security Management System (ISMS). This standard and code of practice can serve to provide an approach to ISG, although, to some extent by inference. That is, ISO 27001 is a management system with a focus on control objectives, not a strategic governance approach. The linkage between control objectives and strategic business objectives is not explicitly addressed. CobiT shares similarities with ISO 27001 and ISO 27002 regarding the depth of functional territory, although organized differently. In this respect, CobiT covers IT governance extensively. ISO 27002 is concerned with the security of information assets as a group and in its view this is well beyond just the IT systems. Therefore the standard implicitly view that the IT domain has the majority proportion of the organization's information assets and is charged with securing them. However, there is also a vast quantity of information that resides outside IT such as financial information. ISO 27002 identifies 133 security controls to satisfy 39 security objectives in order to address IS risk exposures in the area of confidentiality, integrity, and availability. ISO 27002 is an advisory document, not a formal specification. In particular, Clause 15 of ISO 27002 is totally dedicated to compliance and ISG objectives specifying controls related with legal requirements (control 15.1), security policies (control 15.2) and information systems audit compliance (control 15.3). ISO 27002 sees Risk Management as an essential part of Best Practices in IT and as a process to ensure Information Security Governance (Pretorius and Solms, 2004).

The National Cyber Security Summit Task Force Corporate Governance Framework (CGTF)

This is an ISG framework, formed in 2003, to promote global, regional and local corporate governance (CG) reform initiatives, improve institutional framework for good CG and facilitate improved CG practices in developing countries towards organizational compliance. In particular, item 3 in the framework refers to the security responsibilities for the Board, senior management and workforce towards compliance and governance objectives. The details described in the framework can be used to identify whether the security conditions exist, to what extend and how can the organization reach a higher level of compliance. CGTF supports that information security is not only a technical issue but also a governance challenge that involves Risk Management, reporting and accountability. As such, it requires the active engagement of executive management. (CGTF, 2004). CGTF has developed CG codes of best practice as generic recommendations with the aim to improve and guide the governance practices of corporations within a country's specific legal environment and business context.

THE ROLE OF ITSG IN E-BANKING

Prophetically, Dewan and Seidmann (2001) predicted the e-banking will consist of two classes namely very large banks and small niche banks. This distinction was clarified in a study from Southard and Siau (2004) in which depicted that smaller banks can actually compete with larger national banks at the same level through the use of technology. This capability to obtain a market

share regardless of size shows how the banking industry is polarizing with very large banks and small niche banks at either end of the spectrum. As Figure 4 illustrates, banks will need to focus their Internet technology strategy along this continuum. Movement along the continuum is only toward the upper left. This restricted movement foretells the future of e-banking. Banks will either maintain their positions or will be forced, through acquisition or merger, towards the upper-left segment of the continuum.

Information security (IS), which may include protection of consumers' personal data and safe transactions to prevent misuse, is paramount for the growth of any sort of online trade, including e-banking. This factor has been cited as the most critical success factor for e-banking among others (Shah and Siddiqui, 2006). The same author outlines the importance of upgrading the technological infrastructure of e-banking, not only with advanced legacy systems but also with policies and user management practices that will enable a safer e-banking environment. Along with IS the strategic nature of e-banking has been identified as a success factor for the adoption and usage of e-banking however, little empirical evidence exists in the literature (Gikandi and Bloor, 2010).

In a real-world context banks refuse to publish security incidents to the general public for fear of losing customers and reputation. In this respect, they frequently lack in a sound ITSG program capable to assure that e-banking will satisfy business and security requirements. An ITSG program can actually increase IT performance and Risk Management in e-banking through management or leadership processes where visibility to the effectiveness of the security program will be the key to verify results and promote a security culture. In other words, organizational accountability for security is the pathway to future security and business investments in the e-banking domain (ITSG, 2007). In Figure 5 we represent the role of ITSG in e-banking taking into consideration the e-banking continuum described in Figure 4.

This figure indicates that smaller banks that usually lack in resources contrary to larger banks, can build an ITSG framework which will differentiate them from competition and gain the

Figure 4. E-banking continuum
Source: Adopted from Southard and Siau (2004)

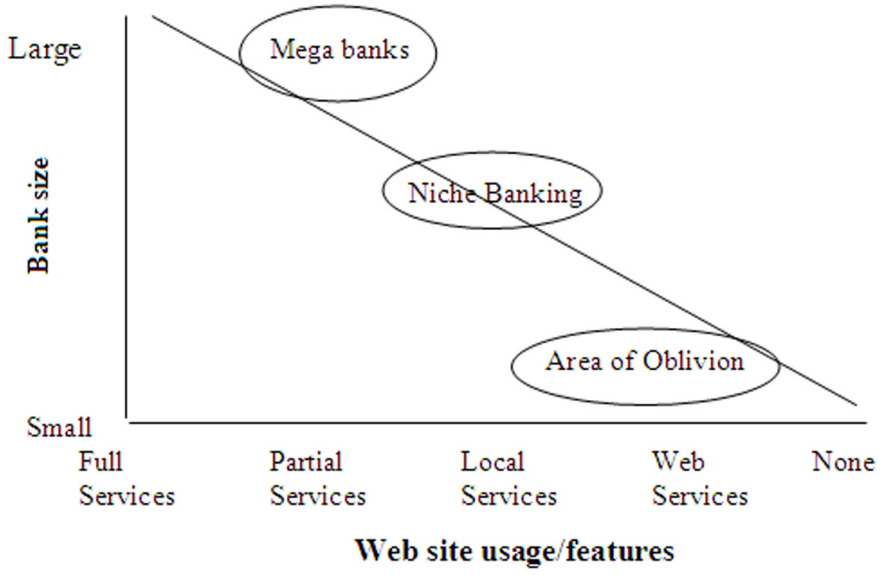
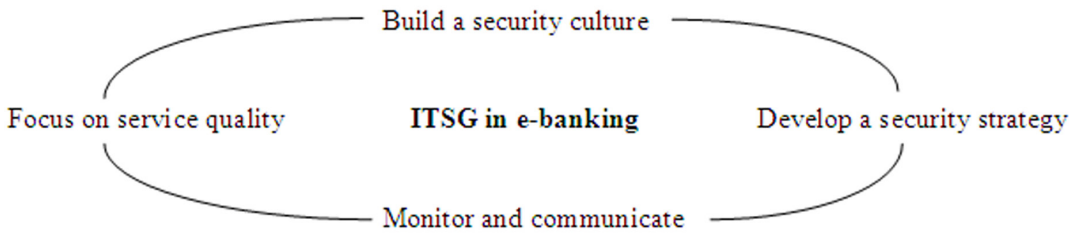


Figure 5. ITSG framework for e-banking



relative advantage in the e-banking services. Relative advantage is the degree to which consumers perceive a new product or service as different as and better than its substitutes in which the theory "diffusion of innovation" stands (Rogers, 1962).

In this respect the security culture requires active participation and a shared understanding among stakeholders in order to coordinate activities and adapt to changing circumstances including social, technological and business environment. Training and security awareness programs are of paramount importance from the Board of Directors to future customers but this may not be sufficient enough if banks do not publicize their improvements through the media and press in order to increase consumer confidence in e-banking (Gikandi and Bloor, 2010). The security culture highly depends on the security strategy the bank employs for e-banking. Small, niche banks focused more on external portals can create a dynamic and constantly evolving security strategy which will enable them to compete with larger banks. Most critical factors included in a security strategy usually are

1. Business integration,
2. Building e-trust
3. Obtain support from upper management and
4. Promote and protect the functional areas of e-banking (Shah and Siddiqui, 2006).

Within the security strategy, clear policies should be formed in compliance with industry-related standards based on the unique environment of the service provider.

Security is useless if it cannot be communicated in clear and unambiguous terms. This is highly important in e-banking since the complexity of technological advances usually distracts users and inhibits adoption of e-banking. For this reason, monitoring and communication can increase performance, user satisfaction and minimize security incidents. New trends in monitoring complex systems such as e-banking include automated methods with consistent metrics such as the Security Content Automated Protocol (SCAP) from the National Institute of Standards and Technology (NIST) which is described later.

Smaller banks that concentrate on local accessibility as their niche advantage rather than full e-banking services can enhance their e-banking status by focusing on the service quality. Contrary to larger banks which focus on mass-customization, small banks through their own unique security strategy can compete on a local level with a greater service quality. Key components that are considered important in the quality of service in e-banking, with an emphasis on Internet banking, include speed of service (e.g. download e-banking content), enhanced navigation and interactivity (Vachirapornpuk and Broderick, 2002).

Therefore, the main purpose of ITSG in e-banking is to offer a shield against the diversity of risks that can impact the security objectives of e-banking, however, the security objectives for e-banking do not include the usual triad namely the confidentiality, integrity, availability but extend to non repudiation and authentication of information (Basel Committee, 2003). Moreover, the role of

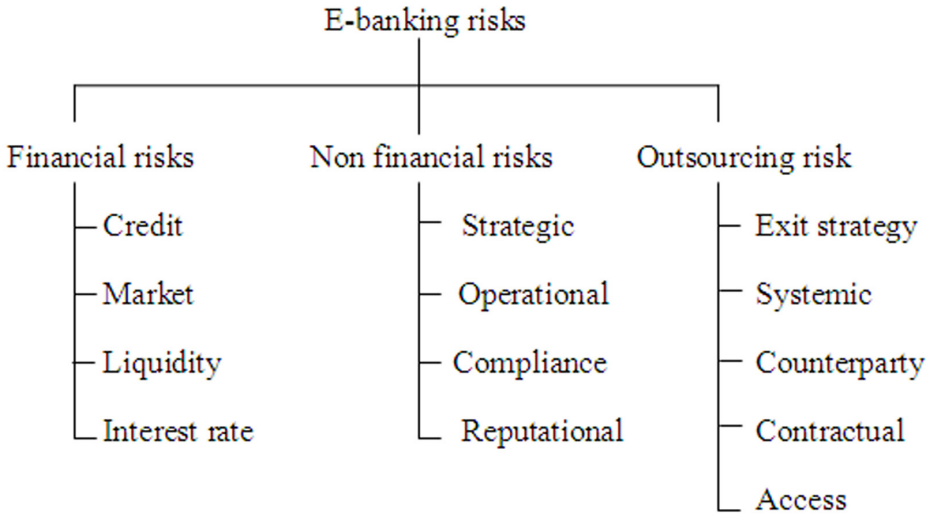
ITSG in e-banking is to combat risks and result in tangible benefits such as improved internal processes and controls, potential lower audit and insurance costs, market and customer differentiation and as tool for competitive advantage (Reserve Bank of India, 2011). An ITSG program for e-banking should rely on a well-defined organization structure to eliminate gaps between business and IT and also to minimize overlaps in technology management (Kondabagil, 2007).

E-BANKING RISKS

The vast majority of best known Risk Management methods, frameworks and best practices in e-banking suggest security policies, procedures, standards, and guidelines as the key components in order to provide management, support compliance and direct employees with what is expected as security behavior (Kouns and Minoli, 2010). Up to this point, there is no distinct Risk Management approach for this domain but only generic models modified to suit the e-banking environment (Tanampasidis, 2008). However, the e-banking environment is characterized as highly dynamic and involves perceptible changes such as product and service innovation, the unprecedented speed of technological change, the increasing dependence of banks on third-party service providers and the ubiquitous nature of open electronic networks. For these reasons the Basel Committee has acknowledged e-banking risks under two main categories with four subcategories each namely traditional risks or financial risks under credit, market, interest rate, and liquidity risk, and as inherently new risks or non financial risks namely operational, reputation, legal and strategic (Kondabagil, 2007). Figure 6 and following paragraphs provide an overview of the e-banking risks.

Strategic risks can derive when management does not efficiently plan, manage and monitor the performance of the e-banking services and products. In this regard, the need for an effective ITSG process will enable value delivery, performance measurement and management of IT-related risks. This will in turn create competitive advantage, increase customer satisfaction, and improve cost efficiency and innovation (Kondabagil, 2007). Factors influencing strategic risk include, but not

Figure 6. E-banking risks



restricted, to the adequacy of information systems, the increased dependence on outsourcing and third parties and the adequacy of technical, operational, compliance and marketing support. Particularly, outsourcing risk and third parties dependencies have become integral part of e-banking therefore, will be analyzed separately.

Operational risk can be defined under the Basel Committee principles as the risk of loss resulting from inadequate processes, people and systems or from external events. This broad definition is also found on literature as transaction risk, security risk or IT risk (Kouns and Minoli, 2010). Examples of operational risk involve but not limited to internal and external fraud, human factors, and erroneous transaction processing and product and service liability. Operational risk affects the financial institution in the ability to deliver e-banking services and has a direct impact on customer service and satisfaction. Major factors affecting the nature of operational risk are the structure and complexity of the bank's processing environment, complexity of supportive technology and failed outsourced processes. In this regard, a sound ITSG process can mitigate operational risks by acting as an internal control process thereby increasing business value.

Legal risk arises mainly from violations or non-conformance with laws, rules, regulations and ethical standards. Legal risk is also found in the literature as compliance risk (Shah and Clarke, 2009) where non compliance may indicate serious consequences including rating downgrades, monetary fines, enforced penalties, reputational damage and in extreme cases withdrawal of authorization to operate. E-banking is a highly dynamic channel that necessitates a strong governance program where the laws, rules, policies and procedures are clear and implemented in a daily basis. However, since e-banking is still evolving the risk associated with legal issues is considered highly complex because the changing technological environment and the cross-border transactions are deliberate causes for concern.

Reputational risk is described as the risk of significant negative public opinion where the image and the reputation of the bank are badly damaged. Factors affecting the reputation of e-banking system are, but not limited, the loss of trust due to an unauthorized activity on customer accounts, failure to deliver marketing objectives, confusion between services, lack on online communication and the modification of the bank's website (Kondabagil, 2007). For this reason, an ITSG program can help improve reputational risk by establishing monitoring procedures capable not only to prevent failures but educate the customer along with formal incident responses.

Financial risks such as credit, market, liquidity and interest rate risks are considered as traditional e-banking risks. However, their practical implications may be of a different magnitude for banks than non financial risks (Rao et al., 2007). This is true in the case where banks cover a variety of banking activities as compared to banks or solely Internet banks that focus exclusively on e-banking services. For example a liquidity risk may emerge if a bank lacks in resources and has inability to meet its obligations whereas credit risk emerges from a bank's inability to make payments as promised. It should be pointed out here that specific problems may occur at different risk categories. For example an internal fraud can be classified as operational risk but such an event also exposes a bank to reputational and legal risk. Table 1 summarizes the categorization of e-banking risks with the addition of outsourcing risk that will be explained in detail in the next section since it has the ability to affect traditional risks and also cause other risks in the e-banking environment.

OUTSOURCING RISK IN E-BANKING

Public confidence in e-banking is a cornerstone in the stability and reputation of a financial institution. Systems reliability and assurance of security requirements (availability, confidentiality and

Table 1. E-banking risks categorization

Strategic Risk: Associated risk with Board and management decision-making.	Non financial risks
Operational Risk: Associated risk with implementation of e-banking functions.	
Legal Risk: Associated risk with non adherence to law enforcement.	
Reputational Risk: Associated risk with damage to e-trust and image of e-banking services.	
Credit Risk: Associated risk with the bank's inability to meet its obligations in accordance with agreed terms.	Financial risks
Market Risk: Associated risk resulting from changes in market prices, interest rates, foreign exchange rates, equity and commodity prices.	
Interest Rate Risk: Associated risk resulting from falling bond prices due to variability of interest rates.	
Liquidity Risk: Associated risk with a bank's inability of funding.	
Outsourcing Risk: Associated risk resulting from third parties dependence.	

integrity) is therefore the responsibility of the bank even though the e-banking system is operated elsewhere, either domestically or abroad. The main drivers to outsource for banks have been the potential for cost savings and the need to focus on core competencies. Other benefits involve lower personnel costs, instant access to talent and the need not to do extensive training (Angelakopoulos and Mihiotis, 2011). For these reasons, e-banking systems are based not solely on operational efficiencies but also on third party service providers. Therefore, as the range and relative complexity of such outsourced activities increase, so are the risks.

Outsourcing can be defined as any activity that is not performed by the bank itself, but it is supported by a contracted third party (Rao et al., 2007). The most common way for a bank to mitigate outsourcing risks is via an ITSG process in due diligence. This means that a bank needs to ensure that the supported vendors are trusted third parties and through an ITSG process to assess the quality and reputation of their products and services. Particularly, the Federal Financial Institutions Examination Council (FFIEC, 2004) specifies recommendations about selecting a third party service provider when performing due diligence. The most important include

1. Qualifications and background of the vendor,
2. Financial status and reputation,
3. Adherence to legal and regulatory compliance and
4. Insurance coverage.

According to (Arshad et al., 2007) Information Computer Technology (ICT) outsourcing is an act of delegating or transferring a proportion of IT-related decision making rights, business process and material to external providers, who will be responsible to develop, manage and administer these activities in accordance with agreed upon deliverables as explicitly set in contractual agreement. Usually, most commonly outsourced are ISP services, web hosting, ICT application maintenance and support, ICT infrastructure, programming, e-business solutions, application analysis, application support end user, staff/user training, ICT security audit and security policy or standards development.

Outsourcing requires a contract or a solid deal with the third party to ensure smooth cooperation. Particularly the contract arrangements should indicate the type and the range of the arrangement between the bank and the third party namely the terms and conditions of the agreement, ownership of information, limitations, dispute resolution, cost of transition and periodic reviews of the

agreement. Normally outsourcing arrangements are classified into either IT outsourcing or business process outsourcing (BPO). More usually occurs the first arrangement since banks prefer to transfer the technological equipment outdoors (material outsourcing) and keep the business processes performed and managed internally (indoors). Another subset of outsourcing include the "offshore outsourcing" where the arrangement with the third service provider is based outside the bank's territory, mostly because to take advantage of the labor costs. Another type of outsourcing contract is a service level agreement (SLA). This type of contract emphasizes the requirements a bank anticipates from the vendor as far as bandwidth, response time and business expectations are concerned (Shah and Siddiqui, 2006). Outsourcing and the perceived risks affect significantly financial and non financial risks as described in the previous section. For example strategic risks may emerge from the inadequacy of a financial institution to control the activities of the service provider. Moreover, reputation risk may arise when the service provider fail to deliver the promised results and the quality of the service is poor. This has a direct impact on the e-banking system operability and of course on the reputation of the bank. In addition, legal risk (compliance risk) may also manifest if the service provider fail to abide and conform to legal and regulatory provisions. In this respect, operational risk also arises because bank's internal processes are downgraded due to the lack of support from the third party service provider.

Furthermore, outsourcing risk may give rise to *other* risks such as the "Exit strategy risk" which occurs when a bank has high reliance on a vendor and lack in exit strategies. In addition, *other* risks include the "Country risk" which may occur due to offshore outsourcing because economic, political, social and legal climate of the host country, where the service provider is located, prevent to fulfill the contract agreement. Outsourcing risk may also cause "Concentration and Systemic risk" which refers to the risk incidents that happen within the overall banking industry or sector. For example, if e-banking functional areas are dependent upon a certain number of external service providers this cause a number of banks to be indirectly dependent on the same service provider. Other types of risks include "Counterparty risk" which arises due to bad quality of services, "Contractual risk" when the agreement between the parties is not fulfilled as it should be and "Access risk" when the outsourcing arrangement hampers the ability of regulated entity to provide timely data and other information to regulators (Basel Committee on Banking Supervision, 2005). Managing outsourced services in e-banking imply the need for a sound Risk Management approach which will entail a comprehensive ITSG process for managing the whole range of e-banking risks including outsourcing and other third party dependencies.

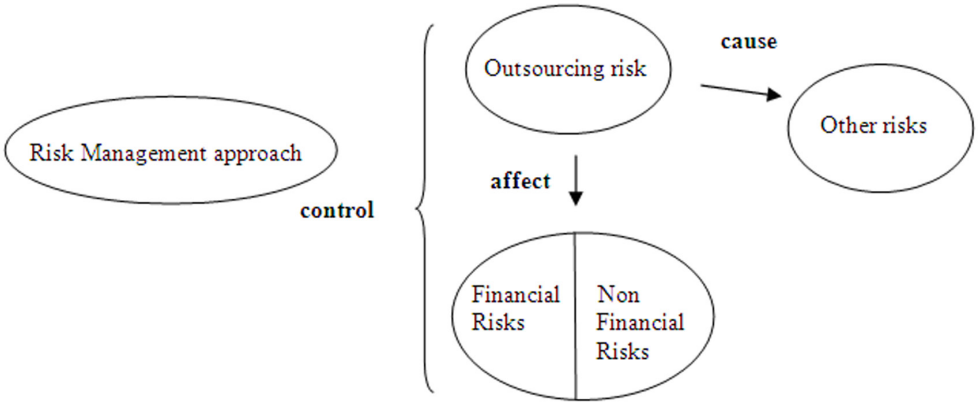
The role of ITSG will be

1. To enforce compliance functions,
2. Combat anti-money laundering,
3. Improve the reputation between the trusted parties and
4. Ensure the privacy of customer information.

Figure 7 shows that outsourcing risk affect traditional (financial) and nontraditional (non-financial) risks such as strategic risks but can also cause other risks such as "country risk" or "counterparty risk." Therefore, evaluation of outsourcing decisions should begin with a proper Risk Assessment namely

1. Identification of the role of outsourcing in the overall business strategy and objectives of the financial institution,
2. Analysis due diligence on the complexity and nature of the vendor,
3. Analysis of risk-return benefits of outsourcing against the vulnerabilities and threats that may emerge upon the possibility of a security incident (Arshad et al., 2007).

Figure 7. Outsourcing risk relationships



Financial institutions relying on e-banking systems should mitigate the overall risk by developing appropriate contingency plans thereby plan for processing alternatives. The contingency planning for outsourced activities could be part of a Business Continuity Planning (BCP). BCP needs to ensure the sustainability of the e-banking system itself and of the activities outsourced. The BCP is a comprehensive written plan of action provides with specific requirements for the staff and infrastructure and establishes the procedures necessary to deal with a disruption and recovery of business functions within the estimated timeframes. At the same time, a Business Continuity Management (BCM) is a trade-off process between costs and benefits and can be included in a wider Risk Management approach (Kondabagil, 2007).

RISK MANAGEMENT IN E-BANKING

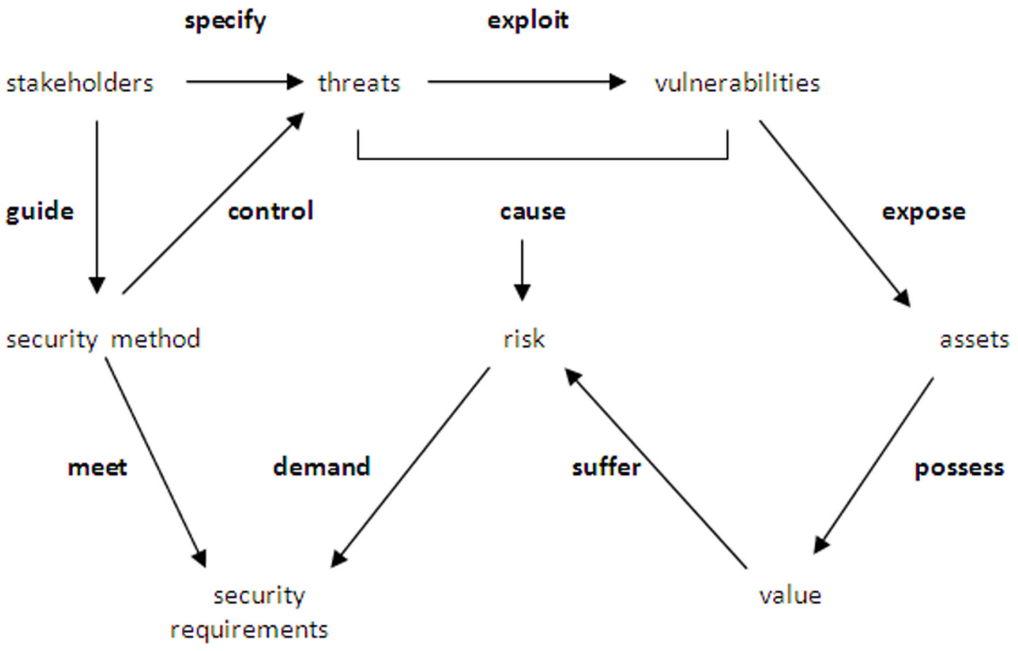
The Risk Management is considered by some resources (SANS Institute, 2003; BSI Standard 100-1, 2006) a discipline and part of information security management. This point of view is also shared by ENISA (2006), naming that Risk Management and Risk Assessment are major components of Information Security Management. Moreover, according to Peltier (2004), Risk Management is the process that allows balancing operational and economic costs of protective measures and achieving gains in mission capability by protecting business process that supports the business objective or mission of the enterprise. In a similar way, (Tsoumas and Tryfonas, 2004) defines Risk Management process as a framework for determining and implementing acceptable security controls. To take things from the beginning and rationalize the purpose of conducting a Risk Management approach in e-banking we must understand the elements and relationships of risk in e-banking. Therefore we explicitly refer to the definitions of risk elements in e-banking such as risk […] the possibility of any deliberate or undesirable action that could cause and result in a negative impact in the e-banking system or the combination of the probability of an event and its consequence (Kondabagil, 2007, ISO 27005). Threat as […] any situation or event that has potential to harm the e-banking system. Threats materialize when they exploit vulnerabilities (Kondabagil, 2007; ISO 27001). Vulnerability as […] a weakness, which is susceptible to be used by a threat to gain unauthorized access to information or disrupt processing. Vulnerabilities can be human errors, weakness in software from the information system, system security practices and procedures, internal controls etc. (Kouns and Minoli, 2010). The threat – vulnerability pairs leads to an unwanted risk, which is subject

of likelihood to be estimated or measured. This likelihood is the probability that a vulnerability will be exploited by a threat which leads to a harm or damage.

Figure 8 shows a semantic net of key concepts related to the management of e-banking risks. The relationship between the likelihood of a threat materializing vulnerability determines the intensity of the risk. An asset is anything that has value to the bank and is part of the e-banking system, therefore, requires protection. Assets can be categorized as *tangible* such as software, hardware and *intangible* such as reputation, user confidence. Normally, assets with higher value will suffer greater risk and will require more protection. The existence of risk requires the satisfaction of security requirements or objectives within the e-banking system namely the availability, confidentiality, integrity, authentication, and non-repudiation (Basel Committee on Banking Supervision, 2003). As most risks cannot be controlled or mitigated fully, some *residual* risk is normally left. Usually the residual risk is accepted by the bank, transferred or insured. The security method is a Risk Management process able to meet the security requirements and decrease the risk to an acceptable level. Stakeholders guide the security method in terms of analysis and results and also identify possible threats to e-banking. This notion is supported by (Solms and von Solms, 2009) who support that Risk Management should involve various stakeholders (from the Chairman of the Board to the youngest worker) to consider the different security behavior towards the system.

ISO 13335-1 defines Risk Management as the total process that entail identifying, controlling, and eliminating or minimizing uncertain events that may affect IT systems. CobiT and ISO 27001 support the utilization of Risk Assessments, as part of Risk Management, to determine what risks need to be mitigated and to what extent. Also CobiT and ISO 27002 sees Risk Management as a core element of an ITSG process. Risk Assessment in e-banking is […] the systematic process of identifying the nature and causes of risks to which e-banking activities could be exposed and

Figure 8. Relationship of key elements of risk in e-banking



assessing the likely impact and probability of these risks occurring (Aggelis, 2005). Moreover, according to Soliman (2006) Risk Assessment is an "objective analysis of the current security controls that protect an organization's assets and a determination of the probability of losses to those assets."

ISO 27001 and ISO 27005 regard Risk Assessment as part of Risk Management with risk identification, risk analysis and risk evaluation described as Risk Assessment phases. Risk treatment is more part of a wider Risk Management approach since it follows the assessment of risks in order to manage and control the residual risks (Brotby, 2009). The risk analysis is conducted to show that a due diligence is performed. Risk analysis also requires a deep knowledge of the financial institution and its surroundings as well as a deep understanding of strategic and operational objectives (Tanampasidis, 2008). For this reason, identification of information assets is required. The risk identification consists of the identification of critical assets to be risk-managed, threats, and vulnerabilities in order to control the consequences of risk event realization. To sum up, Risk Assessment in e-banking is a distributed process that involves steps including (Shah and Siddiqu 2006, Rao et al., 2007; ISO 27005):

- Identification of risk elements in the e-banking processing environment.
- Analysis and magnitude of the risk elements in the e-banking processing environment.
- Outsourcing dependencies and country risks in offshoring.
- Business impact analysis for the BCP in the e-banking processing environment.
- Compliance requirements for the e-banking processing environment.

Thereby, it within the responsibility of the Board and Executive Management to implement a comprehensive Risk Management approach. All risks that could possibly have a negative effect on the well-being of the e-banking system (if and once they materialize) are definitely the responsibility of management. Therefore, all levels of organizational management should be involved in the process of Risk Management (Tan et al., 2010). This notion is also supported by (Brotby, 2009) who suggest separate frameworks for each major category of risk in e-banking such as outsourcing risk, legal risk, operational risk etc. Therefore, an effective Risk Management framework should be built on a formal governance process, rely on individual responsibility and collective oversight, use a combination of advances analysis and be backed by comprehensive reporting and monitoring.

ITSG APPROACHES FOR E-BANKING

We expand important studies (Da Veiga and Eloff, 2007; Rao et al., 2007; Holmquist, 2008) to present the reader with the most commonly used ISG frameworks. The first eight in the row along with CobiT and ISO 27002 have evidence as direct fits in an e-banking environment (Kondabagil, 2007) however we expand into other well known approaches so as to evaluate (Table 2) which one can satisfy ISG objectives more holistically. We consider for comparison not only common ISG objectives/criteria such as strategic alignment and value delivery but also related IS criteria such as IS awareness programs and compliance as means to enhance the applicability of an approach to the specific needs of e-banking.

Basel Committee on Banking Supervision

The Basel Committee objective is to formulate broad supervisory standards and guidelines about the banking industry in the areas of system supervision and regulation. The Committee does not possess any formal supranational supervisory authority and does not enforce any kind of compliance

Table 2. ITSG approach/method comparison

ITSG Approach / ISG Objectives	Basel Committee	Joint Forum	ISO 27002	COBIT	CORAS	OCTAVE	COSO	PCI	FATF	CGC	FFIEC	CGTF	OECD	ISSA	CISWG	ISO 27005	ISO 38500	ISO 15489	NIST 800-39	SABSA	CMM
Strategic alignment	✓	✓	✓	✓	✓	✓	✓	x	✓	✓	x	✓	✓	/	/	✓	✓	✓	✓	✓	✓
Risk Management	✓	✓	✓	✓	✓	✓	✓	✓	x	✓	✓	✓	/	✓	✓	✓	/	✓	✓	✓	✓
Business process assurance	✓	x	✓	✓	✓	✓	✓	x	/	✓	x	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Value delivery	✓	x	✓	✓	✓	✓	✓	x	x	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Resource management	✓	x	✓	✓	✓	✓	✓	x	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Performance measurement	/	x	✓	✓	✓	✓	✓	x	✓	✓	✓	✓	✓	/	✓	✓	✓	✓	✓	✓	✓
User awareness & training	✓	x	/	✓	x	✓	/	✓	/	✓	x	✓	✓	✓	x	x	✓	✓	✓	✓	✓
Certification	x	x	✓	✓	x	x	x	✓	x	x	x	x	x	✓	x	x	✓	✓	✓	✓	x
Internal audit	✓	x	✓	x	✓	✓	✓	x	✓	✓	✓	✓	✓	x	✓	x	✓	✓	✓	✓	✓
Best practice	✓	x	✓	✓	x	x	x	/	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Corporate governance	✓	✓	✓	✓	/	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	x	✓	✓	✓	✓	✓
Incident management	✓	/	✓	x	✓	✓	✓	x	✓	✓	x	✓	✓	x	x	✓	✓	✓	✓	✓	✓
Business continuity planning	✓	✓	✓	✓	✓	✓	✓	x	/	✓	x	✓	✓	x	✓	✓	✓	✓	✓	✓	✓
Ethical codes	✓	x	/	x	x	x	x	x	✓	✓	x	x	✓	✓	x	x	✓	x	/	/	x
Compliance	✓	x	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

✓ = yes/= partial x = no

however it offers comprehensive coverage of Risk Management and ISG issues relating to e-banking such as operational Risk Management, outsourcing, business continuity management, anti-money laundering, privacy of customer information and audit procedures. Specifically in a 2003 report (Basel Committee, 2003), the Committee describes Risk Management challenges, requirements and principles in the area of e-banking. Risk Management principles for e-banking include

1. Board and Management oversight,
2. Identification and evaluation of security controls
3. Legal and reputational Risk Management principles.

Among the challenges the Committee considers to e-banking activities are the complex characteristics of the Internet delivery channel, the speed of change relating to customer innovation and the e-banking trends such as outsourcing diversify the applicability of these principles. Moreover, the Committee in a series of documents expects that such principles must be tailored to fit the exact needs of a bank.

The Joint Forum

The Joint Forum is considered as an advisory group formed under the guidance of the Bank for International Settlements, Basel, Switzerland and consists of three members namely the Basel Committee on Banking Supervision, the International Organization of Securities Commissions (IOSCO) and the International Association of Insurance Supervisors (IAIS). The Joint Forum mainly provides recommendations for the insurance, securities, and banking industries worldwide setting high level principles including Risk Assessment guidelines. Relevant principles about e-banking also refer to outsourcing of e-banking activities and to the importance of a Business Continuity Planning (BCP).

Operationally Critical Threat, Asset, and Vulnerability Assessment (OCTAVE)

OCTAVE stands for the "Operationally Critical Threat, Asset and Vulnerability Assessment," a risk-based strategic assessment and planning technique for IS developed by the Software Engineering Institute of the Carnegie Mellon University Computer Emergency Response Team. This framework is team-driven from business department and IT that cooperate to address the security needs of an organization. OCTAVE is also an asset-driven method and represents visually the range of threats during the evaluation in tree structures. Currently, there exist three variations of the OCTAVE method namely the original OCTAVE method as a comprehensive suite of tools, the OCTAVE-S for smaller organizations and the OCTAVE-Allegro as a streamline approach for IS and assurance. OCTAVE is based on interactive workshops to accumulate the different knowledge perspectives of the employees, the Board and Executives and other stakeholders for the purpose to measure current organization security practices and develop security improvement strategies and risk mitigation planning (OCTAVE, 2003). The OCTAVE approach is driven by two of the aspects: operational risk and security practices. Technology is examined only in relation to security practices. The OCTAVE also characterizes certain criteria as set of principles, attributes, and outputs. Important principles, among others, are the fundamental concepts driving the nature of the evaluation, for example, self direction, integrated management and open communication. OCTAVE also consists of three phases namely

Phase 1: Build Asset-Based Threat Profiles (organizational evaluation),
Phase 2: Identify Infrastructure Vulnerabilities (information infrastructure evaluation, and
Phase 3: Develop Security Strategy and Plan (evaluation of mitigation plans).

The OCTAVE methods acquire certain benefits namely it is *self-directed* since the method is guided by stakeholders, *flexible* since it can be tailored to suit a unique risk environment and, *evolving* since it moves the operational risk-based view of security into a business context supporting the organization's mission and priorities.

Committee of Sponsoring Organization of the Treadway Commission (COSO)

COSO stands for the "Committee of Sponsoring Organization of the Treadway Commission," formed in 1985 to sponsor the National Commission on Fraudulent Financial Reporting (the Treadway Commission) and in 1992 issued the Internal Control – Integrated Framework to help businesses assess and improve their security posture via internal control systems. COSO emphasize on the concept of Enterprise Risk Management (ERM) as a "process effected by an entity's board of directors, management and other personnel, applied in strategy setting and across the enterprise, designed to identify potential events that may affect the entity, and manage risk to be within its risk appetite, to provide reasonable assurance regarding the achievement of entity objectives" (Committee of Sponsoring Organizations of the Treadway Commission, 2004). In this regard, COSO is an enterprise Risk Management framework with four distinct categories namely

1. Strategic (high levels business goals aligned with its mission),
2. Operations (effective use of resources),
3. Reporting (in support to documentation) and
4. Compliance (with applicable laws and regulations).

In addition, the ERM framework is built on eight interrelated components namely

1. Internal environment,
2. Objective setting,
3. Event identification,
4. Risk assessment,
5. Risk response,
6. Control activities,
7. Information and communication and
8. Monitoring.

COSO and similar compliant frameworks (such as CobiT) are generally accepted as internal control framework for enterprises. CobiT is more accepted as an internal control framework for IT. One concern about COSO is the overwhelming nature which can appear for some organizations or systems, such as e-banking, as a heavy task especially if they lack a Risk Management culture (Kondabagil, 2007).

Payment Card Industry Data Security Standard (PCI DSS)

The PCI DSS is an acronym for the "Payment Card Industry Data Security Standard," released in 2004 as a joint effort between all major credit card associations to enhance payment account data security by driving education and awareness about cardholder data security. It includes guidelines for user authentication, firewalls, encryption, antivirus measures, policy issues and others (Koons and Minoli, 2010). In other words, PCI DSS is a widely accepted set of policies and procedures intended to optimize the security of creditcard holders. The latest version of the standard is PCI DSS 2.0 and institutions compliant with this standard show to customers that sensitive credit card information being processed is protected against fraud or financial terrorism. The standard contains twelve major requirements supported by 175 sub-requirements that apply to system components, which are defined as "any element attached to cardholder data environment" (PCI, 2010). The new version supports a prolonged lifecycle of

three years (compared to two years in the previous versions) to ensure multiple opportunities for stakeholder input and feedback in order to remain ahead of the threat landscape.

Financial Action Task Force (FATF)

FATF is an acronym for the "Financial Action Task Force," based in Paris, an inter-governmental body with the purpose to develop and promote policies to combat money laundering and terrorist financing. Forty Recommendations were developed in 1996 by FATF as a policy document issued to provide a set of security controls against money laundering covering from criminal justice to law enforcement (FATF, 1996). In 2001, the FATF expanded its mandate to deal with the issue of financing of the terrorism by creating the Eight Special Recommendations on Terrorism Financing. These recommendations are supportive set of countermeasures to the Forty Recommendations. The security objective of FATF is to set standards against "dirty" money from corruption, terrorism or tax evasion (Task Force on Financial Integrity and Economic Development, 2011). The purpose is to expand and strengthen the bank's ability to handle money from high level political officials, prevent the creation of anonymous companies that cannot be traced to a real person and stop tax evasion as a trigger crime for money laundering.

Corporate Governance Codes (CGC)

CGC is an acronym for "Corporate Governance Codes" issued from the European Corporate Governance Institute. Among the most important governance codes is the "Dey Report," developed in 1994, recommended 14 best practice guidelines for financial institutions. The guidelines provide directions for the Board of Directors about stewardship, strategic planning, Risk Management and internal audits. Another well recognized CGC was the Sarbanes-Oxley Act of 2002 in the United States. This was a legal framework for CG and internal controls. Other CGCs principles about CG are available as full texts from the website of the European Governance Institute. (www.ecgi.org).

Federal Financial Institutions Examination Council (FFIEC)

FFIEC is an acronym for the "Federal Financial Institutions Examination Council," established in 1979 authority with the purpose to set principles, standards, and report forms for the federal examination of financial institutions. FFIEC guidelines have replaced previously issued Banking Circulars BC-177 and BC-226 (Brotby, 2009). The FFIEC publication "Authentication in an Internet Banking Environment" is used by federal financial institutions for compliance with their obligations regarding e-banking systems operability (FFIEC, 2005). The objectives of the publication are to ensure proper identification and assessment of risks associated with Internet-based services as well risk mitigation actions to strengthen authentication controls for e-banking systems. This publication is consistent with the FFIEC "Information Technology Examination Handbook" which presents generic guidance for assessing information technology (IT) risks including corporate governance, internal audit controls and others.

A Platform for Risk Analysis of Security Critical Systems (CORAS)

CORAS is an acronym for "A Platform for Risk Analysis of Security Critical Systems" and is a model-driven risk analysis method developed by the European Union (EU) for the purpose to improve security during the systems design process (Lund et al., 2010). CORAS uses the Unified Modeling Language (UML) to model and target the analysis results in terms of reporting and documenting. CORAS provides a standard for the safety requirements of high security information systems, such as e-banking, supporting Risk Assessments process. The CORAS framework is

based on the Australian/New Zealand Standard for Risk Management AN/NZS4360:2004 and is inspired by the asset-driven strategy of CRAMM. CORAS has eights steps in the risk analysis namely

1. Preparation for the analysis,
2. Customer presentation of the target,
3. Refining the target description using asset diagrams,
4. Approval of the target description,
5. Risk identification using threat diagrams,
6. Risk estimation using threat diagrams,
7. Risk evaluation using risk diagrams and
8. Risk treatment using treatment diagrams.

CORAS covers an extensive range of security objectives from business context goals to IS compliance and legal requirements. The main concern about CORAS and other Risk Assessments, such as OCTAVE and CRAMM, is that the focus is not on trade-offs and calculated risks meaning that there has been no prior activity on determining what are acceptable risks based on budget, time and resource constraints (Houmba et al., 2010)

Organization for Economic Co-Operation and Development (OECD)

OECD is an acronym for "Organization for Economic Co-operation and Development" established in 1947 and its publication of "OECD Principles of Corporate Governance" recommends policies and actions against financial terrorism, tax evasion, money laundering and other actions that can harm the well-being of the society. The principles are a living instrument offering non-binding standards and best practices towards implementation of good CG. Examples of such principles are

1. Ensuring the basis for an effective corporate governance framework,
2. The rights of shareholders and key ownership functions,
3. The equitable treatment of stakeholders,
4. The role of stakeholders,
5. Disclosure and transparency, and
6. The responsibilities of the board.

The OECD also provides a forum in which governments policy makers, investors, corporations and other stakeholders worldwide can work together to share experiences and seek solutions to common problems (OECD, 2004).

Information Systems Security Association (ISSA)

ISSA is an acronym for the "Information Systems Security Association," a not-for-profit international organization of IS professionals and practitioners. The primary goal of the ISSA is to promote management practices that will ensure the confidentiality, integrity and availability of information resources. ISSA has published GAISP V3.0 in 2003 – the Generally Accepted Information Security Principles project - in an attempt to address the challenges that IS faces in front of new changes in regulatory compliance and upcoming risks. Among the benefits and goals of the GAISP are the comprehensive guidance on good CG practice throughout industry, commerce, and government globally; increase the effectiveness and efficiency of business, promote trade and commerce, and improve productivity through good IS practice; enable certification and self-policing of practitioners against a Common Body of Knowledge (CBK); help preserve public trust in the ability to leverage modern information technology while avoiding unintended consequences; ensure global harmonization of culturally diverse IS principles to minimize artificial barriers to the free flow of information that can result from conflicting standards and controls; promote increased customer confidence, trust, and acceptance of vendor products conforming to GAISP (GAISP, 2003).

Corporate Information Security Working Group (CISWG)

CISWG is an acronym for the "Corporate Information Security Working Group" established by Adam H. Putnam in 2003 as an actionable program on the development of information security and compliance metrics to monitor whether or not information security is being effectively managed (CISWF, 2004). The responsibility resides with the Board of Directors/Trustees in its role to adhere to a governance framework. Organizations follow the CISWG guidelines should conduct a Risk Assessment with emphasis placed on key corporate assets and functions. While total risk elimination is impossible, risk mitigation strategies should indicate the amount of residual risk as the level of risk tolerance to executive management in a meaningful way.

ISO/IEC 27005:2008

ISO 27005 is a key IS Risk Management standard that supports the concepts specified in ISO 27001 and is designed to assist the implementation of IS based on a Risk Management approach. ISO 27005 offers general advice for IS Risk Management in an organization supporting the requirements of an ISMS in conjunction with ISO 27001 and ISO 27002. ISO 27005 is applicable to all types of organizations and systems with an intention to manage IT risks that could compromise the organizations information security. ISO 27005 indicate how a Risk Assessment should be conducted without however indicating a certain type of method (ISO/IEC 27005:2008).

ISO/IEC 38500:2008

ISO 38500 is a "Corporate Governance of Information Technology" standard with the objective to provide a framework which comprises of definitions, principles and a model for the Board of Directors to use when evaluating, directing and monitoring the use of IT in their organizations. ISO 38500 is a high level advisory standard applicable to the governance of management processes (and decisions) relating to the information and communication services used. The purpose of this standard is a) to assure stakeholders for a sound CG program if the standard's framework is attained, b) guide directors in governing the use of IT and c) provide a basis of objective evaluation of the CG of IT. Among the principles supported by this standard include the responsibility of stakeholders, a Risk Management strategy for CG of IT and guidelines on human behavior (ISO/IEC 38500:2008).

AS ISO 15489:2002

ISO 15489 is a standard designed to meet records management requirements in businesses and governments. The standard is an Australian codification of the International Standard on Records Management and consists of two parts namely part 1 which describes generally the standard itself and part 2 which describes guidelines for the implementation of the standard. Specifically, part 1 describes a framework for record management with legal and audit considerations (ISO 15489-1:2001). Part 2 is a technical report supports part 1 by providing additional guidance on records management policies and the responsibilities to be defined and assigned to stakeholders (ISO 15489-2:2001). Additionally, the alignment of ISO 27001 to ISO 15489 strengthens the delivery of existing records management systems and its drivers. This is critical to build strong information governance projects, which enable risks to be assessed in an ever-changing information management world (Lomas, 2010).

NIST SP 800-39

NIST 800-39 Special Publication is a standard that describes a Risk Management framework (RMF) as a structured process for managing risks related

to the operation and use of information systems. NIST 800-39 has a similar approach with ISO/IEC 27001:2005 in Risk Management with focus on selecting and documenting security controls for information systems. Additionally, the RMF process describes risk-based protection strategies support the overall goals and objectives of organizations, can be tightly coupled to enterprise architectures, and can operate effectively within system development life cycles. The RFM framework is based on a combination of other NIST Special Publications (e.g. NIST SP 800-53, NIST SP 800-70 and NIST SP 800-37) to support assessment authorization and monitoring of information systems (NIST SP 800-39, 2011).

In Table 2 we compare each approach against a number of ISG objectives under a scale: "yes," "partial" and "no" - levels of fulfillment. For example, the Basel Committee of Banking Supervision for e-banking provides guidelines for monitoring and reporting, however, it does not provide performance measurement in the sense of exact metrics. Most of the aforementioned frameworks, best standards and Risk Management methods suggest security policies, procedures, and guidelines as key components in order to provide management, support compliance and direct employees with what is expected as behavior. Every single approach has its own strengths and weaknesses but none covers all ITSG components. Thereby, according to literature (Rao et al., 2007; Brotby, 2009) customization seems to be a solution when we deal with complex IT environments such as the e-banking environment. This table is intended to outline not only the baseline ISG objectives (namely the first six in the row) but also other objectives related to the concept of ITSG in order to enforce the applicability of a method in the e-banking domain. Thereby, the ISG Objectives and requirements depicted in this table define the internal configuration and management issues for each approach, to a level that is granular enough to be implemented.

EMERGING TRENDS IN MEASURING ITSG PERFORMANCE

In this section we provide insights about the emerging trends in measuring ITSG performance from the perspective of e-banking. Therefore, the significance of an ITSG program relies on constant monitoring, reporting and on the ability to articulate the results in clear and consistent metrics. However, the lack of performance-measuring systems for ITSG makes more prone the risk of incidents such as deficiencies in information systems, human errors and technical breakdowns. The key elements of a sound ITSG program in the e-banking context include a comprehensive Risk Management function capable to deliver the necessary checks and balances for the supporting infrastructure. In this regard, new trends in measuring ITSG include automated IT security methods, such as the Security Content Automation Protocol (SCAP) from NIST, to measure policy compliance evaluation (e.g. FISMA compliance).

SCAP consists of six inter-related components (Table 3) that shape the security requirements of the method namely

1. Automated vulnerability management,
2. Standardized reporting and
3. Conformity with the NIST Validation program.

SCAP components integrate information into an automated flow making security more measurable and comply with NIST federal security requirements (NIST, 2011). SCAP is usually being used to enable enterprise reporting within the U.S. Federal Government but for the purpose of this chapter we briefly describe the role of SCAP as an ITSG tool for generating stronger data control within an e-banking environment.

CVE (Common Vulnerabilities and Exposures)

CVE is a dictionary list of information security vulnerabilities and exposures. This standard defines "vulnerability" as a condition in a system that allows an attacker to

1. Execute commands as another user
2. Access restricted data
3. Pose as a different entity
4. Conduct a denial-of-service.

Every publicly known information security vulnerability or exposure has a unique identification code which includes the following characteristics:

- CVE Identifier numerical figure (e.g., "CVE-1333-1234").
- Status description (e.g. default password).
- Short analysis (e.g. remote command execution).
- Relevant references (e.g. OVAL-ID).

CCE (Common Configuration Enumeration)

Similar to the CVE purpose, CCE (2011) is a complementary standard with an aim to automate the management of vulnerabilities and also provide conformity with policies such as federal information technology security requirements (e.g. NIST). CCE can correlate configuration data across multiple information sources. Each entry contains the following five attributes:

- CCE Identifier numerical figure (e.g."CCE-5678-122").
- Short status description of the configuration issue (e.g. operating system).
- Theoretical Parameters of the tested system (e.g. time, space, specification and settings).
- Viable technical solutions to a given configuration issue (e.g. download a security update).
- Relevant references (e.g. OVAL-ID).

CPE (Common Platform Enumeration)

A method of naming software (e.g. vendor, title, version). Purpose is to foster automation towards identification of the IT platforms to which a vulnerability or element of guidance applies. CPE uniform naming specification encourages community members generate names for new IT platforms in a consistent and formal manner. A CPE Name is a unique collection of components (URI scheme name) given to a specific platform type that is made up of hardware, applications, an operating system, and other possible parts e.g. cpe://microsoft:windows:2000

CVSS (Common Vulnerability Scoring System)

CVSS is a universal open and standardized method for vulnerability scoring. CVSS uses multiple fields for evaluating the overall risk of an individual vulnerability. Two common uses of CVSS are: a) prioritization of vulnerability remediation activities and b) calculation the severity of vulnerabilities discovered on a system. Metrics used to score and prioritize a vulnerability are

1. Base Score Metrics (inherent characteristics of the vulnerability)
2. Exploitability Metrics (related exploit range, attack complexity, and level of authentication needed)
3. Impact Metrics (confidentiality, integrity, availability and impact value weighting)
4. Environmental Metrics (effect of a vulnerability on the system environment)

5. Temporal Metrics (elements about the vulnerability that change over time e.g. availability of exploit, type of fix available and level of vulnerability verification).

XCCDF (eXtensible Configuration Checklist Description Format)

XCCDF is a selection of documents or checklists for automated policy compliance. XCCDF uses an XML specification language to provide compliance with recommendations for minimum security controls under NIST guidelines. This method describes a process for measuring system configuration to a specified document or checklist. Audience of the XCCDF specification is primary *government* and secondary industry security analysts and product developers. Specifically, XCCDF goals are to a) generate documentation b) express policy-aware configuration rules c) support complex systems that may require complex rules d) support compliance scoring e) support customization.

OVAL (Open Vulnerability and Assessment Language)

A method for performing structured tests for reporting purposes. The purpose of OVAL is to create and update a database of system characteristics against OVAL definitions so as to evaluate a system for a specified machine state. OVAL supports, homogenizes and transfers the communication of security content across the whole system. OVAL actual use is similar to a common Risk Assessment process namely: identify and collect configuration data (OVAL System Characteristics); analyze a "specified machine state" such as a vulnerability (OVAL Definition schema) and document and report the final results about the state of a system (OVAL Results schema). OVAL uses a language (in XML format) for storing system configuration information in local systems.

In summary, the purpose of SCAP in measuring ITSG performance in e-banking is to

1. Identify the context of e-banking, existing and new risk elements (vulnerabilities and exposures) in automated fashion and constantly update the candidate list.
2. Analyze and configurate the data from the IT platforms used based on existing controls (policies and settings) and user-system interaction.
3. Score and prioritize ITSG performance.
4. Facilitate community involvement via an enhanced role as a cognitive resource and
5. Insure compliance with NIST 800-53 controls. This integration of efforts can help standardize a highly complex environment and provide real-time risk management.

Other metrics, such as the number of persons trained in security awareness, reduction in fraud losses, in audit findings, or in security incidents (e.g., computer viruses, reported unauthorized data), may also portray the effectiveness of an ITSG program (Solms and von Solms, 2009). Important factor is the experience and security behavior of different stakeholders and the use of the method to acquire the results (qualitative, semi, quantitative, combination).

In addition, attempts to measure ITSG performance using statistics tools, such as the Standard deviation, are not new however there are arguments against their effectiveness (Frankland, 2008). In addition, experts opinion may well be a more sufficient indicator of the effectiveness of an ITSG program however, opinion may be tampered with corrupted practitioners who rely on the FUD (Fear, Uncertainly and Doubt) principle. In this respect, best practices and international standards have already progressed in clearly defining a series of core metrics that characterize an ITSG program. For example ISO 27004 (ISO/IEC 27004:2009), part of ISO/IEC 27000 series, provides guidance on the development and use

of measures and measurement for the assessment of an implemented information security management system, in alignment with ISO 27001 and ISO 27002. Furthermore, NIST SP 800-55 makes reference to security metrics for IT systems and NIST SP 800-80 is a relevant guide for developing performance metrics for IS (US Department of Commerce, 2006).

At this moment, there is no formal approach used across financial institutions about the effectiveness of an ITSG program in e-banking. Any reasonable approach should be satisfactory as long as the methods used are consistent (Brotby, 2009). To be successful, the widespread e-banking sector would have to agree on the metrics to be used and the collection of statistics. In this respect, the effectiveness of an ITSG program should be measured by whether or not defined objectives are achieved. As with any other process, increased productivity and compliance, greater resource utilization, customer satisfaction and successful risk mitigation can be indicators of an effective ITSG program. Another indicator might be trends in strategic, proactive security activities as opposed to purely tactical, reactive ones. For this reason effective policies and procedures must be the foundation for reliable security metrics and measurements.

CONCLUSION

The way Bill Gates in 2008 announced that "banking is essential, banks are not" shows the traditional bank branch is going to phase out and gradually be replaced by e-banking services which will continue to attract new users in favor of lower costs, instant accessibility and reliable customer service. However, as the financial sector and society embraces these new opportunities they have to contend with issues and face challenges that arise in the context of e-banking risks. Therefore, the main question of this chapter is whether an ITSG program can mitigate e-banking risks, increase business value and achieve compliance with industry-related best practices without severe organizational problems. So far, no study has been carried out to establish the ISG objectives influencing the adoption and effectiveness of e-banking or to evaluate relevant ITSG approach features. Therefore, this study was designed to evaluate reputed approaches such as ISG frameworks, best practices and principles, international standards, internal controls and Risk Management methods against standard ISG objectives and additional criteria in order to indicate which approach/method suits best in e-banking. The results of the study indicate benefits and shortcomings each ITSG approach possesses. Customization may be the preferable solution according to each e-banking system security strategy.

Although the majority of financial institutions recognize the importance of an ITSG program as an indispensable factor for the success of IT and corporate governance, they usually equate effective governance with meeting the demands of regulators without recognizing that sound ITSG can actually boost business. In this regard, they avoid using consistent metrics to measure the effectiveness of an ITSG program. New trends in measuring ITSG effectiveness include collection of metrics in a standard and automated fashion using security methods such as SCAP. Particularly, each financial institution is different in risk appetite, scope, complexity and resources therefore analysis of existing frameworks and best standards may indicate further areas for improvement and future research in order to combat the diversity of risks and the different view of stakeholders. For example, it is interesting to see in a future research whether user awareness, education and training programs are in accord with ethical codes proposed from current ITSG approaches.

In this respect, since there is no officially accepted ITSG framework for the e-banking domain, this chapter focused on establishing a strong relationship between Risk Management in e-banking and ISG in order to govern the infor-

mation security in e-banking. To achieve this, we highlighted on the concept of Risk Management in e-banking and ISG. We further examined and compared elements from the most commonly used ISG frameworks, standards and best practices to a number of objectives/criteria that satisfy a sound ITSG program. This comparison leads us to safely propose that no single approach is a "best fit" for e-banking because the state of e-banking varies depending on a number of core capabilities such as country, culture and bank's reputation. Thereby, the main proposals for governing the information security in e-banking is to

- Develop an ITSG framework based on guidance from Figure 5 which can help banks govern information security in e-banking.
- Embrace a security strategy based on the results from Table 2 in order to fit each unique e-banking environment.
- Focus on outsourcing risk since this type of risk possesses more threat and impact for e-banking.

We summarize the chapter by supporting the argument set in the introduction that "Security is a management problem, not a technical problem" and in simple economic terms, it is cheaper and more effective to find and eliminate security problems when the system is developed rather than after have been employed (Villaroel et al, 2005). On the contrary, IS is an issue with multiple key dimensions (e.g. business, economic, culture, legal, politics, standards, technology) that need to be taken into account. Undoubtedly, the existence of many viewpoints ensures a holistic approach towards effectiveness of an ITSG program in e-banking but the final responsibility lies on the hands of the Board Management and stakeholders. In the foreseeable future there will continue to be a need for brick-and-mortar facilities because the current generation of customers still require the personal contact and also because there are still some functions such as cash withdrawals that require a physical facility and personnel. However, the future of e-banking is more than promising and depends heavily on the development of technology. Future research on the state of relationships (e.g. dependencies) among the multiple key dimensions (business, culture etc.) that affect an ITSG program, will offer useful insights about which dimension is more critical than other.

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Chapter 15
Systemic Risk, Stress Testing, and Financial Contagion:
Their Interaction and Measurement

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ABSTRACT

Despite the acknowledgment of the relevance of Systemic Risk, there is a lack of consensus on its definition and, more importantly, on the way it should be measured. Fortunately, there is a growing research agenda and more financial regulators, central bankers, and academics have recently been focusing on this field. In this chapter, the authors obtain a distribution of losses for the banking system as a whole. They are convinced that such distribution of losses is the key element that could be used to develop relevant measures for systemic risk.

Their model contemplates several aspects, which they consider important regarding the concept of systemic risk: an initial macroeconomic shock, which weakens some institutions (some of them to the point of failure), a contagion process by means of the interbank market, and the resulting losses to the financial system as a whole. Finally, once the distribution is estimated, the authors derive standard risk measures for the system as a whole, focusing on the tail of the distribution (where the catastrophic or systemic events are located).

By using the proposed framework, it is also possible to perform stress testing in a coherent way, including second round effects like contagion through the interbank market. Additionally, it is possible to follow the evolution of certain coherent risk measures, like the CVaR, in order to evaluate if the system is becoming more or less risky, in fact, more or less fragile. Additionally, the authors decompose the distribution of losses of the whole banking system into the systemic and the contagion elements and determine if the system is more prone to experience contagious difficulties during a certain period of time.

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1. INTRODUCTION

The importance of systemic risk is hardly disputable. Furthermore, it is at the heart of intense discussions for all regulators and financial authorities. Despite the relevance of systemic risk for the maintenance of financial stability and its recent popularity, it is still work in progress as we lack a universal definition and tools to measure it. However, after the unfortunate recent events, there is a renewed and shared interest by the national and international financial authorities in developing such necessary tools. One of the first challenges to overcome is the confusion on the field created by a few terms recently used, all of them associated with systemic risk: financial contagion, too-interconnected to fail, systemically important institutions, systemic losses, liquidity risk, financial networks, etc. Nevertheless, we argue that what is necessary is a common language to define systemic risk and simple, yet robust, ways of measuring it. We will adopt, for practical reasons the following definition[2]: Systemic risk can be broadly defined as consisting of two components: an initial (macroeconomic) shock and a contagion mechanism. The initial shock weakens one or several financial institutions and then contagion might arise as a result of such shock. Regarding contagion, there can be different channels of transmission. For example, the interbank market, just to mention one of the most widely studied transmission channels in the literature.

Having defined systemic risk, we can now focus on ways to measure it in order to manage it. In most standard risk models, there are risk measures such as expected loss, VaR, CVaR, etc. These risk measures can provide us with an idea of the size of the loss and its likelihood in a systemic crisis. Having said so, in our opinion it is very important to estimate, in the best possible and accurate form, the distribution of losses for the system as a whole, instead of adding up individual risk measures for each bank.

Financial contagion is one of the key elements on the definition of systemic risk; in fact, both terms were used in an interchangeable way in the past. Nowadays, it is clear that it is just one of the components of systemic risk, a very important one though. However, it is not easy to model or quantify financial contagion especially in the presence of indirect contagion or contagion through indirect links.

As in the case of systemic risk, there are many definitions for financial contagion due to the complex way in which financial institutions are related today. Additionally, it is difficult to verify empirically if financial difficulties are transmitted between financial institutions or whether the cause of financial distress is something different, like common exposures. Furthermore, it is necessary to distinguish between two different types of contagion: direct and indirect contagion. While direct financial contagion[3] has been studied widely by several central banks[4], indirect contagion[5] is in contrast difficult to estimate due to the inherent information problems faced by the financial authorities and researchers.

More recently, there has been a furor to study systemic risk by means of network theory to the point that the term "too interconnected to fail'' is widely known by international regulators. Even though, we believe that such approaches (graph theory and network models) are very useful in understanding the relevance of particular institutions due to their connections in the financial system, and to model the transmission of shocks they are not enough to model adequately systemic risk. The studies on payments systems and network theory are the perfect example of a successful application of such approach in the arena of systemic risk but they can only provide a limited view of the problem. The topology of the network of funds flows on the payment systems is very useful to identify some banks, which are relevant players in such a system, banks that can be considered of systemic relevance because of the role they play. Nevertheless, systemic risk is more than payment

systems. Systemic crises are typically extreme events regarding its severity but not on their frequency; as a consequence, such events belong to the tail of the distribution of shocks and this makes the modeling of such events particularly hard because non-linearities might be present.

In this chapter, two institutions are said to be connected if there is an exposure between them in any direction. We have already expressed that Complex Derivatives (CDS) exposures and indirect connections may be problematic. Additionally we think it is important to mention that from our experience problematic connections in banking systems are those:

- That for the bank which is lending, such connection represents an important percentage of its Tier1 Capital.
- When "overexposed"[6] banks have their lending highly concentrated (something that could be easily measured by using the Herfindahl-Hirschman Index).

Regarding indirect connections, it is difficult to avoid being exposed to the same types of shocks, because many institutions have similar business models, and all strive to invest in those areas with the best returns. The extent to which a certain type of shock can hit the banking sector could be limited by a high degree of diversification of each financial institution, which would limit the extent to which it suffers from a shock.

Regulation could be enhanced to ensure a "higher degree" of diversification in the financial sector. However, even this type of regulation may fall short form obtaining the desired results. For example, several very diverse companies may have foreign exchange debt and fail when the exchange rate changes abruptly rendering diversification regulation useless. Moreover, certain aspects of financial connections must be taken into account:

- Some activities are necessary and difficult to change. Banks which act like "hubs" in any network of the financial system are particularly important, as a failure or disruption of any of such banks could threaten the stability of the system. It could be difficult and costly to find a bank (or a group of banks) which can substitute such hub-like banks.
- Banks' connectedness may depend on aspects such as: Preference, peer monitoring costs and Too-Big-To-Fail (TBTF) moral hazard driven choices.
- It is commonly accepted that in normal times strong interbank linkages are fundamental for the functioning of the interbank market, for it is through these connections that liquidity travels across banking institutions. It is also accepted that in times of crisis these connections tend to dry up. There is a danger that any regulation that limits interbank connections may be costly in good times and not applicable in bad times.

In addition to the approaches on systemic risk measurement, contagion analysis and network models to study financial stability, there is another tool, which is becoming increasingly important for the financial authorities: Stress testing. Stress tests have become very relevant in recent times and can be considered as an almost standard tool in risk management. Many commercial and central banks, insurers and regulators perform stress tests as part of the risk management strategy of their respective institutions.

Stress testing can have several definitions but in Borio et al. (2012) the authors provide a simple yet useful one: "In its broadest sense, stress testing is a technique to test the stability of an entity or system under adverse conditions" (p. 2).

From the perspective of global financial regulators as well as from the perspective of central banks, stress tests are now an unavoidable tool for designing policies to preserve financial stability. Moreover, stress testing is a common part of the

financial stability reports elaborated by central banks. However, stress tests face some criticisms, as in the cases of Iceland and Europe the responsible of performing such tests have failed to identify serious weaknesses in the banking system.

It is important to note that from the financial stability perspective, stress testing have evolved from individual tests to system wide macroeconomic stress tests. This approach has been defined in Sorge and Virolainen (2006): "A system-wide stress test can be defined as a measure of the risk exposure of a group of financial institutions to an `exceptional but plausible' stress scenario" (p. 114).

From a financial authority point of view, the methodologies for the design of stress tests can be divided in two approaches: the bottom-up approach and the top-down approach explained in Sorge (2004) and Cihák (2007). The top-down approach is commonly used by central banks. In this approach, the purpose is to evaluate the impact of a scenario using aggregated data. Nevertheless, by using such an approach some relevant aspects could be ignored; for example, the interconnections between banks and the inherent contagion. On the other hand, under the bottom-up approach the objective is to evaluate the impact of a particular scenario by using data from the individual portfolios of the relevant institutions. The bottom-up approach should deliver more precise results; unfortunately, such an approach is limited by the lack of data and the complexity of the financial system.

In this work we employ the bottom-up approach as we possess relatively good information on the individual banks, the interbank market and the size of the Mexican banking system permits to perform computer simulations to estimate the distribution of losses for the banking system as a whole. It is important from our point of view the relevance of performing coherent system wide stress test as it has been pointed out in Sorge and Virolainen (2006).

The design of scenarios is a relevant aspect in stress testing. It is important to point out that the result of the stress tests depends heavily on the design of such macroeconomic scenarios. The real objective to design a stress scenario is that it must satisfy the conditions of being a severe event and its probability of occurrence is not zero. To this end, the aspects that generate the most vulnerability to the financial system must be identified and should be incorporated on the design of the stress scenario.

2. RELATED LITERATURE

There are different proposed methodologies to measure systemic risk and financial stability. For example, Goodhart et al. (2006) propose a general equilibrium model, which includes heterogeneous agents, endogenous defaults, and credit and deposit markets. In Segoviano and Goodhart (2009), the authors infer the multivariate density, which they use to derive relevant measures of distress for individual banks, groups of banks and the distress on the system due to an individual bank. In a different approach, in Boss et al. (2006) the authors use a simulation model, which they use to estimate the distribution of losses for the system as a whole. We have common features with this approach and the differences are due to different levels of development or availability of the information. Another relevant work is Aikman et al. (2009), in which the authors put in place a complex simulation model to study financial stability.

Additionally, there are some other works related to systemic risk, which follow totally different approaches; for example, in Barnhill and Souto (2008), the authors propose to use portfolio simulation to study systemic risk in Brazil. In Bartram et al. (2007), the authors find that the probability of a breakdown of the international financial system is small; although, things have changed recently and their conclusions may not hold any more. In Lehar (2005), the author proposes a risk

management methodology for assessing the risk in the regulators' portfolios (financial systems); however, the author discards contagion as an important element in systemic risk. Nevertheless, as we already said, things have changed a lot in recent times.

As it was mentioned in the previous section, there are two types of contagion: direct and indirect. Regarding direct contagion, the empirical literature on contagion through the interbank market found little evidence of contagion on their respective banking systems (Blavarg & Nimander, 2002; Boss, et al., 2004a; Boss, et al., 2006; Degryse & Nguyen, 2004; Furne, 1999; Graf, et al., 2005; Lehar, 2005; Muller, 2006; Sheldon & Maurer, 1998; Toivanen, 2009; Upper & Worms, 2004; Wells, 2002). Nevertheless, it is important to mention that most of these studies were conducted before the global crisis began. In any case, during the global financial crisis contagion did materialize; though due to the lack of proper information, we are unable to determine if contagion propagated through direct or indirect connections. As a result, it has become evident that measuring contagion through the interbank market alone is not enough, there are relationships not directly measured which were ignored in such studies (i.e. indirect contagion, similar business models, portfolios, etc.). Additionally, there are some instruments that are difficult to evaluate in times of crisis (complex products, credit default swaps, etc.).

On a different line of research on financial contagion and systemic risk, there has been a recent furor for research on network theory (graph theory) and financial stability. Moreover, the term "too interconnected to fail" it is now part of the financial authorities' language. It is common nowadays to see graphs and networks describing financial systems, trading networks, banking networks, interbank markets, etc. For example in Boss et al. (2004b), the authors describe the network topology of the Austrian interbank market; whereas in Iori et al. (2005), the authors study the Italian overnight market from the point of view of network theory, and Markose et al. (2009) illustrates how to develop a network model of the credit default swaps market. Despite such a current fame, there has been constant research in the past on network theory in finance and economics. However, there is now the general idea that such approach could be useful in understanding, measuring and managing systemic risk (Battiston, et al., 2009). In fact, bankers are fighting to stop recent proposals to implement policies to handle the Too-Big-To-Fail (TBTF) problem; instead, they argue that such policies should be oriented to the too interconnected to fail issue[6].

A lively discussion is taking place in global forums regarding such too interconnected to fail issue. Nevertheless, we believe that is not clear whether the network topology of the interbank market alone can be used to derive measures for financial stability or regulation purposes. Although the analytical models of Allen and Gale (2000) and some simulation models Nier et al. (2006) might disagree on this. We believe that the initial shocks, their likelihood, and the severity of the losses must be taken into account on the modeling of systemic risk. Otherwise, the conclusions extracted might be misleading.

In our simulation model we pretend to generate macroeconomic scenarios instead of generating "shocks" to the system as the risk factors are interrelated. For example, an increase on the interest rates would lead to a change on the market distribution of losses and would also lead to an increase on the defaults on the credit portfolio. Along this line, banks would be affected not only on its market portfolio but on its credit portfolio as well. Additionally, the second round effects like financial contagion could cause further losses to the banks.

We contribute to the field by proposing a practical and simple approach to estimate the distribution of losses for the banking system and we show some interesting measures which can be derived once such distribution is estimated.

Moreover, there is an important concern about how to measure the systemic contribution of a financial institution and with our approach it is possible to estimate the individual contribution of a particular institution to the systemic risk. Finally, our approach allows performing stress testing in a coherent way, even considering second round effects like contagion.

The remaining part of the chapter is structured as follows: Section 3 explains the simulation model in detail, Section 4 presents the results of the execution of the simulation model for Mexico, and finally, Section 5 draws some conclusions on the model and the results. Appendix A provides details on the macroeconomic model used.

3. SIMULATION OF JOINT LOSSES FOR THE BANKING SYSTEM

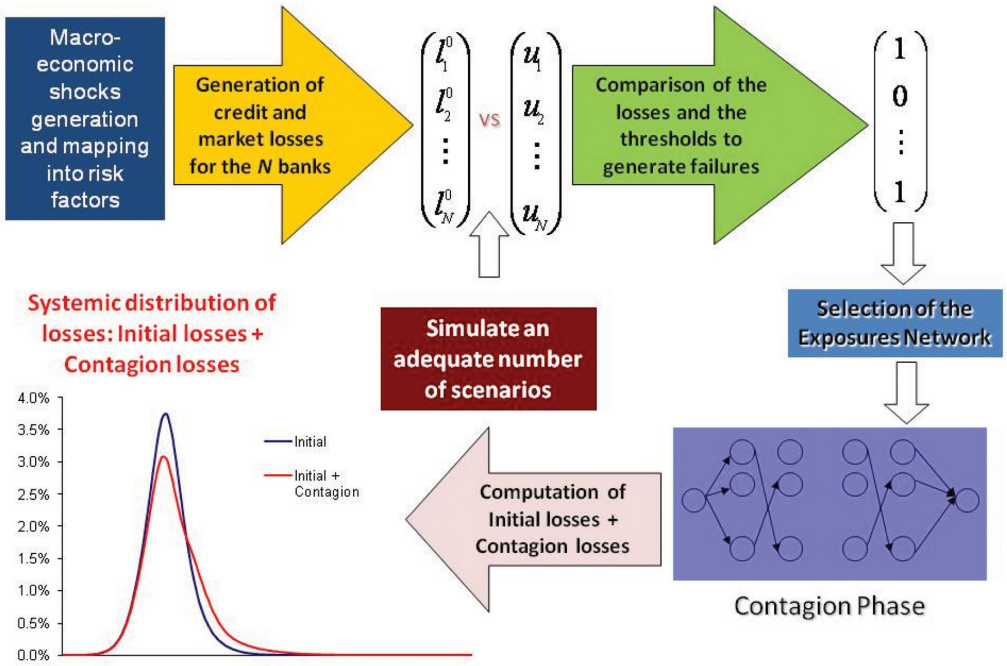
Distributions of losses are a very important tool in risk management because such distributions allow the risk managers to compute several standard and well understood risk measures. Figure 1 illustrates schematically the simulation algorithm used to estimate the distributions of losses for the financial system.

In order for us to estimate the distribution of losses for the system, we need to be able to generate joint losses. Joint losses are correlated by common or similar exposures and especially in times of financial hardship. We have developed a simulation model to allow the estimation of the distribution of losses of the system as a whole.

In previous works (Márquez-Diez-Canedo & Martínez-Jaramillo, 2007; Márquez-Diez-Canedo, et al., 2009), we have estimated the distribution of losses for the banking system first using just the probabilities and secondly by using the individual distribution of losses for each bank.

While this approach has several advantages such as relying on detailed historical information and using this information to generate adverse shocks to the financial system, it lacks a clear

Figure 1. The simulation algorithm



link between these shocks and real economic variables. It is not possible to know what kind of underlying events are causing the shocks being evaluated. It also faces technical and data challenges: to compute the joint distribution, a copula to merge market and credit losses distributions is used. A very important part of the process is the calibration of the copula with banks' financial data, such as ROA, in order to capture the joint dependence structure. This information is not fully available for all the banks in the system, mainly because new banks[7] have not been reporting these indicators for long enough, hence previous studies were limited to a subset of the banks in the system.

Having a model linked to economic variables overcomes some of these difficulties. For instance, each shock can be mapped to the realization of variables and vice versa. This is very helpful for policy analysis. It also makes the information requirements less demanding: banks' losses can be parsimoniously modeled as functions of the realizations of economic and financial variables, avoiding the calibration process as well as the computation of the copula, with the added advantage that, if properly modeled, market and credit losses are jointly determined hence capturing the interdependence between these kind of losses.

Once losses caused by the initial shock are determined, the contagion process takes place through the interbank market, and the final effect on the financial system as a whole depends on the magnitude of the effects caused by the initial losses combined with the interbank exposures and the interconnectedness of these exposed banks.

The interbank lending market plays a crucial role in liquidity transmission between banks. This market is the most recognized (or at least one of the most studied) channel for financial contagion. Moreover, there is a worldwide concern on characterizing the financial network of exposures in order to derive measures of financial fragility. However, such network changes constantly and some examples will be provided.

3.1. Data

The data used to obtain the system's distribution of losses for the Mexican banking system consists on the daily interbank exposures, the macroeconomic information used to build the macro model (GDP, interest rates, stock indexes, etc.) affecting credit and market risk factors, which have an effect on banks portfolio and Tier 1 capital.

Regarding the interbank market, the Mexican central bank has daily data that can be used to calculate the matrix of interbank exposures of the Mexican financial system, from January 2005 onwards[7]. The interbank exposures considered in this study comprise all the uncollaterized interbank lending, securities being hold, which are issued by other banks, the credit component of derivative transactions and credit lines as part of the interbank market. This type of information is rarely available with such detail, so it is possible to perform analysis without making assumptions that might be unrealistic.

For example, a common approach along this line of research is making the assumption of maximum entropy on the distribution of the interbank exposures but this is not a realistic one (as it is pointed out in Graf, et al., 2005[8], contagion in a network built under the maximum entropy principle and without such assumption), at least not in the Mexican case.

Figure 2 shows a typical network of exposures and in Figure 3 we can see only the largest exposures for such day. This is the network representing the interbank market that will be used during this work.

The exposures on the Mexican interbank exposures network vary widely as the Mexican banking system is quite heterogeneous. As one might expect, big banks tend to have larger exposures than medium or small size banks. It is also important to note that the size of the exposure by itself is not as important as the size of the exposure relative to the Tier 1 capital of a bank. Exposures, which represent an important proportion of the Tier 1

Figure 2. The Mexican interbank market (quantities are in millions of pesos)

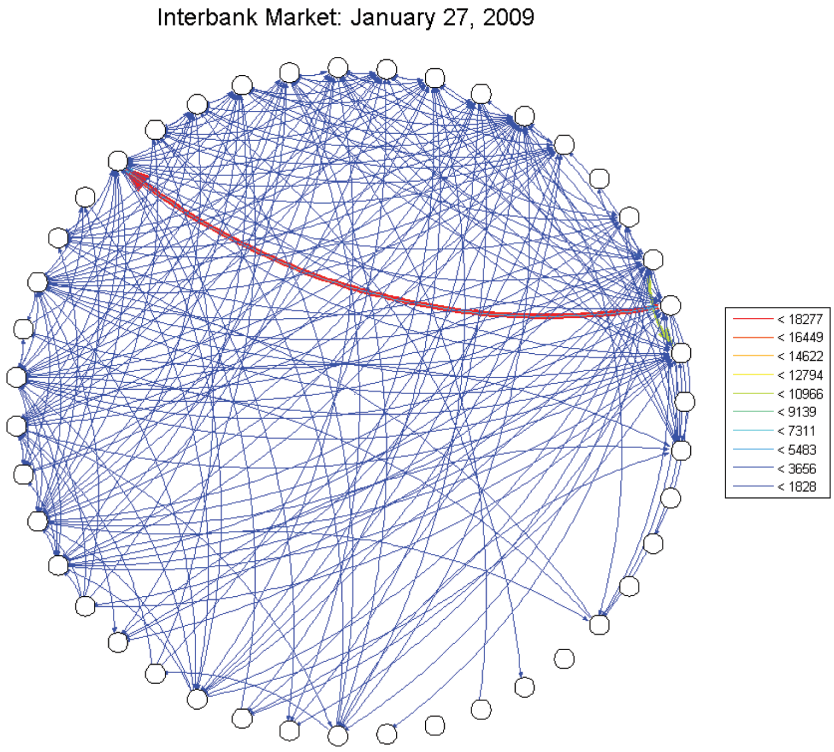
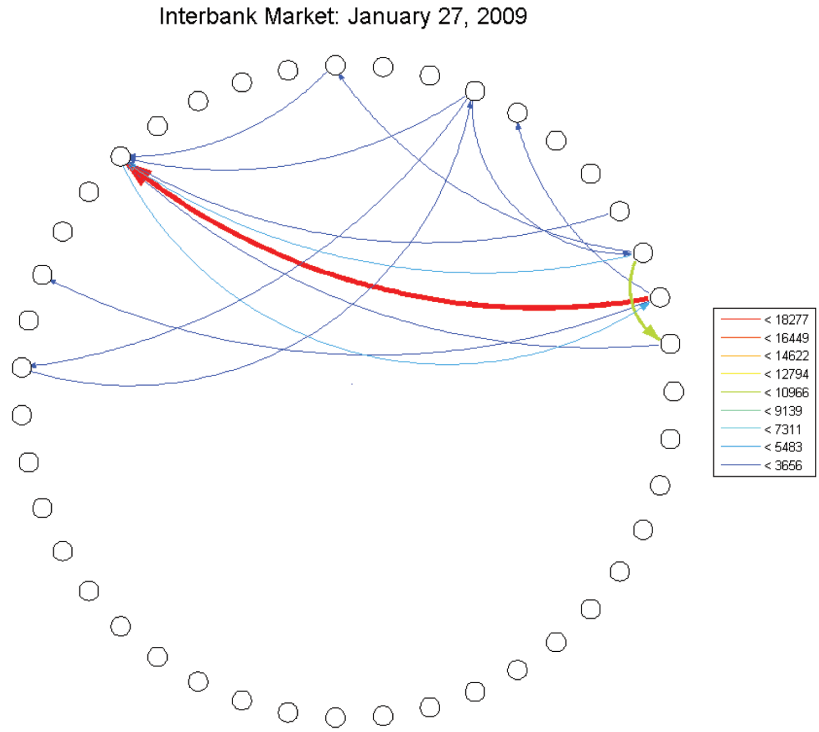


Figure 3. Large exposures at the Mexican interbank market (quantities are in millions of pesos)



capital, are the exposures, which could detonate contagion in the case of failure of the institution that is borrowing from a particular bank.

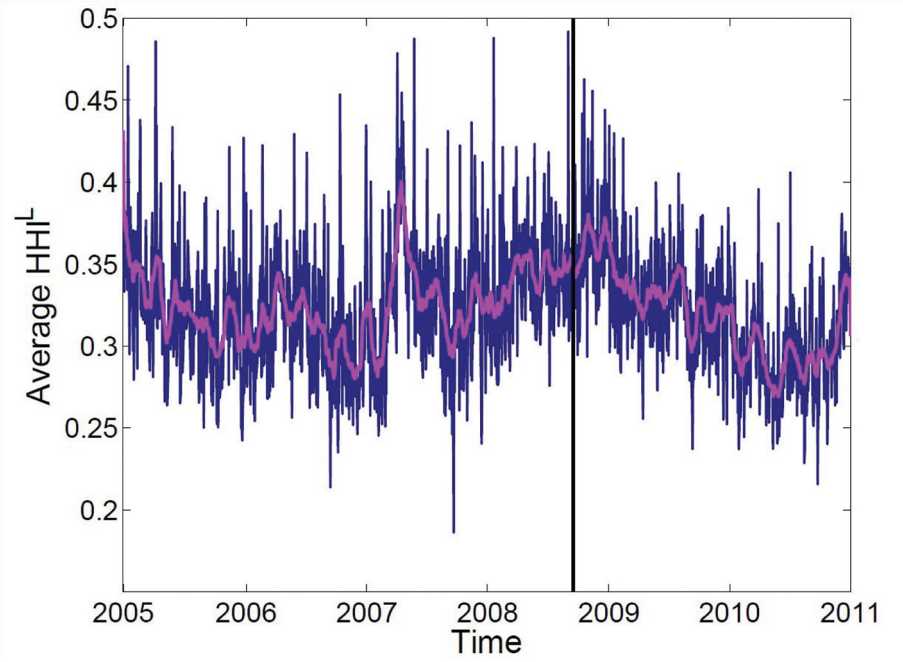
Concentration plays also an important part in contagion as it is possible that a bank which has many counterparts is lending or borrowing in a concentrated fashion and as a consequence is more vulnerable to experience important losses as a consequence of the failure of one of its borrowers. Moreover, it could also be problematic for a bank to have its funding sources very concentrated as the failure of an important lender could compromise the liquidity needs of a bank.

The Herfindahl-Hirschman Index (HHI) is a measure which is normally used in the context of competition in a market or industry but in this context we will use it as a measure of concentration. A HHI close to one is associated with a full concentration in lending or borrowing, whereas a HHI close to zero indicates a diversification among the counterparts of a bank. Figure 4 shows the evolution of the average HHI for the banking system. Although, a relative low concentration is shown in this figure, things are different from bank to bank. The range of possibilities goes from banks, which tend to diversify in lending or borrowing, to banks which lend or borrow in a highly concentrated fashion. Even a bank can behave differently on lending and borrowing having a HHI for lending close to one and a HHI for borrowing close to zero.

In addition to the HHI, one important measure, which can be useful to describe concentration and preference for lending and borrowing, is the Preference Index proposed in Cocco et al. (2009). This measure provides an estimate of the intensity of the relationship between two banks over a period of time and this is important in particular during periods of stress. This index can be computed from the lending or the borrowing side for each pair of banks, a PI close to one is associated with a high preference for a particular counterpart, whereas an index close to zero is associated with a low preference for a specific counterpart.

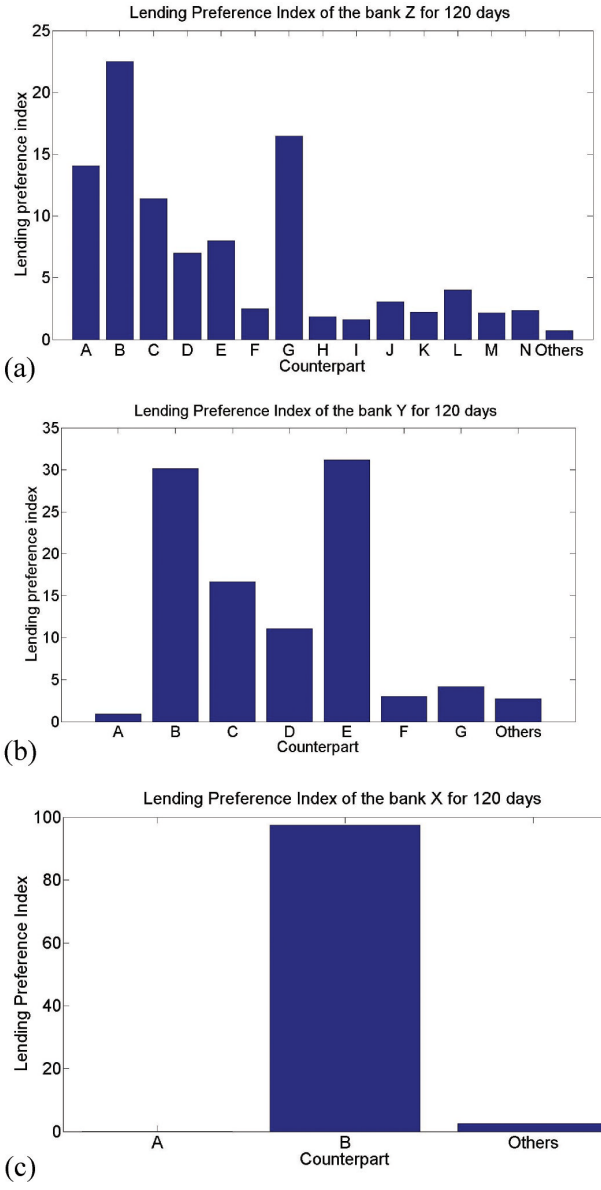
The time window plays an important role on the preference index, the authors in Cocco et al.

Figure 4. Evolution of the average HHI for the banking system



(2009) originally proposed a window of 30 days, in the examples shown here, a window of 120 days is used. Figure 5 shows the lending preference indexes for three different banks: X, Y, and Z. From this figure, it is shown that bank Z has its lending relatively diversified, but it has a strong relationship with bank B as of all the exposures this bank had in 120 days period, more than 20% were only with bank B. On the other hand, bank X had its lending highly concentrated in just one counterpart, whereas bank Y has two relevant counterparts, which account to around 60% of its exposures for the 120 days period of study.

Figure 5. Preference index for various banks: (a) Lending PI for a 120 days period for bank Z; (b) Lending PI for a 120 days period for bank Y; (c) Lending PI for a 120 days period for bank X



These two simple measures provide us with a clear idea of the heterogeneity in concentration for the system. It was shown that, despite the system's HHI being relatively low, concentration changes from bank to bank and even within the same bank from lending to borrowing.

3.2. The Link to Economic Variables

When the goal of the analysis goes beyond the day-to-day activity and is more policy oriented, it becomes more appealing having a shocks generation process that has a direct interpretation within the context of the real economy that complies with minimal consistency requirements and that has the flexibility to explore different sets of conditions.

Depending on the scope of the work and the type of analysis to perform, there are several alternatives to establish the link between losses and the real economy. Some approaches are more theoretically sound or more robust than others, and options range from highly sophisticated dynamic GE models to relatively simple statistical models. Ultimately, considerations such as information availability, and the trade-off between tractability and predictive power, led us to opt to model the links between losses and economic variables using structural Vector Autoregressive (VAR) models.

Despite its limitations, we considered it was the most suited approach given the characteristics of the problem we were analyzing. We are modeling the short-term effects of shocks in the credit and market portfolios of banks in order to evaluate the possible contagion effects that these shocks can have. We have enough information to compute very accurately the impact of these shocks in the market portfolio, and to take full advantage of this information, projections on a bigger set of variables was necessary. In order to parsimoniously consider all these variables, a relatively simpler model offered better alternatives. And this approach also considerably simplified the estimation of the joint distributions of market and credit. A little bit more detailed description of the model is covered in A.

It also offers relatively simple yet powerful alternatives to evaluate extreme conditions[9]. It is highly likely that "brute force" simulation leads to no occurrence of shocks with a systemic impact; but it is still of interest knowing the possible effect of some events on the tails of the distribution. The parametric assumptions and the structure of the model allow evaluating these events while assigning weights to their probability of occurrence. For example, if one is willing to explore what would happen if variable x increases in at least 4 standard deviations, a whole simulation process can be done conditional on x, and its probability can be determined.

Finally, the point to emphasize here is that, for policy analysis, it is necessary to have a link between the distribution of losses and the real economy, but the way to do it is far from unique. In general, the more data intensive the evaluation process of systemic risk, the more beneficial a relatively simpler model is.

3.2.1. Scenarios Generation

As described in Appendix A, scenarios are generated following the same spirit of impulse-response function construction methodology. Two sets of scenarios were generated (below there is a lengthier discussion about this): 30,000 "standard" scenarios, according to the underlying normal distribution (See Figures 6 and 7); plus 5,000 "tail" scenarios, where the different variables were set to receive severe shocks (for example, a simultaneous four standard deviations increase or decrease), and the rest of the random shocks were generated conditional on these realizations[10].

4. RESULTS

In this section, we will present the results of the execution of the simulation using the model de-

Figure 6. The loss distributions for the Mexican banking system

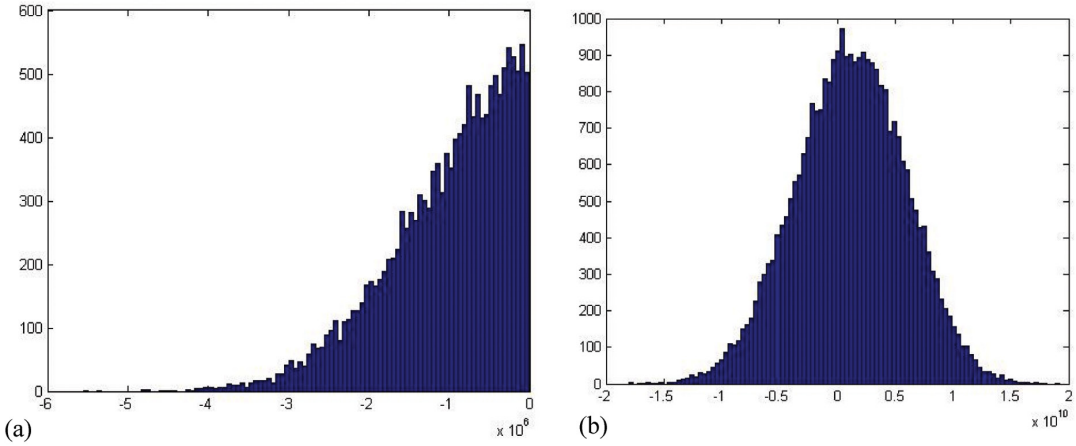
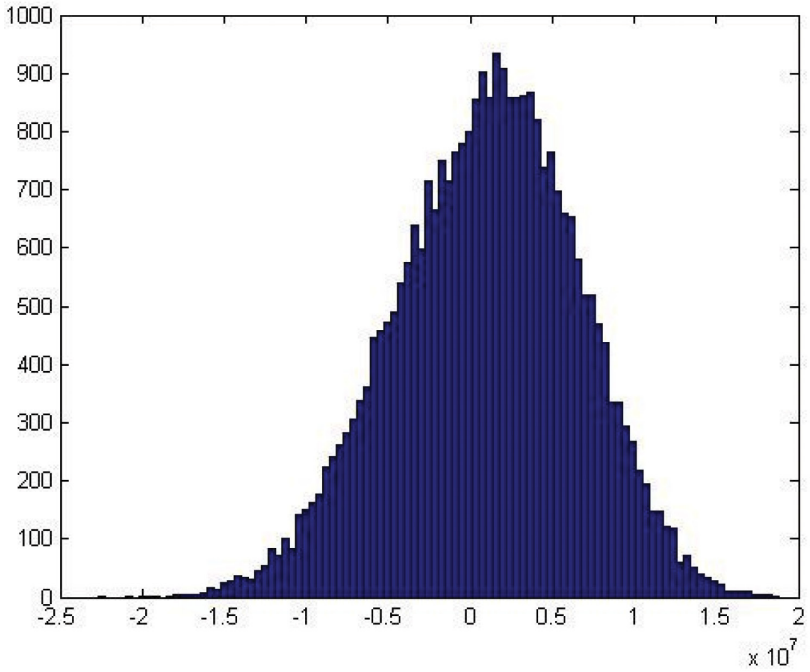


Figure 7. The joint loss distribution for the Mexican banking system



scribed in the previous section. We will present in first place the System's Distribution of Losses (SDL) originated from shocks to the macroeconomic model, which are translated into market and credit losses. Afterwards, we will show the effect on the distribution of losses of some stronger shocks and the derived contagion effects.

4.1. The System's Distribution of Losses

The first case described here is the estimation of the SDL by using 30,000 random shocks originated from a parametric distribution.

Such a distribution can be seen in Figure 7 where it can be seen that it behaves closely to a normal distribution, which is not surprising given that underlying the macroeconomic shocks was the assumption of a normal distribution. Given the levels of capitalization of the Mexican banks and the size of the generated shocks, there are no contagious defaults taking place under any of these 30,000 generated scenarios.

This is precisely one of the main problems in measuring systemic risk, events which threaten the system (*systemic events*) are located far in the tail of the SDL. One way to cope with such issue is to generate a huge number of simulations in order to populate properly the tail of the distribution. This is the way in which we proceed in the past[11]; nevertheless, under the current framework is not possible anymore as the valuation of the market portfolios for each bank takes a considerable computing effort.

Fortunately, given that we are able to generate the consistent scenarios from a normal random shock, it is possible to bias such generation process to more extreme regions and more importantly, it is possible to estimate the probability of such an event to happen. This characteristic of the simulation model is as important as the consistency aspect of the generation process as it is possible to bias the distribution of the generation process to focus on the tail of the distribution without simulating a large number of scenarios and preserve the consistency (in terms of the generated model) of the scenarios. Having said so, we can generate scenarios that, although they are highly unlikely, at least they are in the region of possible things. We believe that this approach is more promising that the individual idiosyncratic defaults which found little evidence of contagion in previous studies.

Figure 9 shows together the 30,000 "normal" scenarios next to the 5,000 "tail" scenarios. These figures illustrate in a stylized fashion the processes of biasing the scenario generation process to the tail of the distribution. A very important remark is that the tails of such distributions do not correspond to the same generation process, and the graphs are not actual histograms. However, we took such liberty for illustration purposes. In this distribution, we can observe the amplified[12] losses, which were generated by biasing the scenario generation process. Losses corresponding to such scenarios are derived from extreme movements in economic variables.

Figure 8 shows the realizations of some risk factors (Cete interest rate, output, delinquency rate, and the stock index) under these extreme conditions.

The resulting distribution from the merging of the above-described distributions can be observed in Figure 9. From this figure, we can observe how it is possible to populate the tail of the joint distribution with coherent scenarios.

Even though the capitalization levels of banks in the Mexican financial system is high, contagion under the 5000 "extreme" scenarios did occur and the case is worth exploring in detail. Figure 10 shows the distribution of losses under different types of shocks. From this figure, it is possible to see the sensitivity to different factors under stress as well as to determine which factors have larger impact for the system as a whole.

4.2. Systemic Relevance of Financial Institutions

At the core of macro-prudential regulation is the determination of the participation of an institution in the systemic risk. There are many recent proposals, which vary widely on their underlying models. In Tarashev et al. (2009), the authors borrow the Shapley value concept from game theory, although it is not clear if such concept can be directly used in the context of systemic risk. A different stream of work is the one followed by the Financial Stability Board (FSB) in which it is proposed that the condition of systemic relevance of a financial institution is associated with size, lack of substitutability and interconnectedness (See FSB, 2009). Following a totally different

Figure 8. Realizations of some risk factors under the "tail scenarios"

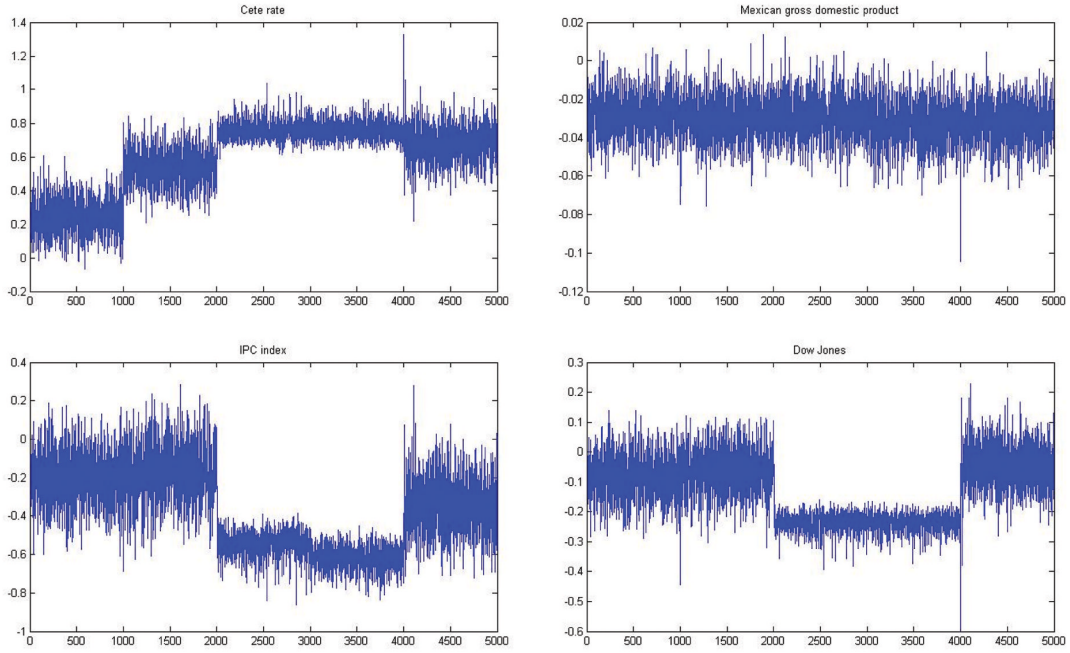
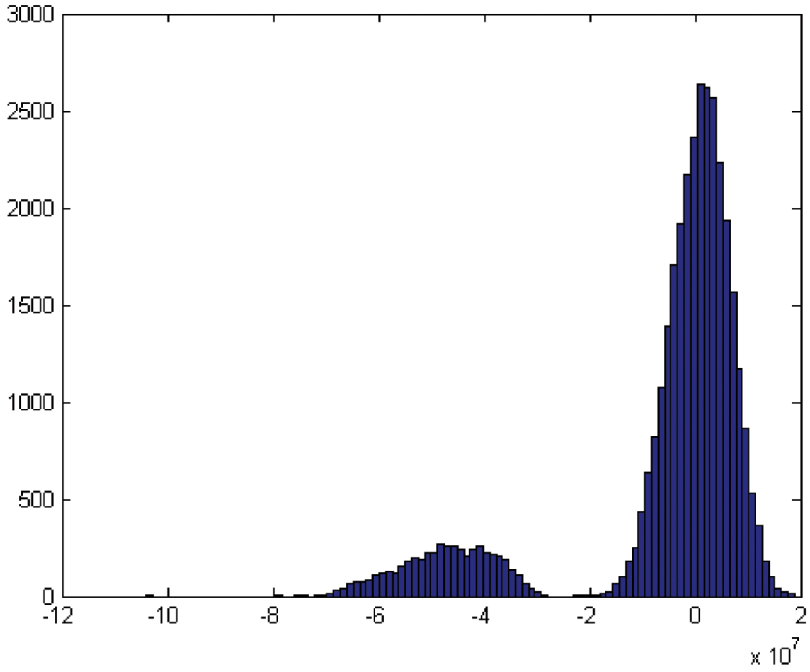


Figure 9. The distribution of losses for the Mexican banking system 35,000 scenarios including 5,000 biased scenarios



approach Adrian and Brunnermeier (2008) define a risk measure which they call the CoVaR[13]. Such value can be defined as the Value at Risk (VaR) of financial institutions conditional on other institutions being in distress. In this work, we are interested on the VaR of the banking system conditional on particular banks being in distress.

We find that the CoVaR is probably the best from the above-mentioned measures as it can be easily derived once the SDL has been obtained[14]. Moreover, such distribution and measure encompasses the elements proposed in FSB (2009) as in our proposal the interconnectedness element is implicit in the estimation of the contagion process.

The precise definition of CoVaR can be revised in Adrian and Brunnermeier (2008) but in order to illustrate in a graphical way how such measure works we will show some interesting graphical representations. Figure 11 illustrates the distribution of losses for the system and the distribution of the system given that bank B3 is in distress. Figure 12 shows the same distribution of losses for the system and the distribution of losses of the system given that bank B2 is in distress. Finally, Figure 13 shows the same case but using bank B1 to condition the distribution of losses for the system.

From the previous figures, we can see that the contribution to the risk of the system is different for each bank. For example, bank B3 is the one from these three banks, which contributes more to the systemic risk while bank B1 is the one, which in fact has a negative correlation with the system in terms of losses when one is located at the tail of the distribution. If we compute, as it is proposed in Adrian and Brunnermeier (2008), the difference between the *CoVaR* and the unconditional financial system *VaR*, $\Delta CoVaR$, such measure captures the marginal contribution of a particular institution to the overall systemic risk. Although, $\Delta CoVaR$, does not measures the contribution of an institution to the overall risk, it is important from the systemic risk perspective and contribution as it captures the expected participation of institutions

Figure 10. Losses under stress scenarios

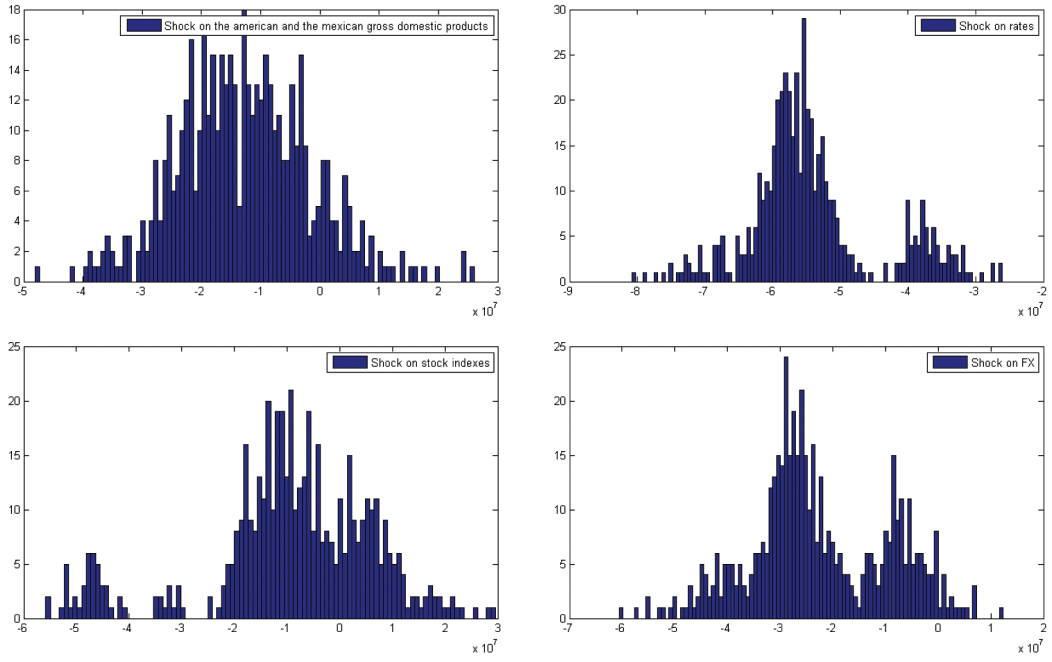


Figure 11. The distribution of losses for the system and the distribution of the system given that bank B3 is in distress

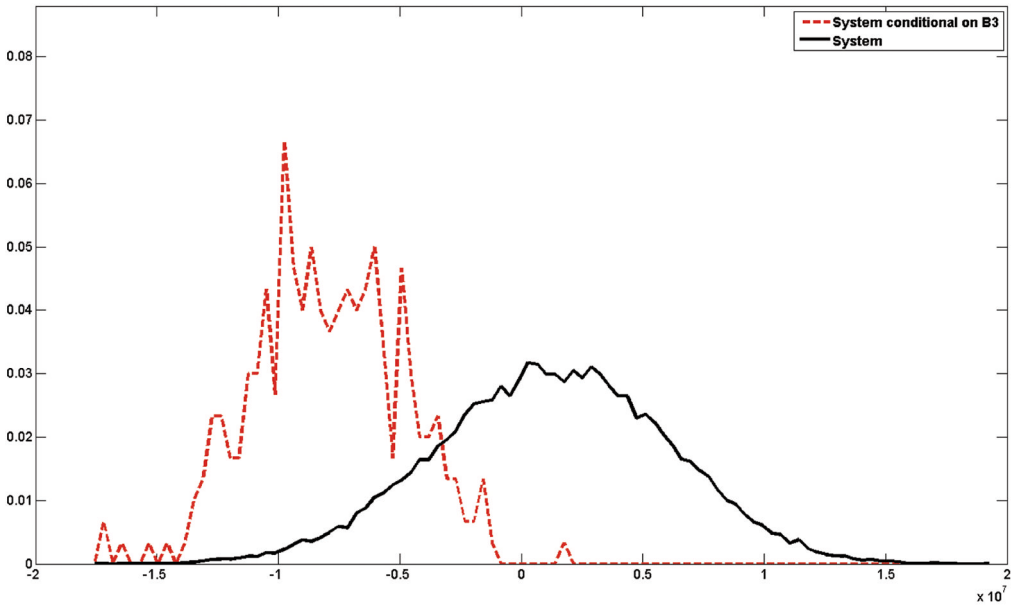


Figure 12. The distribution of losses for the system and the distribution of the system given that bank B2 is in distress

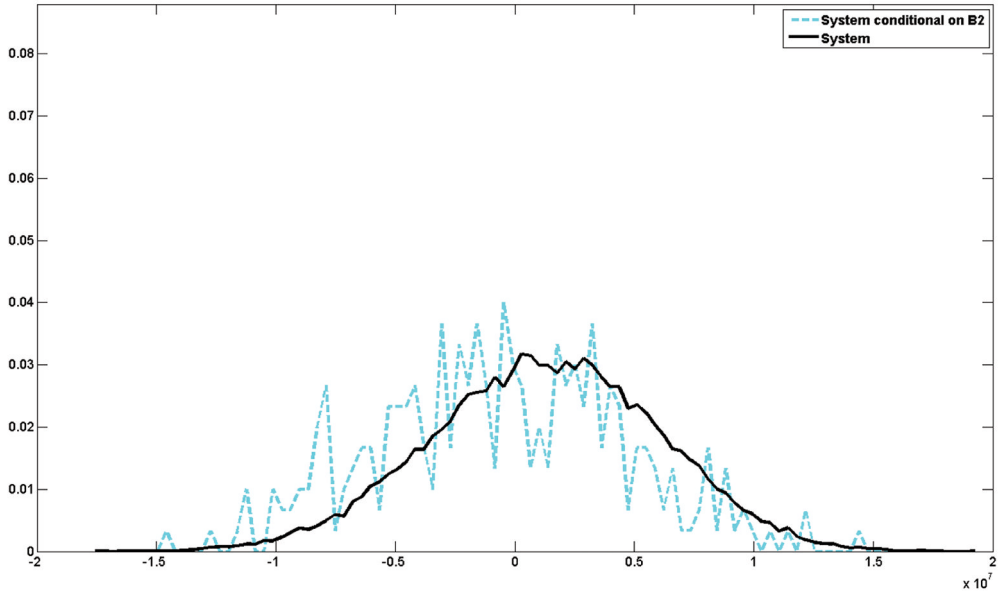
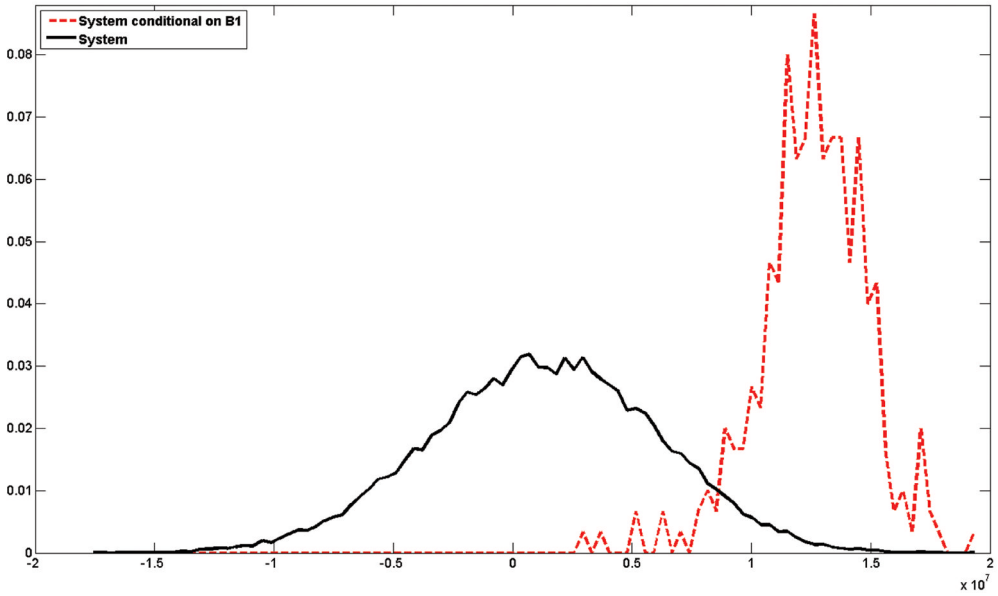


Figure 13. The distribution of losses for the system and the distribution of the system given that bank B1 is in distress



in systemic events, which are the relevant events in the study of systemic risk.

Finally, from our experience and given that there is not a proper counterfactual available to compute other systemic risk measures; this measure could represent the best option for measuring the contribution to the systemic risk by financial institutions, computed either by estimating the SDL or by quantile regression. This measure, $\Delta CoVaR$, is a tractable alternative to focusing on several different measures, which can be difficult to combine.

4.3. The Contagion Process

The Mexican financial system is very well capitalized. On average, its capital ratio is of around 16%, with a minimum of 11.6% and a maximum of 424%. This explains to a great extent the lack of sensitivity to shocks because banks are able to absorb losses without risking individual solvency and avoiding triggering a contagion process.

Nevertheless, when considering the "tail" scenarios a very interesting case of study arose. After a very severe shock in the stock market index, and foreign and domestic interest rates the regulatory capital of three banks went below the minimum requirement[15]. These banks were small banks in the system; in Figure 14, we observe such troubled banks in black, the exposed banks to them in white, and the banks with no exposures to such banks in gray. The composition of its portfolio made them practically immune to credit effects, so this was purely a market risk effect. If this were an idiosyncratic failing process, it was likely that this failure would have gone unnoticed.

The interesting part occurred through the contagion phase: the magnitude of the shock led to failure to three banks, but several of the remaining banks were weakened by it, to the extent that the failure of these banks to honor its interbank obligations caused the failure of a medium sized bank and some small banks. This in turn led to the failure of a set of small and medium banks

Figure 14. Interbank exposures network on June 30 2011 after an initial shock

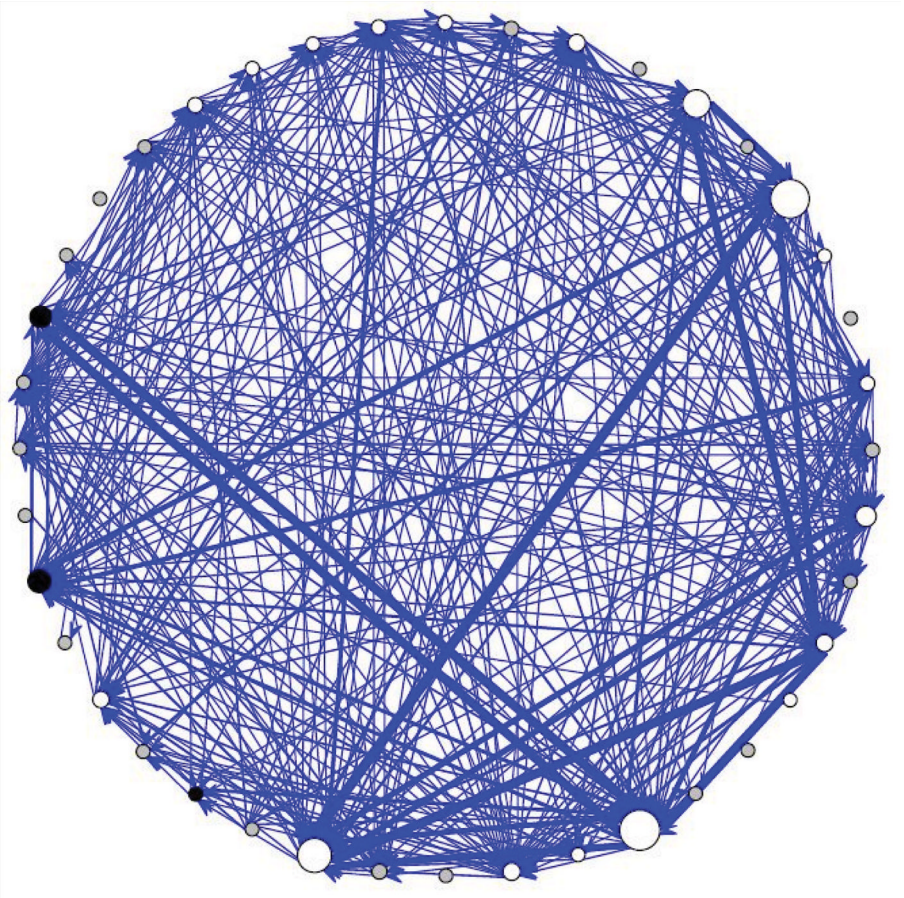
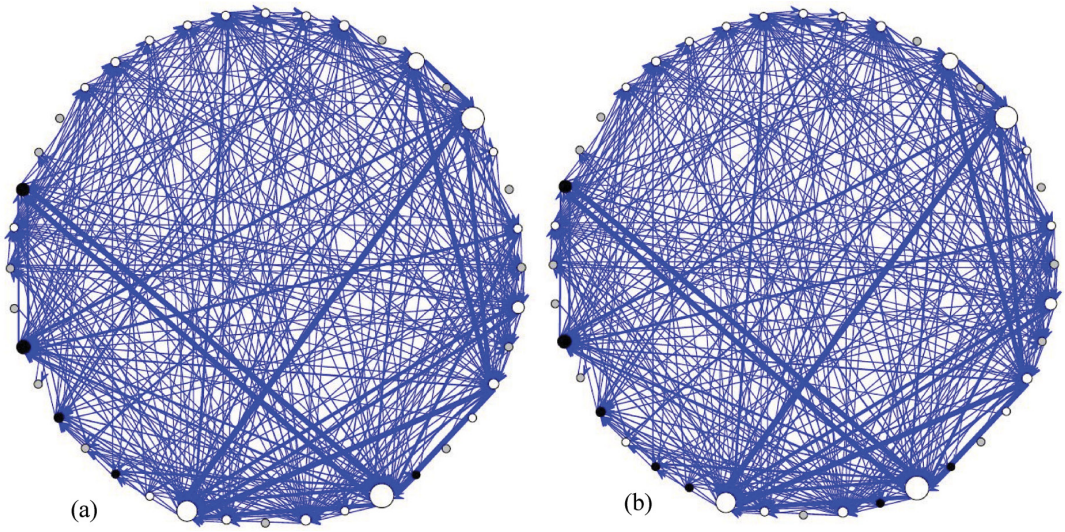


Figure 15. The interbank exposures network on June 30 2011: (a) Intermediate state of the interbank exposures network on 30 June 2011; (b) Final state of the interbank exposures network on 30 June 2011



(Figure 15a). At the end, seven banks would have failed, including a medium size bank (Figure 15b).

The exercise with the most severe scenarios provided qualitatively similar outcomes (though are not reported here). The difference with the above reported scenario is that in some occasions the initial shock caused the failure of less banks, causing the failure of some more banks in successive rounds. This case is one of the worst within the 5,000 stress scenarios. Table 1 summarizes the stress scenarios with some descriptive statistics.

Table 1. Statistical measures for the distribution of losses of the system

	System	
	After the Shock	**After the Contagion**
Minimum	50,700,000	40,600,000
Maximum	-67,300,000	-101,000,000
Average	-26,632,388.33	-42,622,139.79
Std. Deviation	20,626,417.41	29,779,314.13
$VaR_{0.99}$	-60,600,000	-91,300,000
$ES_{0.99}$	-61,458,955.22	-92,247,183.1

5. CONCLUSION AND FURTHER WORK

The main conclusions we can extract from this work is that although in recent times the topic has received a well-deserved importance into the regulatory arena, there are relevant aspects which we believe should not be ignored.

For some time the literature adhered to the belief that the topology of the network was enough to characterize the systemic riskiness of a particular financial system. Previous work (Márquez-Diez-Canedo, et al., 2009) shed some light about that issue and pointed at the fact that is not only the topology but also the size and concentration of the exposure.

This exercise brings to light one more issue, the relevance of the initial macroeconomic shock. It also carries one more argument against the idiosyncratic, one-by-one, evaluation of failures: it is impossible to dissociate banks from their economic environment. Pretending a "caeteris paribus" failure would be misleading.

Another important conclusion is that, to some extent, it could be the case that size does not matter. The focus has been traditionally on larger banks, and rightly so, but it should not be at the cost of disregarding smaller banks. As evidenced by the case study, a severe enough shock can weaken the whole system to the extent that just a little push can drop the first dominoes.

There are still issues that need to be addressed. The first one is, these simulation exercise may be understating the systemic effect. After all, this is the one-month effect of a shock, especially misleading in credit, where losses usually take longer to take place. The issue here is how to deal with the implicit trade-off: a more accurate credit risk measurement requires a sacrifice in the market risk measurement accuracy and vice versa.

Another issue is the weight of the tails of the parametric distribution. To keep methodological consistency, the underlying assumption was that of normality in the shocks even though we know that extreme events tend to occur more often than predicted by the light-tailed normal distribution. Using a distribution with heavier tails is an alternative worth exploring that would not require a change of paradigm.

Finally, one needs to acknowledge a limitation of this framework in terms of policy analysis: current infrastructure allows obtaining quite accurate market and credit risk measurement given the financial position of the participants of the system. However, a more complete policy analysis requires the ability to analyze "what if" cases, which necessary need to consider that financial positions are not exogenous, that are an endogenous element that can also impact the risk factors. Moreover, bankruptcy cost are not considered in the current framework but it is important as bankruptcy cost could deplete even more bank's assets causing

larger losses to other banks and this in turn could alleviate the necessity of very large initial shocks in order for triggering contagion.

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ENDNOTES

1 The opinions expressed here are those of the authors and do not represent the views of the Mexican Central Bank.

2 This definition is shared by Márquez-Diez-Canedo et al. (2009) and Rochet (2009).

3 Particularly in banking systems through the interbank market.

4 See Upper (2007) for a good survey on the literature.

5 Indirect contagion usually refers to similar business models or implicit correlations.

6 Overexposure is explained in detail in Martínez-Jaramillo et al. (2010) and refers to banks that are exposed on the interbank exposures network by an amount, which could bring their capital ratio below the regulatory minimum.

7 See the note in the *Financial Times* "Bankers to Lobby for Softer Reforms" on January 24th 2010.

8 In the last few years, the numbers of banks in Mexico has been increased.

9 In fact, we have data from previous years, but due to differences on the quality of such information, we can only fully trust the data from January 2005.

10 See Mistrulli (2007) for a comparison of contagion in a network built under the maximum entropy principle and without such assumption.

11 The analysis of extreme conditions or "stress scenarios'' can be tricky using VAR models, especially when underlying the model there is a normal distribution of shocks. The normality assumption implies that extreme, or sometimes not even so extreme, realizations occur with probability virtually zero. The problem with this situation is that experience tells that shocks tend to have heavier tails

than those predicted by normal distributions and these "extreme" virtually impossible realizations occur much more often than the model predicts; hence, it is highly relevant to assess, regardless of the projected probability of occurrence, the effect of these scenarios.

[12] Notice that the white noise assumption considerably simplifies this exercise.

[13] In Márquez-Diez-Canedo et al. (2009) the number of randomly generated scenarios was five million.

[14] In a strict sense, the probability of such extreme events is in a different order of magnitude.

[15] The CoVaR should not be confused with the CVaR (Conditional VaR).

[16] Alternatively, the CoVaR can be derived by quantile regression, as done in Adrian and Brunnermeier (2008).

[17] In a slight abuse of terminology, we will refer to this kind of event as a "failure."

[18] For instance, within the context of stress testing, VAR models reportedly perform poorly near the tails of the distribution.

[19] In our case, the most recent available information.

[20] The market risk-measuring infrastructure used by Banco de México was used to perform the valuation of the portfolio at each different scenario.

[21] All expressed in differences in logs.

[22] Experience in the Central Bank indicates that this variable can be important for modeling during stress scenarios.

[23] As usual, one of these dummies was dropped.

[24] See Hamilton (1994).

[25] See Enders (2004).

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APPENDIX: GENERATION OF CONSISTENT SCENARIOS

Previous versions of this work parted from joint losses distributions, considering market and credit losses. Once getting the joint distribution (using a copula) simulations were made to generate initial losses, which were used as starting point to analyze the contagion process. Nevertheless, to make a more accurate assessment of systemic risk, it has to be established a link between the real sector and banks' losses. So as far as the previous work had gone, underlying the simulation process is the idea that "something" happens, but what is that "something"? To attain this goal a Vector Autoregressive Model (VAR) approach has been followed. It is widely known that VAR models allow taking into account multiple variables and their interactions in a parsimonious way so despite its limitations[16] this was the methodology followed to model the economic background underlying banks' losses. Market losses are directly determined by some financial variables such as yield curves or stock indexes, but in their determination, these variables interact with other "real economy" variables, and they are also affected by external shocks either directly (exposition to a foreign stock index, for example) or indirectly by the effect that these external shocks may have in the domestic variables (for example, the domestic stock index follows closely movements of the Dow Jones index).

The availability of highly detailed data about banks' positions allows us to consider very specific conditions for each bank and to realistically assess the effect of each one of these shocks in the current[17] period. At any given time, given that time's financial positions and a relatively small set of variables and "risk factors"[18] the losses distribution is computed.

The scenarios generation process consists of three steps: the estimation of the VAR model, the estimation of other complementary models to complete the scenarios to make the valuation of the position, and finally the scenarios generation process.

1. The Macroeconomic Model

The macroeconomic model uses twelve variables. In the choice of variables was also considered which variables have a direct impact in possible banks' losses. The variables used are[19] Real GDP (y_{Mex}), Cete interest rate (r^c), the consumer price index (π), real exchange rate (e), unemployment rate (u), the Mexican stock exchange index (*ipc*), loan portfolio (*TL*), and past due loans (*PDL*), US GDP (y_{US}), treasury bill interest rate (r^{tb}), the Dow Jones stock index (*DJ*), and the Brazilian stock index Bovespa[20] (*bov*).

The general form of the model is a customary VAR setting: $Y_t = \boldsymbol{c}\sum_{i=1}^{p} A_i Y_{t-i} + \sum_{m=1}^{3} \delta_m D_{mt} + e_t$ which basically states that the set of variables in the *12x1* vector *Y* is jointly determined by *p* lagged values and dummy variables for each quarter[21] (D_m). This model follows the spirit of structural VAR models, hence not all variables enter as explanatory variables (that is, some components of matrices A_i are zero).

However, the structural constraints were tried to be kept at a minimum, hence all domestic variables (GDP, cete rate, exchange rate, unemployment rate, inflation, stock index, loans, and past due loans) interact with each other; additionally, all domestic variables are affected by foreign variables, but foreign variables only are affected by other foreign variables.

Quarterly data from the second quarter of 1985 up to June of 2011 was used, and $p=4$, that is, the number of lags used was 4 quarters. For the estimation it was assumed that the errors were normally distributed, $e_t \sim N(\boldsymbol{0},\boldsymbol{\Sigma})$, where $\boldsymbol{\Sigma}$ is the covariance matrix between the shocks. Coefficients were estimated using Maximum Likelihood[24]. Table 2 shows the joint significance χ^2 test statistic for all the lags of a variable.

Table 2. Estimation results: Columns=dependent variables; Rows= independent variables

	$GDP_{M,X}$	e	r^c	π	u	TL	PDL	IPC	GDP_{US}	$r^{t,b}$	DJ	Bov
$GDP_{M,X}$	122.274 (0.000)	7.452 (0.113)	8.504 (0.074)	17.313 (0.001)	13.294 (0.009)	7.867 (0.096)	16.710 (0.002)	18.696 (0.000)	33.282 (0.000)	19.042 (0.000)	17.076 (0.001)	4.963 (0.291)
e	5.135 (0.273)	6.512 (0.164)	32.380 (0.000)	21.129 (0.000)	5.593 (0.231)	2.965 (0.563)	34.692 (0.000)	10.475 (0.033)	11.571 (0.020)	11.511 (0.021)	3.607 (0.461)	50.646 (0.000)
r^c	1.684 (0.793)	8.558 (0.073)	22.905 (0.000)	10.325 (0.035)	12.224 (0.015)	1.155 (0.885)	15.505 (0.003)	18.291 ()0.001	9.819 (0.056)	4.687 (0.320)	11.849 (0.018)	16.170 (0.002)
π	11.405 (0.022)	3.110 (0.539)	19.290 (0.000)	259.128 (0.000)	5.473 (0.242)	25.481 (0.000)	20.027 (0.000)	68.548 (0.000)	8.363 (0.079)	6.688 (0.153)	26.007 (0.000)	38.653 (0.000)
u	12.164 (0.016)	4.167 (0.383)	8.846 (0.063)	5.471 (0.242)	4.170 (0.383)	4.210 (0.378)	2.682 (0.612)	11.058 (0.025)	20.073 (0.000)	16.164 (0.002)	6.105 (0.191)	9.852 (0.042)
TL	18.720 (0.000)	18.355 (0.001)	9.686 (0.046)	51.076 (0.000)	6.843 (0.144)	78.158 (0.000)	5.943 (0.203)	66.511 (0.000)	9.538 (0.048)	2.354 (0.670)	22.456 (0.000)	9.294 (0.054)
PDL	14.475 (0.005)	12.462 (0.014)	3.426 (0.489)	29.735 (0.000)	26.898 (0.000)	26.335 (0.000)	37.471 (0.000)	13.650 (0.008)	25.533 (0.000)	8.937 (0.062)	16.498 (0.002)	3.978 (0.409)
IPC	2.800 (0.891)	14.685 (0.005)	9.724 (0.045)	7.471 (0.112)	13.608 (0.008)	10.405 (0.034)	17.843 (0.001)	7.969 (0.092)	5.265 (0.261)	1.498 (0.826)	2.080 (0.721)	20.663 (0.000)
GDP_{US}									6.376 (0.172)	1.074 (0.898)	5.700 (0.222)	
$r^{t,b}$									6.553 (0.161)	20.697 (0.000)	1.579 (0.812)	
DJ									6.646 (0.155)	4.643 (0.325)	0.975 (0.913)	
Bov							1.331 (0.856)	1.331 (0.856)	4.414 (0.352)	0.310 (0.989)	4.775 (0.311)	91.329 (0.000)

The impulse response functions were computed when a one standard deviations shock occurs. It was decided to show the responses of only the most relevant variables: Figures 16, 17, 18, 19, 20, 21, show the impulse response functions of such variables. The subtitles within each graph indicate the impulse variable.

2. Other Variables that play a Role as Risk Factors

To complete the valuation of the market portfolio, another set of variables is required to attain the goal. Interest rates yield curves, exchange rate, as well as some other stock indexes may have an impact in the bank's portfolio. A more accurate modeling of these variables would require a much more complex framework and more detailed information, and that also would be beyond the scope of this work. Nevertheless, to model changes in these variables the spreads and stock indexes were modeled independently using autoregressive processes, and to get the interest rate curves for Cete, Tbill, and Libor, the variables used in the structural VAR were also used along with some nodes of the curve. Once these nodes were estimated, the curve was completed using a cubic Hermite polynomial.

Figure 16. Impulse-response functions: change in Mexican GDP when other variables change by one standard deviation

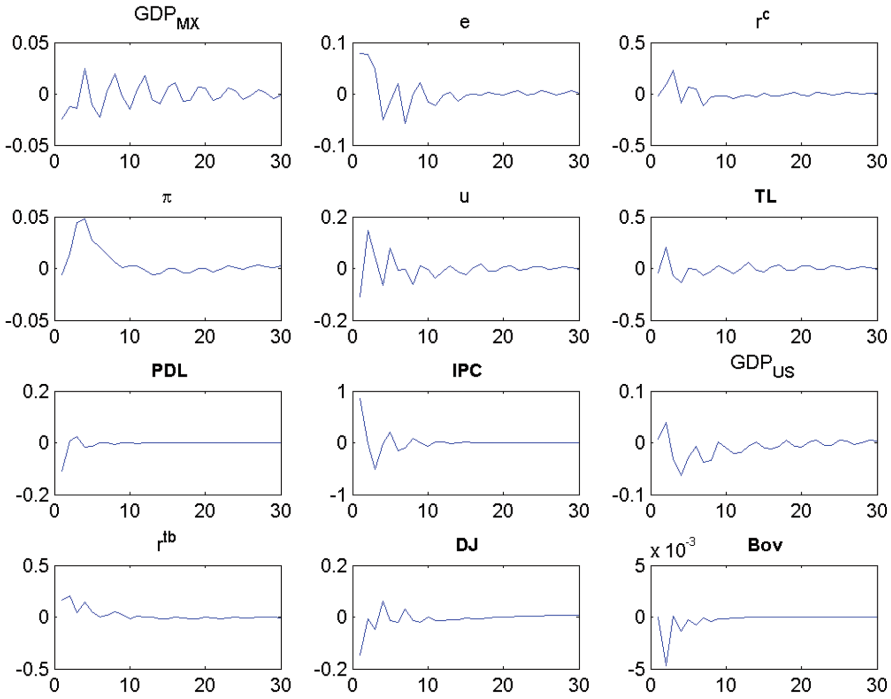


Figure 17. Change in real exchange rate when other variables change by one standard deviation

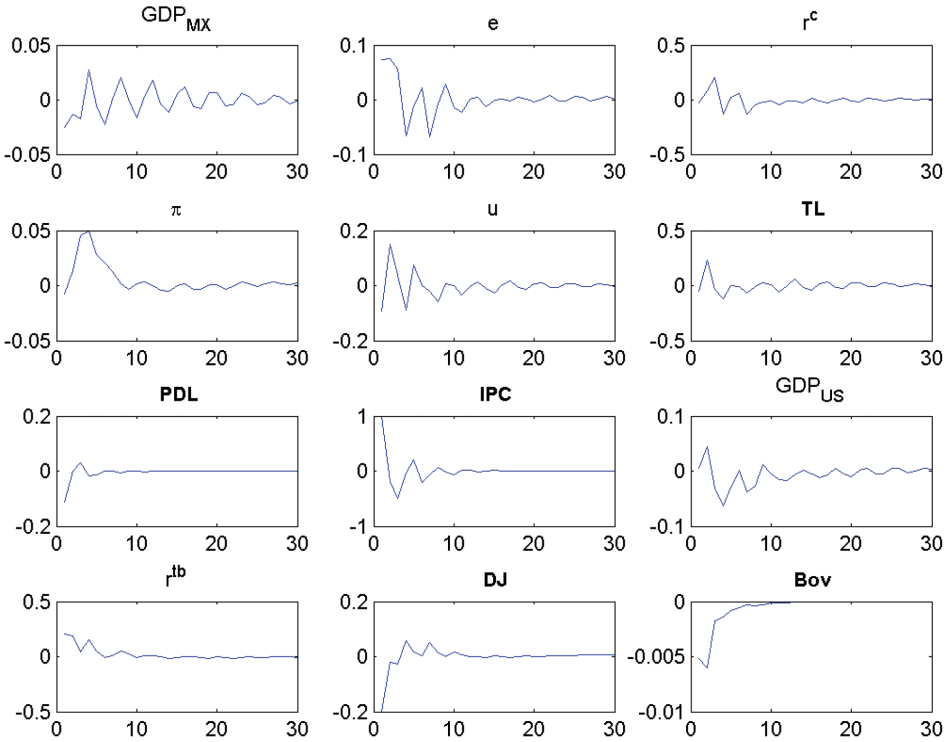


Figure 18. Impulse-response functions: Change in Cete interest rate when other variables change by one standard deviation

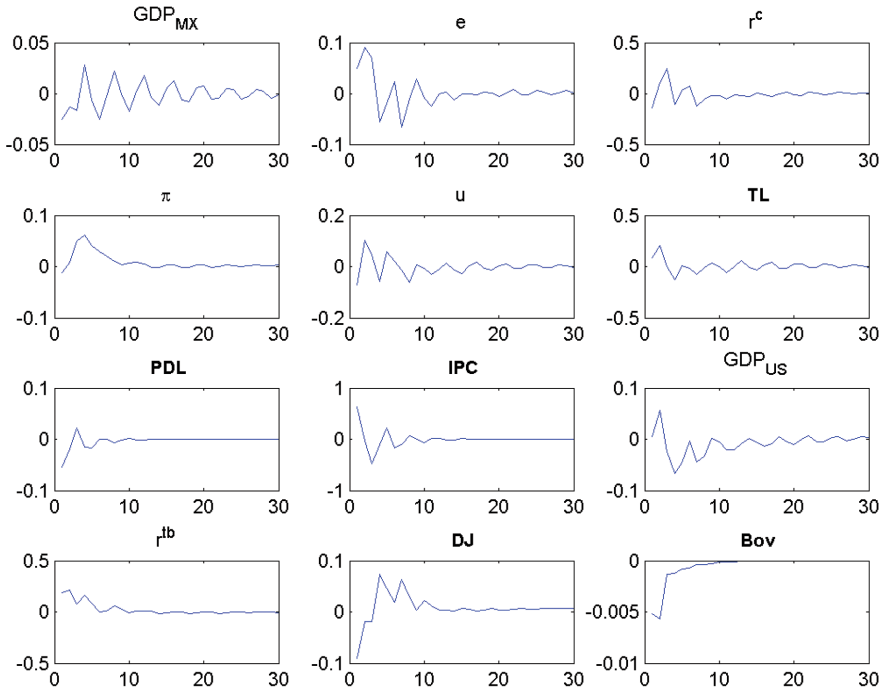


Figure 19. Impulse-response functions: Change in loans in good standing when other variables change by one standard deviation

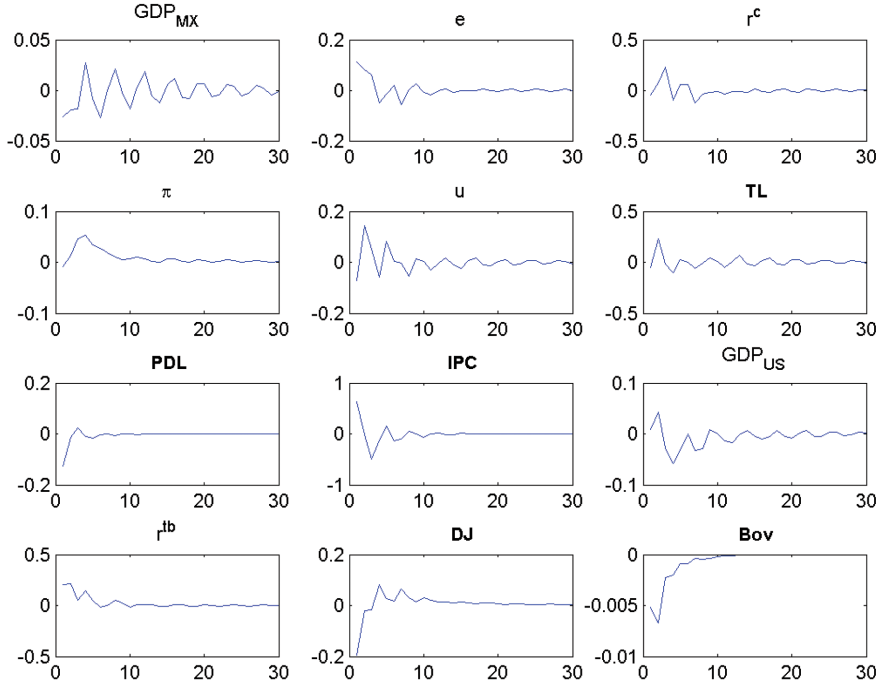


Figure 20. Impulse--response functions: Change in past-due-loans when other variables change by one standard deviation

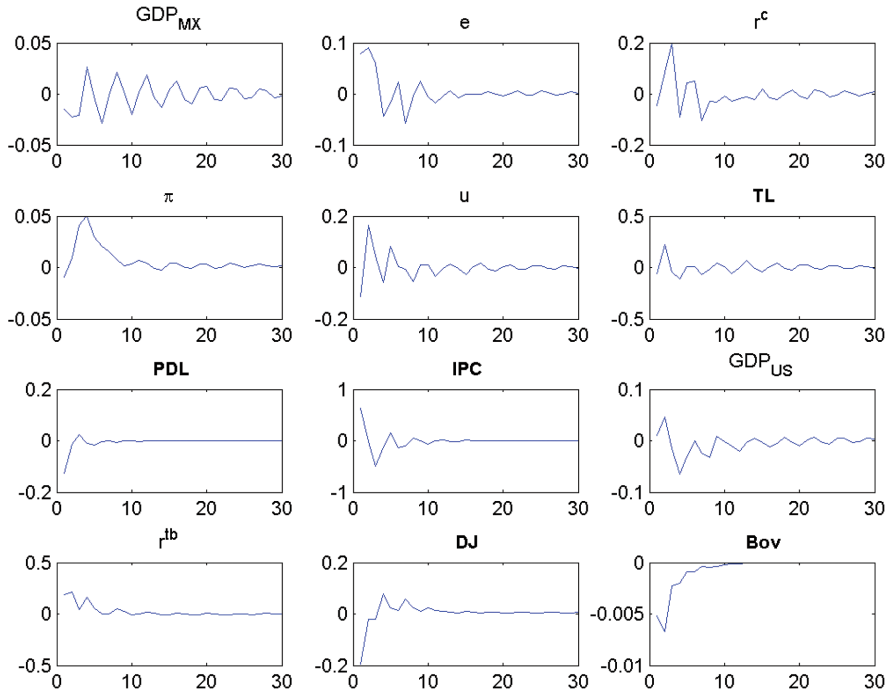
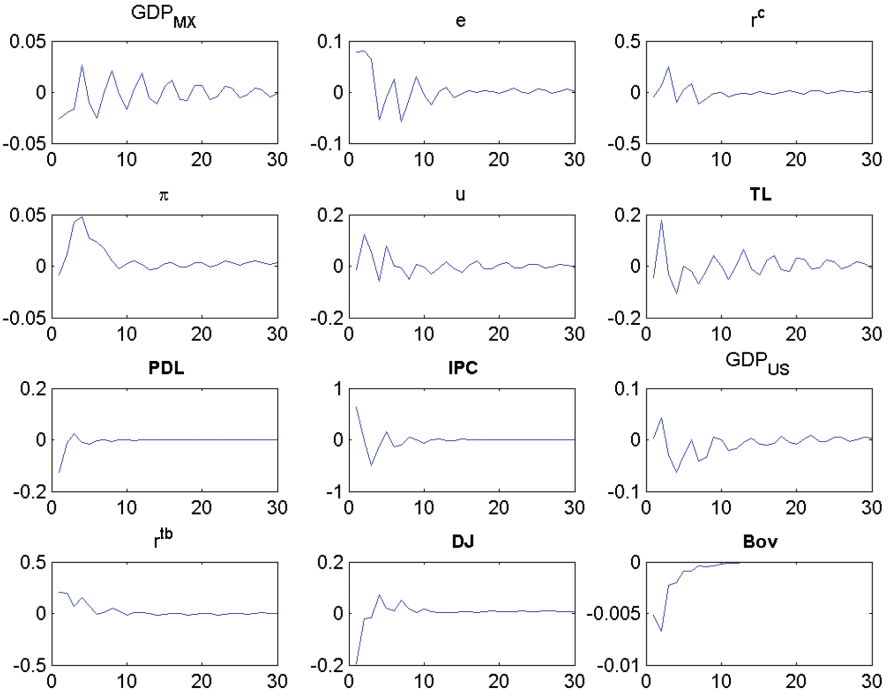


Figure 21. Change in IPC stock index when other variables change by one standard deviation



3. Scenario Generation

Once all the parameters were estimated, the generation of scenarios was done simulating random shocks and transferring the effects of the shocks using a Choleski-type decomposition of the covariance matrix estimated from the macro model.

Formally, the structural model is assumed to include a matrix of coefficients of contemporaneous effects:

$$BY_t = \sum_{i=1}^{p} \Gamma_i Y_{t-i} + \varepsilon_t, \quad Y_t = \sum_{i=1}^{p} B^{-1}\Gamma_i Y_{t-i} + B^{-1}\varepsilon_t, \quad Y_t = \sum_{i=1}^{p} A_i Y_{t-i} + e_t$$

The implication is that, considering contemporaneous effects, and if the model is rightly specified, the exogenous shocks are uncorrelated, that is $\varepsilon \sim N(\mathbf{0},\mathbf{D})$ where **D** is a diagonal matrix. This allows generating the scenarios to draw independent normally distributed random numbers, and using the matrix $\mathbf{B}^{-1}$ to contemporaneously "transfer" the error effect to the rest of the variables, in a similar fashion to the one used to build impulse-response functions.

The **B** matrix was obtained by a Choleski-type factorization of the estimated covariance matrix ($\mathbf{\Sigma}$). The ordering was $GDP_{US} \rightarrow TBill \rightarrow DJ \rightarrow Bov \rightarrow cete \rightarrow e \rightarrow GDP_{MX} \rightarrow u \rightarrow TL \rightarrow PDL \rightarrow \pi \rightarrow ipc$.[25]

Each realization of ε together with the estimated coefficients determines projected levels of the relevant variables in the model. To complete the scenario, the interest rate curves are also affected by the same shocks (for example, the TBill curve is affected by the same shock that affected the TBill in the VAR model) and the other variables are affected by autonomous shocks.

Credit deserves a lengthier discussion. It seems that a greater effort was exerted on the market side of the losses distribution, and to some extent, it is right. The fundamental problem is the disparity of the risk horizon for both portfolios. While for market a one month horizon seems too long, for credit one month is hardly enough for marginal changes. This is the trade-off facing all those studying the joint distribution: to sacrifice accuracy in market position and to analyze a longer term to get significant credit effects or to get more accurate market losses but accepting that credit losses will be low and any significant credit effect will materialize in a few more months. We opted for the second option, and to determine the effect of shocks in credit losses the estimator for the change in delinquency rate was used as a proxy for credit losses weighted by current levels of delinquency rates by bank.

Chapter 16
Behavioral Finance in Theory and Practice

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ABSTRACT

Behavioral finance is a new approach in finance literature. The main idea is that investors are not as rational as they are assumed to be. Therefore, financial markets could be better understood by using models that capture the effects of both rational and irrational investors. The critics of behavioral finance could be grouped into two main categories: limits of arbitrage and psychological factors. This chapter concentrates on both challenges and possible contributions of behavioral finance theory to the modern finance theory, which is mainly based on rational expectations theory and efficient market hypothesis.

INTRODUCTION

Behavioral finance, which, as the years go by, is looking less and less like a minor subfield of finance and more and more like a central pillar of serious finance theory. - Robert J. Shiller

In Modern Finance literature, much of economic and financial theory is based on the notion that individuals act rationally and consider all available information in the decision-making process. However, researchers have uncovered a surprisingly large amount of evidence that this is frequently not the case. Dozens of examples of irrational behavior and repeated errors in judgment have been documented in academic studies. This controversy in the field of Modern Finance involves the evolution of what has become known as behavioral finance. Researchers are publishing an increasing number of academic articles devoted to the potential applications of these new findings. Interest in the topic was triggered by two major developments: increasing empirical evidence that existing financial theories are deficient in fundamental ways, and the development of prospect theory by Daniel Kahneman and Amos Tversky in 1979. Prospect theory presents a brief model of decision-making with an alternative to subjective expected utility which makes assumptions of more realistic behavior.

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This new approach, called behavioral finance, has emerged in the financial environment as a response to the difficulties faced by the traditional paradigm. In broader terms, behavioral finance argues that some financial phenomena can be better understood by using models in which some agents are not fully rational. More specifically, it analyzes what happens when we relax one, or both, of the two tenets that underlie the finance view of rationality. In some behavioral finance models, agents hold beliefs that are not completely correct, most commonly because of a failure to properly apply Bayes' law. In other models, agents hold correct beliefs but make choices that are normatively questionable. Contrary to EMH theory, human decision-making is the starting point for behavioral finance.

It is possible to define behavioral finance as a sub discipline of behavioral economics which incorporates findings from psychology and sociology into its theories. One of the crucial properties of modern finance is the use of few tools to explain many different situations in real life. Behavioral finance is also constructed with few tools that have many uses. Some of the tools of behavioral finance are identical to those of modern finance, but some are different because they reflect a different model of human behavior. The tools of behavioral finance include susceptibility to frames and other cognitive errors, varying attitudes toward risk, aversion to regret, imperfect self-control, and preferences as to both utilitarian and value-expressive characteristics (Statman, 1999-1, p. 19). In the literature, there is considerable research which provides evidence about the insufficiencies of modern financial theories in financial markets. Thus behavioral finance models are developed to explain investor behavior or market anomalies when rational models provide insufficient explanations (Glaser, Moth, & Weber, 2003, p. 2). To understand the research agenda, methodology, and contributions, in the following subsections, behavioral finance theory will be discussed in broader terms.

First of all, this section will explain Behavioral Finance Theory, focusing on the main topics of this newly developing area of Modern Finance. These main topics include the following: non-behavioral finance built on the efficient market hypothesis; anomalies in financial markets beginning with evidence of inefficiency in the financial markets; limits to arbitrage operations in real world financial markets, and the impossibility for rational traders to consistently offset the effects of noise traders; psychological evidence showing that individuals do not always behave rationally in their decision-making processes; and applications of behavioral finance theory to some important subjects in finance.

BEHAVIORAL FINANCE: THEORETICAL BACKGROUND

The field of behavioral finance is not new. At the core of behavioral finance is the idea that the principle derived from these social sciences can be useful to improving knowledge of the behavior of the financial market. Many investors have long considered that psychology plays a key role in determining the behavior of markets (Brabazon, 2000, p. 2). During the classical period, economics had a close link with psychology. Economists began to distance themselves from psychology during the development of neo-classical economics as they sought to reshape the discipline as a natural science, with explanations of economic behavior deduced from assumptions about the nature of economic agents. The concept of homo economicus was developed and the psychology of this entity was fundamentally rational. Nevertheless, psychological explanations continued to inform the analysis of many important figures in the development of neo-classical economics, such as Francis Edgeworth, Vilfredo Pareto, Irving Fisher and John Maynard Keynes (Cornicello, 2004, p. 24).

Psychology had largely disappeared from economic discussions until the 1950s. Later, a number of factors contributed to the resurgence of its use and the development of behavioral economics. Expected utility and discounted utility models began to gain wide acceptance, which generated testable hypothesis about decision-making under uncertainty and intertemporal consumption. An increasing number of empirical studies with evidence supporting the presence of continuous anomalies challenged the rational behavior hypothesis. Nonetheless, many principles on which behavioral finance is based are not new. Indeed, they return to the origins of economic theory. Adam Smith, who is considered the father of modern economic thought with his book, "The Wealth of Nations," wrote a lesser known book called "The Theory of Moral Sentiment." In this work, there are insights into human psychology, many of which are relevant today in behavioral finance. For example, he wrote "we suffer more... when we fall from a better to a worse situation, than we ever enjoy when we rise from a worse to a better." This explains well the principle of loss aversion. At the same time, Jeremy Bentham, whose utility concept had an important influence on the foundation of the neoclassical economy, wrote extensively about the psychological underpinnings of utility (Cornicello, 2004, pp. 23-24).

The ignorance of the psychological approach in economic theory, and consequently in finance theory, began with the neoclassical revolution in which all the studies in this field were constructed based on the assumption of the nature of *homo economicus*. In the early part of the 20th century, the works of some economists, such as Vilfredo Pareto, Irving Fisher, and later, John Maynard Keynes, had some psychological insight, however, discussion about the influence of psychology on finance had largely disappeared (Cornicello, 2004, p. 24). During the second half of the 20th century, interest in the psychological principles of economics reappeared. Psychologists like Daniel Kahneman and Amos Tversky started using the economic model as a benchmark against which to contrast their psychological models. Tversky and Kahneman's 1979 article on prospect theory could be accepted as the main contributor to the growth of "modern" behavioral finance (Kahneman & Tversky, 1979).

In the 1980s, interest in behavioral finance started to grow rapidly as different studies representing evidence about anomalies -which traditional theories were not able to explain- in the financial markets emerged. This interest in behavioral finance continues to grow today with a number of scholars and practitioners actively involved in these studies, as well as with a far-reaching and growing base of literature. It is necessary to note that behavioral finance theory attracted great favour among finance academics and researchers after Daniel Kahneman won the Nobel Prize in Economics.

However, it is only in recent years that a series of concerted formal studies have been undertaken in this area. Paul Slovic's paper on individual's misperceptions about risk (1972), and Amos Tversky and Daniel Kahneman's papers on heuristic-driven decision biases (1974) and decision frames (1979) played seminal roles (Brabazon, 2000). Perhaps the most important paper in the development of behavioral finance was written by Kahneman and Tversky in 1979. This paper, "Prospect Theory: Decision Making Under Risk," used cognitive psychological techniques to explain a number of documented anomalies in rational economic decision making (en.wikipedia.org). Further milestones in the development of the field include a well-attended and diverse conference at the University of Chicago (see Hogarth & Reder, 1987), a special 1997 edition of the respected *Quarterly Journal of Economics* "In Memory of Amos Tversky" devoted to the topic of behavioral economics, and the award of the Nobel prize to Daniel Kahneman in 2002 "for having integrated insights from psychological research into economics, especially concerning human judgment and decision-making under uncertainty."

The results of these studies were at variance with the rational, self-interested decision-maker posited by traditional finance and economics theory. Although several definitions of behavioral finance exist, there is considerable agreement between them.

Lintner defines behavioral finance as being "the study of how humans interpret and act on information to make informed investment decisions" (Brabazon, 2000, p. 2).

Thaler defines behavioral finance as "simply open-minded finance," claiming that "sometimes in order to find the solution to an [financial] empirical puzzle it is necessary to entertain the possibility that some of the agents in the economy behave less than fully rationally some of the time" (Brabazon, 2000, p. 2).

In his study, Olsen asserts that "behavioral finance does not try to define 'rational' behavior or label decision making as biased or faulty; it seeks to understand and predict systematic financial market implications of psychological decision processes" (Olsen, 1998, p.11). It should be noted that no unified theory of behavioral finance exists at this time (Brabazon, 2000, p.2). Olsen points out that most of the emphasis in the literature thus far "has been on identifying behavioral decision making attributes that are likely to have systematic effects on financial market behavior" (Olsen,1998, p.12).

One idea core to behavioral finance is that the principles derived from the social sciences can improve the knowledge about investors' behavior in financial markets. This research doesn't imply a rejection of previous theories. On the contrary, it provides a useful theoretical framework upon which studies on behavior finance try to improve. Despite strong evidence that securities markets are highly efficient, there is a growing body of evidence that long-term historical phenomena contradict the efficient market hypothesis and cannot be captured plausibly on models based on perfect investor rationality. The "irrational investors approach" assumes that securities market arbitrage is imperfect, and thus that prices can be too high or too low (Baker, Ruback, & Wurgler, 2004, p. 1). These phenomena are referred to as stock market anomalies. Behavioral finance seeks to understand and explain these recognized phenomena.

The underlying assumptions of the efficient market hypothesis are that transaction costs are zero, markets are not segmented, and there is easy entry into the security markets (Hollman, 2005, p. 22). The behavioral assumptions that underlie the efficient market hypothesis argue that investors act in an unbiased fashion to maximize the values of their portfolios, which is usually referred to as rational expectations, and that investors always act in their own self-interest (Hollman, 2005, p. 22). Behavioral finance questions the validity of these last two assumptions. Researchers in cognitive psychology and the decision sciences have documented that people systematically make errors in judgment and mental mistakes. Behavioral finance as a new area for research may be able to explain these anomalies in the efficient market hypothesis.

Eugene Fama, the pioneer who identified the three forms of the efficient market theory, argued that the theory survives the criticisms of behaviorist academics who point out anomalies in the markets. Fama claimed that market anomalies are chance results. Any new models introduced to explain anomalies should be considered in relation to how they view the big picture. Fama believed existing behavioral models are inadequate because they seek to explain specific anomalies, and there is no overriding theory that could overturn the efficient markets model. It appears that until there is a unifying theory, there is no validity (Fama, 1998, p.283). However, this does not mean that there are no anomalies in the markets and the EMH is performing perfectly in the market mechanism (Hollman, 2005, p. 23).

According to Shiller, the basic problem with the efficient markets hypothesis is that it is telling a half-truth. The hypothesis is useful when presenting market efficiency as a simple concept to college students and amateur investors, but they may come to believe that it is easy to get

rich quickly. However, this is not the case when trading in speculative financial markets. The short-run, day-to-day or month-to-month profit opportunities that people imagine they have found are probably not there. Shiller's response to Fama emphasized that the real world is not very similar to the world presented in Fama's assumptions (Shiller, 2002, p. 11).

In his 2003 paper, Glaeser wrote that psychology is not going to argue that human beings do not respond to incentives, nor is psychology going to suggest that risk-free opportunities for profit will be possible. If anything, situationalism creates more of a problem for psychology than for economics. In the real world, situations are man-made. To understand heterogeneity across time and space, psychologists need theories that explain how exogenous variables shift the supply of cues, framing, and other situational factors. For example, psychology tells us that people form beliefs in large part by listening to people around them, so it isn't a surprise that there can be cognitive errors in their decision making process. But psychology doesn't help us to understand the exogenous factors that lead to different errors in different times, such as in the financial markets. If it is possible to combine economic insights about the supply of influence and psychological insights about the impact of that influence, then a chance to understand equilibrium outcomes can be achieved (Glaeser, 2003, p. 3).

It should not be underestimated that the theories related with psychology used to support behavioral finance, and to challenge the efficient market hypothesis. Within the last two decades, finance literature has accumulated a substantial number of observations of anomalies inconsistent with the efficient market hypothesis. These anomalies suggest that the underlying principles of the efficient market hypothesis are not entirely correct. It may be necessary to look also to other models of human behavior that have been studied in social sciences (Shiller, 1999, p. 1307).

Behavioral finance offers a forum that goes beyond the limits of economic assumptions in pursuit of a better model of financial behavior that includes both cognitive and emotional behaviors. One could argue that prospect theory is the behavioral theory that has the most remarkable impact on economic research. Thus, in the next subsection of this study will briefly discuss the prospect theory of Kahneman and Tversky.

MAIN FOCUS OF THE CHAPTER

Prospect Theory

Prospect theory was developed by Daniel Kahneman and Amos Tversky in 1979. Starting from empirical evidence, it describes how individuals evaluate losses and gains. In the original formulation, the term prospect referred to a lottery.

Kahneman and Tversky developed this theory to remedy the descriptive failures of expected utility (EU) theories of decision making. Prospect theory attempts to describe decisions under uncertainty, and has also been applied to the field of social psychology.

Shiller refers to prospect theory as a mathematically-formulated alternative to the theory of expected utility maximization -- an alternative that is supposed to capture the results of such experimental research (Shiller, 1999, pp. 1308-1310).

Prospect theory is probably the most widely accepted behavioral theory and has the most impact on economic research. It is very influential despite the fact that it is viewed by many economists as less important than expected utility theory. Expected utility theory offers a restrained representation of rational behavior under uncertainty. It works well as a foundation for an economic theory based on the assumption of strictly rational behavior. However, it is known that in certain circumstances EU incorrectly predicts human behavior as it is shown in experimental evidence. Many theories

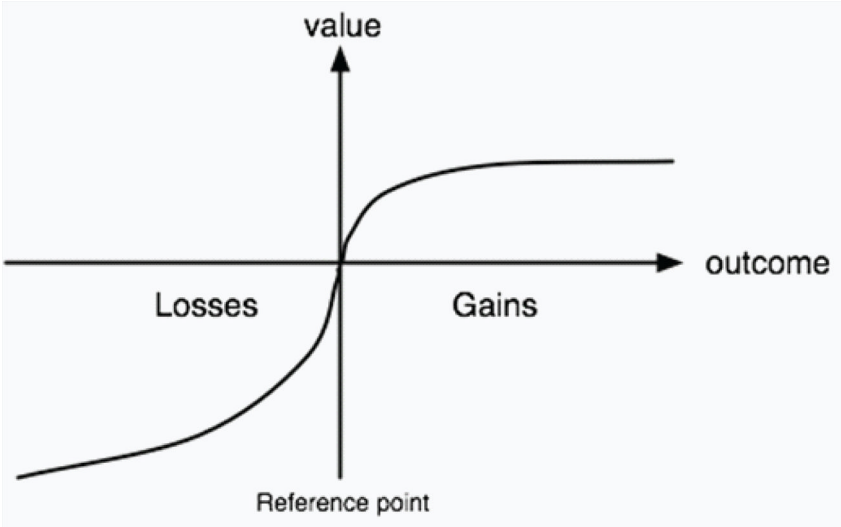
are created to match this evidence, prospect theory being foremost among them. As mentioned at the beginning of this section, prospect theory was first developed by Daniel Kahneman and Amos Tversky in their milestone paper, "Prospect Theory: An Analysis of Decision under Risk" (1979). In prospect theory, Kahneman and Tversky formalized loss-averse behavior and other seeming anomalies as behavioral elements. They replaced the utility function with a valuation function that evaluates changes in expected income from the current level based on a current reference frame that conditions expectations. While increases in income are weighted by a small marginal utility, decreases in income are weighted by a larger marginal utility (Figure 1).

Prospect theory is basically divided into two stages: editing and evaluation. In the editing stage, the different choices are ordered following some heuristic so as to simplify the evaluation stage. The evaluations around losses and gains are developed starting from a reference point. The value function (sketched in Graph1) which passes through this point is s-shaped, and as its asymmetry implies, given the same variation in absolute value, there is a bigger impact of losses than of gains (loss aversion). Some behaviors observed in economics, like the disposition effect or the reversing of risk aversion/risk seeking in case of gains or losses (termed the *reflection effect*), can be explained referring to prospect theory.

The three main characteristics of Tversky and Kahneman's value function, which replaces the expected utility value function in the investor's decision, are as follows (Mullainathan & Thaler, 2000, p. 6):

- The value function is defined over changes to wealth rather than levels of wealth (as in Expected Utility) to incorporate the concept of adaptation.
- The loss function is steeper than the gain function to incorporate "loss aversion," which is the concept that people are more sensitive to decreases in their well-being than to increases in their well-being.
- Both the gain function and loss function display diminishing sensitivity (the gain function is concave, the loss function is convex) to reflect experimental findings.

Figure 1. Hypotetical value function
Source: Kahneman and Tvesrky 1979, p286



> To fully describe choices, prospect theory often needs to be combined with an understanding of "mental accounting."

In conclusion, the discontinuity on the slope at the reference point is probably the most significant element evidenced by prospect theory. But at the same time, it doesn't accurately define what determines the location of the reference point, nor how to distinguish the difference between very high probabilities and extremely high probabilities. The experimental evidence shown by Kahneman and Tversky does not point out systematic patterns which could be codified in a generalized theory; therefore these elements could not be specified (Cornicello, 2004, p. 26).

Shiller reviewed prospect theory in finance, positing that expected utility theory, with its rational expectations derivative, is still the dominant paradigm for investor decisions in finance and for economic decisions in general (1999, pp.1308-1309). Here it will be useful to note that the importance of behavioral finance theory has been growing rapidly in the last decades. The full range of asset pricing models are surveyed and assessed by Campbell in 2000. He focused on the interplay between theory and empirical work and on the trade-off between risk and return. Facts about interest rates, aggregate stock prices, and cross-sectional patterns in stock returns have stimulated new research on optimal portfolio choice, intertemporal equilibrium models, and behavioral finance (p.1515).

Many of these models have been used to identify anomalies in investor behavior. Cochrane also discusses the broad category of alternative APMs, called multifactor models (Gorener, 2003, p. 20).

A paper by Barberis, Huang and Santos from 2001 discusses prospect theory in the context of national income accounts, incorporating consumption and changes in wealth as part of the reference frame. They also surveyed recent finance literature that focuses on prospect theory and loss aversion (Barberis et al., 2001, p.48).

Another research direction in the literature follows the practice of the first Kahneman and Tversky paper, and obtains responses by surveying. This approach seems less satisfactory than working with a large panel of historical data: as Kahneman and Tversky point out, survey responses may be influenced by the phrasing of the questions.

Recently, prospect theory has been entering the literature about investor behavior. In many cases, however, it keeps its links with psychology. Many sensible and plausible ideas from psychology do not come into finance in forms that are readily testable, particularly with high frequency data. This matter is well illustrated by Shefrin in the year 2000. He identifies and discusses several practices associated with reference dependence, including mental accounting, hedonic editing, regret minimization, and what is commonly called isolation (Gorener, 2003, p. 21).

The original Kahneman and Tversky (1979) paper contains these concepts. However, the scope for analyzing them in the historical financial market data only does not seem very promising, as the findings should be supported with empirical findings using real market financial data.

In brief, prospect theory differs from many other psychological theories in that it has a solid mathematical basis, which gives economists the opportunity to play with it. Prospect theory has some elements similar to expected utility theory. In both theories, individuals maximize a weighted sum of "utilities," but the difference with prospect theory is that the weights are not the same as the true probabilities, and the utilities are determined by a "value function" rather than a utility function.

It can be argued that behavioral finance literature has two important aspects: cognitive biases and limits to arbitrage. These two subjects will be discussed in the following subsections.

Basic Cognitive Biases

Cognition refers to any kind of knowledge or opinion about oneself on the world. Two cognitions

can be either relevant or irrelevant to one another. If they are relevant, then they must be consonant or dissonant (i.e. that one does not follow from the other). Dissonant cognitions produce an aversive state which the individual will try to reduce by changing one or both of the cognitions. The basic cognitive biases are mentioned in the following subsections.

1. **Heuristics:** Heuristics, or rules of thumb, make decision-making easier. But they can sometimes lead to biases, especially when things change. These can lead to suboptimal investment decisions. When faced with N choices for how to invest retirement money, many people allocate using the 1/N rule. If there are three funds, one-third goes into each. If two are stock funds, two-thirds goes into equities. If one of the three is a stock fund, one-third goes into equities (Ritter, 2003, p. 431). In 2001, Benartzi and Thaler showed that some investors follow the 1/N rule when dealing with complex investment plans (Benartzi & Thaler, 2001, p.96).
2. **Loss Aversion, Mental Accounting and Framing:** As described above, prospect theory shows an abrupt change of the slope at the reference point which leads to a large asymmetry between the value that people give to gains and the value they give to losses. In other words, for people, and consequently for investors, the displeasure that they feel from a loss is greater than the pleasure they feel from a gain. In their 1991 paper, Tversky and Kahneman suggested that in the domain of money, people value a loss roughly twice as much as an equally sized gain (p.1060). This asymmetry in valuation is called loss aversion (Ritter, 2003, p. 431).

One of the leading studies on loss aversion is by Samuelson in his 1963 paper, in which he illustrated loss aversion. Samuelson asked a group of colleagues if they would accept a bet that could win them $200 with a probability of 50%, or lose them $100 with the same probability. One of his colleagues said that he would not bet, but he would take, if he offers 100 such bets. Because, he thought for one time is not enough to make it reasonably sure that the law of average will turn out in his favour (Samuelson, 1963, p. 51). Benartzi and Thaler presented another example in their 1995 paper: Suppose that an investor must choose between a risky asset that pays an expected 7% return per year with a standard deviation of 20% ; similar to stocks, and a safe asset that pays a sure 1% return with a standard deviation of 0. By the same logic that is applied to Samuelson's college student, the attractiveness of the risky asset will depend on the time horizon of the investor. The longer the investor intends to hold the asset, the more attractive the risky asset will appear, so long as the investment is not evaluated frequently. Put another way, two factors contribute to an investor being unwilling to bear the risks associated with holding equities: loss aversion and a short evaluation period. This is referred to as *myopic loss aversion* (Benartzi & Thaler, 1995, p. 75).

Mental accounting is the set of cognitive operations used by individuals and households to organize, evaluate and keep track of financial activities (Thaler, 1999, p.183).

The existence of myopic loss aversion is not only due to loss aversion; it is also tied to another element: mental accounting. Mental accounting is constituted by a wide range of cognitive processes related to the way people analyze and treat the results of transactions and other financial events. Mental accounting is also related to framing. A *frame* can be defined as the form used to describe a decision problem. It is the decision maker's subjective conception of the acts, outcomes and contingencies associated with a particular choice. The frame that a decision maker adopts is controlled partially by the formulation of the problem and by the norms, habits, and personal

characteristics of the decision maker. It is often possible to frame a given decision problem in more than one way. Framing effect is a change of preferences between options as a function of the variation of frames, such as through variation in the formulation of the problem. In finance theory, it is assumed that the frame is irrelevant to the behavior, because the frame is assumed to be transparent. But this is not always so. When a person has difficulty looking through an opaque frame, his decision typically depends on the particular frame he uses (Cornicello, 2004, p. 24). Framing can also be defined as the idea that the way in which a concept is presented to an individual matters (Ritter, 2003, p. 432).

In sum, there are three interrelated elements of mental accounting. The first is the way incomes are framed or experienced. For example, individuals give different weights to money according to the way it is obtained. Money obtained by hard work is more valued than money obtained from the lottery, because the latter is considered unexpected and costless (Cornicello, 2004, p. 24).

Another psychological inclination among individuals is to catalogue events into different mental accounts based on superficial attributes. An idea underlying mental accounting is that decision makers have a psychological inclination to separate different types of gambles into different accounts, and to make decisions according to the prospect theory of each account, ignoring the possible interactions among them (Cornicello, 2004, p. 24). This can have the effect of people arbitrarily dividing their investments into separate accounts. For example, many people have a household budget for food, and a household budget for entertaining. At home, where the food budget is present, they will not eat lobster or shrimp because they are much more expensive than fish casserole. But in a restaurant, they will order lobster and shrimp even though the cost is much higher than a simple fish dinner. If they instead ate lobster and shrimp at home, and the simple fish in a restaurant, they could save money. But because they are thinking separately about restaurant meals and food at home, they choose to limit their food at home (Ritter, 2003, p. 432).

Finally, the last psychological inclination among individuals is related to the length of time in which mental accounts are evaluated. This could suggest, for example, that people who "balance" their account every week, as opposed to people who balance their account every month, are more likely to spend money won in a lottery during the same week than in the subsequent ones. As time passes, the effect decreases (Cornicello, 2004, p. 24).

Loss aversion is related to other elements, one of which is the so-called endowment effect. The endowment effect was first identified by Thaler in his work dated 1980. Thaler used the term to refer to the finding that randomly assigned owners of an object appear to value the object more than randomly assigned non-owners of the object. In sum people value an object more once their property right to it has been established (Kahneman, et al., 1991, p.194). Thus, as a result of endowment effect, people assign more weight to a loss than to a foregone gain, and are influenced by loss aversion for this reason (Ritter, 2003, p. 433).

Loss aversion makes people suffer a so-called status quo bias. This implies that individuals tend to prefer the status quo to changes which involve losses of some goods, even when these losses are offset by gains of other goods. A status quo bias can also exist without the presence of loss aversion. This can be due to the costs of thinking, transaction costs, or psychological commitments to prior choices. The existence of these two biases are represented well in prospect theory (Cornicello, 2004, p. 28-29).

3. **Overconfidence:** The concept of overconfidence is based on a large body of evidence from cognitive psychological experiments and surveys showing that individuals -men are more overconfident than women- overestimate their abilities and estimations, as

> well as the precision of their information. This excessive self-confidence is perhaps the steadiest principle in psychology of judgement. Overconfidence leads people to overestimate the probability of success and to underestimate the probability of failure. It also makes people create confidence intervals that are too narrow when they have to decide on uncertainty conditions, and then they become more surprised than they expect to be by the results (Cornicello, 2004, p. 30).

It is clear that there is a link between rationality and overconfidence. Many economists would agree that their definition of rationality should not be taken too literally. According to their definition, individuals have an unlimited ability to observe and process information. In real life, individuals have limited processing abilities, and hence use ambiguous rules to translate the information they receive from the environment into estimates of cash flows and firm valuations. For example, investors -- especially individual investors – could not incorporate the news about antitrust proceedings against Microsoft into concrete views about the future competitiveness of the industry, and how this, in turn, would affect Microsoft's future cash flows. Instead, they did much of their analysis based on "hunches" or "feelings," which can be easily influenced by behavioral biases (Daniel & Titman, 2000, p. 4).

Overconfidence is one of the most strongly documented behavioral biases in behavioral finance literature. DeBondt and Thaler found that stocks that experience extremely good performance over a three to five year period tend to be outperformed by prior "losers" during the subsequent three to five years (DeBondt & Thaler, 1985, p. 793; Fama, 1998, p. 285). And they explained these results by investors' overreaction. They pointed out that investors believe great performance in the past is a proxy for great performance in the future, and as a result investors bid up the prices of past winners without thinking that firms can't grow forever. DeBont and Thaler argued that overreaction could be taken as a prediction of behavioral finance altering the efficient market hypothesis (DeBondt & Thaler,1985, p. 793;' Fama, 1998, p. 285).

In their summary of the micro foundations of behavioral finance, DeBondt and Thaler (1994) stated that "perhaps the most robust finding in the psychology of judgment is that people are overconfident." Entrepreneurs, managers, investment bankers, and market professionals, -such as security analysts and economic forecasters- can all exhibit overconfidence bias. Moreover, some evidence suggests that experts tend to be affected more by overconfidence bias than relatively inexperienced individuals (DeBondt & Thaler,1995, p.24; Rodriguez, 2002, p. 4).

Experimental evidence also suggests that the degree of overconfidence varies according to the situation an individual faces. Overconfidence is generally stronger for more diffuse tasks for which feedback is slow, such as making diagnoses of illnesses, as opposed to more mechanical tasks which provide immediate and conclusive outcome feedback, such as weather forecasting, horserace handicapping, or solving arithmetic problems. While there are clear disadvantages associated with overconfidence, there are also offsetting benefits which suggest that, overconfidence may increase an individual's chances of passing on their genes. Evolutionary theories suggest that individuals who appear to be the strongest and the smartest are more likely to attract women and reproduce. For similar reasons, being confident may enhance short-term economic survival. Even in the money markets, where results are easy to measure and reward, assuming the past investment performance equal, portfolio managers who appear more confident will attract clients more. The ability to act as smart and strong is therefore a survival psychological inclination which provides a comparative advantage to individuals with overstated opinions of themselves (Daniel & Titman, 2000, p. 4).

In stock exchange markets; evidence indicates that reactions to new information are generally asymmetrical and industry related in transactions. There is a strong reaction to bad news about stocks that performed well in the past, while the reaction to bad news about stocks that performed badly in the past is relatively small. This is seen as important in behavioral explanations of the value anomaly since when past winning stocks are subject to a larger response to negative surprises, they tend to be *more* volatile than past losing stocks, thereby contradicting the rational relationship between risk and expected return. This shows that investors generally fail to judge correctly when dealing with uncertain outcomes. Overreaction to bad earnings announcements of past winners and under-reaction to good earnings announcements from past losers can be identified as a trading pattern. The failure of investors to alter their beliefs about certain stocks, and to foresee that a good earnings signal from a past losing stock is a sign of more earnings to come, creates opportunities for certain investment strategies, such as the momentum and contrarian, to achieve above average results (Andrikopoulos, 2007, p. 63).

Consequently, an important point in this theory is that individuals can better fool others about the strength of their abilities if they can first fool themselves. At this point, it should not be forgotten that financial markets are interactive. In other words, self-confident individuals will appear to be more competent than individuals who are insecure about their own abilities. As a result, individuals who successfully filter information in ways that add to their self-confidence may, in theory, be more successful than individuals who always interpret information rationally (Daniel & Titman, 2000, p. 5).

4. **Representativeness vs. Conservatism:** People tend to underweight long-term happenings and put too much weight on recent experience. This is sometimes known as the "law of small numbers." For example, when equity returns have been high for many years, many people begin to believe that high equity returns are "normal."

Representativeness could be defined as; people tend to judge the probability of an event by finding a 'comparable known' event and assuming that the probabilities will be similar. Representativeness bias was first identified by Kahneman and Tversky (1972, p.430). If things change, people tend to be slow in picking up on the changes. In other words, they *anchor* onto the ways things have normally been. According to conservatism bias people are slow to adapt to new conditions (Shiller 2002, p.4). The conservatism bias is at war with the representativeness bias. If things change, investors will underreact as a result of conservatism bias. But if there is a long enough pattern, they will adjust and possibly overreact, underweighting the long-term average (Ritter, 2003, p. 433).

5. **Disposition Effect:** The disposition effect refers to the pattern of people are reluctant in realizing *paper losses* and hasty in realizing *paper gains*. Acoording to Shefrin and Statman people sell winners to early and hold loosers to much. And they named this bias as disposition effect.(Shefrin and Statman,1985 p.777) For example, if someone buys a stock at $30 whose value drops to $22 before rising to $28, most people will not want to sell until the stock rises above $30. The disposition effect evidences itself in lots of small gains being realized, and a few small losses. In fact, people treat as if they are trying to *maximize* their taxes. However rational investor neither should be so reluctant about losses nor so hasty about gains. It is also possible to find evidence for the disposition effect in aggregate stock trading volume. In a stock market, trading volume tends to grow during a bull market,. If the market then turns back, trading volume tends

to fall. The sharp drop of the Japanese stock market by over 80% from the late 1980s to the mid 1990s can be given as an example. The fact that volume tends to fall in bear markets results a decrease in the commissions of stock brokerage houses. And this means a high level of systematic risk. As an example, in the U.S., aggregate stock market volume has not dropped since the beginning of the bear market in April 2000. This may be due to increased trading by institutions, since stock trading by individuals has in fact declined. The significant drop in transaction costs associated with the move to decimalization and technological advances partly account for this (Ritter, 2003, p. 433).

6. **Herding:** Do investors "flock together," or "herd," when they trade securities? Do some investors follow the lead of others when they trade? (Wermers, 1999, p. 581).

According to Nofsinger and Sias herding can be defined as a group of investors trading in the same direction over a period of time (Nofsinger & Sias, 1999, p. 2263). Herd behavior occurs when many people make the same action in order to mimic the behavior of others. The reason why people's judgments are similar is partially due to the fact that people react similarly to the same information. At the same time, the social environment also has a strong influence on people's judgment. When an individual's judgement clashes with the judgement of a large group, the individual tends to change his judgement to fit that of the crowd. Because he simply thinks that all the other people could not be wrong, and as a consequence, the propensity of the crowd affects the individual's decision making process. The individual accepts the large group's judgement rather than facing the fear of expressing a contrary opinion in front of the group. Psychologists have demonstrated the existence of herding behavior in several experiments (Cornicello, 2004, p. 33).

Even if people are completely rational, herding behavior can still exist. People may participate in herding behavior when they take into account the judgment of others, even if they know that everyone else is behaving in a herd-like manner. This results in group behavior that can be defined as irrational since it arises from an information cascade. The information cascade may appear when individuals overweight the signals from the crowd and ignore, or underweight, their private information. Accordingly, they mimic the crowd (Kim & Nofsinger, 2005, p. 239).

Furthermore, when talking about herding and the effect of the crowd upon the individual's decision-making process, the effect of word-of-mouth enthusiasm should be noted. Word-of-mouth enthusiasm accelerates the effect of herding behavior over the market (Shiller, 2002, p. 14). People generally trust their friends, relatives, and colleagues. Consequently, their suggestions can influence a wide range of individual decisions, including financial decisions. Talking with other people about buying opportunities can have an important influence on investment decisions. Besides, the media has the power to influence the individual's decisions, but with less power than word-of-mouth (Cornicello, 2004, p. 34).

Limits of Arbitrage and Noise Trading

Noise trading is trading on noise as if it were information (Black, 1986, p. 531).

Noise traders are investors whose investment decisions rely more on psychological factors than on sound investment management principles (Andrikopoulos, 2007, p. 61).

Misvaluations of financial assets are common in financial markets thus it is easy to reliably make abnormal gains from these misevaluations. There are two types of misevaluations: those that are recurrent or arbitrageable, and those that are non-

repeating and long-term in nature. As a result of misevaluations in the market, trading strategies can be profitable. Because of this, hedge funds and other smart investors search the market continuously, and keep them from ever getting too big. By this way, the market mechanism works efficiently. In long-term, it is nearly impossible to identify the peaks and troughs in real time until they have passed. And it is may be very risky. For example; getting into early risks causes losses that wipe out capital as it is in the Long Term Capital Management case. A worse situation is if limited partners or other investors are supplying funds, then withdrawals of capital after a losing streak may result in buying or selling pressure that exacerbates the inefficiency. Hedge funds may be accepted as a group of investors who positively affect market efficiency because they are in the search for misvalued assets in the markets and try to make money in this way. A relative value hedge fund takes long and short positions, buying undervalued securities and finding highly correlated securities that are overvalued, then takes arbitrage position. A macro hedge fund, on the other hand, takes speculative positions that cannot be easily hedged, such as shorting NASDAQ during the last two years (Ritter, 2003, p. 434).

Glaser, Noth and Weber surveyed the literature about arbitrageurs and their effect in market efficiency. They argued that the effect of arbitrageurs is limited in financial markets, at least in the short horizon (Glaser et al., 2004, p. 6).

The following is a good example of the limits of arbitrage in the financial markets which is mentioned in the preceding paragraphs: The case of Royal Dutch Shell. In the beginning Royal Dutch Petroleum and Shell Transport and Trading are independently incorporated in the Netherlands and England respectively. The current firm emerged from a 1907 alliance between Royal Dutch and Shell Transport and Trading. The new firm has been 60% owned by Royal Dutch Petroleum and 40% owned by Shell Transport and Trading. Royal Dutch trades primarily in the US and the Netherlands and Shell trades primarily in London. According to rational models, the shares of these two companies (after adjusting for foreign exchange) should trade in a ratio of 60:40. But they do not. The actual price ratio has deviated from the expected one by more than 35% for more than a year. It does not make sense to explain this disparity with taxes and transaction costs. According to Froot and Dabora stock prices are affected from the location of trade (Froot & Dabora, 1999, p.13). This is the violation of the law of one price and is a simple, but well known example illustrating that prices can diverge from intrinsic value because of the limits of arbitrage rule (Glaser et al., 2003, p. 5). Some investors do try to exploit this mispricing, buying the cheaper stock and shorting the more expensive one, but this is not a sure thing, as many hedge funds learned in the summer of 1998 (Mullainathan & Thaler, 2000, p. 8).

The crucial assumption on which EMH depends is that the beliefs of human beings are rational. This is consistent with the widely accepted economic theory which postulates that rational decision-makers search for the option which has the largest subjective expected utility, determined by reference to probabilities derived from the available information set. Economists have long resisted the possibility that human beings may act irrationally in the market setting, which is a large part of the foundational stone of agents rationality in the EMH. Irrational behavior that interferes with market efficiency has become known as “noise” (Glen, 2005, p. 97). According to Black; noise is the opposite of information. Investors in financial markets mainly trade on noise as it is information causing inefficiencies in the financial markets (Black, 1986, p.529).

Noise refers to those pricing influences that are not associated with rational expectations about the underlying value of the asset (Glen, 2005, p. 98). Such expectations are not necessarily rational. They should not be. Investment strategies based on noise may represent anything from loyalty to

a friend to a personal heuristic. The noise theory is not so concerned with why individual investors show these suboptimal actions, but rather the effect of irrational behavior on the market (Glen, 2005, p. 98).

Noise theory models "hold that the public capital markets are infected by a large volume of trading based on information unrelated to fundamental asset values. These trades are largely undertaken because of underlying emotional or psychological impulses unrelated to the asset's value. Besides, most investors do not have the capacity or inclination to make comparative investment decisions independently, making them susceptible to external expressions of experts and peers. In the end, even if a public capital market is efficient in the sense of swiftly incorporating public information into security prices that does not necessarily mean that securities prices in that market reflect fundamental values. Although Noise Theory has recently received extra attention, the notion itself is old, dating to John Maynard Keynes. Keynes assumed that investors on the whole were not conducting fundamental analysis, but rather, were more apt to act based on information unrelated to the fundamental value of the particular asset.

The central idea of noise theory is that information unrelated to fundamental values has an impact on the prices of capital assets. However, this is not noise theory's most important contribution to modem economic analysis. The "more important implication of noise theory is that it reveals markets to be nonlinear systems, to which the linear mathematics and reasoning that underlie the EMH are inadequate (Glen, 2005, p. 99).

Black introduced the concept of noise traders to finance literature. Noise traders have an impact in financial markets, and trade on anything other than information. Black highlighted that noise trading is essential to the existence of liquid markets. It is noteworthy that noise may be the main reason of inefficiencies in financial markets but it also makes them possible. As noise trading makes the market more liquid by improving trading volume in the market (Black1986, pp. 531).

In financial markets, there is always a group of investors investing through the advice of financial gurus; they trade actively on the stocks or base their trading strategies on price patterns and other popular models (Cornicello, 2004, p. 22).

It can be argued that noise traders generally lose money in the markets while information traders often earn a profit. The presence of noise traders in the market also influences market prices. Of course, the higher the number of noise traders in the market, the greater their influence on asset prices, even though it would be more profitable for people to trade on information. However, it should be emphasized that if it is not easy to take positions against noise traders as information traders would fail to correct the mispricing and to earn a profit (Ritter, 2003, p. 431).

The presence of noise traders in financial markets and the effect of their trades on the market are closely related with the arbitrage possibilities. The efficient market hypothesis explains that the presence of the irrational investor is deleted by the rational arbitrageurs who cut out the irrational investor's influence on stock prices.

In financial markets, arbitrage opportunities are risky and therefore limited. The opportunities for arbitrage are based on close substitutes for the security in which noise traders invest. It is not easy for an arbitrageur to take position and eliminate the mispricing effects of noise traders, especially in the short run (Ritter, 2003, p. 431). These are usually available for derivative securities, like options or futures, but occasionally the arbitrage requires notable trading volume. In other cases, there are no close substitutes. An arbitrageur cannot sell stocks and buy a substitute portfolio at the same time because this simply does not exist. In this case, the arbitrageur can only sell or lessen his exposure to the stocks, but this arbitrage is not risk-free, and if the investor is risk adverse, his interest in

this arbitrage will be limited. There are two main difficulties for this type of trading strategy. First, arbitrageurs cannot take an adequate amount of positions in order to offset the effects of noise because of the increasing risk. As information gives him an opportunity but does not guarantee the profit. Taking larger positions will increase the risk and this will limit the arbitrageur. Secondly, the arbitrageur can never be sure if he is trading on information or noise. If the information used has already been included in prices then he will be trading on noise. In this situation one can never be sure until it comes through. Consequently, the presence of arbitrageurs on the market does not eliminate the effect of the noise traders because of the limits of arbitrage in financial markets (Black, 1986, p. 532).

BEHAVIORAL FINANCE: CONTRIBUTIONS TO MODERN FINANCE THEORY

In literature, it has been highlighted that bias and framing effects driven by heuristic, cause market prices to deviate from fundamental values. Additionally, it has been suggested that behavioral finance may offer an explanation for empirical evidence which casts doubt on existing financial models (Brabazon, 2000, p. 5). In 1985, De Bondt and Thaler argued that overreaction or underreaction may occur in financial markets as investors rely on representativeness bias (DeBondt & Thaler, 1985, p. 793). Investors could become excessively optimistic about past winner stocks and excessively pessimistic about past loser stocks, and this bias could cause prices to deviate from the fundamental values. As a result of the biased attitudes of investors, overreaction and underreaction of investors to new information occurs in financial markets. Anchoring and overconfidence may lead analysts to fail to adjust their earnings estimates sufficiently in case of unexpected price changes. This could lead to subsequent price adjustments as analysts revise their incorrect estimates. According to Brabazon, as a result of the arguments of behavioral finance several implications about behavioral patterns may arise in financial markets (Brabazon, 2000, p. 5). Such as the:

- Overreaction or underreaction to price changes or news.
- Extrapolation of past trends into the future.
- Lack of attention to fundamentals underlying a stock.
- Focus on popular stocks.
- Seasonal price cycles.

If such patterns exist, there may be scope for investors to exploit the resulting pricing anomalies (differences) to obtain superior risk adjusted returns. On a theoretical level, the exploitable pricing anomalies undermine the current credibility of the EMH and these findings should be accepted as a contribution for a better explanation of the real markets not a as a challenge to the mainstream in finance. In contrast, behavioral finance assumes that, in some circumstances, financial markets are informationally inefficient (Ritter, 2003, p. 430).

FUTURE RESEARCH DIRECTIONS

It is possible to posit that there is no detailed framework incorporating the varying findings of behavioral finance. In the light of these findings it may be possible to develop better models for explaining complex financial markets. These models will incorporate behavioral explanatory variables may outperform traditional financial models (Brabazon, 2000, p. 5). New models should also overcome the model dredging problem which is one of the major criticisms of behavioral finance. In essence, these models would generate "new" information which had not previously been incorporated in investors' decision models (Brabazon, 2000, p. 5).

CONCLUSION

Behavioral Finance is a recently developing approach in finance literature. And as a result of its challenging findings to the modern finance theory it is mainly ignored across the traditional academic environment. However its arguments are solid and assumptions are more close to the real markets this new approach has a rapid development in recent years. Main idea of the behavioral finance is that, investors are not as rational as they are assumed to be. Therefore, financial markets could be better understood by using models which capture the effects of both rational and irrational investors.

Behavioral Finance and Efficient Market Hypothesis are not competing approaches, but rather complementary approaches. The merger of these two areas of research is an inevitable event which is very possible to occur in the near future. Finally it should be noted that behavioral finance is not a separate discipline, but will increasingly become part of mainstream finance. The real markets especially financial markets are so complicated, without the depth and breadth of different approaches combined it will not be possible to capture the magic of real markets.

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KEY TERMS AND DEFINITIONS

Behavioral Finance: A field of finance that proposes psychology-based theories to explain movements in stock markets. Within behavioral finance, it is accepted that the investors are that smart as they assumed to be.

Cognitive Biases: Cognitive bias refers to an impairment of judgment leading to irrationality and perceptual distortion. It may occur as a result of moral and emotional motivation, limited access to information or influences of the society leading to a decision or judgment that is not fair.

Noise Trading: A rational agent is an agent who has clear preferences, models uncertainty via expected values, and always chooses to perform the action with the optimal expected outcome for itself from among all available actions.

Prospect Theory: This theory describes how individuals evaluate losses and gains. The theory is proposed by Daniel Kahneman and Amos Tversky.

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Section 2
Development and Design Methodologies

This section covers some of the most cutting-edge tools and techniques used by professionals in the fields of Banking, Finance, and Accounting. As bankers and industry leaders discover new methods of managing customers and predicting market trends, sharing such insights with the greater community leads to higher profits and growth. Investor management, predictive analytics, portfolio management, and emerging ICT tools are only some of the areas seeing constant improvement. The 14 chapters that make up this section explore the development and design methodologies that bridge the gap between fundamental concepts and real-world applications of Banking, Finance, and Accounting.

Chapter 17
Drop-Out Risk Measurement of E-Banking Customers

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ABSTRACT

During the last decade, the national financial markets have shown a great transformation that has failed to reduce the high rate of existing banking in spite of the current financial crisis. This high level of competition makes financial institutions concerned about the loyalty of their customers to maintain or increase their market share and profitability. In this chapter, the authors propose a statistical model that measures the risk of customers dropping out of a Spanish financial institution, and this is a widespread method for the financial sector in general. The risk depends on socio-demographic and economic factors, as well as–most importantly–on the levels of satisfaction and trust that the bank produces in customers. Research shows that the proposed model can help institutions to know which customers have a greater risk of dropping out and, therefore, establish some recommendations for their loyalty.

INTRODUCTION

Nowadays, online trading is regarded as the most potential tool for companies, which will mean a revolution in both the buying habits of consumers and the formulas of relationship between consumers and companies (Sharma and Sheth, 2004). Currently, over 90% of total OECD firms have access to the Internet. Although in Spain it is slightly lower (86.6%), the trend in recent years shows signs of an approximation to the average OECD countries (AMETIC, 2010).

Even though it is true that the use of the Internet will be more or less intensive depending on the sector and size of the company, there are certain sectors, such as finance, tourism and the media, where the Internet has a major presence (Badia, 2002) and shows a value creation (Luque

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and Castañeda, 2007) as well as the generation of significant investments (AMETIC, 2012). In these sectors, as claimed by Rainer and Turban (2009), the Internet is considered to be a revolutionary tool that contributes to change and ways to do business. In this sense, financial institutions have modified their business models, paying special attention to e-Banking.

Generally speaking, the use of e-Banking is increasing annually, and at the present moment 28.7% of Internet users make financial transactions online (comScore, 2012) with significant growth prospects (see Figure 1).

In regards to Spain, both the number of Internet users and the use of most online services, including e-Banking, have increased as shown in Table 1.

Payment is one of the most important elements of any business because it makes the sale complete. In the case of e-commerce, payment is still an essential element requiring a payment system akin to the medium used. Consequently, e-Banking is presented as the main payment tool in financial transactions online (Molavi et al., 2011). Thus, e-Banking will be automatically offering modern and traditional bank services and products to customers directly and with the help of electronic connection channels (Alagheband 2006).

Meeting the needs of customers along with fulfilling their differentiation and loyalty are the three most important business objectives for financial institutions, thus promoting the loyalty of customers who make payments through online

Figure 1. Percentage of worldwide access of users to e-banking

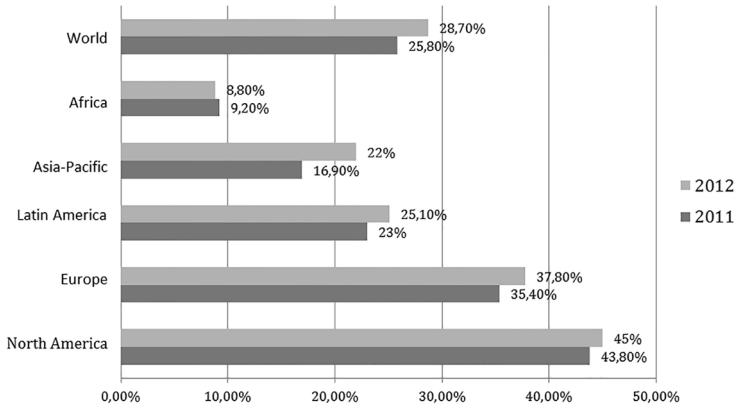


Table 1. Internet services used for personal reasons in the last three months

	2011	**2012**
Total of people who have used the Internet in the last 3 months	23,196,058	24,075,125
Communication services and information access: Sending or receiving emails	88.10%	88.50%
Other services: Using services related to travel and accommodation	58.40%	58.00%
Other services: Selling products or services (direct sales, auctions, etc.)	10.10%	12.20%
Other services: Phoning or making video calls (via webcam) through the Internet	21.80%	31.00%
Other services: E-banking	**42.00%**	**45.40%**

Source: INE (2012)

banking. Due to the privileged position they have enjoyed, financial institutions have not traditionally been characterized by using tools that favored customer loyalty, whereas in recent years, there are multiple actions that are performed in order to make the relationships with their customers profitable, rather than adding new customers, as this is much more expensive than keeping an existing one (Bhattacherjee, 2001).

In recent years, the current situation in the financial sector has been characterized by (Momparler, 2008):

1. Increased competition,
2. Development of technological innovations,
3. Greater accessibility to services,
4. Social interaction of financial customers,
5. Requirement of a lower cost per bank transaction,
6. Counting on customers with higher financial knowledge, and
7. Ease of access to new technologies.

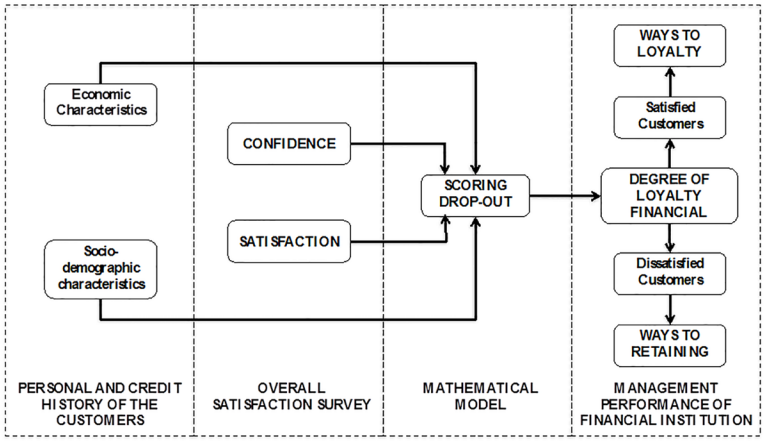
This complicated situation has forced financial institutions to enhance and personalize their service level as well as to involve the entire organization in the search for greater linkage and customer profitability using tools such as Customer Relationship Management (CRM).

Can statistics help financial institutions and banks in customer faithfulness and loyalty according to their needs? In order to answer this question, this manuscript aims to test the importance that customer loyalty implies for financial institutions and whether that loyalty can bring them a higher profit (Reichheld, 1996), for which empirical research was conducted using a survey of 946 clients of a Spanish financial institution, following the scheme presented in Figure 2. The research results suggest that statistical models provide a great service to detect those customers with high risk of dropping out, though, after viewing a large number of descriptors, a different model can be obtained for each entity within a financial system using, for this, the same methodology.

In this sense, the objective of this work is to determine a method that can assess the existing probability for an e-banking customer not to be faithful to the bank, therefore measuring the risk of loss of an e-banking customer.

For this, we divided the work as follows: in section 2 we define the concept of faithfulness after an extensive review of literature dealing with marketing and consumer behavior. In this regard, we establish the relationships between loyalty and satisfaction and confidence, respectively. In section 3 we present the theoretical relationship of the subject to explain following the concepts

Figure 2. Outline of the research model



defined in previous sections. For this, after posing the objectives and appropriate hypotheses, we propose an empirical model to determine the chance of a customer being loyal or, conversely, leaving the financial institution. In Section 4 we present the results obtained by the proposed model, also analyzing its predictive power. Finally, we reach a series of conclusions and implications from this work.

2. LITERATURE REVIEW

Brand Loyalty and Service Loyalty

Scientific literature proposes an understanding of loyalty generally speaking from a multidimensional perspective (Day, 1969, Brandt, 2000) although it is usually understood from the conative, attitudinal and cognitive perspectives.

From the conative point of view, faithfulness is understood as a repetitive purchase behavior of people or organizations (Bass, 1974, Dick and Basu, 1994; Fournier, 1998) improving the relationship between the two sides (Yi, 1990). From the attitudinal standpoint, loyalty is seen as a feeling of attachment of individuals to a product, service or company (Hallowell, 1996). Finally, the cognitive viewpoint of loyalty includes the two previous approaches, focusing on the results of the brand (Segarra, 2007).

Even though most of the research has traditionally been centred on customer loyalty in relation to tangible assets (brand loyalty), the other sectors, particularly the service sector, should not be forgotten.

Many customers understand faithfulness or loyalty in terms of working with an entity regularly or just with the level of satisfaction that their entity offers. In this sense, loyalty is defined as a "continuum" where the relationships depend on attitudinal and behavioral components discussed above.

There are many classifications that have been made about loyalty using different criteria, based on: purchase patterns of consumers (Brown, 1952), strength or integrity of the individual and the social or community support (Oliver, 1999), satisfaction, involvement and commitment (Diller, 2000), or the relationship between customers and company (Christopher et al., 1994), etc.

The most noticeable consequences of loyalty are the reduction in the search of new shopping alternatives, positive word of mouth a growth of the number of recommendations, attraction of new customers, better perception of sales efforts and increased recurring purchasing, among others.

Relationship between Loyalty and Satisfaction in Financial Customers

In literary terms, satisfaction is considered to be an antecedent in the behavior of customer loyalty (Rust & Oliver, 1994) and allows the company to maintain and encourage long-term relationships and improve profitability and customer loyalty (Shankar et al. 2002; Ranaweera et al., 2005).

Different studies find that facilitating customer satisfaction allows the company to maintain and favour long-term relationships as well as improve profitability and customer loyalty. In order to achieve this objective more easily, banks take actions of segmentation allowing the identification of critical elements for a particular segment so that it enhances the propositions of value which it identifies as keys.

As seen from the different studies analyzed and the review of scientific literature on extracting groups of consumers, in recent years different studies have focused on obtaining user segments of services offline (eg, Karjaluoto et al., 2002; Cameron et al., 2006) and online (eg Muñoz-Leiva et al., 2010).

For some time, various authors have investigated the influence of expectations on satisfaction. Under the classical paradigm of disconfirmation of expectations (EDT) the conclusion is that sat-

isfaction is formed from the comparison between the results of the experience gained and previous expectations (Oliver, 1980; 1981), resulting in a gap or difference between both called disconfirmation of expectations. There will be positive disconfirmation when the result of that difference exceeds expectations, whereas disconfirmation will be negative if the result does not reach the level of expectations. Therefore, we can conclude that there will be satisfaction when generating positive disconfirmation, while dissatisfaction will appear with negative disconfirmation and, consequently, positive or negative attitude respectively, increasing the likelihood of the e-Banking customer dropping out, thus favouring defection to other competitors in the financial sector.

Moliner (2004) summarizes the two major determinants of EDT approaches. On the one hand, the subtractive or objective disconfirmation approach, which refers to the difference between the performance of the product or service and the comparables. On the other hand, the subjective disconfirmation approach, in which the difference between the performance of the product or service and the expectations represents a subjective assessment of the consumer.

Meanwhile, satisfaction will be influenced by the pre-purchase attitude that the expectations generated (Howard, 1974). According to this relationship between satisfaction and attitude, the model of Howard (1974) finds that satisfaction judgments create attitudes and intentions about future purchasing behavior, so this conditions the future business relationship with the financial institution. Moreover, this attitude is affected by the degree of satisfaction created from disconfirmation of expectations, resulting in a post-purchase attitude which, combined with the prior intention, leads to a further intention that causes certain behaviors (Miller, 2004).

Therefore, our research will take specific transaction approach, defining satisfaction as a general attitude manifested by consumers in relation to their experience of purchasing behavior.

Relationship between Loyalty and Trust

Research conducted in recent years has shown how confidence is an element that helps maintain commercial relationships, being this aspect of great importance in the business sector (Barroso & Martin-Armario, 2000; Bigné & Blesa, 2003; Garcia et al., 2008).

Confidence has been studied and defined in many scientific disciplines, being analyzed in each of them in a different light. However, it can be defined from different perspectives (Hernández, 2010). From a cognitive point of view, Dwyer et al. (1987) defined it as 'the belief that the word or promise of one part is reliable and that it will meet its obligations in a relational exchange' and is therefore the result of past experiences with the company and its reliability. By contrast, from the behavioral perspective confidence is defined as 'the willingness from one part to be vulnerable to the actions of the other side on the basis of the expectation that the latter will perform a particular action important to the one trusting, regardless of the ability to monitor or control the other side'[1].

Because of all this, we can conclude that confidence has the following effects (Segarra, 2007):

1. Reducing the perceived risk associated with opportunistic behaviour by the agent,
2. Increasing self-confidence to a greater extent, and
3. Reducing transaction costs arising from the business relationship.

Customer Retention and Loyalty

Customer retention is understood according to the previous conative approach where, precisely, the purchase of products or services will repetitively guarantee bonding with the company or brand, so it seems obvious to consider that both concepts are related (Diller, 1996). In the financial industry this relationship was evidenced since 'loyalty

is described as the duration of the customer's relationship with a provider and the number of products he purchases', this definition being closely related to the concepts of satisfaction and confidence above.[2]

The economic situation around the financial industry today (reduced interest rates, lower intermediation margins, search of efficiency and productivity, cost containment, etc..), has forced to focus the interest of financial institutions on the final client, so that the customer knowledge that an organization has, together with his experience, will be a decisive influence on the level of bank satisfaction. In addition, attracting new customers can be seen as a cost five times higher compared with maintaining an existing customer; thus, it seems clear that banks strive to keep their customers satisfied (Bhattacherjee, 2001) reducing the risk of attrition and favouring their retention. For this reason, many companies develop their business model through the Relationship Banking (Barrutia & Echebarría, 2002), which is based on favouring the most faithful customers in order to improve their profitability and make this satisfaction an exit barrier. In this regard, those customers with a higher level of connection will be more likely to hire new financial products and thus, improve their engagement and satisfaction as demonstrated below.

Consequently, we can describe customers' loyalty to financial institutions in response to both satisfaction and confidence (Kim et al., 2009).

METHODOLOGICAL ISSUES

Objectives and Hypotheses

Resulting from literary review, the research starts from the hypothesis that Spanish bank customers maintain a high degree of loyalty to the institutions with which they have contracted the services of credit and savings both because of convenience and habit and because of satisfaction and confidence with the service received (Santiago, 2008). Moreover, we consider the hypothesis that the scale of bank loyalty comes to be defined to a greater extent by the satisfaction than by the quality of service received by the bank.

In this regard, the issue to explain is the risk of desertion or abandonment of a client in a financial institution, which can be understood as the customer leaving or behaviour change (Malhotra et al., 2008). On the other hand, Garland (2002) defines it as the abandonment of the customer of a product or service for another one, while Crie (2003) believes that attrition is both active and destructive response to dissatisfaction and that is reflected in the break-up of the relationship with the brand, product or supplier. We agree with Stewart (1998) when he defined desertion as the end of the relationship between the customer and the bank.

There are previous studies that have analyzed the issue of bank desertion. Some authors see it as a customer complaint about the financial institution (Crie, 2003), but they limit their analysis to a broader sense of the term. A complementary theory assumes that customers who complain about their dissatisfaction have the opportunity to leave or remain regular customers of the financial institution (Sheth et al., 1999; Arnould, 2004).

In our research we take into account a stricter theory about this concept, proposing a series of hypotheses in relation to the concept of abandonment of a financial institution for reasons of financial dissatisfaction and disloyalty. These are:

H1: There is a meaningful relationship between e-banking customer classification according to connection with the financial institution regarding turnover and customer desertion.

H2: There is a statistically significant relationship between the abandonment of an e-banking customer and two products linked with the financial institution, such as hiring or not, at least, one credit card and debit card numbers contracted with the institution.

H3: There is a relevant relationship between customer satisfaction and confidence manifested in several items recorded in a survey of overall satisfaction, and customer abandonment or desertion.

H4: The impact of qualitative variables concerning confidence and overall satisfaction in the study of bank loyalty is greater than the quantitative and qualitative variables assessed by the financial institution.

Data Collection

Along with the study of the concept of bank loyalty in relation to customer satisfaction and confidence, in this paper we intend to explain the reasons why customers of financial institutions may drop from one institution to another in order to meet their needs of credit and savings. At the same time, we propose a model for future prediction concerning any customer, whether potential or not, in a bank. To do this, we use the binary logistic regression technique, which can be applied to a database containing full information on a number of clients in a Spanish financial institution.

For that, the dependent variable in the statistical model we propose is dichotomous, with a value of 0 for customers who have finished their savings and credit activities with the institution under study and 1 for customers who are still customers of the institution. For both situations a maximum period of 18 months is considered since the collection of information in the satisfaction survey, not exceeding the limit of two years used by previous studies (Stewart, 1998; Malhotra et al., 2008; Santiago, 2008).

The data provided is derived from the general activity satisfaction survey that Caja Rural of Granada[3] makes to customers every other year, and it was carried out between September and October 2009.

The Web form consisted of a total of 10 *likert* questions with five graduations and was uploaded on the servers of Caja Rural of Granada Computer Service. The survey was limited to the assessment of a number of items, which we gather in Table 2 of the present chapter.

As indicated in Table 3, the final sample consisting of 946 individuals was randomly divided into two subsamples with the intention of performing a post-validation on the estimated logistic regression model by assigning 75% of the total cases to estimate the statistical model and the remaining 25% to the validation of the same (Bensic et al., 2006). The sampling error for this

Table 2. Website survey developed for e-Banking customer of Caja Rural of Granada

Rate your level of agreement with the following statements where 1 = strongly disagree and 5 = strongly agree).					
Availability of access to e-banking Caja Rural of Granada.	1	2	3	4	5
Availability for e-banking operations.	1	2	3	4	5
Clarity and understanding of information in e-banking.	1	2	3	4	5
Agility in the process of conducting o0perations/queries e-banking.	1	2	3	4	5
Easy navigation and management of e-banking Caja Rural of Granada.	1	2	3	4	5
Adjustment of the transactions available in e-banking Caja Rural of Granada to your needs.	1	2	3	4	5
Usefulness of information provided on e-banking website.	1	2	3	4	5
Confidence in the privacy of the data and the operations performed on electronic banking Caja Rural of Granada.	1	2	3	4	5
Security that transmits electronic banking Caja Rural of Granada.	1	2	3	4	5
Rate your overall satisfaction with e-banking Caja Rural of Granada.	1	2	3	4	5

Table 3. Random sample data

Financial Institution: Caja Rural of Granada **Date of data collection:** 2009		
Cases (N)		
Non Drop-Outs	**Drop-Outs**	**Total**
661	285	946
Estimation Sample (75%)		
Non Drop-Outs	**Drop-Outs**	**Total**
496	214	710
Validation Sample (25%)		
Non Drop-Outs	**Drop-Outs**	**Total**
165	71	236

selection was 3.19% in the proportion estimate (with a confidence level of 95% and P = Q = 0.5).

On the other hand, Table 4 shows the variables separate from the issue we want to explain. The database includes information on economic and socio-demographic characteristics of the customers of the entity, as well as qualitative variables drawn from the above survey. The latter are known as categorical variables with 5 possibilities or states expressed by customers, with 1 indicating strongly disagree and 5 strongly agree.

The Model

Regarding the method of analysis, in order to avoid the disadvantages presented by the models of Linear Regression and Discriminant Analysis -identified by Mures et al (2005)-, we apply the Binary Logistic Regression as a technique to propose a model whose response or dependent variable is a *dummy* variable with a value of zero (0) when the customer leaves the bank and operations in favour of another institution, and one (1), when otherwise the customer is loyal to his financial institution.

The statistical model comes from the structural *random-utility* model proposed by Green (1993), in which the unobserved vector (1 x N) of expected profit b_m for bank customers who leave is a linear function of an unobserved vector (k x 1) of coefficients γ_m a noticed matrix (k x N) of independent or explanatory variables *Um* and unobserved vector (1 x N) that collects the random disruption ϵ_m.

$$b_m = \gamma_m' \times U_m + \epsilon_m \quad (1)$$

Table 4. Explanatory variables

Variable	Concept
ZONE	Geographic location fo the agency or branch. Dummy variable: (0) Central Area; and (1) Outskirts.
PROD_NUM	Number of products that the customer has contracted with the financial institution.
PROF_RAT	Customer profitability ratio with the financial institution (gross income/financial products).
RAT_LIQUID	Customer cash ratio with the financial institution (loans/total assets).
PROD_CLASS	Customer classification based on their connection with products in the financial institution. Dummy variable: (0) Customer with low connection; and (1) Customer with high connection.
VOL_CLASS	Customer ranking based on volume of business with the bank. Dummy variable: (0) Customer with low turnover; and (1) Customer with high turnover.
RENT_CLASS	Customer listing based on the degree of profitability that contributes to financial institution. Dummy variable: (0) Customer that provides low profitability; and (1) Client that provides high return.
PAYROLL	Establish payroll direct deposit in the financial institution. Dummy variable: (0) No; and (1) Yes.
PENSION	Hiring a pension plan with the financial institution. Dummy variable: (0) No; and (1) Yes.

continued on following page

Table 4. Continued

Variable	Concept
DEB_CARD	Customer has contracted debit card. Dummy variable: (0) No; and (1) Yes.
CRED_CARD	Customer has contracted credit card. Dummy variable: (0) No; and (1) Yes.
DEBCARD_NUM	Number of debit cards that the client has with the financial institution during the period that he has remained a customer of the institution.
AGE	Age of customer at the time of evaluation.
GENDER	Gender of the borrower. Dummy variable: (0) Male; and (1) Female
MOBILE	Use of the mobile phone in banking transactions. Dummy variable :(0) No; and (1) Yes.
MAIL	The customer has an email account. Dummy variable: (0) No; and (1) Yes.
SELF-EMPLOYED	The client is independent worker. Dummy variable: (0) No; and (1) Yes.
YEAS AS A CLIENT	Time of the borrower as a customer of the entity.
E-BANK_NUM	Number of e-banking transactions of the customer.
E-BANK_AMOUNT	Average amount of the customer in e-banking transactions.
CLARITY	Level of openness of the financial institution with the customer. Categorical variable: (1) Very Dissatisfied; (2) Somewhat Dissatisfied; (3) Neutral; (4) Somewhat Satisfied; and (5) Very Satisfied.
AGILITY	Level of agility in the financial institution operations. Categorical variable: (1) Poor; (2) Fair; (3) Good; (4) Very Good; and (5) Excellent.
CONFIDENCE	Level of customer confidence in the financial institution. Categorical variable: (1) Dissatisfied; (2) Somewhat Dissatisfied; (3) Somewhat Satisfied; (4) Satisfied; and (5) Very Satisfied.
SECURITY	Security level that the client has when performing e-banking operations. Categorical variable: (1) Poor; (2) Fair; (3) Good; (4) Very Good; and (5) Excellent.
CUSTOMER SERVICE	Level of customer satisfaction regarding the customer service department. Categorical variable: (1) Strongly Disagree; (2) Disagree; (3) Neutral; (4) Agree; and (5) Strongly Agree.
SATISFACTION	Overall level of satisfaction that he financial institution provides. Categorical variable: (1) Very Dissatisfied; (2) Somewhat Dissatisfied; (3) Neutral; (4) Somewhat Satisfied; and (5) Very Satisfied.

Similarly, a function is proposed relating to the expected costs c_m of the customers who drop out of the institution. The transfer cost responds to the cost of switching between different brands of products or services (Chen and Hitt, 2002).

$$c_m = \delta_m^{'} \times W_m + \mu_m \tag{2}$$

On the other hand, a customer who remains faithful to the institution brings about the expected benefits b_b and expected costs c_b, so that when a customer is faithful (y = 1) or leaves the institution (and = 0), the difference between the net result when being loyal and dropping out (y^*) is positive.

$$y^* = (b_m\text{-}c_m) - (b_m\text{-}c_m)$$

$$y^* = (\gamma_m' \times U_m - \delta_m' \times W_m - \gamma_b' \times U_b + \delta_b' \times W_b) + (\epsilon_m - \mu_m - \epsilon_b + \mu_b)$$

$$y^* = \beta' \times X + \epsilon > 0 \quad (3)$$

Building a logistic regression model assumes that ϵ takes a logistic distribution, so the cumulative distribution function can be reflected as shown in the equation.

$$\Lambda\left(y\right) = \frac{e^y}{1+e^y} \quad (4)$$

The maximum likeliness estimator corresponds to a vector (k x 1) x β^* that maximizes the next function:

$$\ln L = \sum_{i=1}^{N} \ln \Lambda\left[\beta' \times X_i \times \left(2\, y_i - 1\right)\right] \quad (5)$$

Considering the above, the estimated risk of drop-out for the customer *i* can be expressed as shown in the equation

$$E\left[y_i\right] = \Lambda^* = \Lambda\left(\beta^{*'} \times X_i\right) \quad (6)$$

The variation in the probability of faithfulness or, otherwise, drop-out of the customer from the financial institution due to variation in any of the continuous independent variables is shown in the following equation.

$$\frac{\partial E\left[y\right]}{\partial X} = \Lambda^* \times \left(1 - \Lambda^*\right) \times \beta^* \quad (7)$$

Logistic regression supports the use of categorical variables by using dummy variables. In these cases, the variation in the estimated probability of dropping out because of a variation in a dummy variable is similar to the one calculated by means of the expression (7) (Menard, 2009).

Among the parametric techniques, the choice of Binary Logistic Regression as statistical technique is due to the large utility in the following topics gathered in the works of Eisenbeis (1981) and Lawrence and Arshadi (1995):

- Logistic regression is not as strict as linear regression regarding the performance of the strict hypothesis of linearity, normality, homoscedasticity and independence.
- The statistical properties are more suitable than the linear models, where at times inefficient estimators are obtained.
- It recognizes the categorical variables with greater flexibility than the linear models.
- It makes it possible to estimate the probability of drop-out or desertion from a financial institution, according to the values of the independent variables.
- The model determines the influence of each independent variable on the dependent variable (loyalty and abandonment) depending on the OR (Odds Ratio or advantage). This is defined as exp (β), where exp is the base of natural logarithms (a constant whose value is 2.718) and β is value of the regression parameter of the independent variable in the model. Thus, exp (β) represents the value of the odds when the explanatory variable takes the value 0; in other words, success is much more likely than failure when the explanatory variable is 0.

ANALYSIS OF RESULTS: MODEL ESTIMATION AND VALUATION

Explanatory Analysis of the Model

Below we show the logistic regression analysis on the data from our study in which we set the goal to characterize the abandonment or desertion of a customer from a financial institution starting from a set of explanatory factors. In this regard, Table 5 displays the first results of the logistic regression analysis.

Table 5. Drop-out logistic model: Variables, coefficients and significance (starting solution)

Variable	β	S.E.	WALD	SIG.	Exp (β) OR
ZONE	-0.218	0.358	0.372	0.542	0.804
PROD_NUM	0.108	0.098	1.236	0.266	1.115
PROF_RAT	0.021	0.034	0.379	0.538	1.021
RAT_LIQUID	0.024	0.016	2.130	0.144	1.024
PROD_CLASS	-1.410	0.672	1.266	0.260	0.244
VOL_CLASS	0.503	0.447	4.398	**0.036**(*)	1.654
RENT_CLASS	-0.484	0.489	0.981	0.322	0.616
PAYROLL	-0.173	0.404	0.183	0.669	0.841
PENSION	-0.585	0.477	1.504	0.220	0.557
DEB_CARD	-0.988	0.676	2.140	0.144	0.372
CRED_CARD	0.641	0.372	2.969	**0.085**(**)	1.898
DEBCARD_NUM	0.904	0.307	8.652	**0.003**(*)	2.470
AGE	0.014	0.017	0.644	0.422	1.014
GENDER	-0.560	0.401	1.954	0.162	0.571
MOBILE	0.264	0.347	0.579	0.447	1.302
MAIL	-0.558	0.497	1.259	0.262	0.572
SELF-EMPLOYED	-0.662	0.515	1.652	0.199	0.516
YEAS AS A CLIENT	0.057	0.050	1.291	0.256	1.058
E-BANK_NUM	0.001	0.001	0.892	0.345	1.001
E-BANK_AMOUNT	0.000	0.000	0.093	0.760	1.000
CLARITY			47.134	**0.000**(*)	
(2)	2.435	0.575	17.922	**0.000**(*)	11.418
(3)	5.246	0.770	46.457	**0.000**(*)	189.827
(4)	2.930	1.488	3.876	**0.049**(*)	18.723
(5)	7.053	68.046	0.028	0.897	1156.322
AGILITY			25.321	**0.000**(*)	
(2)	1.132	0.574	3.890	**0.049**(*)	3.102
(3)	3.553	1.729	23.732	**0.000**(*)	34.931
(4)	3.956	1.177	4.322	**0.009**(*)	52.247
(5)	6.378	15.688	0.301	0.297	588.749
CONFIDENCE			5.679	0.224	
(2)	1.638	0.814	14.047	**0.000**(*)	5.144
(3)	1.459	1.205	12.4666	**0.000**(*)	4.300
(4)	3.454	1.960	3.104	**0.038**(*)	31.614
(5)	5.297	15.777	0.413	**0.077**(**)	199.731
SECURITY			7.214	0.125	
(2)	0.086	2.170	0.002	0.968	1.090
(3)	2.152	1.756	1.501	0.221	8.601
(4)	2.590	1.197	4.678	**0.031**(*)	13.324
(5)	0.084	0.787	0.011	0.915	1.087

continued on following page

Table 5. Continued

Variable	β	S.E.	WALD	SIG.	Exp (β) OR
CUSTOMER SERVICE			47.317	0.000(*)	
(2)	0.691	0.719	3.925	**0.021(*)**	1.996
(3)	1.117	1.829	2.814	**0.078(**)**	3.055
(4)	2.200	1.245	3.124	**0.072(**)**	9.022
(5)	2.766	0.669	17.075	**0.000(*)**	15.890
SATISFACTION			34.017	**0.000(*)**	
(2)	1.744	1.815	18.095	**0.000(*)**	5.711
(3)	3.582	0.731	32.459	**0.000(*)**	35.935
(4)	4.579	3.338	6.607	**0.010(*)**	97.412
(5)	4.924	1.707	19.602	**0.000(*)**	137.643
Constant	-10.686	1.911	31.281	**0.000(*)**	

Chi-Square: 896.137; d.f.: 44; sign.: 0.000
(*) 5% significance level; (**) 10% significance level

We understand that the design of the model should not conclude at this point, but we have to re-build the model including parameters or variables whose coefficients beta are statistically significant so that it can be possible to transcribe a mathematical equation (terms 3 and 4). Thus, dating processing obtained from the customer satisfaction survey with the financial institution and its credit history (by binary logistic regression module of SPSS software vs. 20) concludes the final results shown in Table 6.

Regarding the evaluation of the model and its coefficients as shown in Table 6, it is appropriate to interpret the influence of the explanatory variables on the dependent variable. Firstly, we emphasize the influence of the customer classification carried out by the financial institution regarding their connection with the volume of business of the institution. According to the way this variable is designed, we accept a positive sign in the estimator or coefficient, as $exp\ (\beta i) = exp\ (0.678) = 1.969$ is the OR to appear as the

Table 6. Desertion logistic model: Variables, coefficients, and significance (final solution)

Variable	β	S.E.	WALD	SIG.	Exp (β) OR
VOL_CLASS	0.678	0.322	4.429	0.035(*)	1.969
CRED_CARD	0.448	0.328	3.153	0.086(**)	1.566
DEBCARD_NUM	0.659	0.202	10.648	0.001(*)	1.927
CLARITY			51.545	0.000(*)	
(2)	2.429	0.526	21.345	0.000(*)	11.350
(3)	4.910	0.695	49.938	0.000(*)	135.674
(4)	3.643	1.351	7.267	0.007(*)	38.199
(5)	6.839	9.703	0.039	0.778	933.980
AGILITY			22.933	0.000(*)	
(2)	0.669	0.672	2.013	0.030(*)	1.952
(3)	3.000	0.651	21.250	0.000(*)	20.079
(4)	3.299	2.628	4.677	0.000(*)	27.106
(5)	5.128	9.385	0.488	0.156	168.762

continued on following page

Table 6. Continued

Variable	β	S.E.	WALD	SIG.	Exp (β) OR
CONFIDENCE			6.363	0.182	
(2)	1.721	0.361	22.770	0.000(*)	5.595
(3)	1.360	0.574	15.225	0.000(*)	3.898
(4)	3.9148	1.700	8.368	0.004(*)	50.320
(5)	4.974	10.960	0.740	0.076(**)	144.676
CUSTOMER SERVICE			50.741	0.000(*)	
(2)	0.423	1.645	4.431	0.011(*)	1.527
(3)	0.824	1.728	3.279	0.075(**)	2.279
(4)	2.131	1.068	3.983	0.46(*)	8.8423
(5)	2.603	0.614	17.952	0.000(*)	13.498
SATISFACTION			36.973	0.000(*)	
(2)	1.993	1.938	20.937	0.000(*)	7.358
(3)	3.224	1.119	35.333	0.000(*)	25.133
(4)	3.992	2.812	7.760	0.005(*)	54.241
(5)	4.933	1.686	20.023	0.000(*)	138.868
Constant	-9.668	1.223	62.529	0.000(*)	

Chi-Square: 696.359; d.f.: 44; sign.: 0.000
(*) 5% significance level; (**) 10% significance level

category "one" instead of "zero." The estimate indicates that customers with a high turnover with the financial institution are 1,969 times more likely to be loyal than customers with a low turnover. In the second place, the explanatory model is sensitive to ownership or not of credit cards contracted with the institution with a confidence level of 90%, though. In this case, *exp (βi) = exp (0,448) = 1,566* indicates the fact that credit card holders are 1,566 times more likely to remain bank customers and not desert from the financial institution. The next significant characteristic explaining bank loyalty is considered a numeric variable in which *exp (βi) = exp (0.659) = 1.927* is the OR per debit card hired. That is to say, a person who contracts one more credit card with the financial institution is 1,927 times more likely to be loyal to the institution than the customer who has one less credit card contracted.

With respect to categorical variables, the interpretation of the OR for each category cannot be performed independently, but through a comparison with the reference category. In the case of the variable concerning the degree of customer satisfaction with the financial institution as to the clarity of management, the interpretation is as follows: A "very satisfied" customer has an associated probability of being faithful 11,350 times higher than a "dissatisfied" customer.

On the other hand, a "somewhat satisfied" customer is about 135 times more likely to be loyal than a customer who is "dissatisfied" with management clarity, and so on for the categories in which the associated significance level is less than 0.05 or 0.1. With respect to the other categorical variables, the interpretation is similar, keeping in mind that the comparisons are made in relation to the reference category. Likewise, the above-mentioned interpretation can be made from an opposite perspective. For example, with respect to the variable SATISFACTION, those overall dissatisfied customers are 54.241 times more likely to drop out than overall satisfied customers.

To sum up, suppose the estimator sign is positive; thus, when the independent variable increases in one unit, the log-odds about the likelihood of being a faithless customer increases in the value of the respective coefficient, and vice-versa for

negative estimator. Therefore, all the independent variables of the final model influence on the behaviour of financial loyalty of each customer, accepting the evidence supported by the research hypotheses H1, H2, H3 and H4.

Regarding the goodness of fit, the software calculates coefficients similar to R2 calculated in linear regression, specifically the Cox and Snell R^2 and Nagelkerke R^2, whose corresponding values (Table 7), point out a good fit in logistic regression.

Another source which has been consulted in order to evaluate the goodness of fit of the model is the Hosmer-Lemeshow test. (Table 8), where observations are grouped for each of the two groups defined by the dependent variable depending on a contingency table. The goodness of fit determines the degree of resemblance (adjustment) existing between the observed values and those predicted by the model. It can be seen how the Hosmer-Lemeshow test gives a satisfactory result, given that its significance level is over 5% and cannot, therefore, reject the null hypothesis of equal distributions and, consequently, we can assume that the model provides a good fit to the data.

Table 7. Goodness of fit: Pseudo-R2

-2 Log of Authenticity	R Squared of Cox and Snell	R Squared of Nagelkerke
252.288	0.615	0.871

Table 8. Goodness of fit: Hosmer-Lemeshow test

Chi-Squared	d.f.	SIG.
3.975	8	0.859

The classification matrix, that is to say, the table of estimated values versus observed values (Table 9), shows the degree of classification accuracy. It can be seen how, for an optimal cut-off point of 0.57, we obtain an accuracy of 94.6% in the correct classification of the borrowers of the database.

Predictive Analysis Model

It is interesting to assess the predictive ability or efficacy of the model, which is carried out from the classification presented in Table 10, where the observed values for the dependent variable are listed, distinguishing between customers who drop out of the bank (0) and customers who are loyal to the company (1), as well as the values predicted by the estimated model, which are applied to customers who were kept for the validation sample. As said, the correct classification rate obtained in the validation process was 92.3%, measuring the accuracy with which the model achieves to discriminate both groups among the cases (customers who are loyal to the bank and dropouts). We can also identify a similar percentage after applying the expressions taken from Table 6 to the holdout sample for validation.

The values of sensitivity and specificity are the coordinates of the ROC curve. It is necessary to keep in mind that its value ranges from 0.5 to 1, so that the best possible prediction method would be placed at the left upper corner, or coordinate (0,1) of the ROC space, representing 100% sensitivity

Table 9. Classification matrix

Observed		Predicted		
		Y		Correct Percentage
		Non Drop-Outs	Drop-Outs	
Y	Non Drop-Outs	480	16	96.7
	Drop-Outs	22	192	89.7
Total Percentage				94.6

Table 10. Classification matrix model validation process

Observed		Predicted		
		Y		Correct Percentage
		Non Drop-Outs	Drop-Outs	
Y	Non Drop-Outs	156	9	94.5
	Drop-Outs	9	62	87.3
Total Percentage				92.3

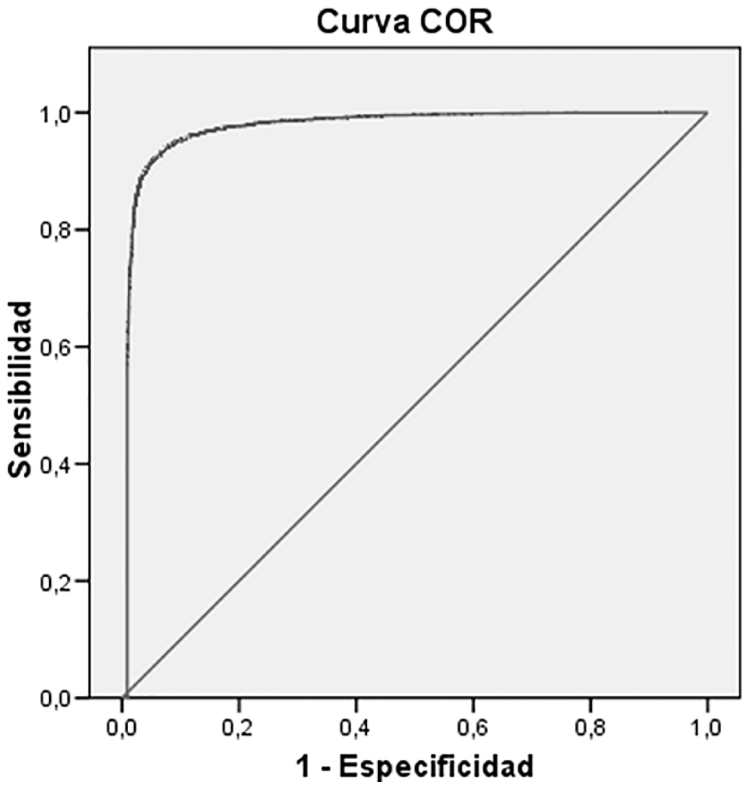
(no false negatives) and also 100% specificity (no false positives).

This point (0.1) is also called a perfect classification. In this line, as can be seen in Figure 3, the ROC curve of the model approaches the left upper corner of the chart, which confirms that the model has a correct capacity of discrimination between the two groups of customers.

CONCLUSION AND IMPLICATIONS

During the last decade the Spanish financial system has undergone a profound transformation since it has been influenced by different factors, such as increased competition, massive technological changes, greater accessibility to services by customers, higher levels of competition, reduced margins, and so on, bringing as a result that most

Figure 3. ROC curve



organizations try to ensure customer loyalty by means of satisfaction and confidence. Our research comes to evidence that, apart from these two classical variables reviewed by scientific literature, it is necessary to analyze socio-demographic and economic factors of the clients themselves to determine the risk of dropping out.

While some authors have defined models of loyalty for a financial institution, the novelty of this research is the approach that has been given to e-Banking customers as well as the level of accessibility to the information that has been analyzed. The model we present has confirmed that there are factors that affect the probability of customer drop-out of a bank. Although it is an ad-hoc model for each bank, the methodology can be generalized to any savings and credit institution with the loyalty of its customers as one of its objectives, provided that, as specialized literature suggests, there exists a binding relationship between dropping out and satisfaction, trust and other socio-demographic and economic variables of customers. According to the results, satisfaction and confidence do not necessarily lead to bank loyalty. However, they are required conditions for this loyalty to happen, having achieved a correct classification rate close to 95%. The proposed model shows the probability for a customer to be disloyal and, therefore, abandon the bank, so that the latter can concentrate their efforts towards loyalty those with higher probabilities.

After a first evaluation of the proposed model and the analyzed variables, we can conclude that the assumptions cannot be rejected, thus accepting the statements of the same.

From the perspective of the financial institution management, customer loyalty will become a fundamental goal (Hypothesis 1 and 2). In particular, the products "credit card" and "debit cards" appear in our model as key variables in the financial relationship with the customer. In order to achieve this relationship, in the last decade the institutions implemented various management systems like CRM, which tries to increase customer loyalty with regular campaigns through the branch network. In addition, these campaigns are reinforced by general communication actions of the network, thus favouring up-selling and cross-selling strategies while reducing low membership and improving its products.

Besides, the qualitative aspects in establishing business relationship with the customer, as revealed in Hypotheses 3 and 4 -such as clarity, agility, confidence, customer service and satisfaction-, strengthen the loyalty of customers to the entity, for which the implementation of a CRM strategy will be essential.

Loyalty will be, therefore, the most important aim of financial institutions in the next years because it will get more compensation due to a high linkage that keeps the e-banking customer with the bank. For that, considering the low cost of transfer when facilitating the dropping out in the banking sector, managers must focus their efforts on developing loyalty activities basically for handling customer complaints.

However, the institution should not wait until there are complaints and must take actions in order to increase customer satisfaction and the quality of the service offered, as there is the risk of losing a large number of customers before taking appropriate action.

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KEY TERMS AND DEFINITIONS

Banking: Entities responsible for providing financial services credit and saving and other financial intermediation activities.

Confidence or Trust: The willingness of a consumer to be vulnerable to the actions of an online store based on the expectation that the online store will perform a particular action important to the consumer, irrespective of the ability to monitor or control the online store.

Drop-Out Risk: The risk exists that a customer cancels their contract with a financial institution and, subsequently, enter as a customer with another bank.

Logit: Parametric statistical technique of obtaining probability of occurrence of a particular event that is used to classify a set of subjects into two groups.

Loyalty: A customer`s attitude toward the e-retailer that results in repeat buying behavior.

Receiver Operating Characteristic (ROC): A graphical plot which illustrates the performance of a binary classifier system as its discrimination threshold is varied.

Satisfaction: The result of comparison between a subjective experience and prior base reference.

ENDNOTES

1 Mayer *et al.* (1995).

2 Javalgi & Moberg (1997) in Segarra (2007)

3 Caja Rural of Granada is a credit and savings bank that is part of Caja Rural group, including a structure of 203 offices (in the provinces of Granada, Malaga, Almeria and Madrid), a network of 234 ATMs, a staff of 832 employees and a positive balance of € 20.1 million by the end of 2010.

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Chapter 18
Modeling the FX Market Traders' Behavior:
An Agent-Based Approach

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ABSTRACT

In this chapter, the authors use an Agent-Based Modeling (ABM) approach to model trading behavior in the Foreign Exchange (FX) market. They establish statistical properties (stylized facts) of the traders' trading behavior in the FX market using a high-frequency dataset of anonymised OANDA individual traders' historical transactions on an account level spanning 2.25 years. Using the identified stylized facts of real FX market traders' behavior, the authors evaluate the collective behavior of the trading agents in resembling the collective behavior of the FX market traders. The study identifies the conditions under which the stylized facts of trading agents' collective behaviors resemble those for the real FX market traders' collective behavior. The authors perform an exploration of the market's features in order to identify the conditions under which the stylized facts emerge.

1. INTRODUCTION

Classical economics are based on simplifying assumptions such as perfect rationality and homogeneous trading agents, some of which do not hold true in practice. Classical economics fails to explain the dynamics of traders' behaviour, and the forces that drive such behaviour. LeBaron (2006a) declared "…this world was build on the assumption that asset markets were powerful computational engines, and were able to aggregate and process the beliefs and demands of traders, leaving in place the full set of properly processed information currently available" (p. 1187).

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This leads to the need for the development of alternative approaches to enhance our understanding of financial market behaviour, in order to go beyond traditional theories of economics, which are based upon many unrealistic assumptions. The Agent-Based Modelling (ABM) approach attempts to tackle more efficiently some of the limitations of the analytical models that deal with economics and finance. ABM approach has been developed in the last decade to explore and study the behaviour of financial markets.

In this study, we focus on the Foreign Exchange (FX) market, which is the most liquid financial market in the world. We build agent-based models of FX market traders in which the trading agents' collective behaviour resembles, to a certain extent, the collective behaviour of the real FX market traders. The aim is to identify conditions under which the statistical behaviour of agent-based models of traders resembles those for the real FX market traders. Due to the complexity of the financial markets, it is difficult to identify which features of the market are responsible for the emergence of the traders' statistical behaviour in an agent-based market.

Our approach to the modelling of FX market traders' behaviour is based on simple elements. The trading agents' trading strategy is based on a zero-intelligent directional-change events trading strategy (DCT0) (ALOud, et al., 2010). Limit orders are incorporated into the agents' investment strategy. The trading agents are modelled to respond to physical time to account for the different market trading seasonalities such as intra-day and intra-week seasonality.

The initial part of this study is to observe the micro-behaviour of FX market traders to establish stylized facts with regard to their collective trading behaviour in the market. This is performed using high-frequency data at an account level, which represent the physical transactions of over 40,000 anonymous accounts trading on OANDA trading platform under the same terms and conditions. The dataset is provided by Olsen Ltd. To our knowledge, this dataset is the biggest available high-frequency dataset relating to the FX market traders' behaviour.

One of the main constraints with regard to agent-based models of traders is the ability to validate them due to the lack of knowledge and data about the statistical behaviour of real traders' behaviour. Using the identified stylized facts of real FX market traders' behaviour, we evaluate the trading agents' collective behaviour. By relating the statistical behaviour of real traders' behaviour to the agent-based models of trades, we may find a pathway to identify the essential elements necessary for modelling the FX market traders' trading behaviour.

The rest of the chapter is organized as follows:

- Section 2 presents a brief background of the different approaches used in the literature for studying the FX market traders' behaviour.
- Section 3 describes the design routes with regard to agent-based modelling in finance.
- Section 4 presents an overview of high-frequency data in finance.
- Section 5 describes the two datasets used in this study, and their potential usefulness.
- Section 6 conducts a microscopic analysis of FX traders' behaviour in order to establish some of their stylized facts.
- Section 7 describes the simulated FX market, reviews its main features, and presents the experimental results.
- In Section 8, a description is provided of the key elements that may be responsible for the emergence of real FX market traders' collective behaviour.
- In Section 9, we discuss recommendations in terms of modelling the FX market traders' behaviour.
- Section 10 explores possible lines for future research.
- Section 11 presents the conclusion.

2. BACKGROUND

There are three major approaches that have been used to study and analyse the behaviour of FX market in the literature: behavioural finance, empirical models, and Agent-Based Modelling (ABM).

The Behavioural Finance approach is a psychology-based theory used to explain the behaviour of financial practitioners and their effects on the market. A good review of the Behavioural Finance approach can be found in Shleifer (2000), Barberis and Thaler (2003), and Subrahmanyam (2007). There is a substantial amounts of work which has established the existence of several psychological underpinnings for FX market traders' behaviour, such as traders' herding behaviour (Kim, et al., 2004), feedback trading (Aguirre & Said, 1999; Bjønnes & Rime, 2005; Laopodis, 2005), heterogeneous expectations and beliefs (Frankel & Froot, 1990a, 1990b; Lto, 1990; MacDonald & Marsh, 1996; Oberlechner, 2001; Menkhoff, et al., 2009), traders' overconfidence (Barber & Odean, 2000; Glaser & Weber, 2007; Oberlechner & Osler, 2008), and loss aversion bias (O'Connelle & Teo, 2009).

The second approach uses empirical microstructure models to study the FX market microstructure. A number of studies concerning FX markets have studied, through empirical models, the effect of order flow (Evans & Lyons, 2002a, 2004a; Berger, et al., 2006), market news arrival (Almeida, et al., 1998; Evans & Lyons, 2002b; Andersen & Bollerslev, 2003; Chang & Taylor, 2003; Evans & Lyons, 2004b), fundamentals trading on price movements and behaviour of market participants.

The Agent-Based Modelling (ABM) approach represents the features of a real financial market towards providing a behavioural explanation of the statistical properties of the financial market that are far from traditional assumptions of economics. The ABM approach models the financial markets as a group of interacting heterogeneous trading agents who can adapt to their market, learn from the information they obtain, and react dynamically to price movements and events on the market. LeBaron (2001a), Cristelli et al. (2011), and Samanidou et al. (2007) provide a good review of some financial market models.

Although the existence of various approaches for studying the FX market, many properties concerning the FX market traders' behaviour have not been revealed. We find that previous studies have acquired a large sample of low frequency dataset, or a small sample of high-frequency datasets, neither of which are at account level. Based on that, we have studied FX market traders' behaviour by combining a microscopic study of FX market traders' behaviour with agent-based modelling, which we have referred to as a bottom-up approach. The microscopic analysis of actual FX market traders' behaviour aims to establish stylized facts of real FX market traders' behaviour. To establish stylized facts, we use a large sample of high-frequency dataset of individual traders' transactions at an account level. Using the identified stylized facts, we evaluate the collective behaviour of the agent-based models of traders.

Despite the existence of previous or contemporary works on modelling the financial market using ABM, they have generally attempted to replicate some of the stylized facts of financial market. However, many of the studies pay less intention to identify the features and conditions that are responsible for the emergence of market behaviour. Some of the studies developed highly complex models of the financial market, which, due to their complexity, prevented them from identifying the conditions that are accountable for the reproduction of the real financial markets stylized facts. LeBaron (2001b) declares, ".. it is important in agent based models not just to replicate features of real markets, but also to show which aspects of the model may have lead to them" (p. 226). In fact, it is important to have the minimal, simplified set of elements, that still capable of resembling the market. Alfi et al. (2009a,

2009b) based their works on having the maximum mathematical simplification, which focuses on the essential elements that can generate the stylized facts of real market behaviour. Martinez-Jaramillo and Tsang (2009) identified the minimal set of conditions under which the statistical properties of price series in the artificial market resemble those of the real financial markets.

3. DESIGN ROUTES WITH REGARD TO ABM

Several design routes regarding the trading agent type, market mechanisms, traded assets, time, and validation have been used in previous works on agent-based financial markets (Lebaron, 2001a). However, all the developed agent-based financial markets are based on the same concept in that the macro behaviour is a result of the micro interactions of the market participants.

3.1. Agents

The type of the trading agents that will be used in the agent-based financial market model is, without any doubt, the most important design question, and decision when building a model of a market. Several options for the design with regard to which type of agents will be used, exist from zero intelligence as in Gode and Sunder (1991), Sunder (2004), and Cincotti et al. (2005) to genetic programming based agents as in Edmonds (1999), Chen and Yeh (2001, 2002), and Martinez-Jaramillo and Tsang (2009).

Real-World Strategies

There are several design routes that one can take when representing the trading agents that will participate in the market. The simplest way is to model agents in which their trading rules replicate trading strategies that are used in the real financial markets. However, no learning takes place for this type of agent. This direct method results in interesting outcomes but, at the same time, comes with a few costs. One of these is that this type of agent might lack a well-defined objective function. In other words, agents with a utility function can measure and evaluate their performance in the market. A further criticism is the dynamics of interactions in which traders in real markets modify their investment strategy over time.

Zero Intelligence

Another type of agent design is the "zero intelligence" agent in which their behaviour is ruled by a simple budget constraint. Although their trading behaviour gives the impression of being a form of learning, these types of agents do not learn. Gode and Sunder (1991) were the first to introduce the concept of the "zero intelligence" agent. The authors used this type of agent to model market transactions in double auctions. Similar are the one done by Sunder (2004), Daniel (2006), and Cliff (2009).

Learning and Adapting Strategies

In relation to the learning mechanism, there are agents that are modelled to learn and adapt to the new conditions in the market. An example of market models using such a type of agent is the Santa Fe artificial stock market. Similar to these are the ones done by Arthur et al. (1997), Arifovic (1996), Chen and Yeh (2001), Markose et al. (2003), and Martinez-Jaramillo and Tsang (2009). This type of agent uses a variety of artificial intelligence techniques to model changes in agent strategies. This approach has some drawbacks. Among them is the complexity of the computational tools that are used in modelling the trading agents. In addition, the complexities of the evolved agents' strategies represent a limitation to this approach. Although, many obvious trading opportunities are missing, this is a clear indication that the use of learning agents is not particularly satisfactory.

In the SF ASM, in addition to the learning mechanism, there is another important aspect that distinguishes this type of agent from any others. This is the implementation of forecasting. The prediction is made using a classifier forecasting system in which current market information is mapped into a conditional forecast of future prices and dividends (Lebaron, 2006a). Examples of market models where predication strategies are used are Arifovic (1996), Arthur et al. (1997), Edmonds (1999), Chen and Yeh (2001), LeBaron (2001b), Zimmermann et al. (2001a), Yang (2002), Markose et al. (2003), and Martinez-Jaramillo and Tsang (2009).

Objective Function

A different way to design the agents is to make use of the objective function. Agents could be modelled with an objective function either implicitly or explicitly with regard to the agent's decision-making process. An implicit objective function implies that the agent's objective is incorporated indirectly into the decision making process. An example of an implicit objective function is maximizing the agent's outcomes. On the other hand, most of the agents in market models have an explicit objective function where the agent's performance in the market can be measured through the use of the utility function. Examples of such models are the ones developed by Palmer et al. (1994), Arthur et al. (1997), Yeh and Chen (2000), Chen and Yeh (2001), Zimmermann et al. (2001b), Yang (2002), LeBaron (2003), Markose et al. (2003), Martinez-Jaramillo and Tsang (2009).

Social Learning

There are agents whose strategy is based on observing other individuals' trades in the market and adjusting their strategies based on the observed actions of these other traders. This phenomenon is often called "social learning" (LeBaron, 2006a). An example of market models using such an agent are the models introduced in Kirman (1993), Lux (1995), Bak et al. (1997), Lux (1998), Cont and Bouchaud (2000), Alfarano and Lux (2003), Alfarano et al. (2005), and Hott (2009). These market models aim to model the trading agents by incorporating herding behaviour. Hott (2009) showed that price bubbles can be explained in terms of herding behaviour.

We have summarized above the most important design issues regarding the modelling the trading agents. In addition, we have illustrated some examples of agent-based market models, which use different trading agents' design.

3.2. Trading

Trading, the market mechanism, is the second most important design question which faces the researcher when building an agent-based market. Caution and efficiency in designing the actual details of trading in the market models is essential. There are varieties of trading mechanisms that one can use in an agent-based market.

The majority of agent-based markets follow three methods of solving this design problem. The simplest way is to assume that price movements respond to the excesses of demand and supply. Thus, if there is an excess of demand, the price will rise. Conversely, if there is an excess of supply, the price falls. This method is very fast to compute but comes with some cost. An earlier version of the Santa Fe Artificial stock market used this trading method. In addition, there are some agent-based market models that use the same method for the trading mechanism including Farmer (1998), Cont and Bouchaud (2000), Chen and Yeh (2001), Markose et al. (2003), and Martinez-Jaramillo and Tsang (2009). Farmer and Joshi (2002) the author used a similar trading mechanism but the excess demand or supply for assets is filled by a market marker.

Alternatively, there is a model of the market where a local equilibrium price can easily be found. This method requires us to define a market with

more economic structure so that a certain temporal equilibrium price can be found (Martinez-Jaramillo & Tsang, 2009). Examples of market models using this type of trading mechanism are Arthur et al. (1997), Levy et al. (1994).

The last trading method is to model the actual trading mechanisms found in markets. This method implies the implantation of a realistic trading mechanism as used in a real market. It is applied frequently for modelling high-frequency data. Examples of models with such a type of mechanism are Gode and Sunder (1991), Yang (2002), and Chan (1999).

3.3. Assets

The traded assets are an important characteristic of every agent-based market. There are mainly three major issues regarding the modelling of the traded assets: number of assets, types of assets and the assets' properties.

Regarding the number of traded assets, the majority of agent-based markets have two different assets: a risk free asset and a risky asset. A small number of agent-based markets operate with more than two assets in the market, and this definitely leads to a complexity in the agent-based market and in the analysis of the asset price time series. Concerning the types of assets, in most of the agent-based markets, the agents have the choice of opting a risky asset and a risk-free or one of them. The risk-free asset could be cash or bonds, while the risky one could be a stock, a currency or even a security associated to a fundamental value such as the models in Farmer (1998) and Martinez-Jaramillo and Tsang (2009), or it could be associated with a fundamental value such as the one suggested by Lux (1998).

3.4. Benchmarks/Validation

Nearly all agent-based financial markets throw up many important questions concerning the validation of the various agent-based market structures. The validation of the agent-based market verifies if the model is related to reality. Any agent-based market must be capable of reproducing several features of the real market. LeBaron (2001a, 2003) and Gilli and Winker (2003) indicate the importance of validation in an agent-based financial market.

There are a few things that can be done in order to validate the various mechanisms of the agent-based market. One approach is to make useful benchmark cases in which the behaviour of the real market is well defined. Alternative approach is to use parameters in the agent-based market resulting from either real or experimental markets. Some examples of works in which parameters from real or experimental markets have been used are Chen and Yeh (2001), Zimmermann et al. (2001a, 2001b), Winker and Gilli (2001), LeBaron (2003), and Gilli and Winker (2003).

3.5. Time

Timing is another important design issue in building agent-based markets. In an agent-based market, timing refers to many things including the time span of the previous information considered by the agents. This is an important issue in terms of an agent-based market as almost all the learning mechanisms are fed by previous information. LeBaron (2001c) performed an experiment to explore the impact of different memory lengths of the agents with regard to market prices.

Timing refers also to the order in which events occur. In other words, trading in most agent-based financial markets is synchronized by the designer. These models are based on the assumption that all trades take place between two discrete points in time, whereas in reality there are no fixed periods. This is by no means a clear indication that this assumption is not realistic and the need to address this issue in agent-based financial markets is vital. Some examples of models with trading synchronization are Levy et al. (1994), Arthur et al. (1997), Farmer (1998), Zimmermann et al.

(2001a), Markose et al. (2003), and Martinez-Jaramillo and Tsang (2009).

Timing refers also to the frequency with which agents update their strategies. As can be observed from reality, traders update their trading rules over time, and this has an impact on their performance and as well as on the dynamic of market prices. For example, agents in LeBaron (2001b) and Martinez-Jaramillo and Tsang (2009) updated their strategies in the market, based on a fixed periodicity. On the other hand, agents in Markose et al. (2003), Gilli and Winker (2003), and Martinez-Jaramillo and Tsang (2009) updated in an endogenous way.

3.6. Limitation

The agent-based financial markets literature reveals some of the objective and design limitations of such models. On the objective limitations side, one of the major limitations is that the majority of agent-based markets focus on replicating some of the stylized facts of real markets, while they pay much less attention to identifying the key aspects that are responsible for the emergence of real financial market behaviour. Identifying the key aspects that are responsible for replicating the real market should be the primary objective of any agent-based financial market since such identification leads us to a critical understanding of real market behaviour.

With regard to the design limitations, the complexity of some of the agent-based financial markets, which prevent from identifying the key aspects those are responsible for the emergence of financial market behaviour. In addition, the timing issue represents a crucial limitation on agent-based markets. In the majority of agent-based markets, trading is synchronized and, most importantly, there are no representations of physical time in terms of the market. In addition, most of these models use low-frequency timing such as daily timing, in order to represent time, which does not reflect the real market. This is a clear indication that these two assumptions are not realistic and there is a vital need to address this issue. Besides, one of the main agent-based market constraints is their validation. The lack of market data, especially high frequency data, in order to validate the accurate of agent-based market, appears to be an obvious critical issue in many agent-based markets.

In this work, we have presented an agent-based FX market in which we attempt to cope with some of the existing limitations associated with previous work in agent-based markets, in an attempt to precisely replicate FX market trading activity.

4. HIGH-FREQUENCY DATA

Studying the financial market using a large number of observations, often referred to as High Frequency Data (HFD), without doubt, improve our understanding of the market. Financial transactions data are now recorded at gradually increasing levels due to advances in computer technology and data storage, which have brought a dramatic fall in the cost of data recording.

High frequency data in finance refers to an extremely large amount of data, which is the full record of transactions and their associated characteristics at frequencies higher than on a daily basis (Engle, 2000). According to Dacarogna et al. (2001), "The number of observations in one single day of a liquid market is equivalent to the number of daily data within 30 years" (p. 6). The structure of HFD depends on the institution's policy with regard to the production and gathering of data (Brownlees & Gallo, 2006).

HFD should be the primary source for those who are involved in analyzing and understanding financial markets seeing that it has power over unique features that are lacking in data recorded at lower frequencies, such as intra-day data. HFD have been widely used to study various market microstructures and related issues by both the academic community and industry. The analysis

of HFD is valuable with regard to many issues in finance, including price movement detection, studying the market statistical properties, competition among related markets, the strategic behaviour of market participants, and the modelling of real time market dynamics (Yan & Zivot, 2003). Empirical studies on the use of HFD are offered by Andersen (2000), Engle (2000), Ghysels (2000), and Dacorogna et al. (2001).

With the introduction of HFD come new challenges associated with the processing and analysis of these HFD. On the processing challenge side, HFD may have a variety of erroneous or misleading observations and data gaps that are not reliable in terms of actual market trading activity. Some of these errors may result from computer system errors or internal system procedures using dummy ticks (Dacorogna, et al., 2001; Bingcheng & Zivot, 2003). For instance, recording failures can lead to data gaps, and database viruses can lead to missing ordered time series observations (Yan & Zivot, 2003). Consequently, these data need to be filtered prior to a direct analysis in order to eliminate observations, which appear to be incompatible with existing market activity. A clean dataset is an essential pre-condition for moving onto the next step, which involves analysing these data. A failure to recognize these data errors in the data sets may cause ambiguous results in the statistical analysis. In the literature there are some contributions on HFD filtering issues (Blume & Goldstein, 1997; Dacorogna, et al., 2001; Falkenberry, 2002; Brownlees & Gallo, 2006; Oomen, 2006).

In terms of the challenge posed by the analysis, with this HFD increase, many questions arise as to which analytical approach should be used in dealing with such vast amount of data that typically exhibit intense and enormous periodic patterns in market activity. One major issue when the data is of a higher frequency is the choice of time intervals as it is one of the central decisions regarding the analysis of the financial market. HFD allows us to study the financial market at varying time intervals, from microseconds to years. Some time intervals on a HFD may not contain any transactions. Moreover, the analyst dealing with HFD must aggregate the time series data to fixed time intervals, as the transaction data are inherently irregularly spaced in time (Russell, 1999).

5. DATA DESCRIPTION

This study is supported by two high-frequency datasets from Olsen Ltd. Olsen Ltd is a research-driven organization that contributes to the public understanding in the FX market. OANDA provides Olsen Ltd with HF market historical data. The aim is to conducts a number of researches that can contribute significantly to the finance area. OANDA Ltd, short for "Olsen And Associates," is an online trading platform for the trading of foreign currencies. OANDA is considered to be the largest online trading platform in terms of trading volume and high liquidity. OANDA offers a unique feature in that it is the only platform that stores the individual traders' transactions details and their position history over long time horizons representing the worldwide exposure of traders in the FX market.

5.1. EUR/USD Historical Prices Dataset

In our study, we use dataset of high-frequency EUR/USD historical prices that took place from January, 1 2007 to March 5, 2009. Each record in this dataset contains the timestamp, bid rate and ask rate. We aggregated the data over a one-second time interval, which gave us 2,592,000 tick prices over 30 days to avoid the use of extremely HFD in a very small time window. We feed these high frequencies EUR/USD historical prices into the FX market simulation, to have the traders react to price movement in the market.

5.2. Historical Transactions Dataset

We have used the analytical results from the HFD of individual traders' historical transactions to evaluate the collective behaviour of the agent-based models of traders in reproducing, to a certain extent, actual FX market trading activity. This HFD represents individual traders' physical transactions made available on an anonymous basis spanning 2.25 years, from January 1, 2007 to March 5, 2009. The HF dataset contains about 147 million transactions carried out by 45,845 different accounts trading in forty-eight different currency pairs under the same terms and conditions. Each transaction includes the following information: the trade type, the trade timestamp, the traded currency pair, the executional price, the units and the amount traded. However, in this study we used the historical transactions of EUR/USD only.

The data is filtered to remove any possible unreliable transactions in terms of the traders' actual activity. Filtering HFD must be customized, based on the structure of the data. The primary step in the filtering procedure that we conduct relies in two things: studying OANDA's internal system storage procedures that can affect the consistency of the data, and understanding the nature and structure of the data. The major issue concerning the dataset is the extraordinary and sudden drop of transactions flow in October 2007 with an increasing number of accounts. Additionally, OANDA's system storage procedures, storing one executed order in several transactions, and internal interest payment procedures creating dummy transactions. Carrying out several filtering steps, the number of transactions in the dataset was reduced to a total of 114 million transactions. To validate the filtering process, we have tracked the individual traders' transactions from opening to closing their positions on each traded currency pair. In addition, we compared the intraday seasonality of the trading activity pattern against the reported seasonality in the literature. For a fully detailed description of the transaction dataset filtering process, refer to Masry et al. (2010).

The individual traders' historical transactions dataset is very valuable for many reasons. Firstly, there is the existence of a large number of different traders represented by individuals, banks, central banks, hedge funds, and others. Secondly, there are a large number of high frequency trading volumes, which are rich in terms of observations, and some interesting patterns that are valuable for analysis, in order to understand the forces that drive market behaviour. Thirdly, there is the existence of different types of trades following different currencies. Finally, there is the existence of a wide variety of trading strategies, which have a great impact on the analysis and understanding of traders' behaviour.

6. STYLIZED FACTS OF TRADERS' BEHAVIOUR

Stylized facts are the observed statistical properties of the traders' trading behaviour in the financial markets. Such stylized facts are established from the statistical analysis of financial market data. Gathering basic stylized facts with regard to the behaviour of traders and their trading activities is an important step in modelling real financial market traders. In building a model of the financial market, stylized facts are considered to be the first verification criteria (LeBaron, 2006b). Without such facts, it is difficult to validate the accuracy of the agent-based models of traders.

To establish stylized facts of the FX market traders' behaviour, we need to explore high-frequency data related to their historical trading transactions in the market. High-frequency data allows us to explore some aspects of trader behaviour that could not be observed at lower frequencies (e.g. using daily data). Having surveyed the FX market traders' behaviour literature, we find that previous studies have acquired a large sample of low frequency dataset of traders' transactions, or

a small sample of high-frequency datasets, neither of which are at account level. These do not allow a comprehensive study of actual FX market traders' behaviour. Fortunately, our study is supplied with a high-frequency dataset, described in section 4.2, representing the physical transactions of over 40,000 anonymous accounts trading under the same terms and conditions.

In this section, we conduct a microscopic analysis of FX market traders' trading behaviour to establish stylized facts about their trading behaviour. These stylized facts can be grouped under two main headings: correlation and the seasonality of trading activity. We find a daily and weekly periodic pattern of FX market trading activity. Additionally, correlation of FX market trading activity has been confirmed for the number of buy and sell orders, as well as for the number of opening and closing positions.

6.1. Correlation Behaviour with Regard to Trading Activity

A convenient way to discover statistical properties of market trading activity is to conduct a correlation study. The linear correlation coefficient is a measurement of level of the dependence between variables. It measures the relationship between two series of variables *x* and *y*, and is defined as follows:

$$corr\left(x_i\ ,y_i\right) = \frac{\sum_{i=1}^{n}\left(x_i - x\right)(y_i - y)}{\sqrt{\sum_{i=1}^{n}\left(x_i - x\right)^2 \sum_{i=1}^{n}(y_i - y)^2}}$$

with the sample means:

$$x = \sum_{i=1}^{n}\frac{x_i}{n} \quad \text{and} \quad y = \sum_{i=1}^{n}\frac{y_i}{n}$$

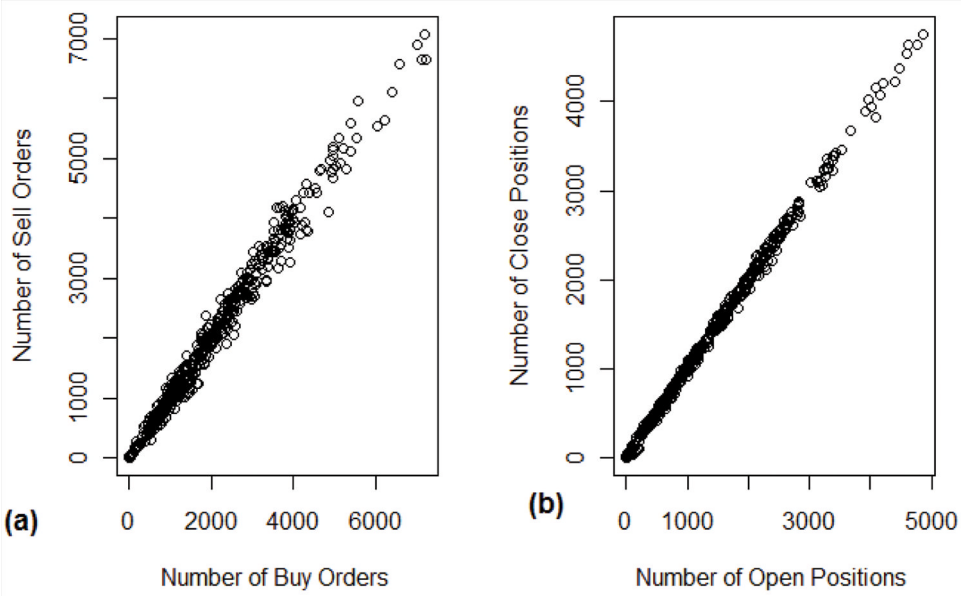
In this section, we examine, with regard to the trading activity in EUR/USD, the dynamic relationship of the number of buy and sell orders, and the number of opening and closing positions (Figure 1). This is done using hourly correlation calculation intervals over January 2009. This analysis helps in understanding the direction of the trading activity flow in the market, and how the trading activity direction could affect market behaviour.

We found that an increase in the number of buy orders induces an increase in the number of sell orders, and vice versa. Conversely, we can hypothesise that an increase in the number of buy orders would lead to a rise in the number of sell orders, and vice versa. Such a relationship exists also for the number of opening positions against the number of closing positions for EUR/USD, Figure 1b. Figure 1a shows the relationship of the hourly number of buy and sell orders for EUR/USD during January 2009. We can observe that the dots in Figures 1a and 1b form almost a straight line that slopes upwards to the right. This is a reflection of a positive linear relationship between the number of buy and sell orders (Figure 1a), as well as the number of opening and closing positions (Figure 1b). The strength of their positive correlation is reflected in their correlation coefficient, which is 1 for the number of buy and sell orders. In addition, the correlation coefficient is 1 for the number of opening and closing positions. The hourly number of buy and sell orders varies in the same direction. It is important to point out that this positive correlation does not mean that changes in the number of buy orders cause the changes in the number of sell orders, and vice versa. To determine what causes changes in the direction of number of trading activity, an assessment of the overall market conditions must be conducted.

6.2. Seasonal Patterns of Trading Activity

A periodic pattern exhibiting in the flow of market trading activity is referred to as seasonal. This seasonality of trading activity has been found in FX market trading activity at intraday and in-

Figure 1. The hourly relationship for (a) the number of buy and sell EUR/USD orders (left) and (b) the number of opening and closing EUR/USD positions: A sampling interval of $\Delta t = 1$ is chosen and the sampling period covers 31 days



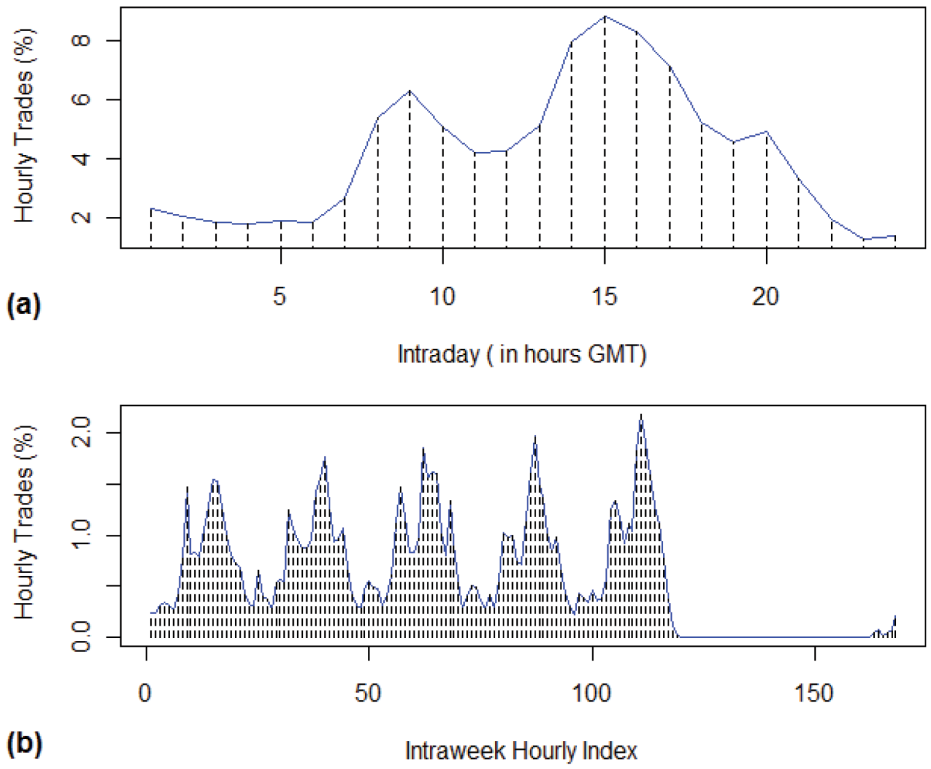
traweek frequencies (Figure 2). The intraday and intraweek analysis of trading activity shows the worldwide FX market trading activity as a function of daytime and weekdays. The seasonality statistics reveal a great amount of information about the FX market's active trading hours, volume of trading activity, and how the trading flow might develop. The analysis outcome allows us to tackle the seasonality patterns of trading activity from the 24-hours trading round in the worldwide FX market in different geographical locations. The behaviour of the intraday patterns of trading activity is associated with the changing present in the worldwide FX market's main market centres (e.g., London, Tokyo, and New York). These different market centres around the globe have different opening and closing trading times. When the trading hours of these market centres overlap, the number of trading activity increases due to more traders participating in the market. Overlapping business hours are said to take place when two or more market centres are open simultaneously.

Intraday Seasonality of Trading Activity

The intraday seasonality analysis constructs a uniform time grid with 24 hourly intervals, showing the trading activity of the daily business trading hours of the main market centres in the worldwide FX market. It is defined by means of the hourly changes in market trading activity over a defined period of time. In other word, it stands for the aggregated number of trading activities occurring in each hour (hour 0 to hour 23) of the day, divided by the total number of trading activity over a defined time period.

Figure 2a constructs a uniform time grid with 24 hourly intervals, showing the intraday seasonality for EUR/USD trading activity that existed on the individual traders' historical transactions dataset. We can spot the double U-shaped pattern of trading activity that is reported in the literature (Dacorogna, et al., 2001; Ito & Hashimoto, 2006). To illustrate this phenomenon, during the first trading hours of the day (in hours GMT),

Figure 2. The intraday and intraweek seasonality of EUR/USD trading activity



the East Asia market centres were active, and a high number of trading activity is taking place. Then the trading activity declines slightly due to a market centre lunch break and closing time. Following that, the trading activity increases sharply around 7:00 am GMT, which is when there is are overlapping trading hours between the East Asia and the European FX market centres. The trading activity increases sharply around 01:00 pm GMT due to the overlap between the business hours of the Europe and those of the American FX market centres.

Afterwards, the number of trading activity starts to decline around 4:00 pm GMT, which is when the London market closes, and declines sharply around 9:00 pm GMT when the New York market closes.

The analysis of the intraday seasonality of trading activity indicates that the trading activity starts to peak within the opening trading times of the market centres in the morning. Following that, the trading activity declines during the lunch break of the market centres and then peaks in the afternoon again. During the market centres' closing hours, the trading activity gradually declines. The intraday seasonality of trading activity has two peaks in which the second peak is higher than the first. The first peak of trading activity takes place when the European FX market centres are open, while the second peak takes place when the European and American FX market centres are open simultaneously. The minimum hourly number of market trading activity outside weekends occurs during the first opening hour of the Sydney market, about 10:00 pm GMT time, when it is nighttime in America and Europe.

Intraweek Seasonality of Trading Activity

Due to the small number of participants in the FX market during weekends, weekends witness extremely low trading activity. This in turn implies weekly periodicity patterns with regard to the flow of FX market trading activity. Consequently, it is imperative to add intraweek statistics to the intraday statistics when analysing the flow of FX market trading activity (Dacorogna, et al., 2001). The intraweek analysis of FX market trading activity uses a uniform time grid of 168 hours from Monday 0:00 – 24:00 to Sunday 0:00 – 24:00 (GMT) to display the aggregated number of trading activities in each hour of the weekdays, over a specified period of time. This demonstrates the active trading period of the main FX market centres during the day, the same as for the intraday seasonality of trading activity.

Figure 2b shows the intraweek seasonality for EUR/USD trading activity that exists on the individual traders' historical transactions dataset. The patterns can be explained by considering the weekend effect and the main market centres' business trading hours during the day. An extremely low level of trading activity takes place from Friday at 21:00 to Sunday evening at 22:00 as a result of the weekend effect. In contrast, the main FX market business trading hours demonstrate the active trading period of a working day. We can see that the maximum number of daily hours (around 13:00 to 15:00 GMT) of trading activity occurs during the overlapping business hours in which European and American market centres are open simultaneously.

7. MODEL OF FX MARKET TRADING ACTIVITY

The market simulates the FX market trading activity on at the level of a market-maker market. Since the FX market operates continuously 24 hours a day the market applies physical time to account for the different FX market seasonalities. For simplicity of our analysis, we assume that there is only one currency pair (EUR/USD) available for trading in the market. The market uses high-frequency historical prices for EUR/USD by feeding these prices into the market and having the traders react based on such information.

A currency pair in the market represented as a base and quote in which these two currencies are traded. The bid rate denoted by B_t over the period t at which a trader can sell base currency and buy an equivalent amount of the quoted currency to buy the base currency, go short. Respectively, the ask rate denoted by A_t over the period t is the offer rate at which a trader can buy base currency and sell an equivalent amount of the quoted currency to pay for the base currency, go Long. A currency pair exchange rate at time t is denoted by $r(t)=B_t/A_t$.

The market is populated by a number of trading agents that participate in the market in terms of buying and selling currencies. We consider N trading agents divided in N_c counter traders and N_t trend following traders ($N = N_c + N_t$). We keep N constant at 10^4 trading agents. A trading agent i is able of holding at any time t in the market: (a) a risk free asset (cash) denoted by $c_i(t)$, and (b) a risky asset (currency) denoted by $h_i(t)$, or (c) both of them. The trading agents are modelled to responds to price changes and events affecting the market. Particularly, they look for detecting periodic patterns in the price fluctuation. A trading agent take a decision $d_i(t)$ at each time step t of the simulation, based on the trading agent budget constraints and preferences. All the market orders placed by the different trading agents will be completely satisfied. However, limit orders will be executed only if the order's constraints are achieved. At the end of each time step t of the market, the trading agents' holdings of cash and the risky asset will be updated, based on the currency pair exchange rate r (t) at time t.

There are two basic components, which characterize the model; the trading agents' behaviour and the validation of the trading agents' collective behaviour in replicating FX market trading activity.

7.1. Trading Agents

An important point is to have a description of the trading agents' behaviour, which is as simple as possible, and with the minimal number of parameters which are still able to produce stylized facts of the collective FX market traders' behaviour. The simplicity is very important to allow for a detailed interpretation of the origin and nature of the stylized facts of real traders' behaviour in isolation from complex trading behaviour.

Initial Wealth Distribution

Since our intention in building models of the traders' activity is to mimic real market traders' behaviour, the trading agents are endowed with different amounts of cash, based on a power law distribution. Pareto (1897) showed that the income distribution in many countries follows a power-law distribution. In the follow-up to Pareto's work, a number of studies supported Pareto hypothesis by providing evidence from empirical data (Steindl, 1965; Atkinson & Harrison, 1978; Persky, 1992).

The power-law distribution is employed in the simulation by converting a random number that is uniformly distributed into a number that is distributed along the power-law distribution. The power-law and the random variable are related via:

$$\int_{p_0}^{p_1} c.p^{-\alpha} = \int_0^x 1.dx$$

where p_0 and p_1 is the lower and upper bounds respectively from which the laws hold. C is a constant value define by:

$$c = \frac{-\alpha + 1}{p_1^{(-\alpha+1)} - p_0^{(-\alpha+1)}}$$

α is the scaling exponent for a power-law distribution and x is a random number drawn from a uniformly distributed number. Combining these two equations, the power law has the following form:

$$p\left(x\right) = \left(\frac{x\left(-\alpha+1\right)}{c} + p_0^{(-\alpha+1)}\right)^{(-\alpha+1)}$$

Estimating the value of the scaling exponent for a power-law distribution is very important due to its role in characterising the distribution. The larger the scaling exponent, the steeper the curve, consequently implying more small scales that large ones. Caution in estimating the scaling exponent is essential; a number of experiments was carried out to decide on the more fitting scaling exponent for the model.

Trading Strategy

The trading agents' behaviour is based on the zero-intelligence directional-change events trading strategy (DCT0) in which the trader commit himself to a fixed threshold (percentage) (Aloud, et al., 2010). DCT0 traders look into the price time series based on intrinsic time changes rather than physical time changes. The physical time changes are the changes that occur in time series from milliseconds through hourly to daily changes, in which the flow of time is discontinuous. Alternatively, the intrinsic time basic unit of the price time series is an event. An event is defined as the total price movements exceeding a defined threshold by the trader. These events identify crucial points, which formulate an opportunity to trade.

An event can take one of the two forms an upturn event or downturn event. An upward run is a distance between an upturn event and the next

downturn event while a downward run is a distance between a downturn event and the next upturn event. An upturn (downturn) event terminates a downward (upward) run, and starts an upward (downward) run. During an upward run, a last high is constantly updated to the maximum of (a) the current market price p(t) and (b) the last high price p_h. Similarity, during a downward run a last low is constantly updated to (a) the minimum of the current market price p(t) and (b) the last low price p_l. A downturn event occurs when the absolute price change between the current market price p(t) and the last high price p_h is lower than the threshold Δx_{dc} used by the trader: $p(t) \leq p_h \times (1-\Delta x_{dc})$.

An upturn event occurs when the absolute price change between the current market price p(t) and the last low price p_l is higher than the threshold Δx_{dc} used by the trader: $p(t) \geq p_l \times (1-\Delta x_{dc})$.

At the beginning, the last high and last low are set to the initial market price. Whenever a trader detects an upward event, according to the used threshold, he will conclude that the market in on upward run, which could means an opportunity to trade. Similarity, a downturn event means a downturn run in which it is an opportunity to trade.

Two different groups of the trading agents are identified based on DCT0: contrary traders and trend-following traders. A contrary trader opens a position (place an order) predicting that the price will move in the opposite direction. For example, a contrary trader may open a new long position when the price goes down according to the threshold used by the trader. Later, the contrary trader closes the position as soon as the price rises by the used threshold. In contrast, a trend-following trader takes advantage of market trend movements, assuming that the current market trend will continue. A trend follower opens a new long position when the price is rising while a short position is taken when the price is dropping. To illustrate, a trend follower enters into a new short (long) position if the current bid (ask) rate declines (go ups) by a percentage which is equal to, or above, the used threshold by the trader.

The buying and selling orders placed by these two groups of traders are market orders. The market orders are orders for immediate execution at the current price on the market. To develop a complete investment strategy for the trading agents, we incorporate two types of limit order; profit-taking limit order and stop-loss limit order in which a trader must declare the price at which they wish to close their current open position. The profit taking limit order is an order to close a position to lock a certain profit realization. For example, to close a long position the profit taking limit order price must be higher than the purchasing price, whereas to close a short position, the profit taking limit order price must be less than the selling price. The stop-loss limit order is an order to closes a position once a specified loss threshold is reached to limit the loss potential on a position. In detail, a stop-loss limit order to close a long (short) position becomes a market order after the bid (ask) price is at, or below (above), a specified loss threshold price (stop price) defined by the trader.

Profit Objectives and Risk Appetites

Modelling the traders using some of the real traders' behaviour characteristics generates, to a certain extent, realistic models of traders. A trader's profit objective and risk appetite characterizes his trading activity, which obviously affects the volume and flow of market trading activity. Based on that, using the individual OANDA traders' transactions dataset, we map the traders' profit objectives and risk appetites into the agent-based models of traders.

This is done through tracking each trader's transactions in each of his traded currency pairs in terms of tracing the number of currency units bought and sold sequentially by the transactions' execution time. Consequently, we trace a trader's different types of orders with regard to a given currency pair from the opening to the closing of a position. This allows us to define the traders'

profit and loss thresholds by which they decide to close their positions. The threshold represents the magnitude of price movements as a result of which traders decide to place a new order. From this micro-analysis we observe the following: (a) in the case of the traders' profit objectives, the majority of traders place a new trade order based on small price movements compared with their previous order. Based on this observation, every trading agent is assigned a profit threshold by means of a continuous uniform distribution that is identified with a narrow range of thresholds values. (b) In contrast, the length of holdings on a losing position tends to be extensive. This indicates that many trading strategies of real traders involve a high degree of risk. This was mapped into the agent-based models of traders in which we defined the trading agents risk appetites to be four times their profit objectives.

Trading on Margin

Trading on margins allows a trader to place an order where the order size larger than the Net Asset Value (NAV) of his account which involves borrowing from the market-maker executing the transaction. Trading on margins depend on the leverage ratio used by the trader. A leverage ratio of x:1 is a margin requirement of y% ($\frac{1}{x}$) which means that if the trader decides to place an order, then the trader must have at least y% of the order's size available as a margin.

Trading on margins involves a high risk so to manage the risk, trading on the margin makes use of a course of action referred to as a margin call. A margin call is a procedure to automatically close all of a trader's open positions to prevent a trader from losing more than the amount of cash in his account. A margin call occurs once the net asset value of a trader's account falls below the minimum margin needed to cover the size of his currently open positions.

Activation Initial Condition

To model a realistic trader's behaviour, it is imperative that initially traders are active in the market at different times, just as is the case in reality. Otherwise, a high level of liquidity will occur at the beginning of the trading period, which in turn implies an extremely low level of liquidity at the end of the trading period. Accordingly, we set up the activation of initial conditions in modelling the traders' behaviour. Such a condition controls when an individual trading agent will be active in the market for the first time. The activation of the initial condition is based on a small random probability, which is defined before the simulation starts, and remains constant during the simulation.

Trading Time Window

In modelling the trading time window for the trading agents, we take into account the effect of the main market centres' trading hours and market holidays on the market trading activity of the FX market worldwide. Although the FX market does not imply a fixed trading time window as in the stock market, giving traders 24 hours a day to trade, the trading hours of the worldwide FX market main market centres have a significant effect on the FX market trading activity. The main market centres of the FX market worldwide have different business trading hours and traders' preferences, which characterize and determine the flow and volume of trading activity in the FX market.

The trading hours of the main market centres of the worldwide FX market can be divided into four major trading sessions (Dacorogna, et al., 2001): the Sydney, Tokyo, London, and New York sessions. The trading activity starts to increase during the opening hours of the FX market sessions, while during a market session's closing hours, the trading activity declines. The trading activity increases sharply when two or more market sessions overlap. This is due to more traders participating in the market.

Based on the critical role of the FX market sessions on FX market traders' behaviour, each trading agent is assigned one of the FX market sessions, based on a continuous uniform distribution. The reason behind using uniform distribution assumption is that we want to assign equally the main FX market trading sessions to the trading agents. This is because traders from different geographical locations attempt to trade more frequency during most of the main FX market centres trading business hours, given that they spot many investment opportunities.

Nevertheless, the trading time window for the trading agent is not restricted to their trading sessions. They are able to place orders at any time during the day when their specified conditions are met. However, during the day, based on a very small probability, a trading agent is not allowed to place an order outside his session hours, except for closing an open position if the price movement reaches the expected profit or hits a stop loss limit. Under these conditions, a trading agent may place an order outside his session hours without any conditions.

The weekends in the FX market witness an extremely low level of trading activity due to the small number of market participants. Based on this, in modelling the traders, we take into account the weekend effect on FX market traders' behaviour. The trading agents are allowed to trade during the weekends, based on a small probability. Such a probability is defined before the simulation starts, and remains constant.

Random Trading

Several FX market traders place an order in response to factors other than price movements and events affecting the market. Based on this, we incorporate the role of random trading into the agents' trading strategy. To demonstrate this, when a trading agent has no open position, and the price movements have not achieved the trading agent's expectations based on a very small random probability, the trading agent can open a new position. Such random probability is defined before the simulation starts, and remains constant during the simulation.

7.2. Experiment

This section describes the experimental results performed with the aim to obtain a realistic traders behaviour. Speaking broadly regarding the experimental design, the experiments were carried out using various time horizons of the year in order to confirm that the collective trading agents' behaviour replicate, to a certain extent, the collective FX market traders' behaviour. The market operated for a period of one month, where each trading round lasted one second. For simplicity in our analysis, there is only one market maker, one currency pair (EUR/USD) available for trading, and the number of traders was kept constant, at 10^4 traders.

Validation Design

To validate the accuracy of the trading agents' behaviour in resembling the collective behaviour of real FX market traders, we define the stylized facts of real FX market traders behaviour by observing their micro-behaviour in the market, as reported in Section 5. Following this, we observe the collective behaviour of the trading agents to establish their stylized facts. Using the identified stylized facts of the collective behaviour of real FX market traders and trading agents, we measure the similarity.

Results

In this section, we present the experimental results under which the stylized facts of the collective behaviour of real FX market traders are exhibited. It is worth mentioning that several experiments using different sets of the model's parameters were

carried out before obtaining a realistic traders' behaviour in the market.

The validation of the agent-based models of traders is based on correlation and the seasonality of FX market trading activity. From the simulation outcome, we found a positive linear relationship between the numbers of buy and sell orders, reflected in their correlation coefficient, which is 1. Additionally, the correlation coefficient is 1 for the number of opening and closing positions. These two relationships exist in real FX market trading activity, as reported in Section 5.1. The observed intraday and intraweek seasonality of EUR/USD trading activity from the simulation outcome resemble, to a certain extent, the dynamics present in intraday and intraweek seasonality of EUR/USD trading activity in the real FX market, refer to Section 5.2. However, the number of the real FX market trading activity during the day is much higher than that from our FX market model. This is due to the fact that few traders participate in our FX market model compared to the real FX market.

Figure 3a shows the intraday seasonality of EUR/USD trading activity from the simulation outcome. The patterns dynamic captures the double U-shape or 'camel-shape' pattern reported in the literature (Dacorogna, et al., 2001; Ito & Hashimoto, 2006). We can see that it follows the same pattern as the one presented in the intraday seasonality of the real FX market EUR/USD trading activity in Figure 2a, with two peaks, the second of which is higher than the first. The first trading activity peak takes place when the Tokyo and London trading sessions overlap around 08:00 GMT, while the second one takes place when the London and New York trading sessions overlap around 13:00 – 16:00 GMT. The minimum hourly activity occurs around 3:00 – 6:00 and 20:00 – 21:00 GMT. This is when Tokyo and Sydney markets are open, and the New York market is starting to close, respectively. Additionally, we can see that the trading activity starts to peak within the opening trading business time of the market centre in the morning. To illustrate, the number of trading activity increases at 01:00 GMT which is when the Tokyo trading session opens, then when the London trading session opens, it increases again at 08:00 GMT. When the New York trading session starts, the number of trading activity increases sharply at 13:00 GMT, which is when the London and the New York markets' trading sessions overlap due to the fact that more traders are participating in the market.

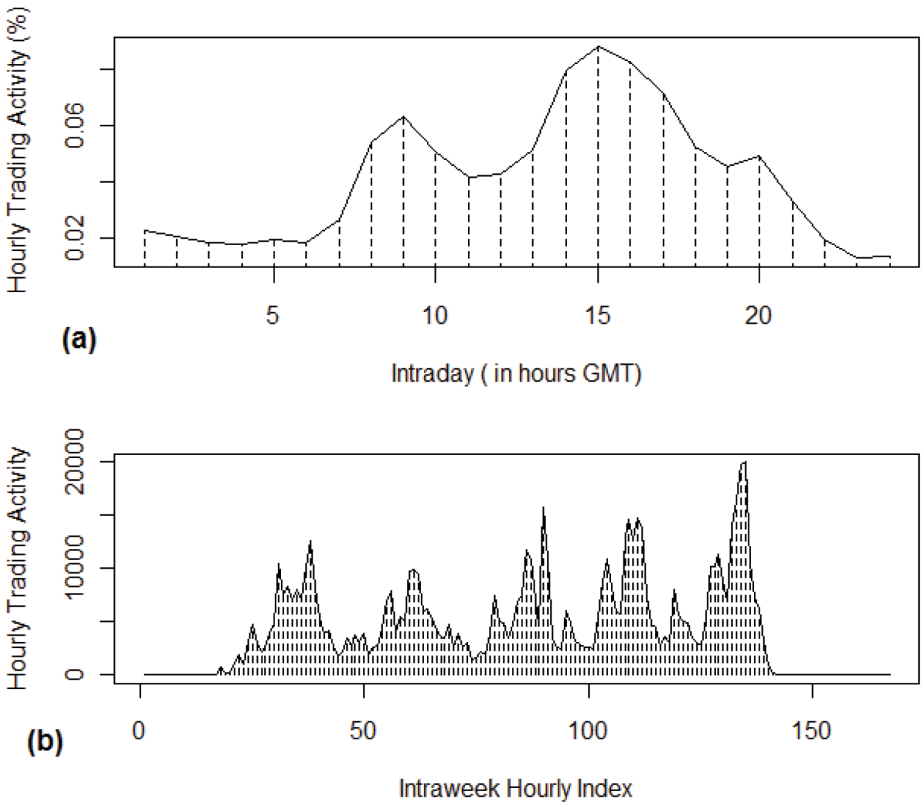
Figure 3b shows the intraweek seasonality of EUR/USD trading activity in terms of the simulation outcome. We can see that the seasonality dynamic of the trading activity exhibits similar behaviour to the intraweek seasonality of the real FX market in terms of EUR/USD trading activity in Figure 2b. The number of trading activity declines sharply during the weekend due to the small number of participants. The highest number of trading activity on each day occurs when London and New York trading sessions overlap around 13:00 – 16:00 GMT.

8. ORIGIN OF THE TRADERS COLLECTIVE BEHAVIOUR STYLIZED FACTS

... it is important in agent based models not just to replicate features of real markets, but also to show which aspects of the model may have lead to them (LeBaron, p. 226).

In the previous section, we have seen that our model of FX market trading activity is able to generate some of the stylized facts of the FX market traders' collective behaviour. Nevertheless, in our model, the stylized facts were obtained from a combination of specific values of the model's parameters. In this section, we want to modify some of the model's parameters in a number of ways in order to understand the nature and origin of FX market traders' collective behaviour stylized facts. This can be address in a systematic way in order to understand how the stylized facts emerged.

Figure 3. The intraday and intraweek seasonality of EUR/USD trading activity on January 2009 from the simulation outcome



8.1. The Simplicity of the Model

With a complex model, it is a difficult task to search for conditions under which stylized facts emerge. The complexity of some models of financial markets prevents the developer from identifying the aspects of the model that account for the emergence of stylized facts. Accordingly, we attempt to offer a description of the parameters involved in the model as simply as possible that are capable of replicating the stylized facts of the collective FX market traders' behaviour. This has an important consequence for investigating the origins of traders' behaviour stylized facts by means of exploring each of the model's parameters in isolation of the impact of the other parameters.

The simplicity of our model relies in two main aspects: the use of a simple market mechanism in which we used a currency pair (EUR/USD) of historical prices as a substitute for generating artificial prices from the model, and the simple representation of the trading agents. The trading agents' trading strategy is based on a zero-intelligent directional-change event trading strategy (DCT0) in which the trading agents respond by buying or selling to a periodic pattern in the price time series based on their expectations.

8.2. Heterogeneity

One of the things that microeconomics teaches you is that individuals are not alike. There is heterogeneity, and probably the most important

heterogeneity here is heterogeneity of expectations. If we didn't have heterogeneity, there would be no trade. But developing an analytic model with heterogeneous agents is difficult - Kenneth Arrow, The Changing Face of Economics, (p. 301).

The role of heterogeneity in modelling the activities of the financial market traders is imperative seeing that, in reality, there are a large number of traders who have different degrees of wealth, demands, aspirations, trading hours, trading strategies, etc. The heterogeneity without doubt affects and characterizes the flow of trading activity in the market. In our model, heterogeneity exists in four forms: (a) the different behavioural groups of zero-intelligence DCT0 traders, (b) within each group the trading agents are endowed with different amounts of cash (wealth), (c) the trading agents have different profit objectives and different risk appetites that lead to the existence of long and short term investors, and (d) the trading agents use different trading time windows that build a source of heterogeneity into the model, leading to the characterization of different trading activities.

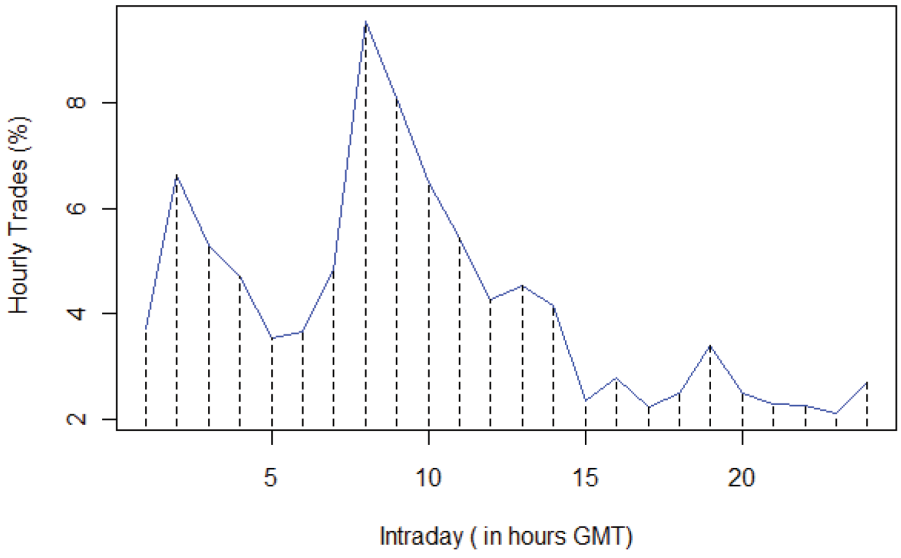
8.3. Activation of the Initial Condition

The activation of the initial condition proved to be of vital important in replicating the collective behaviour of FX market traders. Since, if all traders initially start to be active in the market at the same time, this will result in an extremely high level of liquidity in the market at the beginning of the trading period, compared with the middle and the end of the trading period. However, this is not the case in reality.

To test the impact of the inclusion of the activation initial condition on replicating the intraday seasonality of FX market trading activity, we turn off the initial trading condition with regard to the model. Figure 4 shows the intraday seasonality of EUR/USD trading activity from the simulation outcome without the activation of the initial condition.

A simple inspection proves the lack of realism of the dynamics of intraday seasonality patterns for the following reasons:

Figure 4. Intraday seasonality of EUR/USD trading activity from the simulation outcome without the activation of the initial condition



- There are two trading activity peaks, which occur when the Tokyo and the Sydney trading sessions are open simultaneously. This is not the case for the seasonality of FX market trading activity, given that the first peak of trading activity occurs when the London trading session is operating, while the second peak takes place when the London and New York trading sessions overlap.
- The number of trading activity starts to drops sharply around 07:00 am (GMT time zone). This is when the European market opens. Additionally, the number of trading activity continues to decline through the day, even when the American markets open, and the European and American markets are open simultaneously between 01:00 pm to 04:00 pm GMT. In reality, the FX market witnesses a high number of trading activity when the European market operates, and then a much higher number of trading activity when the European and American markets are open simultaneously due to more traders participating in the market.
- There is no increase in the number of trading activity during the opening hours of the FX market trading sessions in contrast to reality when the number of trading activity increases throughout the opening hours of the FX market trading sessions.

We can conclude that such an initial activation condition represents an important element in replicating the collective behaviour of FX market traders. The initial activation condition is based on a small random probability. After a number of conducted experiments, we found that verifying the initial activation probability does not affect the accuracy of trading agents' behaviour in terms of reproducing the FX market trading activity. However, we found that verifying the initial activation condition affects the trading number, in that using a high initial activation probability results in a highest number of trading activity, while a low probability results in a low number of trading activity. Cautiousness in choosing the appropriate value of initial activation probability is important.

8.4. Profit Objective

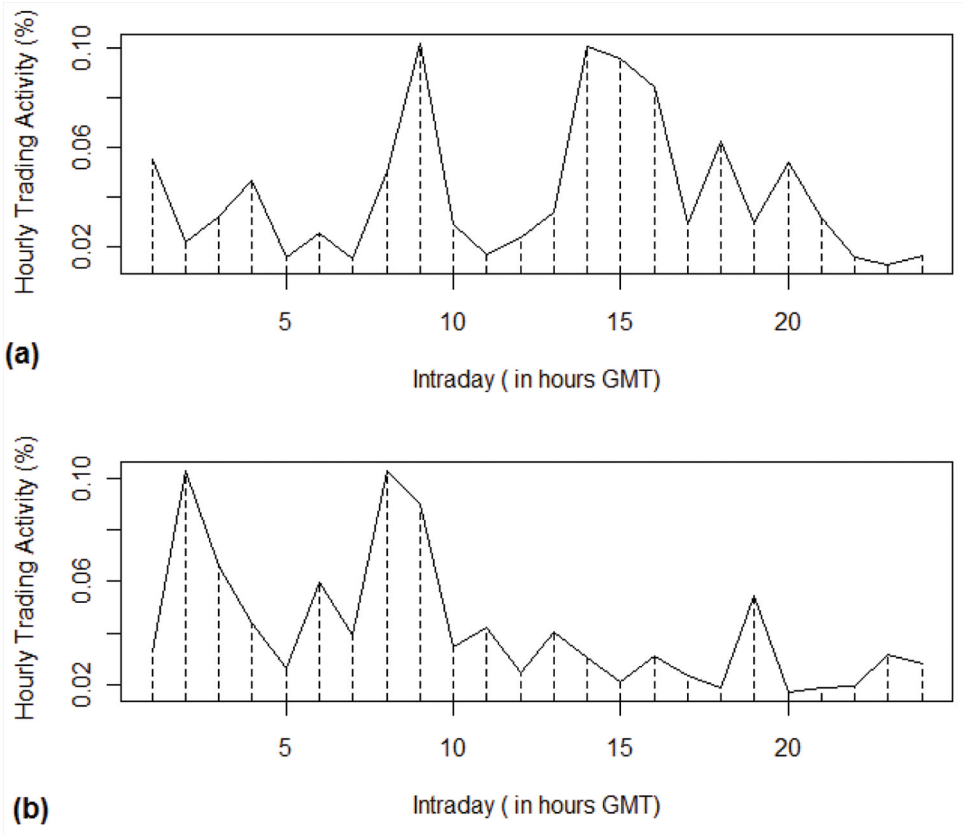
The right setting for the trading agents' profit objectives is one of the most relevant factors responsible for replicating some of the stylized facts of collective behaviour of FX market traders. The choice of continuous uniform distribution for the traders' profit objectives rather than other distribution methods was capable of replicating the different seasonalities of trading activity.

In order to test the impact of different distribution methods for the trading agents' profit objectives on the intraday seasonality of FX market trading activity, we performed some experiments in which we used a power-law distribution or normal distribution instead of a continuous uniform distribution. Figure 5 shows the intraday seasonality of EUR/USD trading activity from the simulation outcome using normal distribution (a) and power-law distribution (b).

We can observe by a simple inspection that the dynamics of intraday seasonality are not realistic. In the case of a normal distribution (Figure 5a), we can spot that there is a sort of continuous fluctuation in the intraday seasonality of trading activity which is not the case in reality. In the case of the power-law distribution (Figure 5b), it is not possible to recognize the well-known double U-shape of FX market intraday seasonality of trading activity within the various patterns in the graph. Verifying the scaling exponent for the power law distribution does not change the unrealistic results. However, due to space limitations, we will not report all these results.

The power-law distribution and the normal distribution characterize unfairly distributed profit objective values that imply more values in terms of traders' profit objectives than others. For in-

Figure 5. The intraday seasonality of EUR/USD trading activity from the simulation outcome using normal distribution (a) and power-law distribution (b)



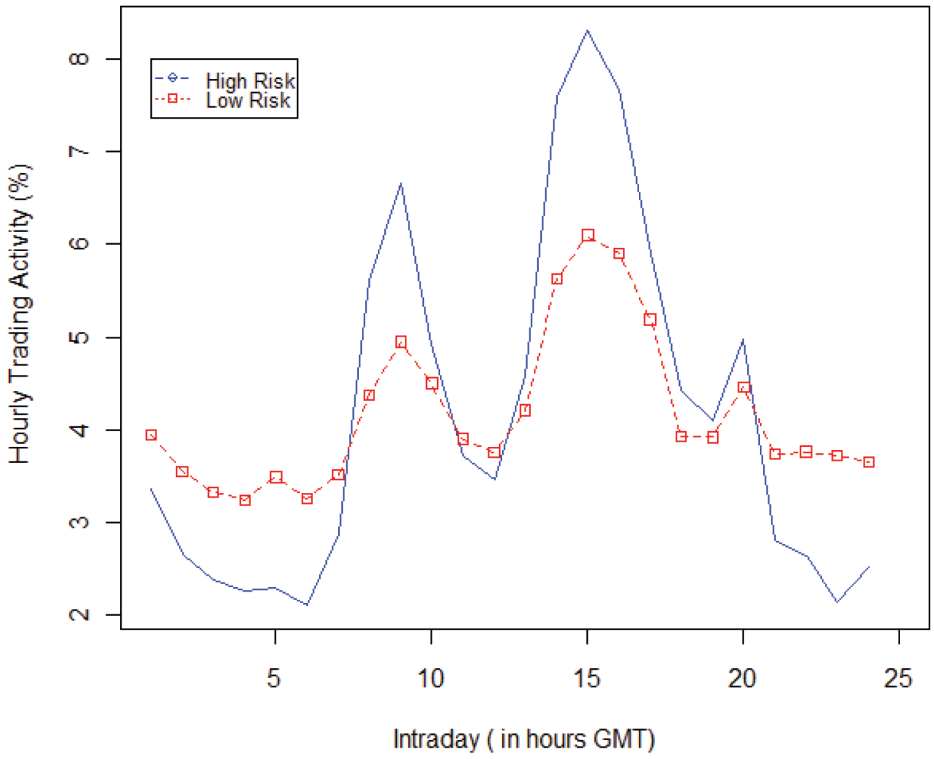
stance, a power law distribution would assign high profit objectives to only a few traders, whereas low profit objectives apply to the majority. This results in a large group of traders having similar behaviour patterns and preferences, whereas in reality, traders have a variety of preferences and demands. For that reason, choosing a continuous uniform distribution is a good option seeing that it gives an equal distribution with a variety of profit objective values for the trading agents.

8.5. Risk Appetites

We observed from the microscopic analysis of OANDA individual traders' historical transactions, the existence of high risk trading in the market in which traders' risk appetite is higher than their profit objectives (as described in Section 6.1.3). Based on this observation, we defined the trading agents' risk appetites to be four times their profit objectives.

In order to test the impact of such a parameter on the seasonality dynamic of trading activity, we performed several experiments in which the trading agents' trading strategy involved high risk or low risk. In Figure 6, we can see the intraday seasonality of EUR/USD trading activity from the simulation outcome with risk appetites equal to the traders' profit objectives (low risk) and risk appetites four times the traders' profit objectives (high risk). Due to space limitations, we will not report the results with all the other possible values of traders' risk appetites. From the figure, we can see that when the trading agents'

Figure 6. The intraday seasonality of EUR/USD trading activity from the simulation outcome with low and high trading risk



trading strategy involves high risk, the patterns of intraday seasonality of the FX market trading activity is precisely exhibited. Meanwhile, when the trading agents' trading strategy involves low risk, the patterns of intraday seasonality moves within a narrow level of the resistance, whereas in reality it is wider.

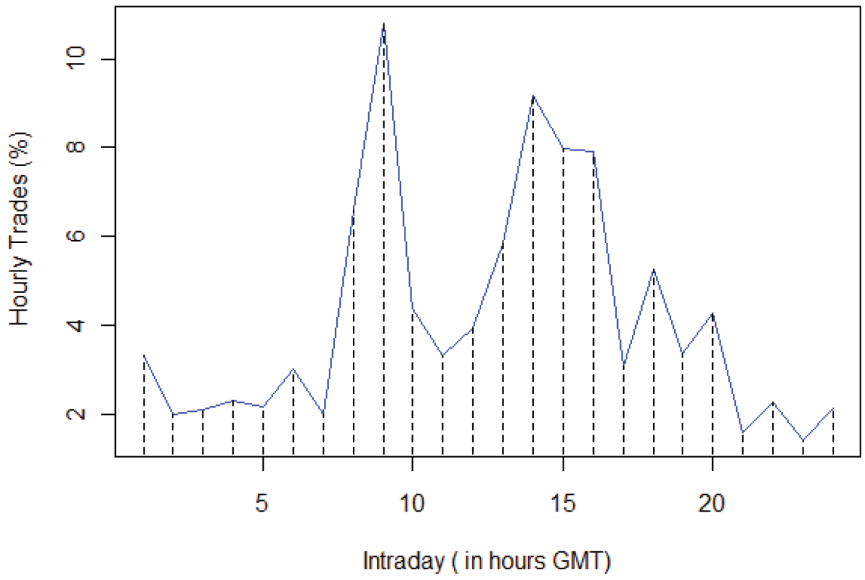
8.6. Limit Orders

The generation of limit orders, profit-taking limit orders, and stop-loss limit orders during trading has an important effect on replicating some of the stylized facts of FX market traders' collective behaviour. To test the impact of the inclusion of limit orders on the intraday seasonality of trading activity experimentally, we performed several experiments in which we had either profit-taking limit orders, or stop-loss limit orders, or none of them.

Figure 7 shows the intraday seasonality of EUR/USD trading activity from the simulation outcome without the two types of limit orders being generated. We can observe that the dynamic of intraday seasonality is not realistic for the following reasons:

- The intraday seasonality of trading activity has two peaks in which the first peak is higher than the second peak. The first peak of trading activity occurs when the European FX market trading sessions are open, while the second peak occurs when the European and American FX market sessions overlap. This is in extreme contrast to the dynamics of the intraday seasonality of trading activity in the FX market in which the second peak of the trading activity is higher than the first peak.

Figure 7. The intraday seasonality of EUR/USD trading activity from the simulation outcome without the two types of limit orders being generated



- There is some degree of continuous fluctuation at the end of the dynamic intraday seasonality of trading activity, which is not the case in terms of the FX market intraday seasonality of trading activity.

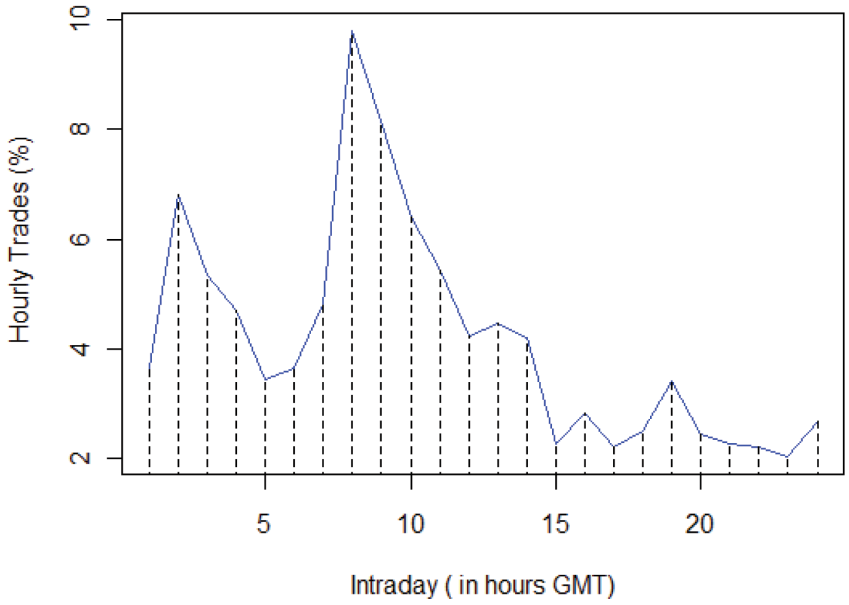
These unlikely results might be caused by the lack of a comprehensive trading strategy in which the trading agents must lock a certain profit realization, or seek to limit the potential loss for their open positions. What we can conclude from these results is that the two types of limit orders represent an important element in the generation of realistic FX market traders' behaviour.

8.7. FX Market Trading Sessions and Market Holidays

Although the FX market operates 24 hours a day and does not imply a fixed trading time window, the number of trading activity increases during the opening time of the FX market trading sessions in the morning, while during the closing time of the FX market trading sessions, the number of trading activity falls. The overlapping business hours of two or more market sessions always witnesses a high number of trading activity compared to other trading hours. Additionally, the weekends in the FX market exhibit a low number of trading activity. These in turn shows the effectiveness of the FX market trading sessions and weekends with regard to trading behaviour.

At the beginning, we modelled the trading agents without incorporating the role of FX market trading sessions and holidays. The reason behind our decision is that algorithmic trading, also referred as automated trading, which uses computer programs to place orders automatically, has attracted many FX traders, and, most importantly, has a significant impact on the growth of the FX market. Evidently, our decision was not absolutely precise, seeing that some of the stylized facts of the FX market traders' behaviour did not emerge in the stylized facts of the collective behaviour of our agent-based models of traders. Figure 8 represents the intraday seasonality of EUR/USD trading activity from the simulation outcome, without incorporating the role of FX market trading sessions.

Figure 8. The intraday seasonality of EUR/USD trading activity from the simulation outcome, without incorporating the role of FX market trading sessions



We can obviously spot that the intraday seasonality of FX market trading activity is not exhibited, in that it is impossible to spot the "double U-shape" that is reported in the literature. This is case for the following reasons:

- The highest number of trading activity takes place in the first hour of the day, as well as around 07:00 am GMT. Following this, the trading activity declines throughout the day, which is in contrast with the case in the FX market. The highest number of trading activity in the FX market takes place when the London and New York trading sessions overlap.
- During the business hours of the London and the New York trading sessions between 08:00 am – 09:00 pm GMT, there is a sharp drop in the number of trading activity, whereas in reality the FX market witnesses an increase in the number of trading activity during the opening hours of the London trading session, and a much greater rise in the number of trading activity within the opening hours of the New York sessions, in view of the fact that the London and the New York trading sessions overlap between 01:00 pm – 04:00 pm GMT.

8.8. Evaluation

One of the main constraints in modelling the market traders' behaviour is the ability to verify if the stylized facts of real traders' behaviour are exhibited. Fortunately, this study makes use of a unique high-frequency set of data of individual trader's historical transactions at an account level. This has allowed us to define some stylized facts with regard to the collective behaviour of FX market traders. Using the identified stylized facts, we can evaluate precisely the accuracy of the agent-based models of traders in resembling the collective FX market traders' behaviour. Most

importantly, this allows us to experimentally trace under which conditions the stylized facts of the FX market collective traders' behaviour are exhibited in our model.

9. SOLUTIONS AND RECOMMENDATIONS

Modelling the market traders' behaviour involves major sequence steps. The initial step is to acquire a good knowledge of the behaviour and mechanisms of the financial market. Mainly understand the dynamics and the forces that drive the traders' behaviour in the market. Exploring the High-Frequency Data (HFD) of individual traders' physical transactions is vital to understand the traders' behaviour. HFD allows greater insights when it comes to observing stylized facts of traders' behaviour in the market. HFD should be the primary source for those who are involved in understanding and modelling financial markets.

In this chapter, we have identified two properties that a well-functioning model of financial market should possess: simplicity and heterogeneity. We believe that the simplicity description of the parameters involved in the model is essential. This is to avoid complexity that could prevent researchers from examining the effect of each of the model's parameters in replicating the real market traders' behaviour. In fact, by using this approach, we found a set of conditions under which some stylized facts of traders' behaviour emerge. On the other hand, the role of heterogeneity in modelling the real traders' behaviour is imperative as it is desirable to model the markets in a more realistic manner. Heterogeneity of all sorts and forms must be incorporated in modelling the market traders: preferences, demands, aspirations, trading time windows, budget constraints, trading strategies, etc.

The validation of the agent-based models of traders verifies if the stylized facts of real traders' behaviour are exhibited. Agent-based models of traders must be capable of resembling, to a certain extent, the collective behaviour of the real market traders. There are a number of approaches that can be used to validate the agent-based models of traders. Our approach is to study the micro-behaviour of individual traders' behaviour in the market through exploring their HFD. This allows for defining stylized facts of the traders' collective trading behaviour in the market. Using the identified stylized facts, one can evaluate the agent-based models of trading. Necessary updates must be applied until the model resembles the real traders' collective behaviour.

The several parameters that one is allowed to define in an agent-based market results in numerous degrees of freedom, which raises some difficulties when modelling the real market. The appropriate selection of the market parameters is a crucial element of the design but, at the same time, is a tricky task. Researchers should conduct experiments with different values for each parameter, and then track the changes in market behaviour. This allows them to define exactly the parameters that will allow the model to replicate some real market features. As noted by LeBaron (2001a), ."... understanding exactly where the parameter boundaries are between simple and complex behaviours is crucial to understanding the mechanisms that drive agent based markets" (p. 258).

10. FUTURE RESEARCH DIRECTIONS

More work is needed to obtain trading behaviour that much more closely resembles the behaviour of real FX market traders. Despite the fact that the stylized facts of our agent-based models of traders replicate some of the stylized facts of real FX market traders' behaviour, it is essential to define more stylized facts regarding the FX market traders' behaviour in order to evaluate the accuracy of the trading agents' behaviour in resembling the

collective behaviour of real traders. Going further, it is necessary to model the FX market trading behaviour in which more than one currency pair is available for trading in the market, in order to examine precisely the conditions under which the stylized facts of traders' behaviour are exhibited.

Another obvious way in which our work can be extended is to conduct a microscopic analysis of the trading agents' behaviour, in an attempt to understand, identify, and measure through simulations, the different forces driving the traders' behaviour. This can be examining under different situations, with the intention of looking for conditions under which collapses occur in the market. Through simulations, one can study the leverage and order size effect on traders' behaviour, and the pressure of margin calls on such behaviour.

Going even further, we could build dynamic maps of traders' positions in the market. These would present a snapshot of the entry prices for all open positions held by the traders in a defined period of time for a given currency pair. The traders' positions maps can provide a new view to spots price changes, trends and the dynamics of traders' behaviour. Besides, some of the different forces driving the FX market can be defined and measured from these maps. Therefore, these maps can be used as indicator of traders' reactions to price movements, expectations of market dynamics, and can measure pressure on prices due to positions' unrealized profits and losses. The traders' trading historical positions map is a useful tool to assess a position's performance at different price levels, seeing that it identifies positions on profits and losses at each price point. This can help traders to visualize an open position at different price levels in order to assess how the position evolves with price movements.

An attractive line of research is to study the interaction between various trading strategies, such as strategies based on directional-change events, with the aim of evaluating different adopted strategies by assessing the traders' performance in the market. This in turn could help us answer a number of questions, which have arisen such as: which adopted trading strategy leads to success or failure under different circumstances? Which trading strategy is most efficient? Going even further, more works could be done in observing the results of the interactions between different traders. Such observations can be used as feedback to change the models of interaction.

One interesting dimension of research is to study price formation on FX markets, which are organized as market-makers markets. Our model of FX market trading activity can be easily modified to generate artificial prices resembling the FX market time series of prices, with the objective of finding conditions under which the statistical properties of price series in the artificial market resemble those of real FX markets.

An interesting and promising avenue of research is to study price competition among market makers in the FX market. Modelling the interactions between various market-makers in the FX market could provide behavioural explanations of some current phenomena in the FX market. There is some interesting research already being done with regard to modelling competition between market-makers (Kyle, 1984; Kyle, 1985; Biais, 2000; Bondarenko, 2001; Nishide, 2006). Unfortunately, these works do not deal with high-frequency markets, which could provide a deep insight into the strategic trading behaviour of market-makers.

11. CONCLUSION

In this chapter, we have identified some stylized facts of FX market traders' behaviour mainly in terms of the seasonalities of their trading activity. We have built agent-based models of traders' behaviour in which their collective behaviour resembles the collective behaviour of FX market traders. We focus on the important elements, which are able to reproduce the stylized facts observed in real market traders' behaviour, and discuss

under which conditions their stylized facts have emerged. This has been addressed in a systematic way to permit an interpretation of the original stylized facts. Simplicity is very important in order to avoid a complexity that could prevent us from identifying the causes behind the emergence of stylized facts. We consider that exploring the high-frequency data of individual traders' historical transactions in the market is the main factor when it comes to achieving realistic modelling of FX market traders' behaviour. Additionally, we consider heterogeneity in modelling the traders' behaviour compulsory. We model heterogeneity in different forms, including traders' initial wealth, profit objectives, risk appetite, the generation of market and limit orders, trading time windows, etc. The different forms of heterogeneity have different effects on the generation of the stylized facts of FX market traders' behaviour. In future works, the model can then be modified in many ways in order to consider more realistic situations for the description of the FX market traders' behaviour. These more realistic situations will also be addressed in a systematic way.

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KEY TERMS AND DEFINITIONS

Leverage: Also called margin, this is the ratio of margin to the maximum transaction size. For example, with a deposit of $1,000 and a leverage of 20:1, a trader could enter a position value of $20,000.

Long Position: A position is said to be long when the base currency in the currency pair is bought (long) while the quote currency is sold (short).

Market-Maker: In the FX market, a market-maker is a dealer-broker firm which quotes both a bid and an offer price in a given currency pair to the market, in order to make a profit through the bid/ask spread. In addition, market-maker is equipped to buy from, and sell to, investors and other market-makers at those quoted bid and ask prices.

Net Asset Value (NAV): A trader portfolio is defined by the Net Asset Value (NAV). The NAV at time *t* is the amount of cash in the trading agent's account, plus/minus all unrealized gains/losses associated with all the account's open positions.

Short Position: A position is said to be short when the base currency in the currency pair is sold (short) while the quote currency is bought (long).

Unit: In the FX market, a unit is used as a quantity of currency. For example: one unit of EUR is one Euro, and one unit of USD is one United States dollar.

Unrealized Gains/Losses: These are the profits/losses that would be produced if an open position were closed at the current currency pair exchange rate.

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Chapter 19
A Competitive Approach to Financial Issues:
Modern Finance Theory

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ABSTRACT

Efficient Market Hypothesis (EMH) is a cornerstone in modern finance theory. Efficient market hypothesis states that it is impossible to make abnormal returns in financial markets because financial asset prices always reflect all available information. This chapter was undertaken in order to give a brief survey of modern finance theory by mainly focusing on the efficient market hypothesis. The authors also discuss the empirical foundations of the efficient market hypothesis. Finally, the main challenges to the efficient market hypothesis are introduced in order to point out a perspective for future research.

INTRODUCTION

There is one important caveat to the notion that we live in a new economy, and that is human psychology…which appears essentially immutable. - Alan Greenspan, September 4th, 1998

In Modern Finance literature, much of economic and financial theory is based on the notion that individuals act rationally and consider all available information in the decision-making process.

The Efficient Markets Hypothesis (EMH) is one of the most crucial building blocks of modern finance theory. The EMH argues that competition between investors seeking abnormal profits drives prices to their "correct" value. The EMH does not assume that all *investors* are rational, but it does assume that *markets* are rational. The EMH does not assume that markets can foresee the future, but it does assume that markets make unbiased forecasts of the future. In contrast, behavioral finance assumes that, in some circumstances, financial markets are informationally inefficient. Contrary to EMH theory, human decision-making is the starting point for behavioral finance.

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First of all, this section will make a brief survey of conventional finance theory, focusing on the main topics of this area in literature. These main topics include the following: non-behavioral finance built on the efficient market hypothesis; rational expectations hypothesis and random walk hypothesis. Then the link between market efficiency and security returns will be introduced with the help of empirical findings of previous studies from the literature. Finally the challenges to the efficient market hypothesis will be briefly discussed in order to show the possible direction for the future research in this area. And the concluding remarks are presented in the final section of this chapter.

MODERN FINANCE THEORY: THEORETICAL BACKGROUND

In recent years, the majority of financial and economic theory has been based upon the idea that individuals' actions are guided by rationality – that people make decisions in light of all the information available to them. Andrikopoulos noted that the years between 1950 and 1960 were the most productive period in finance thought. This was the period in which finance changed from a descriptive discipline to a modern science full of new ideas that needed to be refined. Finance literature focused on exploiting the full potential of mathematical probabilistic and optimisation models. These techniques led to the construction of new theories and models, such as portfolio optimization theory, the capital asset pricing model, and the efficient markets hypothesis. These principles would constitute key influences in the years to come (Andrikopoulos, 2007, p. 53), during which empirical research focused on EMH testing and asset prices modelling.

Among these financial theories, special interest was directed to EMH, which represents the cornerstone of standard academic finance to this day. Although EMH is an appealing description of competitive market equilibrium, it is difficult to follow the developments in financial economics of today's global world in a single direction. This difficulty arises because schools of thought overlap, theories and empirical research are lagging, and technology has greatly changed the way academics think and do research (Buchanan & Bowman, 1995, p. 156). Within two decades of the introduction of these ideas, contradictory evidence from financial markets around the world began to emerge. The appearance of many anomalies led some academics to reconsider their initial beliefs about the applicability of the leading theories of modern finance. This was the beginning of a new era -- the era of behavioral finance. As the new ideas of behavioral finance were introduced, a rigorous academic debate commenced on the validity of these new theories.

MAIN FOCUS OF THE CHAPTER

Modern finance is the body of knowledge built on the pillars of the arbitrage principles of Miller and Modigliani, the portfolio principles of Markowitz, the capital asset pricing theory of Sharpe, Lintner, and Black, and the option-pricing theory of Black, Scholes, and Merton. Modern finance is also based upon Fama's Efficient Market Hypothesis, which is both the most regarded and the most criticized of the principles. Modern finance is compelling because it uses a minimum number of tools to build a unified theory intended to answer all the questions of finance. However, few theories are consistent with all the empirical evidence, and modern finance is no exception. The Efficient Market Hypothesis (EMH) is based on a simple assumption that risk is defined by volatility. According to the theory, investors are risk adverse: they will accept lower returns for a less volatile investment, but are willing to accept more risk for higher payoffs. The theory is simple and elegant, and leads into ingenious mathematical proofs and equations, which may be why it has become so widely accepted (Morien, 2005, p. 1).

Modern Finance, Efficient Market Hypothesis, Random Walk Hypothesis, and Empirical Evidence

Modern finance is the body of knowledge built on the pillars of the arbitrage principles of Miller and Modigliani, the portfolio principles of Markowitz, the capital asset pricing theory of Sharpe, Lintner, and Black, and the option-pricing theory of Black, Scholes, and Merton. Modern finance is also based upon Fama's Efficient Market Hypothesis, which is both the most regarded and the most criticized of the principles. Modern finance is compelling because it uses a minimum number of tools to build a unified theory intended to answer all the questions of finance. However, few theories are consistent with all the empirical evidence, and modern finance is no exception. The Efficient Market Hypothesis (EMH) is based on a simple assumption that risk is defined by volatility. According to the theory, investors are risk adverse: they will accept lower returns for a less volatile investment, but are willing to accept more risk for higher payoffs. The theory is simple and elegant, and leads into ingenious mathematical proofs and equations, which may be why it has become so widely accepted (Morien, 2005, p. 1).

In modern finance theory, people are modelled as "rational," whereas people are modelled as "normal" In behavioral finance. The two terms are not always at odds: rational behavior is usually described as maximizing behavior, and maximizing behavior is quite normal (Statman, 1999-1 p. 20). When offered a free choice between a 10TL and a 20TL, both rational and normal people choose the 20TL.

Additionally, modern finance theory assumes that agents are rational and that the law of one price holds. Two important aspects of agents' rationality are maximization of expected utility and Bayesian learning (Adam, 2002, p. 2). This implies, for example, that choices are time-consistent. From a market perspective, modern finance theory rests on the law of one price, which states that securities with the same payoff have the same price. Arbitrageurs instantaneously eliminate any violations of the law of one price by simultaneously buying and selling these securities at advantageously different prices. Consider, for example, the shares of Turkcell. They are traded simultaneously on the New York Stock Exchange (NYSE) and on the Borsa İstanbul. Turkcell shares should trade for the same prices on both exchanges adjusted for the current USD-TL exchange rate.

The critical question that should be emphasized is whether or not the agents' irrationalities affect market outcomes. If not, this point should not be taken into account by finance researchers. If some or even all market participants are irrational, it is possible that the market mechanism can offset the distorting effect of these individual irrationalities, thereby limiting their impact on prices and allocation. If the market can average out irrationalities dependent upon the structure of the observed behavior, unsystematic irrationalities can be absorbed more easily than systematic deviations from rational behavior (Glaser et al., 2003, pp. 2-3).

In a capitalist society, prices for goods and services play a central role in resource allocation. The strength of capitalism lies in its ability to make these prices reflect essential information so that resources are deployed efficiently.

The following is a classic example of this phenomenon. Consider a fishmonger whose price for fish changes every day in response to availability. These prices have a direct effect on the behavior of customers entering the shop: if the price is high they may choose to eat beef for dinner instead. In other words, the allocation of fish to the most efficient uses (in this case, to the people with the highest marginal utility of fish consumption) is accomplished by price changes. These price changes directly regulate the use of fish (Dow & Gorton, 1995, p.1). This is a very simple model about the market mechanism in an economy.

Now let us consider the equity capital market and its relation to the allocation of funds for capital

investment. If a company's share price goes up, it is not obvious whether its access to equity capital will be altered. According to Dow and Gorton, the mechanism in the stock market differs from the simple fish market, and most other complex markets, in three ways- which is going to be mentioned in the following paragraphs (Dow & Gorton, 1995, pp. 1-3).

First, the equity price is not a marginal value but an average value. The stock market price is a secondary market price: it values the firm as a whole rather than valuing its each simple investment marginally. The role played by the stock price in a stock market is similar to the fish market example only in the simple case where a newly organized firm issues equity for the first time to fund its investment. In this special case, if investors believe that the capital can be more efficiently deployed elsewhere, or if the expected returns on the project are insufficient to induce enough savings, then the price will be low and the project may not be undertaken. However, only an insignificant fraction of investment capital is raised in this way: the vast majority of investment is funded by retained earnings, by seasoned equity issues, or by new non-equity external financing, such as bank loans or bonds.

Second, decisions about the allocation of investment capital are generally delegated to managers with little or no ownership stake in the firm. Managers can decide on dividend policy, leverage, the timing of new issues of seasoned equity, and other securities. They therefore have discretion over the amount of funding available for investing in new assets. The problem of giving managers appropriate incentives is complicated by the fact that their decisions may have implications for the long-term performance of the firm after they have left.

Third, the flow of information in a stock market may be bi-directional: the participants may learn about the quality of the managers' decisions, but the manager may also want to learn the market's valuation of prospective investments. The stock price, although intrinsically irrelevant to the investment decision, may be useful indirectly because it conveys information about prospective investment projects and cash flows. For example a high stock price may signal to the manager that the investors of the firm believe that the firm has profitable investment opportunities. The fact that the manager seeks to infer information from the price means that the stock price is different from the price of fish: the fishmonger's customers do not care that the market price reflects the marginal utilities of other consumers and the marginal costs of fishing. They need only to compare the price with their own marginal valuation. In the stock market, managers (acting on behalf of the shareholders) care about other agents' information as reflected in the price, but the stock price does not reflect the marginal cost of investment funds.

In a setting where consumers learn about product quality from the price, there may be two effects: consumers will infer the quality from the price, and then compare the price to their marginal valuation. In general, Rational Expectations Models capture these two effects. At one extreme, the prices in the preceding fishmonger example have a direct allocative role and no indirect signalling role. When consumers are buying fish it is important that the price reflects information, but the consumers care only about the price and do not need to infer the information that determines the price. In general, commodity prices may have both a direct allocative role and an indirect signalling role. For example, if consumers receive different private signals about the quality of the commodity, the price will convey information about quality as well as information about scarcity. In Rational Expectations Equilibrium, an agent's demand for the fish will depend on the price through this quality inference. They argued that secondary equity prices are at the opposite extreme of fishmonger's prices: they have an indirect signalling role but no direct allocative role (Dow & Gorton, 1995, p. 3).

At this point, these special features of the equity market raise the question of whether "efficient" stock prices are related to the efficient allocation of resources. The two definitions of market efficiency are as follows (Timmermann & Granger, 2004, p. 16):

A market is efficient with respect to information set Ω_t *if it is impossible to make economic profits by trading on the basis of information set* Ω_t.

A closely related definition of market efficiency is:

A capital market is said to be efficient if it fully and correctly reflects all relevant information in determining security prices. Formally, the market is said to be efficient with respect to some information set, Ω_t*, if security prices would be unaffected by revealing that information to all participants. Moreover, efficiency with respect to an information set,* Ω_t*, implies that it is impossible to make economic profits by trading on the basis of* Ω_t

After giving these two brief, but famous definitions of market efficiency, this paper will discuss Fama's Efficient Market Hypothesis (EMH) in detail in the following subsection.

There is large body of research in literature on welfare economics, and an equally large body on efficient markets theory. However, there has been relatively little work linking these two literatures. By and large, welfare economists have not studied corporate control or asset pricing, while efficient-markets researchers have taken for granted that informational efficiency implies economic efficiency. For example, Fama said:

An efficient capital market is an important component of a capitalist system... if the capital market is to function smoothly in allocating resources; prices of securities must be good indicators of value.

Market Efficiency and Security Return Patterns

"Efficient Markets Hypothesis" (EMH) is a powerful idea that can be traced back to Paul Samuelson, whose contribution is neatly summarized by the title of his article: ''Proof that Properly Anticipated Prices Fluctuate Randomly.'' For a market to be informationally efficient, price changes must be unforecastable if they are properly anticipated, i.e., if they fully incorporate the expectations and information of all market participants (Farmer & Lo, 1999, p. 1).

When the term "efficient market" was introduced into economics literature thirty years ago, Fama defined it as a market which "adjusts rapidly to new information and prices fully reflect all available information" (Fama, Fisher, Jensen, & Roll 1969, p.383; Fama, 1970, p.383). It soon became clear, however, that while rapid adjustment to new information is an important element of an efficient market, it is not the only one. In 1991, Fama declared a more reliable definition: asset prices in an efficient market "fully reflect all available information where the marginal benefits of acting on information is lower than marginal costs."(Fama, 1991, p.1575) This definition emphasizes that the stock market processes information rationally, in the sense that relevant information is not ignored and systematic errors are not made. Fama then made his outstanding but dubious assumption that prices are always at levels consistent with "fundamentals"(Beechey, Gruen, & Vickery, 2000, p.2). Fama defined three different forms of efficiency which will be discussed in detail in the following sub section.

Even though the EMH is an appealing description of competitive market equilibrium, it may have some critical disabilities in regard to market factors. Here, it is crucial to emphasise that there are some deficiencies in defining the efficient market. For one thing, the strong version of the hypothesis could only be true if "all available information" was costless to obtain (Beechey et

al., 2000, p.2). If information was instead costly, there would have to be a financial incentive to obtain it. However, there would not be a financial incentive if the information was already "fully reflected" in asset prices. Additionally, if obtaining information would not make the agents better off, why would agents spend their time collecting information? A weaker, but economically more realistic version of the hypothesis is that prices reflect information to the point where the marginal benefits of acting on the information (the expected profits to be made) do not exceed the marginal costs of collecting it. Secondly, to say that prices are consistent with fundamentals there should be a model which provides an adequate link from economic fundamentals to asset prices. "While there are many models in all asset markets which try to provide this link, no one is confident that any of these models fully capture the link in an empirically convincing way" (Beechey et al., 2000, p. 2). This is important since empirical tests of market efficiency – especially those that examine asset price returns over extended periods of time – are necessarily joint tests of market efficiency and a particular asset-price model (Beechey et al., 2000, p. 2).

When the joint hypothesis is rejected, as it often is, it is logically possible that this is a consequence of deficiencies in the particular asset-price model rather than in the efficient market hypothesis. This is the 'bad model' problem (Fama, 1991, p.1593).

Special interest should be directed to the word "efficient" in Fama's well known definition. It appears that the term was originally chosen partly because it provides a link with the broader economic concept of efficiency in resource allocation. Thus, Fama began his 1970 review of the efficient market hypothesis specifically applied to the stock market (Fama, 1970, p.383).

The primary role of the stock market is allocation of ownership of the economy's capital. In general terms, the ideal is a market in which prices provide accurate signals for resource allocation: that is, a market in which firms can make production-investment decisions, and investors can choose among the securities that represent ownership of firms' activities under the assumption that securities prices "fully reflect" all available information at any given time.

It is possible to argue that there is a link between an efficient stock market, which prices reflects all available information (at least up to the point consistent with the cost of collecting the information), and allocation of resources in an economy efficiently. However, further analysis has made it clear that an informationally efficient stock market *does not always generate* efficient allocation of resources in the economy. The two concepts are distinct for reasons to do with the incompleteness of markets and the information-revealing role of prices when information is costly, and therefore valuable (Beechey et al., 2000, p. 2).

In an efficient market, new information is quickly included into prices without bias. Prices in the market fully reflect all available information. Market participants adjust the available supply and aggregate demand in response to publicly available information so as to generate market clearing prices. In major stock markets, where millions of dollars are "voting," it seems plausible that a rational consensus will be reached as to the share prices which best reflect the prospects for future cash flows given available information. Although the EMH may be an elegant economic concept, it is not perfect. It has some important deficiencies (Bowman & Buchanan, 1995, p. 156).

Prices in securities markets may not fully reflect available information. The early literature on market efficiency was widely interpreted as being supportive. But by the late 1970s, the anomalous evidence was growing and beginning to command attention. There is now a substantial body of empirical research which casts doubt upon the degree of market efficiency (Bowman & Buchanan, 1995, p. 156). Even many of the researchers who believe in the concept of the EMH are questioning

whether share markets are as efficient as the (semi strong) EMH dictates. However, though there may be some weaknesses in the market pricing mechanisms, few academics would discard the concept all together. Markets are not simply either efficient or inefficient (Bowman & Buchanan, 1995, p. 157). Market efficiency can be viewed as a continuous running from the perfect market (i.e., precisely strong form efficient) to the inefficient market where excess earning opportunities are around. Any market or securities in a market could be characterised by some degree of efficiency. Following this approach, we might think of the New York Stock Exchange as more efficient than the Borsa İstanbul. Similarly, thin traded shares should be regarded as being priced less efficient in comparing with the actively traded shares. For example TSKB vs Eregli Demir Celik in Borsa İstanbul. It is easy to see evidence of this occurrence in the asset markets around the world. There is a large group of market participants who are not particularly interested in fundamental concepts and definitely reject the idea that shares are efficiently priced. In place of fundamental concepts effecting the market and prices, the participants mainly use their senses - which are biased - in the formation of their trading decisions. Thus these individuals make pricing errors which deteriorate market efficiency. It is argued that, over time, market participants would not develop an unbiased assessment of market efficiency with respect to any given market (Bowman & Buchanan, 1995, p. 157). In the following section, the empirical foundations of EMH will be discussed in brief.

THE EMPIRICAL FOUNDATIONS OF THE EMH

Like the theoretical evidence for the efficient market hypothesis, the empirical evidence also appeared to be strong during the 1960s and the 1970s. In general terms, the empirical expectation of the efficient market hypothesis can be divided in two broad categories: First, when new information about a security is received, the price reacts as it quickly incorporates the new information. The investors who do not have fast access to the latest news (non smart investors) cannot make a profit from the news and the price adjusts accordingly, thereby preventing both an under-reaction and an overreaction, at least in the long run. Second, the security prices do not change without news about its fundamental value, so the price of a security must be equal to its fundamental value (Cornicello, 2004, p. 9).

The principal hypothesis resulting from the quick and accurate reaction of prices to new information is that late information is of no value in making money, where making money is defined as obtaining a higher return after revaluation of the income with a risk adjustment ratio. In this case, the problem is to define an adequate level of risk. This can be measured by a model of fair relation between risk and return, like the capital asset pricing model. It implies that the test can fail because either one of the two hypotheses is false or because both parts of the joint hypothesis are false (Cornicello, 2004, p.9). In general, when the joint hypothesis is rejected, this could be due to deficiencies in the asset pricing model rather than the efficient market hypothesis which is as mentioned before "bad model problem."

Returning to the informational efficiency view, it is necessary to express the informational efficiency of Fama in detail. The three different forms of the efficient market hypothesis were introduced by Eugene Fama in 1965: the weak, the semi strong, and the strong in detail. Each form occurs in a different level of information and knowledge level concerning a stock.

The weak form of the efficient market hypothesis: It is also known as the random walk model and has received much attention among the academics and investment practitioners for years. Noteably, hypothesis dates back to Bachelier's

doctoral dissertation about the of stock prices behavior. But the academic debate over the subject has accelerated after the doctoral dissertation of Fama in 1965. (Hagin 2004, p.55) Random walk hypothesis asserts that the random nature of stock prices can not reveal trends thus there is no way of predicting future prices using past prices. It has become widely associated with the efficient market hypothesis through the work of Fama. It holds that present stock prices reflect all known information with regard to past stock prices, trends, and volume. The weak form implies that knowledge of past stock patterns does not assist investors in obtaining improved performance. Random walk theorists view stock prices as moving randomly about a trend line that is based on rational expectations regarding fundamental factors. Proponents of this view feel that analyzing past data does not permit technical analysis to accurately forecast movements of the prices about the trend line. In addition, new information affecting stock prices enters the market randomly. No predictability exists with regard to news that would affect a stock's price.

The semi-strong form of the efficient market hypothesis: This form of the market efficiency hypothesis states that current market prices instantaneously reflect all public information. This form reflects a substantially greater level of knowledge and market efficiency than does the weak form. The semi strong form would seek to test whether all publicly available information and announcements are quickly and fully reflected in the market prices of stocks. The shifts from the weak to the semi strong form of the efficient market hypothesis represents a remarkable jump. Consequently, investors cannot obtain superior risk-adjusted returns using any publicly available information. Of course, news about the historical prices and returns are among the publicly available information. Therefore the semi strong form of efficient market hypothesis is an extension of the weak one.

The strong form of the efficient market hypothesis: The strong form holds that present market prices reflect all information that is legally possible to achieve about a company. This includes analysis and also any exhaustive studies by institutional financial analysts. According to this form of the efficient market hypothesis, consistently abnormal return performance by market participants is impossible (Hollman, 2005, p. 22). The strong form moves the efficient market hypothesis to a still higher level of information and knowledge. The strong form constitutes a direct challenge to the institutional investor, the most integrated segment of the financial community. Also the strong form of the efficient market hypothesis can be seen as an extension of the semi strong form of the efficient market hypothesis.

Random Walk Hypothesis

The EMH says that the entire history of information regarding a financial asset is reflected in its price and that the market responds instantaneously to new information. According to the EMH, if any patterns exist, they must be so small that no systematic trading strategy can have a better risk/return profile than the market portfolio. That is to say, no one can make abnormal returns in the market. Athanasoulis and Shiller (1997) analysed the significance of the market portfolio with different assumptions.(p.4) Therefore, according to the EMH, no profitable information about future movements can be obtained by studying past price-series. Starting from the there is no riskless gain in financial markets, it is sensible that proponents of the the EMH would choose a model of asset prices that constitutes a "random walk" in price-space. In modern finance theory, theoretical descriptions are mainly based on the assumption that asset prices follow some form of random walk (Johnson, Jefferies, & Hui, 2003, pp. 20-21).

The theory of random walk in stock prices involves two separate hypotheses:

- Successive price changes are independent.
- Price changes conform to some probability distribution.

Independence means that the sequence of price changes leading up to the time period have no influence on the probability distribution of the stock's price. Consequently, in a financial market using a strategy based on past prices data, it is not possible to obtain higher a return than a buy and hold strategy (Cornicello, 2004, p. 10).

CHALLENGES TO THE EFFICIENT MARKET HYPOTHESIS

It can be argued that the basically theoretical background of EMH rests on three arguments which rely on progressively weaker assumptions. First, it is assumed that participants in the market are rational and that they do not make systematic errors in valuing the securities in the market. Second, some investors may be irrational, but as they trade randomly, they cancel out the effects of each other's irrationality without affecting prices. Third, even though there are some irrational investors, they are met in the market by rational arbitrageurs who eliminate their influence on prices. The ideas which challenge EMF are based upon these three assumptions. In the following subsections, this section will briefly discuss these three assumptions in finance literature (Shen, 2002, p. 2).

Agents' Rationality

Recently, there has been a wide range of literature dealing with the rationality of investors. These studies try to examine how investors in financial markets – both professional and individual investors -- actually behave. Many researches in the area demonstrate investor behavior that is difficult to reconcile with rationality or with predictions of modern finance models. In one example, Benartzi and Thaler analyzed retirement savings plans for the heuristic bias. Each savings plan offers a fixed number of investment options that varies across firms. Benartzi and Thaler found that some individuals spread their savings evenly across the investment alternatives and do not take into account the riskiness of the investment options (1995, p.90)As a result, it can be argued that the asset allocation of individuals is influenced by the percentage of stock funds offered. The higher the number of stock funds, the higher the allocation to equities a finding that is difficult to reconcile with agents' rationality (Glaser, Noth, & Weber, 2003, p. 7).

Another aspect of irrational behavior is that the market behavior of investors is influenced by framing. The behavior of market participants' changes depending on the framing of gains and losses (Glaser et al., 2003, p. 7). Traders are willing to pay more for assets if they have a short position at the beginning of a trading period compared to situations with a long position, even though the expected value of both portfolios is the same. In the first case, trading is driven by loss aversion, whereas in the second case, diversification is the main reason for trading (Glaser et al., 2003, p. 7).

Furthermore, agents' rationality requires that all available information is evaluated using Bayes' rule. However, if investors use specific heuristics which put too much weight on recent information, this systematic bias has an impact not only on the price reaction to new information but also on the price reaction afterwards when this error becomes obvious. In their 1997 paper, Barberis, Shleifer, and Vishny built a parsimonious model of investors. In their model they tried to show how investors form expectations of future expectations. Investors in the real markets can make systematic errors when evaluating public information. (Barberis et al., 1997, p.27) Investors are prone to a conservatism bias -- the underweighting of new evidence when updating probabilities. They

are also prone to a particular manifestation of the representative heuristic, which is the tendency to expect even short sequences of realizations of a random variable to reflect the properties of the parent population from which the realizations are drawn (Glaser et al., 2003, p. 7).

Law of One Price

The law of one price is a fundamental concept of finance theory. According to this rule in an efficient market security must have a single price no matter how it is created. Recently, some puzzles have been discovered proving that the law of one price is violated. This violation is so severe that prices are inconsistent with all valuation models. One example is security prices of "Siamese twin" shares, such as Royal Dutch Petroleum and Shell Transport and Trading. Twin shares trade at different places or in different countries and the division of current and future cash flows is fixed to each twin. The case of Royal Dutch Shell is a specific, well-known example in the related literature (Froot & Dabora, 1998, p2; Mullainathan & Thaler, 2000, p.7). The facts are that Royal Dutch Petroleum and Shell Transport are independently incorporated in the Netherlands and England respectively. The current firm emerged from a 1907 alliance between Royal Dutch and Shell Transport in which the two companies agreed to merge their interests on a 60:40 basis. Royal Dutch trades primarily in the US and the Netherlands and Shell trades primarily in London. According to rational models, the shares of these two components (after adjusting for foreign exchange) should trade in a ratio of 60:40. But they do not. The actual price ratio has deviated from the expected one by more than 35%. It does not make sense to explain this disparity with taxes and transaction costs. This is the violation of the law of one price rule (Froot & Dobora 1998, p.4; Glaser et al., 2003, p. 5). This is a simple, but well known example illustrating that prices can diverge from intrinsic value because of the limits of arbitrage. Some investors do try to exploit this mispricing, buying the cheaper stock and shorting the more expensive one, but this is not a sure thing, as many hedge funds learned in the summer of 1998 (Froot and Dobora 1998, p.4; Mullainathan and Thaler, 2000, p. 8).

The second example of evidence against the rationality of market prices and law of one price was presented by Lamont and Thaler. They studied equity carve-outs by analyzing the spin-off of Palm, which was owned by 3Com. In March 2000, 3Com sold 5% of its Palm shares in an initial public offering and kept the remaining 95% of the shares. 3Com announced that its shareholders would eventually receive 1.5 shares of Palm for every 3Com share they owned. Accordingly, the stock price of 3Com had to be at least 1.5 times as high as the stock price of Palm, as long as the value of the whole 3Com company was positive. However, the stock price of Palm was far above the stock price of 3Com, implying a value of 22 billion U.S. dollars of 3Com's non-Palm business. Rational explanations of why arbitrage is not sufficient to avoid violations of the law of one price are examined at in the next subsection (Glaser et al., 2003, p. 5).

Limits of Arbitrage

In financial markets, bubbles and crashes occur from time to time which seems to reject the idea of efficient markets and the positive effect of arbitrage. For example, the NASDAQ Index rose from about 1000 in late 1997 to more than 4500 in March 2000 before declining to 1000 in March 2003. In Germany, the New Market index (Nemax50) rose to more than 9000 in March 2000 and stood at about 310 by the end of March 2003. These huge changes of market indices are difficult to explain using a modern finance model. Additionally, the question arises why arbitrage cannot dampen these swings which, as common sense suggests, are not only due to new information (Glaser et al., 2003, pp. 5-6).

Several models within the rational framework were developed to explain the limits of arbitrage. If the investment horizon is shorter than the time until the fundamental value of an asset is reached, serious mispricing remains a possibilty. Moreover, mispricing can be the result of noise traders as they create additional risk by trading randomly. This additional risk is priced by the market. If noise traders take this additional risk by trading irrationally, they can earn higher returns than rational investors. In other words, irrational investors are not necessarily eliminated from the market due to their losses. It is shown that noise trader risk can worsen mispricing in the short run. If arbitrageurs have short investment horizons, noise trader risk will prevent them from exploiting this mispricing. The literature shows that the survival and the price impact of irrational traders are two independent concepts: They find that the price impact of irrational traders does not rely on their survival in the long- run and that they can influence prices even when their wealth becomes negligible (Glaser et al., 2003, p. 7). At this point it is necessary to note that Fama defined the discussions mentioned in the previous subsections as anomalies in the market (Fama, 1998 p.283).

FUTURE RESEARCH DIRECTIONS

Even for the realization of a simple transaction in a market thousands of variables should met at the right moment. And even in a single stock in a small size emerging market the number average daily transaction is around four million. Therefore, the real markets in real world are more and more complex then the overly simple artificial models of the researchers. Even the overly complex structure of the real markets, according to the widely accepted view among academics in finance, the EMH is still the most adequate hypothesis which could be empirically tested in various samples from different countries. However both the assumptions of the classic assumptions and the arguments of the EMH are not that strong as they were first introduced in 1965. Many reliable studies in literature evidenced that the markets are not that efficient and the investors are not that rational as it was assumed by the EMH. In the presence of these findings the new path for the opponents of the EMH may be the revising of its underlying assumptions and thus its main arguments especially the market efficiency.

CONCLUSION

Efficient Market Hypothesis is a milestone on the road to Modern Finance Theory. Following its first presentation to literature by Fama in 70s, EMH has gained a great deal of interest among the academic environment. A large body of literature has been written in order to discuss its effects over financial markets, and notably over stock markets. The hypothesis is both simple and empirically testable. These properties give rise to its dominance over the challenging theories. However, the internal difficulties involved in testing strict hypotheses about the EMH would make it difficult to reject the hypothesis completely. Proponents of the hypothesis could argue that the literature had indeed uncovered some interesting insights but there is no potential to build a trading system which relies on these anomalies.

Finally, it is noteworthy that; EMH does not assume that all investors are rational, but it does assume that markets are rational. Additionally the EMH does not assume that markets can foresee the future, but it does assume that markets make unbiased forecast errors of the future.

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KEY TERMS AND DEFINITIONS

Agent`s Rationality: A rational agent is an agent who has clear preferences, models uncertainty via expected values, and always chooses to perform the action with the optimal expected outcome for itself from among all available actions.

Efficient Market Hypothesis (EMH): This hypothesis asserts that financial markets are informationally efficient thus it is impossible to make abnormal returns in the financial markets.

Law of One Price: The theory that the price of a given security, commodity or asset will have the same price in all locations when exchange rates are taken into consideration.

Limits of Arbitrage Theory: This theory constitutes that there are many constraints in financial markets that limits the arbitrage opportunities for the rational investors, and resulting inefficiency in financial markets.

Random Walk Hypothesis: In finance theory, the hypothesis states that financial markets and stock prices follow a random path, without any influence by historical price movements. According to this hypothesis it is impossible to predict future movements in financial markets or stock prices by using historical data.

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Chapter 20
Impact of NPAs on Bank Profitability: An Empirical Study

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ABSTRACT

NPA is a "termite" for the banking sector. It affects liquidity and profitability of the bank to a great extent; in addition, it also poses a threat to the quality of asset and survival of banks. The post-reform era has changed the whole structure of the banking sector of India. Now, the economy is not confined to the domestic boundary of the country. The core intention of economic reforms in India was to attract foreign investments and create a sound banking system. This chapter provides an empirical approach to the analysis of profitability indicators with a focal point on Non-Performing Assets (NPAs) of commercial banks in the Indian context. The chapter discusses NPA, factors contributing to NPA, magnitude, and consequences. By using an analytical perspective, the chapter observes that NPAs affected significantly the performance of the banks in the present scenario. On the other hand, factors like better credit culture, managing the risk, and business conditions led to lowering of NPAs. The empirical findings using observation method and statistical tools like correlation, regression, and data representation techniques identify that there is a negative relationship between profitability measure and NPAs.

INTRODUCTION

NPA (Non Performing Assets) broadly defined as non-repayment of interest and installment of principal amount (Das & Ghosh, 2006). Amongst the various desirable characteristics of a well-functioning financial system, the maintenance of the Non-performing assets is an important one. NPA after a certain level is indeed a serious concern for the banking system because credit is essential for economic growth and NPA affects the smooth flow of credit. Banks increases their resources not only from the public deposits but also by multiplying the funds received from the

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borrowers (Bodla & Verma, 2006). Thus, when a loan turns into NPA, it affects the recycling of credit and credit creation. It also affects the profitability of the banks because then the banks have to create more provisions against bad loans.

In India the definitions of NPAs has changed over time. According to the Narasimham Committee Report (1991), those assets (overdraft/ cash credit) for which the interest remains due for a period of four quarters (180 days) should be considered as NPAs. Subsequently, this period was reduced and from March 1995 onwards assets for which interest remains unpaid for a period of 90 days were considered as NPAs. Thus, NPA constitutes an important factor in the banking system as it seriously affects the profitability of the banks.

The NPA can broadly be classified into Gross NPA and Net NPA. Gross NPA reflects the quality of the loans made by banks whereas Net NPA shows the actual burden of banks. The banks and the financial institutions have to take the initiative to reduce NPAs in a time bound strategic approach especially of public sector banks because they dominate the banking industries and also since they have much larger NPAs compared with the private sector banks. This raises a concern in the banking industry because it is generally felt that NPAs reduce the profitability of banks, weaken its financial health and erode its solvency (Karunakar, 2008). For the recovery of NPAs a broad framework has evolved for the management of NPAs under which several options are provided for debt recovery and restructuring. However, with the banking reforms in India and adoption of international banking practices, this issue received due focus. Though the issue has received a considerable attention in the post reform period but the ultimate solution has not yet achieved.

Thus, this research paper focuses on this severe problem and tries to suggest some remedies to overcome it. The paper consists of secondary data which has been collected from different publications such as the Reserve Bank of India publications, the reports published by commercial banks, various issues of the IBA journal etc. The empirical findings using observation method and statistical tools like correlation, regression and data representation techniques identifies that there is a negative relationship between profitability measure and NPAs.

KINDS OF NPAS

1. Gross NPA

Gross NPAs are the sum total of all loan assets that are classified as NPAs as per the RBI guidelines as on Balance Sheet date. It reflects the quality of the loans made by banks. It consists of all the non-standard assets such as sub-standard, doubtful, and loss assets. It can be calculated with the help of following ratio:

Gross NPA ratio = Gross NPAs/Gross Advances

2. Net NPA

Net NPAs are those type of NPAs in which the bank deducts the provision regarding NPAs. Net NPA shows the actual burden of banks. Since in India, bank balance sheets contain a huge amount of NPAs and the process of recovery and write off of loans is very time consuming, the provisions the banks have to make against the NPAs according to the central bank guidelines, are quite significant. That is why the difference between gross and net NPA is quite high. It can be calculated by following.

Net NPAs= Gross NPAs – Provisions/Gross Advances – Provisions

CATEGORIES OF NPAS

The issue of NPA has given due importance after the Narasimham Committee report highlighted its impact on the financial health on the commercial banks and subsequently various asset classification were introduced (Mishra, 2011). It also suggested that for the purpose of provisioning, banks and financial institutions should classify their assets by into four broad groups.

Standard Assets: Standard assets are the ones in which the bank is receiving interest as well as the principal amount of the loan regularly from the customer. Such assets carry normal risk and are not NPA in the real sense. So, no provisions are required for standard assets. Here, it is also very important that in this case the arrears of interest and the principal amount of loan do not exceed 90 days at the end of the financial year. If asset fails to be in the category of standard asset i.e. amount due for more than 90 days then it is NPA and NPAs are further need to classify in sub categories.

Banks are required to classify non-performing assets further into the following three categories based on the period for which the asset has remained *non-performing* and the *realisability* of the dues:

1. Sub-Standard Assets
2. Doubtful Assets
3. Loss Assets

Sub-Standard Assets: With effect from 31st March, 2005, a sub-standard asset would be one, which has remained NPA for a period less than or equal to 12 months. The following features are exhibited by sub-standard assets: the current net worth of the borrowers/guarantor or the current market value of the security charged is not enough to ensure recovery of the dues to the banks in full; and the asset has well-defined credit weaknesses that jeopardize the liquidation of the debt and are characterized by the distinct possibility that the banks will sustain some loss, if deficiencies are not corrected.

Doubtful Assets: A loan classified as doubtful has all the weaknesses inherent in assets that were classified as sub-standard, with the added characteristic that the weaknesses make collection or liquidation in full – on the basis of currently known facts, conditions and values – highly questionable and improbable. With effect from March 31st, 2005, an asset would be classified as doubtful if it remained in the sub-standard category for more than 12 months.

Loss Assets: A loss asset is one which considered uncollectible and of such little value that its continuance as a bankable asset is not warranted-although there may be some salvage or recovery value (Gupta & Kumar, 2004). Also, these assets would have been identified as 'loss assets' by the bank or internal or external auditors or the RBI inspection but the amount would not have been written-off wholly.

IMPACT OF NPA

The health of a bank is reflected not only by the size of its balance sheet but also by the return on its assets. NPAs generate no interest income (Chaudhuri, 2002). The banks are required by law to provide for future loan losses arising from its bad assets (at a coverage of 70%), out of current profits. This not only affects the profitability but also liquidity because now the bank has fewer funds to lend out or recycle. It further increases indirect costs. High NPAs degrade a bank's credit rating, lowering its credibility as well as its ability to raise fresh capital (Indira & Vasishtha, (2001). The NPAs have deleterious impact on the return on assets in the following ways:

1. The interest income of banks will fall and it is to be accounted only on receipt basis.

2. Banks profitability is affected adversely because of the providing of doubtful debts and consequent to writing it off as bad debts.
3. Return on investments (ROI) is reduced.
4. The capital adequacy ratio is disturbed as NPAs enter into its calculation.
5. The cost of capital will go up.
6. Asset and liability mismatch will widen.
7. It limits recycling of the funds.

FACTORS CONTRIBUTING TO NPAS

The banking sector has been facing the serious problems of the rising NPAs. But the problem of NPAs is more in public sector banks when compared to private sector banks and foreign banks (Pradeep, 2007). The NPAs in PSB are growing due to external as well as internal factors.

External Factors

- **Ineffective Recovery Tribunal:** The Govt. has numbers of recovery tribunals which works for recovery of loans and advances. Due to their negligence and ineffectiveness in their work the bank suffers the consequence of non-recovery, thereby reducing their profitability and liquidity.
- **Willful Defaults:** There are borrowers who are able to pay back loans but are intentionally withdrawing it. These groups of people should be identified and proper measures should be taken in order to get back the money extended to them as advances and loans.
- **Natural Calamities:** This is the major factor which is creating alarming rise in NPAs of the PSBs. Every now and then India is hit by major natural calamities thus making the borrowers unable to pay back loans. Thus, banks have to make large amount of provisions in order to compensate loans, hence, reduces profit. Mainly our farmers depend on rain fall for croing. Due to irregularities of rainfall the farmers are not achieving the production level thus they are not repaying the loans.
- **Industrial Sickness:** Improper project handling, ineffective management, lack of adequate resources, lack of advance technology, day to day changing govt. policies give birth to industrial sickness. Hence, the banks that finance those industries ultimately end up with a low recovery of their loans reducing their profit and liquidity.
- **Lack of Demand:** Entrepreneurs in India could not foresee their product demand and starts production which ultimately piles up their product thus making them unable to pay back the money they borrow to operate these activities. The banks recover the amount by selling off their assets which covers a minimum level. Thus, the banks record the non-recovered part as NPAs and have to make provision for it.
- **Change on Govt. Policies:** With every new govt. banking sector gets new policies for its operation. Thus, it has to cope with the changing principles and policies for the regulation of the rising of NPAs. The fallout of handloom sector is continuing as most of the weavers co-operative societies have become defunct largely due to withdrawal of state patronage. The rehabilitation plan worked out by the Central government to revive the handloom sector has not yet been implemented. So the over dues due to the handloom sectors are becoming NPAs.

Internal Factors

Defective Lending Process

There are three cardinal principles of bank lending that have been followed by the commercial banks since long.

- **Principles of safety:** By safety it means that the borrower is in a position to re-pay the loan (both principal and interest). The repayment of loan depends upon the borrowers:
  - Capacity to pay.
  - Willingness to pay.
- **Capacity to pay depends upon**
  - Tangible assets
  - Success in business
- **Willingness to pay depends on**
  - Character
  - Honesty
  - Reputation of borrower

The banker should, therefore, take utmost care in ensuring that the enterprise or business for which a loan is sought is a sound one and the borrower is capable of carrying it out successfully. He should be a person of integrity and good character.

Inappropriate Technology

Due to inappropriate technology and management information system, market driven decisions on real time basis cannot be taken. Proper MIS and financial accounting system is not implemented in the banks, which leads to poor credit collection, thus resulting in NPA. All the branches of the banks should be computerized whether urban or rural.

Improper SWOT Analysis

The improper strength, weakness, opportunity and threat analysis is another reason for the rise in NPAs. While providing unsecured advances the banks depend more on the honesty, integrity, financial soundness and credit worthiness of the borrower. Banks should consider the borrowers own capital investment and should collect credit information of the borrowers:

1. From the bankers.
2. Enquiry from market/segment of trade, industry, business.
3. From external credit rating agencies.

Poor Credit Appraisal System

Poor credit appraisal is another factor for the rise in NPAs. Due to poor credit appraisal the bank gives advances to those who are not able to repay. They should use good credit appraisal to decrease the NPAs.

Managerial Deficiencies

The banker should always select the borrower very carefully and should take tangible assets as security to safeguard its interests. When accepting securities banks should consider the:

1. Marketability
2. Acceptability
3. Safety
4. Transferability.

The banker should follow the principle of diversification of risk based on the famous maxim "do not keep all the eggs in one basket"; it means that the banker should not grant advances to a few big firms only or to concentrate them in few industries or in a few cities. If a new big customer meets misfortune or certain traders or industries affected adversely, the overall position of the bank will not be affected (Prasad, 2004).

Position of Scheduled Commercial Banks

Table 1 reveals the details of deposits and advances of scheduled commercial banks in India from the last six years. The figures exhibits that the deposits of SCBs increased from Rs. 26119.33

Table 1. Deposits and advances of scheduled commercial banks in India (in billion)

Years	Deposits	Credit
2007	26119.33	19311.89
2008	31969.39	23619.14
2009	38341.10	27755.49
2010	44928.26	32447.88
2011	52079.69	39420.82
2012	59090.82	46118.52

Source: www.rbi.org.in

billion in 2007 to Rs. 59090.82 billion in 2012. The advances also shows an increasing trend i.e. the amount increased from Rs. 19311.89 billion in 2007 to Rs. 46118.52 billion in 2012. Thus, it can be concluded that both (i.e. deposits and advances) have been increasing but the amount of advances as compared to the deposits is less (Figure 1).

Table 2 represents the classification of loan assets of scheduled commercial banks in India. Standard assets generate continuous income and repayments as and when they fall due. So, no special provision is required for them. As per the table above the amount of standard assets register a hike of 18,433.97 billion in 2007 to Rs. 45,284.48 billion in 2012. This shows that the SCBs are in good position The amount of sub-standard assets also increased from Rs. 196.80 billion in 2007 to Rs. 675.84 billion in 2012. The amount of doubtful assets increased from Rs. 245.31billion in 2007 to Rs 596.20 billion in 2012. The amount of loss assets increased from Rs. 59.05 billion in 2007 to Rs. 98.92 billion in 2012 (Figures 2 and 3).

Figure 1. Deposits and advances of SCBs

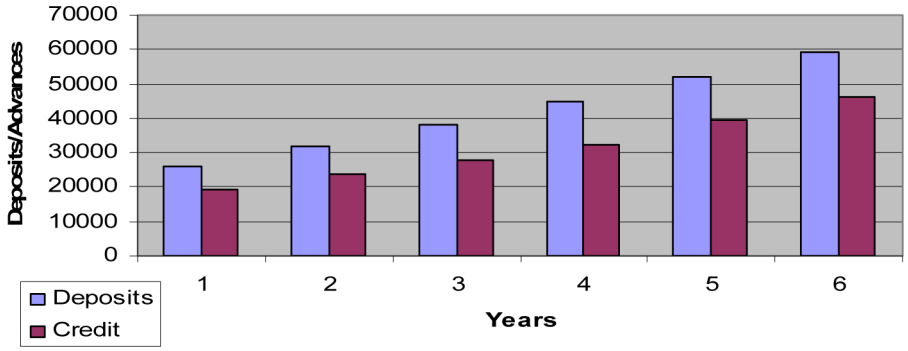


Figure 2. Classification of loan assets (standard assets) of SCBs

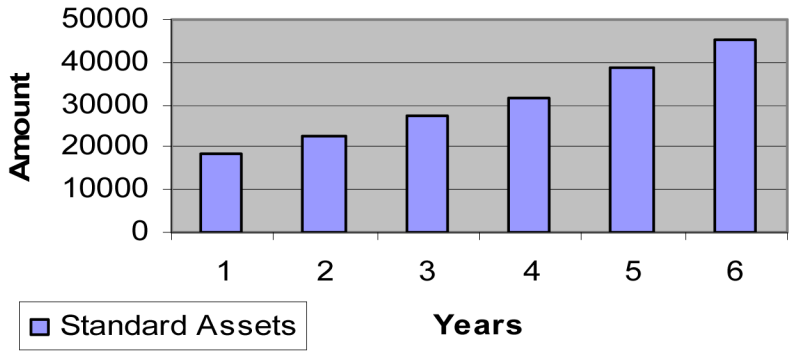


Figure 3. Classification of loan assets of SCBs

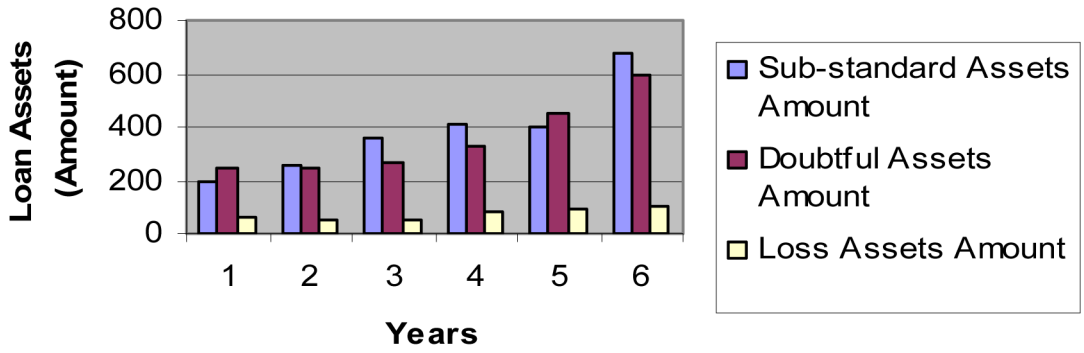


Table 2. Classification of loan assets of SCBs (Amt in billion)

Years	Standard Assets		Sub-standard Assets		Doubtful Assets		Loss Assets	
	Amount	Per Cent	Amount	Per Cent	Amount	Per Cent	Amount	Per Cent
2007	18433.97	97.4	196.80	1.0	245.31	1.3	59.05	0.3
2008	22759.79	97.6	261.13	1.1	242.87	1.0	52.99	0.2
2009	27210.94	97.6	359.21	1.3	267.29	1.0	55.64	0.2
2010	31825.68	97.5	412.92	1.3	326.63	1.0	78.50	0.2
2011	38973.84	97.6	398.75	1.0	448.02	1.1	94.40	0.2
2012	45284.48	97.1	675.84	1.4	596.20	1.3	98.92	0.2

Source:www.rbi.org.in

Figure 4. Gross and net NPAs of SCBs

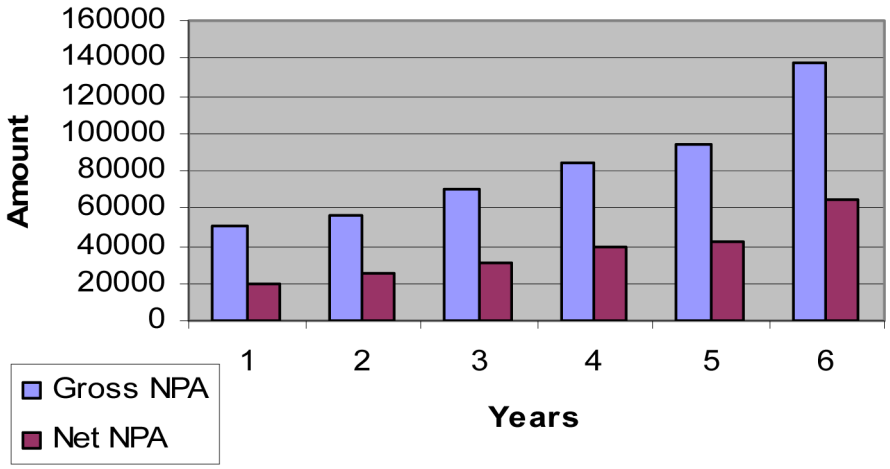
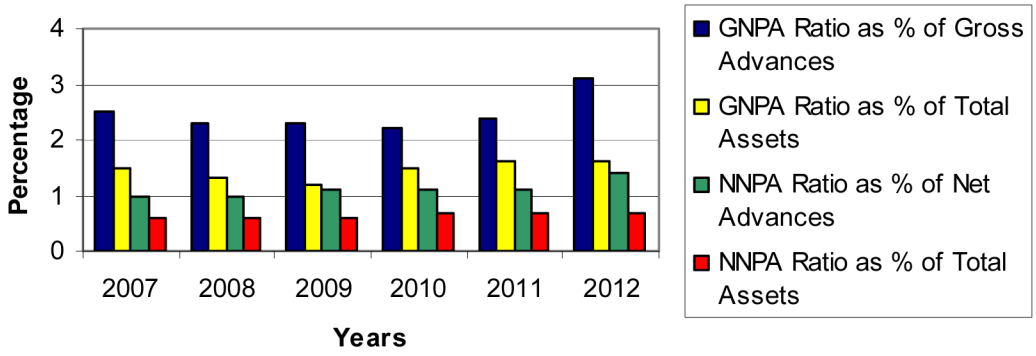


Figure 5. Percentage of GNPA and NNPA in ratio to advances and total assets



In India, non-performing assets of commercial banks gradually declined over the years, such as, Gross NPAs (GNPAs) as % to Gross Advances from 2.5% as on 31st March 2007 to 2.2% as on 31st March, 2010 but it increased in the next couple of years with 2.4% in 2011 and 3.1% in 2012. The Gross NPAs as % of Total Assets also declined from 1.5% in 2007 to 1.2% in 2009 but again increased to 1.5% in 2010 and 1.6% thereafter. The Net NPAs (NNPAs) as % of Net Advances and Net NPAs as % of Total Assets exhibited a meager fluctuation (exhibited in Table 4 along with Figures 4 and 5).

The analysis showed a declining trend in the ratio of GNPAs and NNPAs in the initial years which are a clear indication that the measures adopted by the banks are effective in controlling the menace created by NPAs. It is very important to control the problem of NPAs as there are many problems which are magnified like, Owners and Depositors do not receive a market return on their capital. In worst cases they lose their assets. Nonperforming asset may spill over the banking system and contract the money stock, which may lead to economic contraction and affect its liquidity and profitability which haened in the later years because of the increase in both the ratios.

Statistical Tools to Analyze the Relationship between GNPA, NNPA, and ROA

Managing NPAs has a lot to do with managing productive assets and ensuring effective corpo-

Table 4. Gross and net NPAS of SCBS (amount in RS. CRORE)

Years	Gross NPAs Amount	GNPA Ratio as % of G. Advances	GNPA Ratio % of Total Assets	Net NPAs Amount	NNPA Ratio % of N. Advances	NNPA Ratio % of Total Assets
2007	50634	2.5	1.5	20101	1.0	0.6
2008	56668	2.3	1.3	24730	1.0	0.6
2009	70062	2.3	1.2	31564	1.1	0.6
2010	84745	2.2	1.5	39126	1.1	0.7
2011	94084	2.4	1.6	41813	1.1	0.7
2012	137096	3.1	1.6	64900	1.4	0.7

Source: RBI Publication.

rate governance. If performing assets are turning into NPAs, it is because there is a change in the quality of assets. As of now, NPAs in most of the nationalized banks are within the permissible limits. In this backdrop it becomes very important to understand the relationship of Non-performing assets and profitability, whether decrease in NPAs leads to increase in profitability or not. This information is very vital in monitoring, regulating and policy formulation. Correlation is calculated taking GNPA Ratio (Gross Non-Performing Asset Ratio) with the profitability measure as ROA (Return on Assets). Results are exhibited in Table 5 and Figure 6.

There is negative correlation between GNPA with ROA as shown in above figures. An inverse relationship clearly defines that if nonperforming assets are controlled, it increases the profitability. The above relationship is also strengthened by the most popular statistical method of regression. To have more clarity on the issue, ROA has been taken as dependent variable and GNPA Ratio as independent variable.

Table 6 reveals F value is significant at 0.05 level. It is clearly indicating that the variation caused by independent variables in the value of ROA is significant and cannot be left to chance factors. The above table analyzes the results produced by the Regression Model so as to achieve the objective of analyzing the relationship of NPAs with profitability of banks. The value of Correlation Coefficient (R) and Coefficient of Determination (R square and Adjusted R square) of the finally selected model are less than one which shows the relationship of NPA and profitability is significant at 5% level of significance

Therefore, it is evidently proved that NPAs has an inverse impact on ROA or profitability of banks that means the bank can have an increasing trend of ROA by the effect of the declining trend of GNPAs ratios. This leads us to accept that there is a causal relationship between profitability measure and non-performing ratios. The above analysis would help in improving the quality of assets of banks. In turn the requirement for provisioning would automatically come down and it will directly add to the profit of banks.

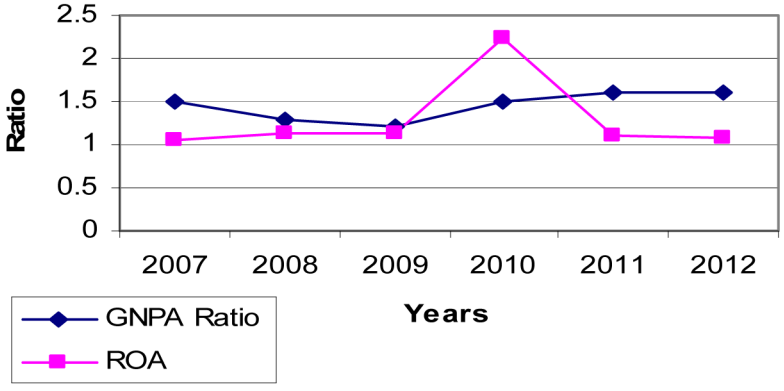
Table 5. Correlation of NPA and ROA in SCBs

Variables	Correlation
GNPA Ratio with ROA	-0.442

Table 6. Model summary and anova (f) results in SCBs

Variables/ Measures	R	R2	Adjusted R2	F-Value	Sig.
GNPA	0.982	0.964	0.965	106.25	.000

Figure 6. Correlation between GNPAs and ROA



CONCLUSION

The analysis concludes that there is a diminishing trend in the ratios of non-performing assets. There is a high degree of negative correlation between NPA Ratios with ROA. Regression model has also repeated the results and that there can be an enhancement in profitability of the banks if the NPAs has a continuous decreasing trend. Consequently, an inverse relationship among profitability and non-performing assets revealed the fact that the bank can have an increasing trend of profitability only by the effective decline in the NPAs. The assessment would help to improve the assets quality of banks, so that, provisioning requirement would automatically come down and it adds to the profits directly which leads to increase in the overall performance of the banks. It is important to manage the level of NPAs for Owners and Depositors also as they can face many problems due to augmented non-performing assets, even they cannot receive their aropriate return on their capital. NPA may spill over the banking system and contract the money stock, which may lead to economic contraction and affect its liquidity and profitability. Though total elimination of NPAs is not possible in banking business as elements of risk is an inseparable ingredient but by effective management it can be minimized.

RECOMMENDATIONS

Relentless monitoring and focus on the continuous viability of the borrowing concern with improved asset classification is must. At the same time all accounts in the Standard category should not be taken for granted and should be subjected to periodical and in-depth review in a systematic manner through a sound adequate loan review mechanism in place.

Banks should ensure that they should move with speed and charged with momentum in disposing off the loss assets. This is because as uncertainty increases with the passage of time, there is all possibility that the recoverable value of asset also reduces and it cannot fetch good price. If faced with such a situation than the very purpose of getting protection under the Securitization Act, 2002 would be defeated and the hope of seeing a must have growing banking sector can easily vanish.

Bank should adhere to "Know Your Customer" norms for identification of borrower, guarantor and verification of their addresses to minimize the risk of default in case of housing sector lending. In respect of agricultural advances, recovery camp should be organized during the harvest season.

Ongoing monitoring of banks borrowers is important to understand the primary cause of corporate decline and to be able to identify the symptoms of a potential distress situation. Loan Officers and staff should be alert and diligent for signs of borrower distress. It is essential to identify signs of distress which diminish the Borrowers capacity to repay debt. Early recognition followed by aropriate action is essential if the bank is to minimize NPAs.

Loan Workout Unit should be created which should be exclusively responsible for managing non-performing and under performing loans to maximize the recovery value from a portfolio of distressed loans, through the employment of an equitable and professional workout process.

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Chapter 21
Enhancement of Efficiency and Effectiveness in Banking through CRM Systems:
A Case of Indian Banking Industry

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ABSTRACT

Financial Services Industry in India is experiencing robust growth and intensity of competition unlimited by geographical operations and multiple methods of service delivery, witnessed by the ever dynamic and increasing role of Information Technology (IT). Relationship Marketing has replaced traditional Transactional Marketing and in this direction, the concept and tools of customer relationship management (CRM) have become significantly important. This research paper examines the multi-fold impact of CRM systems on the growth and efficiency of plethora of banking operations. This empirical study is based on descriptive research design using questionnaire as the key research instrument. Descriptive statistics, Pearson correlation and Stepwise regression and chi-square were used to test the research hypotheses. Cross selling helps to retaining the customer and give more than one platform to engage with the client. It also gives employees an opportunity to learn various non-related products for their skill development for career progression. Banks can improve their efficiency by structured and scientific approach towards cross selling through implementation of CRM tools. Desired results can be obtained by training staff on various products and close tracking on sales process.

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INTRODUCTION

The rapid strides made in the Information Technology (IT) arena have tremendously impacted the way banking is done worldwide. Service delivery systems have undergone a change, whereby the traditional brick and mortar system of servicing customer's requests have been replaced with a mix of brick and click model. The holistic service delivery mix comprises of service delivery methods like In-Store Banking, Door-step Banking and Online Banking intermediated by the complex interplay of human driven and Information Technology (IT) driven methods. Such is the quintessential influence of IT on banking that all major operations/ decisions with regard to deposits, withdrawals, and investments can be made at the click of a mouse on a computer or at an Automatic Teller Machine (ATM) fostering customer confidence and convenience. Important fallout of this IT-driven e-evolution in banking is advances made in customer relationship management (CRM). Banks can differentiate their service offering and reap incremental profits by proper servitization of their product offering. Hence the focus is shifted on profitability along with business volumes for enhancing the efficiency and effectiveness of the banks. In this context profitability has been broadly categorized as Business per employee and profit per employee.

THE CONTEXT

Companies operating in Banking Services Industry experience much more complex market situations and interactions. Customers are becoming all the more sophisticated, knowledgeable and aware. Additionally, the competition is ever increasing. The bank organizations are continuously striving hard to bring the state-of-the-art IT innovations to make banking a convenient and pleasurable experience, thereby increasing the banks' profits. In order to survive, companies must necessarily understand the concept, constituents and the phenomena of 'Relationship Marketing' and CRM systems in the context of banking industry and optimization of resources.

Relationship Marketing

The concept of 'Relationship Marketing' has emerged within the field of Services Marketing and Industrial Marketing in the last years of the twentieth century. One of the most important contributions was Hunt's (1993) proposal, which established that the fundamental element in marketing is the management of interactions, although a decade earlier Berry (1983) had already proposed a formal definition of Relationship Marketing as a strategy to attract, maintain and enhance customer relationships (Beatty et al., 1996). Gronroos (1994) defines Relationship Marketing (RM) as ''Marketing is to establish, maintain and enhance and, when necessary, terminate relationships with customers and other stakeholders, at a profit so that the objectives of all parties involved are met; and this is done by mutual exchange and fulfilment of promises," (Egan, 2004), within the network of relationship (Gummeson, 2002) and acknowledging a stable customer base (Rowley, 2004). Nevertheless, there are few empirical works which have explored the motivations and benefits consumers get from keeping a long-term relationship with a specific bank (Sheth & Parvatiyar, 1995; Bendapudi & Berry, 1997; Gwinner et al., 1998; Reynolds & Beatty, 1999; Henning-Thurau et al., 2002), even though it is obvious that, in practice, such benefits are interpreted as advantages by consumers in terms of their satisfaction and their analysis may render more efficient competitive strategies (Gwinner et al., 1998).

Relationship Marketing Outcome

Consumer satisfaction is a central element in the marketing exchange process, because it undoubtedly contributes to service providers' success

(Darian et al., 2001),the higher the probability that consumers will repeat purchase establishment (Wong & Sohal, 2003) and repurchase highlight the importance of identifying and explaining the conditions under which satisfaction develops (Bejou et al., 1998). The two key elements stand out in the literature of relationship marketing: customer loyalty and word-of-mouth (Henning-Thurau et al., 2002; Wong & Zhou, 2006) and loyalty is one of the primary phases of relationship marketing especially in relation to profitability from a theoretical and empirical approach (Reichheld & Earl Sasser, 1990; Payne & Rickard, 1997; Oliver, 1999). The core of Relationship Marketing is Customer relationships. According to Durkin and Howcroft (2003), a prevalent theme in the Relationship Marketing literature is the influence of technology in increasing channel efficiencies by lowering costs, or by facilitating more meaningful and profitable relationships between channel parties.

Customer Relationship Management

Lang and Colgate (2003) further propose that both Information Technology and non-Information Technology mediums (i.e. human interaction) can be used as an approach towards relationship development. In this arena the term Customer relationship management (CRM) has emerged and being introduced by Berry (1983) in several literature is defined as "a combination of business process and technology that seeks to understand a company's customers from the perspective of who they are, what they do, and what they are like" (Couldwell, 1998). Technological definition of CRM was given as "the market place of the future is undergoing a technology-driven metamorphosis" (Berry & Parasuraman, 1991). Berry stressed that the attraction of new customers should be viewed only as intermediate step in the marketing process. While undertaking a study on the field of customer retention and corporate profitability, Reichheld (1993) stated that the role of customers is essential for corporate performance, so that when relationships with customers endure, profits rise (Sheth & Parvatiyar, 1995). According to the author (Sinha & Iyenagar) Customer Loyalty is one of the major conceptual analyses in CRM. According to Agarwal et al (2006) by strategically linking discrete CRM systems, companies can routinely pass valuable sales or service data to the right person – whoever can offer what the customer needs.

Customer Relationship Management in Service Industries

According to peppers & Roggers Group (2006) where they argued that by utilizing customer relationship management business practices, companies can affordably weather the storms of a down economy by providing cheap growth opportunities fresh strategic capabilities and incremental process changes, meanwhile, implementation of CRM in banking sector was considered by Mihelis et al. (2001). Yli-Renko et al. (2001) have focused the customer relationships of new technology-based firms. According to Smith (2006), building an IT infrastructure for CRM is like building a bridge; it takes comprehension of a need, engineering, reviewing, building, and re-building. Lindgreen and Antioco (2005) suggest that CRM frequently employs IT technology as a means to attract, develop, and retain customers. Although, it must be emphasized that CRM does not necessarily involve IT technology (Park & Kim, 2003). Rowley (2002) recognizes that CRM systems support all stages of the interaction with the customer from order through delivery to after-sales service (Swift, 2001). Services are performances where the employees play a major role in shaping the service experience (Bitner, 1995). Bolton (2004) refers to a bank's CRM system by suggesting that maintaining the processing of checks, withdrawals, transfers, etc. is well established.

Financial Service Industry: An Emerging Scenario

Chaitanya (2005) viewed services industry as a key area which is vital for the economic development of any nation. Often much of the technology is already in place, so the main barrier to building these connections is simply a failure to recognize their value. (Agarwal et al., 2006), indicating thereby that the technology provided has not been absorbed (Arunoday, 1990). As stated by Solow (1987), "you can see the computer age everywhere these days, except in the productivity statistics." Shu and Strassmann (2005) studied 12 banks operating in the US for the period of 1989-1997 and found that although IT has been one of the most marginal productive factors among all inputs, it cannot increase banks' profits (Kozak, 2005). Curry and Susan (2004) in their paper sheds some light on the debate about the extent of use of IT in services, in this case in banking. Role that technology can play in helping to bring mainstream financial services to low-income populations and communities, while making it profitable to do so (Stegman, 2001; Stegman and Lobenhofer, 2002; Lobenhofer, Bredencamp, and Stegman, 2003; Stegman and Faris, 2004). More to the point, a recent industry report forecasts that mainstream financial institutions may be able to capture as much as $3.3 billion, or 22%, of the national unbanked market by 2010 using new self-service technology (Katkov, 2002). Early studies (Sarkar *et al*., 1998) found somewhat weak evidence to suggest that ownership was an important determinant of performance. More recent studies exhibit mixed evidence: while certain studies (Keova, 2003) suggest ownership to have some effect on bank performance, others (e.g., Bhaumik & Dimova, 2004) veer around the view that competition induced public sector banks to eliminate the performance gap that existed between them and both domestic and foreign and private sector banks. More recent research reported differences in the efficiency of Indian commercial banks with different ownership status, level of non-performing loans, size and asset quality (Das & Ghosh, 2006).

Measuring Efficiency and Effectiveness in Financial Service Industry

Since the 1990s, numerous studies have focused on measuring the efficiency of commercial banks. Berger and Humphrey (1997) document 130 studies on financial institutions' efficiency, using data from 21 countries, from various types of institutions including banks, bank branches, savings and loan institutions, credit unions and insurance companies. Richard et al. (2002) evaluate the production efficiency of US commercial banks during 1984-98. They found as strong and consistent relationship between efficiency and independent measures of performance. Girardone et al. (2004) investigate that X-inefficiencies tend to decline over time for all bank sizes. The inclusion of risk and output quality variables in the cost function reduces the significance of the scale economy estimates where deposits are treated as an input since a bank's main business is to borrow funds from depositors and then lend to others. The approach specifies three outputs: the provision of loan services; portfolio investment; and non-interest income and three inputs: bank staff; assets; and deposits. Kumar and Gulati (2009) in their research appraise the efficiency, effectiveness, and performance of 27 public sector banks (PSBs) operating in India and reveals that high efficiency does not stand for high effectiveness in the Indian PSB industry. They measured a positive and strong correlation between effectiveness and performance measure and stated that Indian PSBs should pay more attention to their income-generating capabilities (i.e. effectiveness) relative to their ability to produce traditional outputs such as advances and investments (i.e. efficiency).

Ho & Zhu (2004) in their research realised that company performance evaluation focus merely on operational efficiency. Operational effectiveness, however, which might directly influence the survival of a company, is usually ignored. As a result, in their study the innovative two-stage data envelopment analysis model that separates efficiency and effectiveness to evaluate the performance of 41 listed corporations of the banking industry in Taiwan. They concluded that a company with better efficiency does not always mean that it has better effectiveness. There is no apparent correlation between these two indicators.

RATIONALE FOR RESEARCH

The environment is ever challenging with uncertainty and fear getting magnanimous by the high levels of technological, demographic, social, and global competitive changes. Any organization that relies on an outdated set of beliefs about customer is more likely to accelerate their irrelevance than ensure their success. Many organizations are already dangerously disconnected from their customers. One of the indicators for this disconnect is Bain's research that found 80% of companies believed they were delivering a superior experience while only 8% of their customers thought they were receiving a superior experience. This disconnect will continue to grow as the rate of change in customers' priorities exceeds the rate of change of managements' beliefs about customers. The Bank should quickly diagnose and repair specific customer experience issues that are leading to unnecessary attrition and lost opportunities. The overarching goal is to keep the value proposition and customer experience relevant, compelling, and differentiated. In order to sustain differentiation and even move the market in a new direction, one must offer customers something new; a product, a service, or an experience that both fits with and influences the way they think, feel, or act.

RESEARCH OBJECTIVE AND HYPOTHESIS

This research focuses on gaining a better understanding on how and in what respect the CRM systems are effective in enhancing the effectiveness of the banking business in the Indian context. The specific research objectives are:

Research Objective 1

To analyse the expanded scope of integrating Customer Relationship Management system for cross selling in banks.

Hypothesis 1

H_0: Customer Relationship Management system has no effect on cross selling of banking products.

H_1: Customer Relationship Management system has effect on cross selling of banking products.

Research Objective 2

To identify and understand need for augmenting the income by means of non-interest income through the concept and methodology of cross selling of the products by the bankers.

This objective has been derived in the light of the gaps obtained through the review of literature.

Hypothesis 2

H_0: Cross Selling does not have impact on non – interest income of banks.

H_1: Cross Selling does have impact on non – interest income of banks.

Research Objective 3

To predict the impact of CRM system on enhancing the efficiency of different groups of banks viz. public, private and foreign banks.

To study the trend of efficiency parameter in terms of profit per employee and business per employee of the last few years.

Hypothesis 3

H_0: Customer Relationship Management system does not impact in enhancing efficiency in banking business.

H_1: Customer Relationship Management system does impact in enhancing efficiency in banking business.

RESEARCH METHODOLOGY

A blend of qualitative and quantitative methodological tools was used to analyse the research problem in hand. Exploratory method, specifically literature review was conducted in order to gauge an understanding of the subject area under consideration. The results were substantiated by using Descriptive research design, specifically data collection through surveys using questionnaires as research instruments. The data was collected to describe and deeply understand the types and effectiveness of CRM tools used in banking organizations, analysed both by considering the banking officials and customers of the bank.

Causal research design was also used to explore the possible linkages between the variables (independent and dependent) and to demonstrate their contribution in the performance of the growth of the banks in terms of benefits achieved by implementing the tool by applying parametric statistics (f test, correlation and regression) and non- parametric statistics (chi-square).

Questionnaire was used as a research instrument and consisted of two parts of questions; with Part 1 pertaining to Bank's customer acting as respondents and Part 2 of the questionnaire was used to understand the perceptions of the Banking officials regarding the subject. Part I consist of 23 questions related to the respondents (customers) branch, their account details, benefits they get from banks with respect to Information Technology adopted by the banks, the additional product purchased by them from the bank etc. Part II consist of 29 questions related to the respondents (bank officials) branch, designation, the measurement of their customer satisfaction, the CRM practices the bank is adopting and information related to cross selling of products and services by the banks.

Three Marketing/Information System (IS) professors were asked to review the questionnaire for any possible discrepancies so as to establish the face and content validity of the study. Questionnaire was filtered and overlapping questions were detected and dropped. After the review, the questionnaire were pilot-tested on a group comprised of 40 banking customer respondents and 30 banking official respondents using convenient sampling method, as is common for pilot testing (Sekaran, 2000; Zikmund, 2000). Questionnaires were pilot tested to identify and remove any discrepancies with respect to question wording, problems with leading questions and biasness (Zikmund, 2000).

Also, another pilot survey was conducted in August 2010 on 20 bank officials and 20 banking customer respondents around NCR region, the compositions of which were similar to the final survey respondent's profile (Burns & Bush, 2002; Malhotra, 1999; Parasuraman, 1991; Zikmund, 2000). SPSS was used to test the reliability of the data and yielded a high Cronbach alpha score (0.6).

The sample selection for the study followed sequential steps outlined as seen in the next several sections.

Step 1

The target population for this study was defined as individuals having an account in various bank branches of NCR region at the time the survey was conducted.

Step 2

To establish the sample frame, a list of customers was obtained from education (Students), government and corporate institutions and house hold of the four major regions, Noida, Delhi, Ghaziabad and Faridabad. It was clearly communicated to the respondents that their opinions should reflect their experience on the way they see the banking scenario and deal with.

Step 3

Stage 1: For the selection of the banks, Judgment Sampling Technique was conducted by the 3 panel members/consultants selected on the basis of their consultancy experience in the banking industry. Banks were identified on the basis of profit, market share, customer base and income based on consensus. The banks so identified were Punjab National Bank and State Bank of India as the Public Sector banks, HDFC Bank Ltd. and ICICI Bank Ltd as the Private Sector Banks and Standard Chartered Bank and HSBC Bank as the Foreign Sector Banks. Once the list was obtained from the panel of judges the list of the bank's branches were obtained from the respective banks.

Stage 2: Simple random sampling (lottery method/ fish ball technique) was used for the selection of the branch. The various branches of the banks were listed on paper and a lottery method of sample selection was used to select the branch.

Stage 3: Systematic sampling technique was used for selecting the customer. Every third customer who visited the branch was asked to fill the questionnaire. Simple Random sampling technique was used to find out the sampling interval. The same applies for every bank customer which was taken as the sample.

Stage 4: Banking official's details were generated on the basis of three different grades i.e. junior, Middle and Senior management. Every 2nd employee from senior management, 3rd from middle management and 5th from lower management was chosen as part of the systematic sampling method. This was decided with the help of the attendance list of various banks.

Step 4

The domain of the study was established and banks divided into Public, Private and Foreign banks of NCR region included customers and banking officials from Delhi, Noida, Faridabad, Ghaziabad and Gurgaon. The summary of the data collection is outlined in Table 1.

Cronbach coefficient alpha was used to assess the reliability for a measurement scale with multipoint items (Hayes 1998). The coefficient, which reflects homogeneity among a set of items, varies from 0 to 1. However, a good reliability should produce at least a coefficient value of 0.60 (Hair et al., 1995; Pallant, 2001). Table 2 depicts the reliability analysis of the questionnaire (Part 1 and 2).

The demographic profile of the customers was generated in terms of Age, Marital status, occupation. The categorization of bank officials was done on the basis of the position held by them in the banking organizations.

ANALYSIS AND RESULTS

To analyse the expanded scope of integrating CRM system for cross selling in banks, correlation matrix was established between the Cross

Table 1. Domain of the study along with the sample size

Sectors	Name of the Banks	Sample Size in Case of Customer Questionnaire	Sector Wise Size	Sample Size in Case of Bank Officials Questionnaire	Sector Wise Size
Public Banks	SBI	68	188	12	35
	PNB	120		23	
Private Banks	ICICI Bank	78	114	36	45
	HDFC	36		9	
Foreign Banks	HSBC	8	34	24	43
	Standard Chartered	26		19	
Total		**336**	**336**	**123**	**123**

Table 2. Reliability coefficients

Part of the Questionnaire	Number of Items	Cronbach Alpha
1	41	0.646
2	17	0.602

Selling products (dependent variable) of the bank and the CRM practices (independent variable) being implemented by the bank to see the relationship among the variable (Table 3) and later on the impact of the independent variables on the dependent variable were also examined (details in Tables 4 through 10).

Based on the correlation matrix further the impact of independent variables on the individual dependent variables was examined using the regression. Table 11 provides the summary of the above correlation and regression matrix describing the percentage of contribution of cross selling products (dependent variable) and CRM tools (Independent variable).

Inference: It has been observed by the above correlation and regression matrix that in Cross selling of home loan/auto loan (41%), personal visit followed by email, phone banking as a CRM tool had played a significant role. Trade account (22%) which seems a specialized product does not get affected by CRM initiatives. Products like trade account, is not that effective as stakeholders in such decisions are many. But opening up of trade account is now becoming the rich source of non – interest income of the bank where in Fixed Deposit (17%), Recurring Deposit (46%) got influenced by personal visit followed by email. So if banks focus on this aspect and use CRM tool more effectively as compared to current scenario then the bank can increase their revenue. 34% of the CRM tools help in selling Credit Card. Credit card is more profitable product of the bank. Banks can focus more on CRM tools for segmenting the customers. They can increase the use of this product by the customers and hence can increase the revenue in the form of non – interest income. 38% of the CRM tools help in selling Mutual Fund. Mutual Fund is more upcoming product of the bank. The banks can focus more on CRM tools for selling mutual funds as the Indian Market is increasing at a very fast pace. This will help them to increase the revenue in the form of non – interest income. 50% of the above CRM tools help in selling Locker facility. With the increase in the customer base and also for the security reason and increasing per capita income this product is more in demand. The increase in per capita income has further increased the demand of this service. It is also evident that cross selling is more appropriate or justifiable in domain of retail banking/personal banking, due to decision making process as an individual is deciding on such proposals.

Table 3. Relationship correlation coefficient of CRM system tools with the products of the bank (N= 336)

Products CRM Tools	Auto/ Personal/ Home Loan	Trade Account	Fixed Deposit	Recurring Deposit	Credit Card	Mutual Fund	Locker Facility
ATM	.1360*	.0698	.0205	.1314*	-.0563	-.0225	.1314*
Internet Banking	.1630*	.0836	-.0795	.1575*	.1021	.1348*	.1575*
Phone Banking	.3721*	.1909*	-.0055	.1109*	.3365*	.1026	.2352*
Mobile Banking	.1530*	.1754*	-.0758	.0092	.2964*	.1414*	.0092
Updated Information regarding other products of the bank	.3436*	.0138	.1108*	.1470*	.2135*	.2667*	.3892*
Tele-Calling	.0164	.1601*	.0138	.1005	-.0150	-.0369	.0335
Email	.3097*	-.0138	-.0107	.1470*	.1669*	.0667	-.0259
Letter	.2407*	.1369*	.1508*	.0974	.1534*	.3386*	.4183*
Personal Visit	.1400*	.0000	.3110*	.4671*	.1281*	.2286*	.3892*
Mode Preferred for Information by the Customers							
Tele-calling	.0230	-.1020	-.0300	.1024	-.1589*	-.0658	.1664*
Email	.1060*	.0138	.1895*	.2162*	.0505	-.1333*	.0259
Letter	.3450*	.0534	-.0534	.1523*	.1654*	.4057*	.2345*
Personal Visit	.4567*	.2028*	.3129*	.5695*	.3638*	.4648*	.4757*

*significant at.05

Table 4. Determinants of auto personal/home loans (1 = Availed, 0=Not availed) N= 336

Dependent Variables / Independent Variables	Beta	Simple r	t Value
Personal visit 1= yes 0= No	.399*	.4567*	8.24
E-mail (getting information by the bank) 1= yes 0=No	.243*	.3097*	5.05
Phone Banking 1=Yes 0=No	.253*	.3721*	4.85
Letter 1=Yes 0=No	.194*	.3450*	3.96
Email (preferred mode by the customer) 1= Yes 0= No	.114*	.1060*	2.23
Mobile Banking 1=Yes 0=No	-.108*	.1530*	-2.16

* Significance at.05; Multiple R=.64; R square =.41

Table 5. Determinants of trade account (1 = Availed, 0=Not availed) N = 336

Dependent Variables / Independent Variables	Beta	Simple r	t Value
ATM 1= Yes 0 = No	.016	.0698	-.31
Internet Banking 1= Yes 0=No	-.075	.0836	-1.28
Mobile Banking A6_4 1=Yes 0=No	.088	.1754*	1.38
Email for getting the product information 1=Yes 0=No	.042	-.0138	.651
Personal Visit for getting the product information	-.088	.0000	-1.52
Email as a preferred mode	-.090	.0138	-1.50

* Significance at.05; Multiple R=.46; R square =.22

Table 6. Determinants of fixed deposit (1 = Availed, 0=Not availed) N= 336

Dependent Variables / Independent Variables	Beta	Simple r	t Value
Personal Visit as a preferred mode 1= Yes 0 = No	.160*	.3129*	2.77
Personal Visit for getting the product information 1= Yes 0=No	.264*	.1895*	4.46
Email as a preferred mode 1=Yes 0=No	-.198*	.3110*	-3.49
Email for getting the product information 1=Yes 0=No	.154	-.0107	2.70

*significance at.05; Multiple R=.41; R square =.17

Further independent chi square tests were applied on cross selling products (dependent variable) and the CRM practices (independent variable) adopted by the bank to see the relationship among the groups (Tables 12 through 17).

Based on the statistics from Table 12, it has been observed that in case of Auto/personal/home loan, the results show that there is a significant difference as indicated by chi-square test (7.86) among the private, public and foreign banks with the significant level at.0197. It has been concluded that private banks are more efficient in granting the auto/personal/home loans. In case of Trade Account, the result shows that there is a significant difference as indicated by chi-square test (12.56) among the private, public and foreign banks

Table 7. Determinants of recurring deposit (1 = Availed, 0=Not availed) N= 336

Dependent Variables / Independent Variables	Beta	Simple r	t Value
Personal visit as a preferred mode 1= Yes 0= No	.382*	.5695*	7.64
Personal Visit for getting the product information 1= Yes 0=No	.310*	.4671*	6.38
ATM 1=Yes 0=No	.140*	.1314*	3.17
Email as a preferred mode 1= Yes 0= No	-.168*	.2162*	-3.64
Internet Banking 1=Yes 0=No	.169*	.1575*	3.39
Tele-calling as a preferred mode 1= Yes 0=No	-.151*	.1024	-3.36
Tele-calling as getting such information 1=Yes 0=No	.155*	.1005	3.39
Mobile Banking 1=Yes 0=No	-.129*	.0092	-2.56
Letter a getting such information 1=Yes 0=No	-.106*	.0974	-2.35

*significance at.05; Multiple R=.68; R square =.46

Table 8. Determinants of credit card (1 = Availed, 0=Not availed) N= 336

Dependent Variables / Independent Variables	Beta	Simple r	t Value
Personal visit as a preferred mode 1= Yes 0= No	.356	.3638*	6.76
Phone Banking 1= Yes 0=No	..271*	.3365*	4.63
Tele-calling as a preferred mode 1= Yes 0=No	.223*	-.1589*	-4.74
ATM 1=Yes 0=No	-.198*	-.563	-3.97
Mobile Banking 1=Yes 0=No	.217*	.2964*	3.59

continued on following page

Table 8. Continued

Dependent Variables / Independent Variables	Beta	Simple r	t Value
Personal Visit for getting the product information 1= Yes 0=No	-.149*	.1281*	-2.70
Letter a getting such information 1=Yes 0=No	.091	.1534*	1.74
Internet Banking 1=Yes 0=No	-.165	.1021	-2.85
Updated Information regarding other products of the bank	-.127*	.2135*	2.30

*significance at.05; Multiple R=.58; R square =.34

Table 9. Determinants of mutual fund (1 = Availed, 0=Not availed) N= 336

Dependent Variables / Independent Variables	Beta	Simple r	t Value
Personal visit as a preferred mode 1= Yes 0= No	.299*	.4648*	5.94
Letter to get such information by the bank 1= Yes 0=No	..227*	.3386*	4.04
Letter as a preferred mode 1= Yes 0=No	.117*	.4057*	2.05
Updated Information regarding other products of the bank 1=Yes 0=No	.281*	.2667*	4.93
Tele-calling to get such information 1=Yes 0=No	-.207*	-.0369	-4.06
Mobile Banking 1=Yes 0=No	.257*	.1414*	4.50
Phone Banking 1= Yes 0=No	.164*	.1026	-2.92
Email as a preferred mode 1=Yes 0=No	-.145	-.1333*	-2.70

*significance at.05; Multiple R=.62; R square =.38

Table 10. Determinants of locker facility (1 = Availed, 0=Not availed) N= 336

Dependent Variables / Independent Variables	Beta	Simple r	t Value
Personal visit as a preferred mode 1= Yes 0= No	.331*	.4757*	8.01
Letter for getting such information 1= Yes 0=No	.275*	.4183*	6.42
Tele-calling as a preferred mode 1= Yes 0=No	.229*	.1664*	5.25
Updated Information regarding other products of the bank 1=Yes 0=No	.462*	.3892*	7.93
Tele-calling for getting such information 1=Yes 0=No	-.250*	.0335	-5.29
Emil for getting the product information 1= Yes 0=No	-.254*	-.0259	-5.03
ATM 1=Yes 0=No	.105	-.0225	2.65

*significance at.05; Multiple R=.71; R square =.50

Table 11. Summary of the correlationn matrix (r^2) describing the percentage of contribution of cross selling products (dependent variable) and CRM tools (independent variable)

Dependent Variable (Purchases) / Independent Variable (CRM Tools)	Auto/Personal/ Home Loan	Trade Account	Fixed Deposit	Recurring Deposit	Credit Card	Mutual Fund	Locker Facility
	41%	22%	17%	46%	34%	38%	50%
ATM		√		√	√		√
Internet Banking		√		√	√		
Phone Banking	√				√	√	
Mobile Banking	√	√		√	√	√	
Updated Information regarding other products of the bank					√	√	√
Tele-Calling				√	√	√	√
Email	√	√	√	√		√	v
Letter	√			√	√	√	√
Personal Visit	√	√	√	√	√	√	√

Table 12. Comparison of additional products availed by the customer among the groups

Additional Products/Services Availed from the Bank	Private Banks (N= 116)	Public Banks (N= 188)	Foreign Banks (N=32)	Total	Chi- Square	Result
Auto/Personal/ Home Loans	36 (31.0)	36 (19.1)	4 (12.5)	76 (22.6)	7.86*	Reject
Trade Account	16 (13.8)	8 (4.3)	-	24 (7.1)	12.56*	Reject
Fixed Deposit	48 (41.4)	92 (48.9)	8 (25.0)	148 (44.0)	6.87*	Reject
Recurring Deposit	16 (13.8)	52 (27.7)	4 (12.5)	72 (21.4)	9.87*	Reject
Credit Card	40 (34.5)	32 (17.0)	28 (87.5)	100 (29.8)	66.87*	Reject
Mutual Fund	20 (17.2)	36 (19.1)	-	56 (16.7)	7.26*	Reject
Locker facility	16 (13.8)	52 (27.7)	4 (12.5)	72 (21.4)	9.87*	Reject
Any other	-	20 (10.6)		20 (10.6)	@	Value cannot be computed

*significant at.05

@Chi square cannot be calculated for as the number of cells with expected frequency is less than five.

with the significant level at.001 that is to say that private banks are more efficient in granting the Trade Account followed by the public banks. The reason being that trade account has become the big business for private banks and they are making their employees to make more efforts in selling the trade accounts. In case of Fixed Deposit, the result shows that there is a significant difference as indicated by chi-square test (6.87) among the private, public and foreign banks with the significant level at.032. Public Sectors banks are better in Fixed Deposit because of the larger customer base and more trust by the public on retail front. Most of the time FD is purchased by the households, retired and their mind-set is always that the money is safe with the public banks. In case of Recurring Deposit, the result shows that there is a significant difference as indicated by chi-square test (9.87) among the private, public and foreign banks with the significant level at.007. Again Public sector banks top the list as compared to the foreign banks and private banks with the same reason that people trust with the public banks and large number of customer base. Further, the credit card as a factor was examined; it has been found that there is a significant difference as indicated by chi-square test (66.87) among the private, public and foreign banks with the significant level at.0000. Credit card has been more availed by the customers of the private bank because of the easy availability and better access. Public sector banks have many requirements to fulfil before issue of credit cards. Foreign banks service charges are very high and the customer base is also not that high. In case of Mutual Fund, the result shows that there is a significant difference as indicated by chi-square test (7.26) among the private, public and foreign banks with the significant level at.026. Public Sector banks are better in mutual fund and out of the overall survey more of the customers availed the mutual fund facility from the foreign banks. The reason may be that either the foreign banks do not provide this facility or the customer like to purchase the mutual fund from the public banks

because of trust. In case of Locker Facility the result shows that there is a significant difference as indicated by chi-square test (9.87) among the private, public and foreign banks with the significant level at.007. More of locker facilities are provided by the Public sector banks as compare to the private and foreign banks because of the large no of branches and more customer base of these banks.

There is a significant difference (p =.000) in the service charges for the additional product paid by the customers. The service charges are more with the private sector banks and then to foreign sector banks. The public banks service charges are minimum as compare to other sectors (Table 13).

There is significant difference among the group with p=.000. From the survey it has been found that the service charges of the public sector banks are very reasonable as compared to the private sector and public sector banks (Table 14).

When awareness about the technological services provided by the bank viz. ATM, Internet Banking, Phone Banking and Mobile Banking were examined; the chi-square test showed the significant difference at.05 (Table 15).

Table 16 shows that email is the best preferred as mode or updated information regarding the additional product of the bank as compared to other modes. There is also significant difference among the tools based on the value of the chi square test.

Table 13. Comparison within the groups of any service charges for the additional products purchased from the banks

	Private Banks (N= 116)	**Public Banks (N= 188)**	**Foreign Banks (N=32)**	**Total**	**Chi- Square**
Any Service Charges paid for the additional product	72 (62.1)	60 (31.9)	16 (50.0)	148 (44.0)	26.97*

*significant at.05

Table 14. Comparison within the groups of difference in any service charges by the banks

Factors	**Private Banks (N= 116)**	**Public Banks (N= 188)**	**Foreign Banks (N=32)**	**Total**	**Chi Square**
Higher	44 (37.9)	4 (2.1)	8 (25.0)	56 (16.7)	72.84*
Reasonable	64 (55.2)	140 (74.5)	20 (62.5)	224 (66.7)	
Lesser	8 (6.9)	44 (23.4)	4 (12.5)	56 (16.7)	

*significant at.05

Table 15. Awareness about the technological services provided by the bank

Technological Services	**Frequency**	**Percentage**	**Chi- Square**	**Result**
ATM	316	94.0	85.12*	Reject
Internet Banking	308	91.7		
Phone Banking	228	67.9		
Mobile Banking	240	71.4		

* Significant at.05

Table 16. Mode for updated information regarding product of the bank

Mode for Updated Information	Frequency	Percentage	Chi – Square	Result
Tele-calling	84	25	128.47*	Reject
Email	120	35.7		
Letter	52	15.5		
Personal Visit	56	16.7		

*significant at.05

In this case the empirical analysis of all the banks says that to the great extent Information Technology has changed the banking operation and there is significant difference among the variables regarding the extent of use of IT services in banks (Table 17).

From the above mentioned inferences it can inferred that use of effective CRM tools helps banks selling their various products to their existing customer base. It also helps banks to deepen their relationship and also tie the customers with more threads of different services. This will give higher revenue on one side while on the other chances of attrition goes low.

A report published by rediff.com on Cross-selling, the retail key (2004) says that SBI top brass has given the employees a heavy mandate to fulfil -- at least 50 per cent of all new customers of housing loans, car loans and tractor loans should be covered by SBI Life's insurance products. It is not just insurance that is being given a major push. The banking behemoth's management is also ensuring that adequate number of the branches sell the group's mutual fund products and credit cards to push the total income. SBI is not alone. ICICI Bank, the country's second largest bank after SBI, is also working on a similar strategy - to cross-sell products to its 10-million strong customer base. The bank today boasts of 50 per cent of its credit card sales coming from the bank's depositor base and 25 per cent of home loans from the existing customers. According to ICICI Bank Deputy Managing Director, Kalpana Morparia- "We are aiming to sell 30-35 per cent of home loans in the coming year to our customers. Similarly, we hope to cross-sell credit cards to 60 per cent of the bank's customers. With ICICI Bank's huge customer base, cross-selling has become a reality."

According to S Krishnamurthy, Chief Executive Officer, SBI Life, "We have been able to cover 50 per cent of borrowers of fresh home loans. Since December, we have underwritten about 1,200 home loan proposals each month. Against SBI's expectation of disbursing 200,000 home loans in fiscal 2005, we have targeted to cover 100,000 of these borrowers." "SBI can expect a fee-based income of about INR 15 crore (INR 150 million) this fiscal, which will increase to INR 50 crore (INR 500 mil-

Table 17. Extent of use of IT services in banks

	Frequency	%	Chi – Square	Result
To a great extent	106	86.2	156.49*	Reject
Up to some extent	14	11.4		
Not to the required extent	3	2.4		
Total	123	100.0		

*significant at.05

lion) in 2004-05 and to over INR 300 crore (INR 3,000 million) in the coming years."

According to a recent market study, 87 per cent of Indian banks have made no attempt to cross-sell or up-sell related banking products during the course of customer interaction. "Most of the time, even if customers are themselves enquiring about other bank products, 43 per cent of Indian banks have failed to respond to customers' inquiries,"

Another report by McKinsey & Co, "Banks lack cross-selling capabilities at the branch level, partly as a result of lack of incentive and the fact that banking products have always been bought and not sold."

HDFC Bank, relatively a smaller bank as compared to SBI and ICICI Bank, is seen as the third-largest cross-seller of mutual fund products. The entire push towards cross-selling is to increase fee-based income and enhance retail disbursements.

Some of the interesting facts have also been published regarding cross selling with respect to some individual banks taken as the sample:

- ICICI Bank aims at 35% home loans from bank customers;
- The private sector bank targets 60% sale of credit cards to bank customers;
- SBI targets 50% of retail loans to be insured;
- HDFC Bank third largest cross-seller of MFs.

For the analysis of this objective the secondary data source was used regarding interest and non-interest income of the sample banks. This is analysed in the Tables 18 through 22. Banks Compounded Annual Growth Rate (CAGR) of last 10 years of interest and non-interest income was also taken to analyse the growth of non- interest income viz. – viz. interest income.

Inference: It has been observed from Table 18 that the percentage of non-interest income has increased from 12.38 in 2001 to 14.44 in 2010 for PNB, 13.34 in 2001 to 18.36 in 2010 for SBI (average growth rate is 6% approximately for public sector), 15.45 in 2001 to 22.54 in 2010 for

Table 18. Percentage of interest income viz. – viz: Non – interest income of the public banks (in INR Cr)

Years	Public Sector									
	PNB					SBI				
	Total Income	Interest Income	Percentage	Non-Interest	Percentage	Total Income	Interest Income	Percentage	Non-Interest	Percentage
2010	25088.62	21422.09	85.39	3621.71	14.44	86960.52	70993.92	81.64	15966.6	18.36
2009	22.496.63	19127.22	85.02	3369.41	14.98	76482.74	63788.42	83.4	12694.31	16.6
2008	16291.48	14265.02	87.56	2026.46	12.44	58437.42	48950.31	83.77	9487.11	16.23
2007	13168.85	11236.14	85.32	1932.71	14.68	44671.37	37242.33	83.37	7429.04	16.63
2006	11485.15	9584.15	83.45	1901	16.55	43507.73	35979.57	82.7	7528.16	17.3
2005	10646.21	8459.85	79.46	2186.36	20.54	39549.73	32428	81.99	7121.73	18.01
2004	9836.11	7778.95	79.09	2047.16	20.91	38131.55	30460.49	79.88	7671.06	20.12
2003	8812.17	7485.01	84.94	1327.16	15.06	37541.38	31087.02	82.81	6454.36	17.19
2002	7733.76	6647.87	85.96	1085.89	14.04	34061.76	29810.09	87.52	4251.67	12.48
2001	6692.19	5863.48	87.62	828.71	12.38	30161.82	26138.59	86.66	4023.23	13.34
CAGR	**13.94**	**13.88**		**15.82**		**10.83**	**10.12**		**12.49**	

Source: Capital Line

ICICI Bank, 12.92 in 2001 to 19.07 in 2010 for HDFC (average growth rate is 8% approximately for private sector) (Table 19), 23.07 in 2001 to 29.25 in 2010 for HSBC, 21.46 in 2001 to 36.75 in 2010 for Standard Chartered Bank (average growth rate is 11% approximately for foreign sector) (Table 20). Non – interest income has been garnered by product of third party as mutual funds, credit cards and by providing advisory services to customer on various financial and non-financial

Table 19. Percentage of interest income viz. – viz: Non – interest income of the private banks (in INR Cr)

Years	Private Sector									
	ICICI					HDFC				
	Total Income	Interest Income	Percentage	Non-Interest	Percentage	Total Income	Interest Income	Percentage	Non-Interest	Percentage
2010	33187.23	25706.93	77.46	7480.3	22.54	19983.52	16172.72	80.93	3810.62	19.07
2009	39268.81	31092.55	79.18	8176.26	20.82	19802.9	16332.26	82.47	3470.64	17.53
2008	39667.19	30788.34	77.62	8878.85	22.38	12398.15	10115	81.58	2283.15	18.42
2007	28958.54	21995.59	75.96	6962.95	24.04	8242.52	6647.93	80.65	1594.59	19.35
2006	19368.35	14306.13	73.86	5062.22	26.14	5688.98	4475.35	78.67	1213.64	21.33
2005	12949.56	9409.89	72.67	3539.67	27.33	3824.57	3093.49	80.88	731.08	19.12
2004	12069.22	9002.39	74.59	3066.83	25.41	3040.32	2548.93	83.84	491.39	16.16
2003	12533.38	9368.06	74.74	3165.32	25.26	2481.29	2013.61	81.15	467.68	18.85
2002	2762.27	2151.93	77.9	610.34	22.1	2037.05	1702.99	83.6	334.06	16.4
2001	1469.09	1242.13	54.55	226.96	15.45	1446.33	1259.46	87.08	186.87	12.92
CAGR	**31.82**	**31.73**		**41.4**		**29**	**28.42**		**33.88**	

Source: Capital Line

Table 20. Percentage of interest income viz. – viz: Non – interest income of the foreign banks (in INR Cr)

Years	Foreign Sector									
	HSBC					Standard Chartered				
	Total Income	Interest Income	Percentage	Non-Interest	Percentage	Total Income	Interest Income	Percentage	Non-Interest	Percentage
2010	7301.36	5165.88	70.75	2135.48	29.25	8972.57	5674.89	63.25	3297.68	36.75
2009	9026.35	6326.93	70.09	2699.42	29.91	8880.28	5649.41	63.62	3230.87	36.38
2008	7153.3	4979.22	69.61	2174.08	30.39	7302.43	4878.06	66.8	2424.37	33.2
2007	4994.04	3507.93	70.24	1483.11	29.76	5804.13	4046.18	69.71	1757.95	30.29
2006	3379.04	2201.93	65.16	1177.11	34.84	4204.43	3056.35	72.69	1148.08	27.31
2005	2373.9	1626.83	68.53	747.07	31.47	3276.08	2492.95	76.1	783.13	23.9
2004	2119.34	1413.97	66.72	705.37	33.28	3222.55	2523.19	78.3	699.36	21.7
2003	1969.09	1480.08	75.17	489.01	24.83	2847.49	2286.96	80.31	560.53	19.69
2002	1979.04	1499.47	75.77	479.57	24.23	2161.35	1644.78	76.1	516.57	23.9
2001	1716.27	1320.38	76.93	395.89	23.07	1427.82	1121.46	78.54	306.36	21.46
CAGR	**17.45**	**16.37**		**17.45**		**22.66**	**19.74**		**22.66**	

Source: Capital Line

sectors as Reality services, Trade advisory etc. It has been observed that private banks due to their latest product offering and rich experience in advisory services take a lead in this segment viz. – viz. public sector counterparts. When CAGR of interest income and non-interest income are compared, it clearly indicates that banks having focused on cross selling get substantial growth on non-interest income and also it helps growing their book on lending side and borrowing side, hence increases interest income as well. Leading banks in CRM implementation like ICICI bank has shown CAGR of 31.73% in interest income growth as cross selling help acquiring new customers for interest income from other channels as well. It simply states that by use of cross selling bank can leverage synergy between various channels and be more efficient and productive. This has a significant impact on profitability.

For Non-interest income existing customers are the easiest segment for the advisory services and helps banks to increase their share of wallet from customers. The same can be done by using CRM tools and cross sell to the existing customers. As it can be observed from data that trade account has maximum penetration of 16% in private sector banks, credit card is as highest 40% in private sector banks where in FD and RD are more in public sector bank.

The fact has also been verified by the data collected from the survey whether cross selling of banking services and products have increased the share of non-interest income of banks (Table 21).

This has also been confirmed from the bank officials' survey as well. 88.9% of the private sectors bank employees stated that by cross selling different products to existing customer base, their non- interest income has increased viz. - viz. 77.1% bank employee think on the similar line. Whereas in foreign sector bank, 100% employees think that cross selling of banking services and products have increased the share of non-interest income of the branch. There is also a significant difference among the groups as the value of the chi square (10.68) is significant at.05 (Table 21).

Thus it can be inferred that CRM has helped increased turnover in services provided by the bank and thus augment the not – interest income of the banks.

Same can be further more analysed by Business per employee and Profit per Employee (See Table 22), it is evident that foreign banks leads the pack with highest profit per employee and even private banks with similar level of business levels have far more profitability per employee.

These higher levels of profitability are generated by cross selling various products to existing customer base. It can be achieved by implementing effective CRM tools and focus on Cross selling.

Cross selling is decade old concept in developed countries which was introduced in India by foreign banks later successfully implemented by new age private banks as ICICI and HDFC bank. As per above table Standard Chartered and HSBC shown excellent performance in beginning and later banks like ICICI who focussed on cross selling and offering various products to their customer by becoming Universal Banks their efficiency had shown remarkable growth. Wherein PSU took this concept late due to lack of computerization

Table 21. Do you agree that cross selling of banking services and products have increased the share of non-interest income of your branch?

Cross Selling Impacts the Non-Interest Income of the Bank	Private Banks	Public Banks	Foreign Banks	Total	Chi-Square	Result
Yes	40 (88.9)	27 (77.1)	43 (100)	110 (89.4)	10.68*	Reject

*significant at.05

Table 22. Business per employee and profit per employee of different groups of banks (empty cells indicate no data)

Year	Business per Employee						Profit per Employee					
	Private Banks		Public Banks		Foreign Banks		Private Banks		Public Banks		Foreign Banks	
	HDFC Bank	ICICI Bank	Punjab National Bank	State Bank of India	HSBC	Standard Chartered	HDFC Bank	ICICI Bank	Punjab National Bank	State Bank of India	HSBC	Standard Chartered
2011	6.53	7.35	10.18	7.05	12.22	13.46	0.07	0.1	0.08	0.04	0.23	0.26
2010	5.9	7.65	8.08	6.36	11.36	10.83	0.06	0.09	0.07	0.04	0.12	0.26
2009	4.46	11.54	6.55	5.56	9.62	9.72	0.04	0.11	0.06	0.05	0.16	0.24
2008	5.06	10.08	5.05	4.56	10.12	8.17	0.05	0.1	0.04	0.04	0.17	0.2
2007	6.07	10.27	4.07	3.57	9.8	9.24	0.06	0.09	0.03	0.02	0.14	0.2
2006	7.58	9.05	3.31	2.99	9.76	8.37	0.07	0.1	0.02	0.02	0.12	0.15
2005	8.06	8.8	2.77	2.43	8.53	7.86	0.09	0.11	0.02	0.02	0.1	0.12
2004	8.66	10.1	2.28	2.1	8.21	7.8	0.09	0.12	0.02	0.02	0.06	0.13
2003	8.65	11.2	1.96	1.91	6.23	4.81	0.1	0.11	0.01	0.01	0.05	0.25
2002	7.78	4.86	1.68	1.73	5.96		0.1	0.05	0.01	0.01	0.05	
2001	6.43	8.15	1.42	1.37			0.09	0.1	0.01	0.01		
2000	9.22	8.3	1.06	1.11			0.1	0.11	0.63	0.01		
1999	5.22	5.14		0.94			0.1	0.07				
1998	4.6	4.2	0.76	0.75			0.1	0.08	0.01	0.01		
1997	3.61	3.74	0.65	0			0.08	0.09	0			

Source: Capital Line

and awareness of cross selling but later when they arrived on Core banking System (CBS) platform they started picking on selling various other financial and insurance products to their customers hence giving boost to their non- interest income. Profit per employee has shown remarkable growth from.02 to.08 from 2006 to 2011 in case of PNB who led the PSU pack as taken lead in computerization and tie-up with various Insurance companies for cross selling. By increase in non-interest income (fee revenue), banks had also shown remarkable growth in profit after taxes.

To support the primary data analysis similar related studies with respect to the hypothesis mentioned above has been conducted by different researcher in this regard which is discussed as follows.

A study by Vijay Kumar (2008-09) says that banks also make use of opportunity of cross selling to improve profitability and tapping untapped opportunities in retail segment as retail income continues to grow. There is an immense opportunity for the banks to raise the fee based income.

Mr. K V Kamath Chairman, ICICI Bank Ltd. Stated on cross selling at the time of ICICI bank and ICICI Ltd merger. He has shown how ICICI can really compete with international giants like HSBC and Citigroup, which have bigger clout and financial muscle. The statistics show that the merged entity will have a combined customer base of ten million(six million bond customers and rest bank customers), 390 ATM's, 150,000 credit card holders, 536 bank branches, 500,000 Internet banking accounts, seven distribution channels an head count of 8,300 employees. He further added that one of the biggest advantages stemming from the new merger will be the ability to cross sell a slew of retail products, such as housing loans, car loans, personal finance and credit cards, reducing that share of projects loans from 70 to 50% of the business,. "Further, the merged entity will be able to compete with any threat from global players I see coming to India, he says, as if he had won the war before it began.

According to him, "This merger will awaken wannabe universal banks in to action. It's now or never for the global banking giants (HSBC and Citigroup) to push them in the Indian retail market. Now they will find it impossible to penetrate into the domestic market."

MANAGERIAL IMPLICATIONS

The research has been able to generate useful implications for the bankers. Banks can improve their efficiency by structured and scientific approach towards cross selling through implementation of CRM tools. Desired results can be obtained by training staff on various products and close tracking on sales process. It will provide employee an opportunity to upgrade themselves in other products, hence increase their efficiency an also give higher employee morale.

Cross selling by using CRM tools will help in creating an environment wherein Customer would be getting his entire requirement fulfilled under one roof hence having strong bonding. In the process bank earning would be increased with same resources hence increase in profitability.

It also helps bank in understanding customer better helping bankers taking credit decision faster.

LIMITATIONS AND FUTURE RESEARCH

Limitations of scope with respect to sample survey, sampling area, sample size, types of banking services setup and number of external variables considered exists. Public bank officials had apathetic view in the survey because of overburdening of tasks and could not spare adequate time for responding to questionnaire. Therefore the sample size was relatively less for public sector banks as compared to private and foreign banks. Demographic, psychological and business analysis of customer data has not been incorporated at

this stage which has an important relevance with respect to understanding the effectiveness of CRM system and cross sell. Banks do not have any scientific method of evaluating the implication of cross selling. CRM implementation is still in nascent stage except Private/Foreign and leading PSU banks. Banks generally uses their in-house software/technique for CRM implementation instead of using dedicated structured software for same.

Future research can aim to widen the scope of research in terms of the widening the sample size, geographic area. Some further studies can be carried out on Likert scale to design the factors associated with the effectiveness of CRM System and Cross Selling in changing Banking Scenario. Future studies can also be consider for some more external variables related to CRM tools and its measurement in cross selling for increasing the external validity and clinical significance of research.

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Chapter 22
A Game Theoretic Approach to Corporate Lending by the Banks in India

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ABSTRACT

A series of corporate loan defaults facing the Indian banks in the post-crisis period of 2008 led to the downgrading of India's global credit rating in 2012. Against this backdrop, this chapter delivers an insight to the reader into the games that occur between lending banks and corporate borrowers in addition to the games between the banks themselves in lending competition. The chapter covers various strategies of actions in the structures of bilateral monopoly, duopoly, and oligopoly, the Nash equilibrium, prisoners' dilemma, decision trees, and binomial analysis. In modeling the default probability, the profits of the lender and the borrower, a number of corollaries, one lemma, and one theorem are deduced in this chapter.

INTRODUCTION

An impoverished writer borrows money from several former college friends after finding himself unable to repay a debt. The debt takes on a circular nature where the creditors owe money to each other but the writer walks away (By Shibram Chakraborty, retold by Kaushik Basu to James Lemont).

The official perspective put forth by the economists of the Reserve Bank of India (RBI) towards non-performing loans is that political, economic, social, technological, legal, and environmental factors contribute to the problem of non-performing loans in the credit portfolios of banks in India. In the winter of 2003, the RBI articulated in a note of caution that the domestic banks need to take sufficient care in terms of framing appropriate lending policy such as to dare the borrower to default. This note of caution still remains relevant because a sharp deterioration of the loan quality of the major banks of India led to deterioration of India's global credit rating at the end of 2012. Hence, there is a need to analyze the different forms of actions and games of the banks and their corporate borrowers.

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BACKGROUND

Livemint and the Wall Street Journal (2013) reported:

1. Many of the infrastructure projects would reach their project completion deadlines from the next fiscal year onwards, the time when they are required to start making the loan repayments;
2. Outstanding bank loans to infrastructure firms rose to Rupees (Rs.) 6.9 trillion as of 31 December 2012, up from Rs. 5.96 trillion a year earlier; and
3. Growth of such credit slowed to 16% in the 12 months ending in December, 2012 down from 20.5%.

Dun and Bradstreet (2012) observed that many retailers on the supply side are slowing down their expansion plans and many real estate developers are falling behind schedules in their shopping mall projects due to the continuing credit crunch. The economic slowdown has deeply affected the Indian organized retail sector in terms of deceleration in retail sales growth, footfalls, store expansions, employment rates and, most importantly, profitability. Previously in a similar note, the Indian Express (2010) observed that: (i) the RBI hiked the risk weight on commercial real estate project loans to 1% from 0.4%; and (ii) there was more than a 40% increase in loans to commercial real estate, but side by side nearly 14% of commercial realty assets were restructured by banks.

CRISIL (2011) observed the number of defaults in real estate doubled in December 2011 over the previous year. In 2011, ICRA observed the following:

1. Historically banks have been taking exposure for state power projects as well as for independent power projects, but many banks are approaching the exposure cap on lending to the power sector;
2. Given the concerns hovering over the prospects of the sector itself, the pace of growth of credit to this segment could slow down. Standard & Poor's (2012) warned that India could become the first of the BRIC (Brazil, Russia, India, China) economies to lose its investment-grade status due to bad loans which continue to threaten growth prospects of the economy.

Considering the above dismal state of corporate lending business facing Indian banks, there is a need to reexamine the implications of different aspects of the games between the banks and their borrowers, and between the banks themselves as competing lenders.

OBJECTIVES

Against the backdrop of the loan default crisis mentioned above, this chapter is concerned with the economic analysis of the following aspects of the games in the lending business:

1. Success and failure in bargaining;
2. Cooperation and non-cooperation;
3. Strategies in duopolistic and oligopolistic structures;
4. Nash equilibrium;
5. Prisoners' dilemma; and
6. The probability of default.

EXTANT LITERATURE

The developments of literature on Game Theory in Economics in the past decade includes a few doctoral theses published by universities in the USA and Europe on topics such as the application of Game Theory to political and market institutions like Bouton (2009). These are collections of by-and-large mutually exclusive essays such as Yang (2011), Maredia (2010), Nayyar (2009), Pimienta

(2007) and Platz (2007). However, Gintis (2005) is an exception. Platz (2011) worked on cooperation with coalitions. Yang (2011) worked with, *inter alia,* coalition. Cooperation and coalition are applied to the Indian Bankers' Association (IBA), which is discussed in this chapter in the section titled "Bargaining" in the context of successful bargaining. Allen and Morris (1998) worked with, *inter alia*, asset pricing and heterogeneous prior beliefs.

Asset pricing is discussed regarding how the base rate obstructs loan pricing by causing failure in bargaining in the aforesaid section. Here, repeated interaction between the lender and the prospective borrower is considered. This is a case against Nayyar (2009) who explored how mutual help and cooperation are sustained through repeated interaction even when economic agents are completely self-interested beings. The shadow of heterogeneous prior beliefs is reflected in the Lemma deduced in the section titled, "Non-Cooperation and Cooperation." Gintis (2005) worked with the rational actor model which is applied throughout the chapter. The decision tree of Maredia (2010) is applied in the section titled "Nash Equilibrium." Pimienta (2007) employed equilibrium in non-cooperation which is applied in the sections "The Case of Duopoly" and "Nash Equilibrium."

Cooter and Ulen (2004) applied Game Theory to Law and Economics in the topic 'Settlement Bargaining'. It received succinct treatment in the context of the lender-borrower bargaining in this chapter. In the previous decade, Allen and Morris (1998), Pindyck and Rubinfeld (1995), Shy (1995), and Gibbons (1992) are among the concise works. Shy (1995) is noteworthy in the context of imperfect market structures. Imperfect market structures of duopoly and oligopoly are applied here to obtain several important findings. The advantage of the first mover and the two stage game in Shy (1995) are applied in this chapter in the section titled "Nash Equilibrium." Pindyck and Rubinfeld (1995) are applied to the "Prisoner's Dilemma." Similarly, Gravel and Rees (2004) are applied to bargaining. Gibbons (1992) dealt with strategies in imperfect market structures which are applied to lending business of the banks. Finally, Pindyck (2012) and Pindyck (2013) are unparallel in terms of depth, intelligibility and relevance to the topics in microeconomics such as the cost of new entry and the topics in financial economics such as the pricing of new investment options, respectively.

This chapter seeks to add to game theory literature via the analysis of the decision making processes of:

1. The banks which lend funds to the business community and compete with themselves in the lending business; and
2. The business community which borrows such funds from the banks. A similar but shorter description of existing literature on economic application of game theory is found in Das and Wong (2013).

BARGAINING

Economic games may be cooperative or non-cooperative depending on whether or not sellers make joint strategies. Negotiations are conducted regarding chargeable interest rates between lenders and borrowers. Cooperative games may be explained via the following example: If the cost of lendible funds, which includes deposit costs, etc., is 10% and the borrower is willing to pay up to 12%, both the lender and the borrower would be better off if the rate of interest charged on the loan is somewhere above 10% and below 12%.

The Case of a Private Borrower

The bargaining process in a bilateral monopoly model under the conditions of rationality and efficiency is described by Gravel and Rees (2004). The same may apply to the banks and their borrowers

in India. In India, banks must lend a minimum of 40% of the net demand and time liabilities (NDTL) (i.e., aggregate demand and time liabilities minus interbank deposits). For the banking industry as a whole, the proportion of loans continued over many years must be above 60% of the industry NDTL, in view of the risk averse attitudes of some of the banks who turn away from the financial markets and non-government borrowers. Subject to its objectives of the IBA via its website, the following assumptions of bilateral monopoly are necessary for building up a model of bargaining:

1. The IBA plays the role of the Union of the banks;
2. A bank participates in the bargaining on behalf of the Union;
3. On the borrowers' side, there is a venture capitalist firm as a monopolist in the product market;
4. The product of the above firm with its unique features is not produced by any other firm; and
5. There is no previous record or history of similar businesses.

Assumption 3 is derived from the fact that for a venture capitalist in India without any prior record of success, the cost of raising fund from the capital market may be too high; hence, the need to borrow from a bank. Assumption 5 implies that: (a) non-bank financial companies do not want to extend credit to the bank and; (b) the firm can approach only a bank for funds because of the social objectives of the banks in India. If Gravel and Rees (2004) is strictly followed with respect to the above loan, the profit function of the firm stands to be:

$\Pi_F = R(L) - C(L) = PQ(L) - iL,$

where

$R(L) = PQ(L)$,
$C(L) = iL$,
$R(L)$ = revenue function,
$C(L)$= cost function,
L = amount of loan,
i = interest rate to be paid by the firm,
P = price
s = fraction of the loan amount applied for, actually disbursed to the firm,
$1-s$ = proportion of the down-payment amount, and
Q = quantity sold.

However, this may not be relevant to the bargaining process. Rather, 'Π_F' may be defined to vary inversely with the interested rate 'i' as well as '1-s', because in an emerging economy it sounds quite plausible that a budding entrepreneur does not have much cash to start the business. Hence $\Pi_F = f(i, s)$, where the partial derivatives of Π_F with respect to 'i' and 's' are negative and positive, respectively. Since the non-satiation assumption works for 's', not 'i' the contour line in the i-s plane would be positively sloped for a fixed amount of profit from the firm's viewpoint provided the assumptions of completeness, transitivity, reflexivity and continuity hold here.

The profit function of the bank with respect to the loan is

$\Pi_B = (i - r')*sL + i(1-s)L,$

where r' = reverse repo rate – this is the rate at which the bank park their funds with the RBI. It is the lowest in the fund market.

The above objective function implies that for every one unit of the disbursed loan amount, the bank charges an economic rent 'i-r'' and for the amount of loan not delivered at all, it charges the monopoly interest rate 'i'. The non-satiation assumption here holds only for 'i', not 's', while all other five assumptions those hold for 'Π_F', hold for 'Π_B' also. For any fixed Π_B the contour line

of the alternative sets of 'i' and 's' would be a positively sloped line. If 'i' and 's' are somehow fixed to be constants and the firm refuses to accept the fractions 'i' and 's', it must stop production.

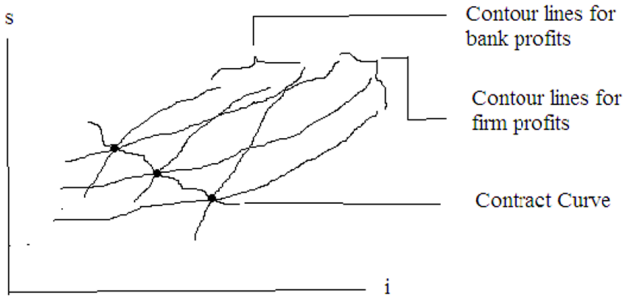
Similarly, the bank must also shut down the lending business if it sticks to a particular combination of 'i' and 's'. Regarding continuity of the businesses, both parties must reach some agreement via adjustment of these two fractions. Here, both of the parties have positively sloped contour lines for different levels of profit, but the magnitude of the slope would differ depending upon the magnitude of the marginal rate of substitution of 'i' for 's' (Figure 1). Again, the slope is likely to increase less for every consecutive equal increase in the interest rate in the case of a lender than it is in the case of a borrower due to the differences in the exact forms of the two objective functions. An intersection between the two is a point of possible agreement. Once the agreement is reached, it is stable because of the legal procedure which follows. The contract curve denotes the set of possible agreement points for consecutive higher and higher levels of profits.

If the bank treats 'i' and 's' as constants, there may be no loan agreement and in that case the entire amount 'L' may need to be lent to the RBI at the rate 'r″'. As a case for failure in bargaining, the simple bargaining model in Varian (1992) may apply to the sellers and buyers of funds. Banks prefer to deploy some deposits for one year. Keeping in mind the cost of funds, the bank expects a minimum return of r1 per annum from a borrower with some specific credit profile (i.e., AA+). This is the bank's reservation price of funds for AA+ borrowers. Taking all borrowers across the credit ratings, the minimum reservation price is called the base rate (Reserve Bank of India, 2010). However, every prospective rational borrower (henceforth 'she') is willing to pay a maximum cost for funds which is her reservation price given the return from her business or income from her profession. Both parties are aware of each other's reservation price. The bank has knowledge about the returns from various businesses and incomes from various professions and the rates charged by other banks to similar borrowers. The bargain revolves around the spread between the above two reservation prices denoted by 'ψ'. She places a request for loan with the manager of a bank branch where she has a current or savings account.

The manager initially may quote a higher rate than the base rate. She may attempt to depress the rate to a level close the base rate. If she further attempts to bargain down, the manager may make a take-or-leave offer and the bargaining process ends without any result. From start to finish, the entire process may take more than one visit to the branch. If they cannot reach any conclusion after several visits, the loan does not occur. But, owing to the time value of money, inflation etc the spread is being continuously discounted.

Being a rational entity, banks do not wish to retain idle funds. The bank discounts the spread

Figure 1. Contour lines and contract curve



at a daily rate 'i1' and she discounts it at a daily rate 'i2'. If, on the first meeting, the parties did not agree on the loan, the manager retains the idle fund. The present value of the spread for the next day is ψe^{-i1}. This is available to her on the next day to share with the manager provided the bargain leads to lending. But the present value of the spread from her view point is ψe^{-i2}. If she feels the market liquidity condition to be comfortable (i.e., $i2 < i1$), she may go to another bank because she will not accept the position $\psi e^{-i1} < \psi e^{-i2}$. However, if the market is suffering from a liquidity crisis, she may agree to borrow. But even if the manager feels a lack of demand for funds owing to comfortable market liquidity, he can not offer a higher spread than ψ by offering a rate below the base rate. The base rate works as a constraint on the bargaining process. It imposes a downward restriction on the price discovery process in the loan market.

NON-COOPERATION AND COOPERATION

An example of non-cooperation may be non-cooperation between the Indian banks and many of the loan applicants from amongst retailers and real estate developers during economic slowdown. The reasons behind such slow down can include:

1. The rigidity to lend in fear of further default on part of the banks as per Dun and Bradstreet (2012);
2. The banks' existing burdens of nonperforming loans as per Fontelana-Khan (2011); and
3. Hike in the risk weight by the RBI on credit to the real estate industry as per Press Trust of India (2005). Such rigidity led to the above mentioned non- cooperation.

From the viewpoint of a prospective corporate borrower, whether the lending official in the bank would cooperate or not depends on the performance of past loan assets of the bank and the credit risk for the relevant industry. When the borrower is a businessman, the loan repaying capacity depends on performance of his business. If it is project finance, there may be information asymmetry between lenders and borrowers regarding the performance of the project at the time of the loan disbursement.

Depending upon the degree of uncertainty in the business, the expected return from the loan or the yield of the loan would vary. A real estate developer's repaying ability depends on the stream of revenues generated from selling office space or apartment. In the state of falling property prices, as reported by Orange (2008), a bank would expect a higher rate of return from the loan and accordingly set the Equated Monthly Installment (EMI) in order to enhance the present value of the future payments although the borrower would prefer a lower EMI. These contrary preferences would lead to obstacles for cooperation. This may be explained with a Lemma after proving it by contradiction.

Lemma: In the state of low demand in any industry, the preferences regarding the amount of EMI contradict between a bank and a corporate borrower in that industry.

Axiom: 'p' is probability of the property market experiencing falling demand and '1-p' is the probability of the property market not experiencing the falling demand.

Proof of the Lemma: If property demand is declining, the value of the future payments to the lender is nV; otherwise it is V, where $n < 1$. The bank official would approve the loan application if the expected value of the future payments is at least equal to V, i.e. $(1-p)V + pnV = V$, i.e. $1+p(n-1) = 1$, i.e. $p(n-1) > 0$, this is possible when $n > 1$. This contradicts the original assumption.

The following are applications of pure strategy, the Nash Equilibrium, maxmin strategy, mixed strategy, sequential game, decision tree, commitment and threat in a duopolistic structure and the

Prisoners' Dilemma in an oligopolistic structure in Pindyck and Rubinfeld (1995) to the strategies of the lending banks.

THE CASE OF DUOPOLY

Deviation from Perfect Competition

Abstraction from the homogenous-product assumption may enable the duopoly model to apply to either of wholesale loan market or retail loan market. It may be supposed there are only two banks in the wholesale loan market – X Bank and Y Bank. One bank is offering low-interest-rate-option-free loans and another bank is offering high-interest-rate loans with foreclosure option. If the banks have any tacit agreement between them, they may not enter each other's market, but when they do not have any and each gets the information that its product is being offered by the other, the situation is similar to the one described in Table 1. The X Bank offers low-interest-rate-option-free loan and the Y Bank offers high-interest-rate-loan with foreclosure option.

If the X Bank chooses to offer the product of the Y Bank, the X Bank's additional profit out of the loan increases to five (5), similar to the case of Y Bank. Hence, there are multiple best options in the cells containing the numerical figures (5, 5) for each bank given what the other bank is doing.

NASH EQUILIBRIUM

The Concept of Nash Equilibrium

The Nash Equilibrium is a concept of game theory in which the optimal outcome of a game is one in which no player has an incentive to deviate from her or his chosen strategy after considering the choices of opponents. Each competitor is assumed to be rational. There may be a single *Nash Equilibrium,* double *Nash Equilibriums* and multiple *Nash Equilibriums*. Table 1 describes double *Nash Equilibriums.*

The Case of the Maxmin Strategy

This strategy may be derived from the assumption of rationality in the Nash Equilibrium. Sometimes Bank X may behave rationally and expect Bank Y to do the same. Bank X may categorize actions as 'right' or 'wrong'. Bank X may consider lending with due diligence to be the 'right' action and lending liberally to the customers having long term banking relationship to be 'wrong' because choosing the 'right' pays maximum and choosing the 'wrong' pays the minimum. However, the RBI established strict rules for the banks lending to the real estate sector (Economic Times, 2011). Bank X expects the considerations for 'right' and 'wrong' on part of Bank Y to be similar. In Table 2, Bank X gains 2 after choosing 'right' whether

Table 1. Additional Profit out of Loan

		Y Bank	
		Low-Interest-Rate-Option-Free-Loan	*High-Interest-Rate-Loan with Foreclosure Option*
X Bank	*Low-Interest-Rate-Option-Free-Loan*	3, 3	5, 5
	High-Interest-Rate-Loan with Foreclosure Option	5, 5	3, 3

Table 2. Additional profit out of loan: Maximin Strategy

		Y Bank	
		Right	*Wrong*
X Bank	*Right*	2, 3	2, 5
	Wrong	1, 3	3, 5

the Y Bank chooses the 'right' or the 'wrong' and gains more in case Bank Y chooses 'wrongly'. However, after choosing 'right' or 'the 'wrong' Bank Y gains uniformly irrespective of what Bank X chooses, but Bank Y gains relatively more by choosing 'wrong'. Though Bank X believes that choosing 'wrong' provides minimum gain, in an attempt to maximize the minimum it chooses 'wrong'. The numerical figures in the bottom right cell constitute the *Nash Equilibrium*.

Mixed Strategy

The strategies in Table 1 and Table 2 are called "pure strategy" because a bank chooses only one action, say, either of 'lending with due diligence' and 'lending liberally' or, either of 'low-interest-rate-option-free-loan' and 'high-interest-rate-loan with foreclosure option'. But, there may be cases in which a bank prefers to choose a mix of both actions. Suppose the banks are operating in the housing loan market where the loan must accompany property insurance. Hence, both the banking product and the property insurance product are sold under the same roof of a bank (e.g., the new generation private sector banks such as ICICI Bank and HDFC Bank assign general insurance business targets including property insurance business to their banking staff and some fast improvising public sector banks like the State Bank of India gives a property insurance agency to some of its banking staff).

In the context of this chapter, it may be assumed that both Bank X and Bank Y sell the housing loan product as well as the property insurance product. Bank X would obtain maximum advantage if it can sell a property insurance product to a borrower to whom it is going to deliver a housing loan product, but will not object if its borrower buys the property insurance product from Bank Y. The situation is described in Table 3 and Figure 2.

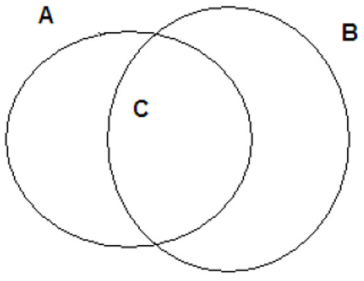
Here both the competitors would prefer the cells – top right and bottom left together. There is no Nash Equilibrium in pure strategies such as Table 1 and Table 2. This is called a "mixed strategy" because the expected additional profit to a bank from each business is the probability-weighted average of two combinations – in one of which the other business is also combined. Here, one may explore the probability such as 'the probability that a customer would choose Bank X out of the two banks for a loan.

Here 'A' indicates the selling of a housing loan product with or without selling any property insurance product by a bank. 'B' means selling a property insurance product with or without selling any housing loan product by a bank. 'C' means selling of both products by a bank.

Table 3. Additional profit out of loan and/or insurance: Mixed strategy

		Y Bank	
		Housing Loan	*Property Insurance*
X Bank	*Housing Loan*	5, 3	7, 4
	Property Insurance	7, 4	2, 1

Figure 2. Venn diagram



A Practical Example

If two banks are ready to sanction housing loan for approved projects like Godrej Prakriti, the above game may happen (Commonfloor, 2013).

Axiom I: There is a probability of 0.67 that a customer would approach Bank X for a loan and hence the probability of 1 - 0.67 = 0.33 that a customer would approach Bank Y for the same loan[1].

Axiom II: There is a probability of 0.45 that a customer would approach Bank X for a property insurance product and hence the probability of 1-0.45 = 0.55 that he would approach Bank Y for the same[2].

Corollary I: The expected additional profit to Bank X from selling a property insurance product is 2.4.

Proof of Corollary I: Here, there are two outcomes in total in the selling of a property insurance product by Bank X: (i) additional profit of '7' from selling of a property insurance product with selling a housing loan product; (ii) additional profit of '2' from selling of a property insurance product without a housing loan product. The probabilities of selling of a housing loan product and a property insurance product by a bank are independent of each other. Hence, the joint probability of selling of a housing loan product and a property insurance product by Bank X equals 0.67 x 0.45 ≈ 0.3 and the probability of selling of a property insurance product without a housing loan product by Bank Y equals 0.45 x 0.33 ≈ 0.15. The expected additional profit of selling of a property insurance product by Bank X equals (0.3x7) + (0.15 x 2) = 2.4.

Corollary II: The expected additional profit to Bank Y from selling a property insurance product is 0.87.

Proof of Corollary II: Using the logic in Corollary I, one may find that the joint probability of selling of a housing loan product and a property insurance product by Bank Y equals 0.33 x 0.55 ≈ 0.18 and the probability of selling of a housing loan product without a property insurance product by Bank Y equals 0.33 x 0.45 ≈ 0.15. The expected additional profit of selling of a property insurance product by Bank Y equals (0.18x4) + (0.15x1) = 0.87.

Corollary III: The expected additional profit to Bank X from selling a housing loan product is 3.95.

Proof of Corollary III: There are two outcomes in total in the selling of a housing loan product by Bank X:

1. Additional profit of '7' from selling of a property insurance product with a housing loan product;
2. Additional profit of '2' from selling of a housing loan product without property insurance '5'.

The joint probability of selling of a housing loan product without selling a property insurance product is 0.67x0.55 ≈ 0.37. The expected additional profit to Bank X from selling a housing loan product is (0.3x7) + (0.37x5) = 3.95.

Corollary IV: The expected additional profit to Bank Y from selling a housing loan product is 1.46.

Proof of Corollary IV: There are two outcomes in the selling of a housing loan product by Bank Y:

1. Additional profit of '4' from selling of a property insurance product with a housing loan product;

2. Additional profit of '2' from selling of a housing loan product without property insurance '3'.

The joint probability of selling of a housing loan product without selling a property insurance product by Bank Y is $0.33 \times 0.45 \approx 0.37$. The expected additional profit to Bank Y from selling a housing loan product is $0.18 \times 4 + (0.37 \times 2) = 1.46$.

The 'Tit for Tat' Strategy

In a duopolistic arrangement, the banks in a housing loan market may try to undercut each other by lowering the interest rate. In the first round of the game, the bank setting a lower interest rate than its rival may earn short term profit, but if the game is repeated an infinite number of times, the rival also would do the same and the short run profit may vanish. This is called the 'Tit for Tat' Strategy.

The Sequential Game and the Decision Tree

When the two banks are not in collusion, they may assume the other would do its best but itself would benefit if it takes the first move. There are two retail housing loan products on demand – one with a 10% down-payment and a 12% interest rate (let 'Ω' denote this product) and another with a 15% down-payment and an 8% interest rate (let 'Θ' denote this product). Each product would maximize the profit of only one Bank. Both banks believe that whoever would first introduce one of the above two products would earn more profit from that product than would the other; hence, each bank chooses to respond to the other Bank by launching the other product. If Bank X launches Ω, Bank Y instantly responds by launching Θ. This is called a "sequential game" because of this instant response from the competitor. If it occurs in multiple rounds, the sequences would be similar. This may be explained using the decision tree in Figure 3.

In response to one rival, if the other introduces the same product, both lose. But in response one rival when the other launches its best product both gain. For Bank X, launching Ω first gives maximum profit of '5', whereas for Bank Y launching Θ in response to the action of Bank X provides the maximum profit of '3'. A bank decides on its move looking at the pay-off to it in the end of the game. This is called "backward calculation" and this form of the game is called the extensive form of the game (Pindyck & Rubinfeld, 1995, p. 470).

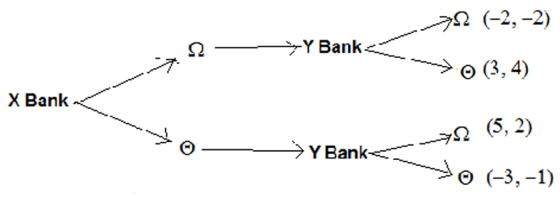
Commitment

The game in Figure 3 reveals that if a bank responds to the move of the other by launching the same product, a loss occurs. Hence, each bank commits itself to launch the other product in response. Such a commitment by one bank is fruitless unless the other believes it. Therefore, a bank should consider some strategic move such as advertisements in national daily publication which occupies a large space in the front page of the newspaper or in the top rated television channels.

Threat

Some actions of one player may work as a threat to the other. If Bank X has already launched product Ω, it is a threat to Bank Y in the case where Bank Y wishes to retain the down-payment at a level of 10% because then Bank Y has no other option to lower interest rate below 12%. If Bank Y charges a rate of interest higher than 12%, it would simply be out of the industry.

Figure 3. Sequential game



PRISONERS' DILEMMA

A detailed concept of the Prisoners' Dilemma is provided by Kuhn (2007).

The Prisoners' Dilemma in an Oligopolistic Structure

Stories of the water meter and airlines industries (Pindyck & Rubinfeld, 1995, p. 467) may resemble that of the Indian banking industry in that the lending business of the public sector banks was almost threefold that of the private sector banks during the financial year 2011-2012 (Reserve Bank of India, 2012). The ratio remained the same in the previous financial year. This consistency may act as a barrier to the entry of a new private sector bank. In this circumstance, the Indian public sector banks may cooperate and divide the market between themselves. However, if they chose competition in lieu of cooperation they may earn only a modest profit. Thus one may consider the Prisoners' Dilemma among these banks.

The Issue of Predatory Pricing

Recently, the RBI approved the entry of serious corporate players into the banking industry (Prasad, 2013). A major policy departure by the State Bank of India by offering zero balance savings accounts may be conceived as predatory pricing with a view to discourage the entry of well-established corporate houses to the banking business (Kurain, 2013).

The Prisoners' Dilemma and the Lender-Borrower Game

Following the symmetric 2x2 Prisoners' Dilemma with ordinal payoffs in Kuhn (2007), one may conceive a game between a lender and a borrower. There may be two cases of cooperation in this case:

1. The borrower is steadily paying the EMIs and the lender is happy – this is the case of a borrower with the top most score given by the CIBIL (Credit Information Bureau (India) Limited, 2013);
2. The borrower defaults and both parties agree to go for a loan restructuring (Alexander & Antony, 2012).

There may be three cases of non-cooperation when the borrower defaults;

1. Only the borrower disagrees to any loan restructuring;
2. Only the lender disagrees to any loan restructuring and
3. Neither agrees to a loan restructuring.

One may substitute

1. 'Lender' with 'Row,
2. 'Borrower' with 'Column',
3. 'Default' with the term 'Defect',
4. 'R' with the term 'Gain' or 'G' and (v) 'P' with the term 'Loss' or 'L'.

One may interpret 'T' as temptation of not cooperating alone and 'S' as surplus generated out of cooperating alone. Thus may be obtained the pay-off matrix in Table 4.

The pay-offs are ordinal (i.e., comparable with respect to being less or more), but the exact amount or quantity thereof cannot be known. There may be alternative situations of the Prisoners' Dilemma given:

Table 4. The lender-borrower game

		Lender	
		Cooperate	*Default*
Lender	*Cooperate*	G, G	C, D
	Default	D, C	L. L

- **Strict Inequality:** $D > G > C > L$, in this case where defaulting is a strictly dominating strategy when the present value of the collateral mortgage is less than the present value of the exposure at default (i.e. outstanding loan). There is no need to assume any other loan covenant except a collateral mortgage. When the present value of the collateral mortgage is more than the present value of the exposure at default, the strict inequality is $C > D$ (i.e. cooperation is the strictly dominating strategy).
- **Weak Inequality:** $D \geq G > L > C$, when the present value of the collateral mortgage is equal to the present value of the exposure at default defecting may be weak strategy as a dominating strategy.

THE ISSUES

In the context of the above game, it is interesting to discuss the issues raised by the Faculty of Management Economics (2013).

The Issue of Zero-Sum Game

The above game can be a zero-sum when there is no collateral mortgage (i.e., default would benefit the borrower at the lender's cost and vice versa*)*. If the outcome is the upper left cell of Table 4, it is a positive sum game. If the outcome is the lower right cell, it is a negative sum game. If the outcome is any other cell, with the presence of collateral mortgage, depending on net loss or net gain it may be a positive or negative sum game.

The Issue of Safest Strategy

If each player suspects that other would defect, it would have the preference $C > D$. If both the players think identically, cooperation would become the safest strategy.

The Issue of Nash Equilibrium

If the present value of the collateral mortgage is equal to the exposure at default, none can increase its pay-off unilaterally. Then, every player would choose the safest strategy. As a result, the upper left cell would be the Nash Equilibrium.

The Issue of Collateral Mortgage

If the borrower chooses to cooperate, there is no need for any collateral mortgage and it becomes a positive sum game. But if there is no room for any collateral mortgage in the prevalent legal frame, each party may choose to defect and it will be a zero sum game in the case of lending.

Binomial Pricing

In line with Hull (2009), using a binomial tree the steps starting from the delivery of retail housing loan up to the payments of EMIs or default by the borrower may be analyzed in order to calculate the probability of not defaulting by the borrower.

Axiom I: A bank has sanctioned the loan because it has a positive net present value after summing up the future stream of payments of EMIs discounted by a risk free rate of return (e.g., the yield of the 10-year government security) and then deducting the loan amount from the above mentioned sum.

Axiom II: A bank's wealth is the total market value of all the physical and intangible assets of the entity minus the debts (Investopedia, 2013). In a risk neutral framework with a risk free interest rate, the magnitude of the bank's wealth should continuously change in order to wipe out any opportunity for arbitrage.

Axiom III: The lending bank parks the repayments instantly at the above risk free return such that the total wealth of the bank increases over a period with the receipt a scheduled EMI. If the borrower defaults such payment,

the total wealth of the bank decreases. In the case of not defaulting by the borrower, the wealth of the bank increases to an extent of the net present value of the investment of the repayment amount.

Theorem: The probability of not defaulting is strictly greater than zero and strictly less than unity.

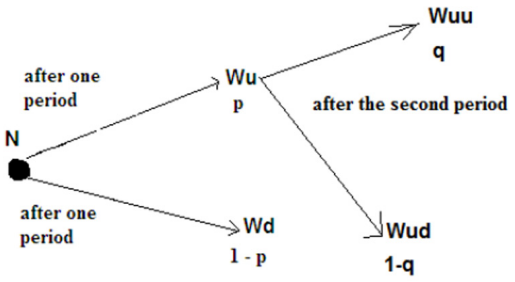
Proof of the Theorem: Suppose 'N' is the wealth of the bank at the time of disbursement, 'p' is the probability of the wealth of the bank being 'Wu' if the borrower does not default (i.e. pays the first EMI and '1-p' is the probability of the wealth of the bank being 'Wd' if the borrower defaults the first installment). The situation is described in Figure 4.

The probability weighted sum of the probable values of the weights should equal the initial net present value (i.e., N = p Wu + (1-p) Wd). The solution for p = {(N-Wd)/(Wu – Wd)}. Here Wu > N because Wu includes investment gains. Therefore, $0 < p < 1$. The analysis may be extended to the second period where there are two cases.

Case I: 'q' is the probability of not defaulting by a borrower in the second period who did not default in the first period. In this case, the wealth of the bank increases to 'Wuu' at the end of the second period to an extent of the net present value of the investment of the second equated monthly installment at the above mentioned risk free interest rate.

Case II: '1-q' is the probability of his default in the second period provided he did not default in the first period. In this case, the wealth of a bank would stand at 'Wud' at the end of the second period. Here, one may calculate 'q' by solving the equality Wu = q Wuu + (1-q) Wud.

Figure 4. Binomial tree



CONCLUSION

This chapter analyzed the decision making processes of:

- The banks which lend to businesses; and
- The business community which demands funds. In the process, this chapter demonstrated that game theory provides insight into the strategies of the lending banks and their corporate borrowers.

In this chapter:

1. The contract curve of the possible points of agreement between a lending bank and a borrower in the bargaining process under the bilateral monopoly frame has been derived;
2. It is observed that
   a. The base rate stipulated by the Reserve Bank of India works as a constraint on the bargaining process between the lender and the borrower by imposing a downward restriction on loan-pricing, and
   b. the Indian public sector banks may cooperate and divide the market among themselves, but if they chose competition in lieu of cooperation, they may earn a modest competitive profit only;
   c. A lemma indicating that contrary preferences of a bank and a potential

borrower may lead to obstacles for cooperation has been derived;

d. The possible location of *Nash Equilibrium* under the assumption of rationality in a duopolistic set up where a bank behaves rationally and expects rational behavior from its competitors is detected;
e. The process of earning of additional profits by the competing banks from lending business by formulating mixed strategies of selling property insurance along with property loan and undercutting each other in similar businesses has been explained;
f. In the duopoly frame the calculation of pay-offs to the banks has been demonstrated when both the banks believe that whichever would first introduce one of the above two products would earn more profit from that product than would the other; hence, each bank chooses to respond to the other bank by launching the other product;
g. The possible strategies of cooperation and defection have been pointed out in the context of *Prisoners' Dilemma* in the lender-borrower game highlighting the role of collateral mortgage; and finally
h. In the binomial pricing model the probability of loan default has been deduced from the relevant axioms.

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KEY TERMS AND DEFINITIONS

Bargaining: Negotiating regarding price between buyer and seller.

Decision Tree: A way of depicting the decision making process in the form of a network whereby one can make a prior estimate of pay-off of every alternative decision.

Dominant Strategy: It is one of the alternative strategies (i.e. courses of actions) that is expected to yield the highest pay-off.

Duopoly: Any market with all characteristic features of perfect competition but only with two sellers.

EMI: Equated Monthly Installment.

Maxmin Strategy: The strategy that is expected to pay the maximum of the minimum pay-offs from other alternatives.

Mixed Strategies: It is the expected or probability-weighted sum of pay-offs from two or more alternative strategies.

Nash Equilibrium: It is that strategy, which has been chosen to be executed with any deviation from the same.

Oligopoly: Any market with all characteristic features of perfect competition but with a limited or few number sellers.

Prisoner's Dilemma: It is a famous simile to describe the process of deciding whether to cooperate or not by two players in a game.

Pure Strategy: It is the opposite of mixed strategy. It is described in terms of the pay-off from this only.

RBI: Reserve Bank of India.

ENDNOTES

1 This may well apply to the HDFC Bank because of lower interest rate in comparison with the ICICI Bank (Roongta, 2009).

2 This assumption is plausible because the HDFC Ergo, the property insurance subsidiary of the HDFC Bank had less premium income in 2012 than did the largest general insurance provider ICICI Lombard, a subsidiary of the ICICI Bank (Akanksha, 2012).

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Chapter 23
Money Supply:
Predictive Analytics in India

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ABSTRACT

Money supply is nowadays expected to contain precise, comprehensive, and real-time information about the macroeconomic system to facilitate decision making of the Central Bank. Because money supply, as driver or driven, is linked from time to time to several other variables like inflation, it touches every lair of civil society and politics. An important aspect of understanding such information is to identify other variables and their interrelations with money supply and the models to quantify and predict the same. This chapter covers various facets and issues of modeling and forecasting money supply in India in a comparative tone between pre- and post-crisis periods.

1. INTRODUCTION

Money supply is a matter of interest to Central Bankers as also economists. There are economists both inside and outside the Central Banks. Sometimes they agree, sometimes there is discord. But nevertheless, from both the view points of academics and administration, the literatures of monetary economics and monetary policy cannot dispense one with another in the process of

1. Defining and measuring money supply,
2. Examining the existing literature on money supply against Indian backdrop,
3. Ascertaining the mode of determination of money supply,
4. Examining the econometric tools in understanding the relationship between money, output and prices,
5. Detecting the endogeneity of money supply, and
6. Dealing with the emerging issues in forecasting money supply in the post crisis period.

2. BACKGROUND

Evolution of models involving money supply as macroeconomic variable in the forms of policy variable as well as target variable in India since early 1970s till today is by and large linked to the development of econometric literature in the

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West. The issues dealt with by those models vary between pre-crisis period and post crisis period. The post crisis period witnessed the emerging issues of liquidity management and deviation from mainstream literature on money supply. Using chronologically classical regression models and time series analysis consisting of co-integration and Granger causality, the above models try to discern measurement and components of money supply and the feedback between money supply, price and output from both sides following orthodox literature except for a few, which expressed interest towards structuralism.

3. MAIN FOCUS OF THE CHAPTER

This chapter would focus on application of econometric methodologies of measuring money supply and relationship between money, price and output in line with the diverse issues cropping up from time to time.

4. DEFINITION AND MEASURES OF MONEY SUPPLY

Indian economists use the terms 'money', 'money supply' and 'money stock' synonymously. The literature on definition of money supply reflects intellectual discourses and dialogues among economists, which need concrete shapes in the form of measures of money supply, because concrete measures of money supply are more useful than abstract concepts for the purposes of modelling and forecasting.

The Reserve Bank of India (RBI) is following the simple sum procedure of measuring money supply in its compilation of monetary aggregates. The RBI publishes data on M_1, M_2, M_3 and M_4 and not on the Divisia index. Here

M_1 = currency with public + demand deposits with the banking system + other deposits with RBI;

M_2 = M_1 + saving deposits with post office savings banks;

M_3 = M_1 + time deposits with the banking system; and

M_4 = M_1 + all deposits with post office savings banks excluding National Saving Certificates.

For forecasting purpose one has to work with whatever information is available. The evolution of the components of the monetary aggregates from time to time reflects that the classical regression technique will not be able to serve the purpose of long run forecasting, because explanatory variables are changing over time. In this context the ARIMA model having the quality of temporal stability can be more useful. A careful perusal of the literature on money supply would reveal that the number of factors affecting money supply is increasing side by side with progress of research in the field. So there may be other factors also, which are so far not discovered or yet to be discovered like simply seasonal cycles in the demand for credit on part of the business community. Existing basic and advanced literatures on time series econometrics like Enders (1995), Patterson (2000), Pindyck and Rubinfeld (1998) and Gujarati (2003) suggest that if requisite data are not available for the variables affecting money supply or all the variables affecting money supply are not known then it is difficult or impossible to explain the movement of money supply using a structural model. Estimation of such a model for money supply may result in so large a standard error as to make most estimated coefficients insignificant and the standard error of forecast unacceptably large. A statistically significant regression equation for money supply may not work out for forecasting

purposes, because after running such regression one has to forecast the explanatory variables, which may prove more difficult than forecasting money supply.

5. AN OUTLINE OF EXISTING LITERATURE ON MONEY SUPPLY

As per the researchers on monetary economics, a detailed account of the changing role of money from Walrasian and Non-Walrasian settings to the more recent theories on the dynamics of the relationships between money, inflation and growth with reference to their historical evolution are available in Friedman and Woodford (Eds.) (2011) and such type of theoretical work did not happen in India. There is a tendency among the Indian researchers to apply the theories developed abroad to up to date empirical data in econometrics models and then, with the help of econometric techniques and compare the results. For example Dash and Goal (2001) applied the theory of Foster (1992) and Chona (1976) applied the theory of Ahrensdorf and Thasan (1960).

In the tune of Krishnamurty (2002), as could Soumya and Murty (2005) be interpreted, the issues emerging from the shift from net domestic assets to net foreign assets on resources side of the monetary base in the wake of financial liberalization and the ensuing changes in the monetary policy i.e. relying more on market based direct measures than on direct monetary controls had been addressed by modelling money supply process in India, e.g. Rath (2001) and Nachane (2001). The latter discussed the impact of liberalization on monetary policy and the link between monetary base and money supply during the post reform period. Models in these works, which, in the language of Krishnamurty (2002), "are large, dynamic, incorporate better inter-dependence of sectors compared to many of the earlier models and attempt to incorporate change in policy regime," and in the language of Bhide (2001) "are those that clearly capture the new policy regime where the prices are market determined, role of public sector is limited to a few sectors and monetary policy becomes independent of the fiscal stance."

6. THE GREAT DEBATE AS TO DETERMINATION OF MONEY SUPPLY IN INDIA

Academics reported that - there were two approaches to money supply determination in India: balance sheet or structural approach and money multiplier approach; the former focused on individual items in the balance sheet of the consolidated monetary sector in order to explain changes in money supply and the latter focused on the relationship between money stock and reserve money; the money multiplier approach emerged strongly as a critic to the balance sheet approach; between January 1976 and January 1978 there was reportedly a hot and rich debate between two groups of researchers, one group led by Gupta who believed in the money multiplier theory, the other group of RBI economists, who were not accepting this theory; the debate gave rise to a number of research papers where mostly regression techniques were used to estimate and forecast money supply function; Bhattacharya (1972), Gupta (1972) and Marwah (1972) used regression techniques to estimate money multiplier in India four years before the debate took place.

In Swamy (1976), the multiplier approach to estimation and analysis of sources of high powered was found for the first time as a monetary model, developed in the context of India. The person to understand importance and applicability of above model in India after Swamy was S.B. Gupta, who admitted his sincere perusal of Swamy's thesis in Gupta (1976b). Gupta's work on monetary modelling before 1975, like Gupta (1973) did not speak of his awareness of the development of this model in monetary literature abroad. Again Gupta (1976a) had certain loopholes. He made

contradictory statements – one in fourth paragraph of p. 125 and another in the first paragraph of p. 126. In the fourth paragraph of p. 125 he tells that banks' credit to government reallocates money supply in favour of government leaving total money supply unchanged, whereas in the first paragraph of p. 126 he told, if government securities comprised a major chunk of assets in the banks' asset portfolios then the reserve ratio would come down and money supply would go up since variations in reserve ratio influenced money multiplier adversely. Without rectifying the contradiction Gupta (1976a) reportedly took the Ministry of Finance, Government of India (GOI) to task when the latter declared government borrowing from banks and government borrowing from RBI substitutable in Economic Survey 1973-74. Gupta (1976a) repeated the first view that GOI's borrowing from RBI increased high powered money and hence raised money supply, whereas GOI's borrowing from banks could not affect RBI and left total money supply unchanged. On the other hand Chona's (1976) paper might be considered as an extension of Ahrensdorf and Thasan (1960) in the Indian context. Table 1, Table 2, Table 3 and Table 4 in Ahrensdorf and Thasan (1960) in the context of Brazil, Canada, Ceylon, Egypt, Federal Republic of Germany, Italy, Japan, New Zealand, Philippines and United States found their Indian counterparts in Chona (1976). For India, separately, Chona (1976) identified behavioural factors and policy induced changes influencing money supply and listed them in Table 5. On the basis of the data presented in Chona's (1976) paper, the stance of RBI's monetary policy was found in the appropriate direction.

After Gupta (1976b), the money multiplier was reported to be found by Jadav (2006) in the non-RBI monetary models explicitly in the works like Ahluwalia (1979), Madhur, Nayak and Roy (1982) and Chitre (1986), and implicitly in the works like Krishnamurty and Pandit (1984), Chakravarty (1987), Nachane and Ray (1989), Jadhav and Singh (1990), Rangarajan and Arif (1990), and in the RBI studies like Singh, Shetty and Venkatachalam (1982) and Rangarajan and Singh (1984). There were, reportedly, attempts like Rao, Venkatachalam and Vasudevan (1981) to go beyond the multiplier approach. Still the concept and use of multiplier is found to have relevance today e.g. Jha and Rath (2003). Further, the technique of forecasting was not reported to find priority in the research works of 1970s conducted after 1972 except for Swamy's PhD thesis and Gupta (1973) involving the multiplier debate. A careful perusal of the papers on determination of money supply in India reportedly gives an understanding of the explanations regarding what are the sources of high-powered money, how the money multiplier works and what are the determinants of money supply, and reveals that money supply can reportedly be forecast either from the liability side, which is money multiplier approach or from the asset side, which is the balance sheet approach. It was advised by researchers that monetary forecasts are required for a variety of purposes. Decisions on monetary policies like cash reserve ratios and refinance of commercial banks by RBI must, by wisdom of researchers, be clearly based on an analysis not only of monetary aggregates of the recent past but also future prospects. The same applies to measures concerning the structure of interest rates and the assessment of commercial banks credit budgets as per researchers. Forecasts of growth of bank deposits reportedly play an important role in estimation of resources available for financing investment and particularly of plan outlays in the public sector. The purpose of forecast is reported to have a bearing on the time horizon over which the forecast is to be made and hence on the methodology to be used, e.g. in the estimation of financial resources available for plan outlays one of the components is based on the growth of bank deposits. There are suggestions in the extant literature to incorporate the following issues:

1. It is also reported that the concept of residency may emerge in near future as one of the determining factors of money supply in India. The Working Group under the Chairmanship of Y. V. Reddy on Analytics and Methodology of Compilation of Money Supply reportedly introduced the concept of residency and recommended changes in the reporting system of commercial banks; residency was supposed to relate to the country in which the holder had economic interest; currency and deposits held by the non residents in the rest of the world sector would presumably be related to balance of payments considerations such as international capital flows rather than to the domestic demand for monetary assets or to the use of money in domestic transactions and should therefore be regarded as external liabilities to be netted from foreign currency assets of the banking system. The Group was reported to propose that, though there was a need to categorize deposit liabilities by residency it might not be appropriate to exclude all categories of non-resident deposits from domestic monetary aggregates as non-resident rupee deposits were essentially integrated into the domestic financial system and only non-resident repatriable foreign currency fixed deposits should be excluded from deposit liabilities and treated as external liabilities; accordingly from among various categories of non-resident deposits at present only foreign currency non resident bank account (FCNR (B)) deposits might be classified as external liabilities and excluded from domestic money stock. As per another reported proposal of the Group time deposits of resident should not include Resurgent India Bonds (RIBs) and India Millennium Deposits (IMDs) based on the residency criterion and exclude banks' pension and provident funds because they were in the nature of other liabilities and were included under 'other demand and time liabilities'; the new monetary aggregates like NM2 and NM3 were therefore based on the residency concept and hence did not directly reckon non-resident foreign currency repatriable fixed deposits in the form of FCNR(B) deposits, RIBs and IMDs.
2. The issue of stability of money multiplier should not skip attention Rath (1999) is reported to find over the period 1980-98 instability in both of broad and narrow money multipliers; however over the part period 1980-90, This study found M_3 multiplier stable; he argued that reasons for such stability might be financial liberalization witnessed in the economy since late 1980; the monthly data on Indian money multiplier showed that it was varying in the range of 2.17-3.72 with a mean value of 3.0; the volatility of the multiplier measured by its standard deviation, which declined during the 1980s from the 1970s, however increased in the 1990s mainly due to frequent changes in the CRR; the movement in the broad money multiplier made the stability of the multiplier a key issue because it could not explain the long run relationship between the broad money and the monetary base. A more recent study by Jha and Rath (2003) covering three time periods April 1980 to March 2000 (Period 1), April 1980 to March 1990 (period 2) and April 1990 to March (Period 3) since financial market deregulation came in India was reported to find all monetary variables in their log level form have integration of order one (I(1)) with lags chosen as Schwartz Bayesian Information Criterion (SBIC) and Akaike Information Criterion (AIC); this study conducted Granger-Engel co-integration tests using ADF test statistics and found that neither M3 nor M1 were co integrated in period 1 indicating unstable multipliers; in period 2 however broad money and narrow money were cointegrated; in period 2 broad money and narrow money

were found to be cointegrated with reserve money which was not the case in period 3 so much so that multipliers were stable in period 2 but not in period 3 because of financial liberalization in period 3.

7. ECONOMETRIC TOOLS IN UNDERSTANDING THE RELATIONSHIP BETWEEN MONEY, OUTPUT, AND PRICES

Studies like in late 1980s by Ahmed, Nachane etc reported that:

1. A series of papers started coming up since 1973 on the relationship among money, output and prices in the Indian economy though Bhattacharya (1972) estimated the relationship between money and output in India with the simple OLS technique; till 1982 in India, research works in this area covered unidirectional causations like from money supply to output and from money supply to prices; after Granger (1969) was published, attention of researchers went towards causality between a pair of economic time series among forecasters in studies of the causal effects of one series on the other; Sims (1972) undertook an exercise based on Granger to detect casual direction between money and income in the post-war data; from the analysis Sims observed that while income did not cause money, money caused income; on the same principle a more detailed study was undertaken by Pierce (1977) to establish the causal relationships between several pairs of variables in the US economy; he observed that numerous economic variables which were generally regarded as strongly interrelated might, with equal validity based on recent empirical evidence, be regarded as independent or weakly related; on the Indian data, Nachane and Nadkarni (1985) undertook a similar study and found that high powered money caused broad money M_3 for short period, M_3 affected price in long run; Sims (1972) in addition to Granger (1969) influenced the studies on Indian economy involving causality; Sims (1972) applied the Granger causality to test for evidence of unidirectional causality between money and nominal income in the U.S. for the period 1947-69; since 1983 papers on causality between money supply and output and between money supply and prices started coming up in India.
2. Brunner and Meltzer (1964) and Cagan (1965) created of curiosity among the Indian researchers on money multiplier 'm' in the identity $M = mR$, where M was money supply aggregate, R was reserve money; two issues of particular concern, stability and predictability were crucial determinants of the superiority or otherwise of the monetary base as an instrument of money-stock control vis-à-vis interest rates as per Pierce (1977) because there developed an extensive literature on money-multiplier forecasting models revolving around these two issues.
3. Burger, Kalish and Babb (1971) envisaged the monetary policy problem facing the US Federal Reserve Board, as one of determining the optimal level of the monetary base for a targeted level of money supply in the face of a stochastically fluctuating money-multiplier; the multiplier was modelled by a regression analysis involving its own lagged values and certain other economic variables; Bomhoff (1977) took a somewhat direct view of the problem and modelled 'm' as a univariate Box-Jenkins ARIMA process; his approach was refined and elaborated in a series of papers by Johannes and Rasche (1979, 1981, 1982) who formulated ARIMA models for the components of 'm' (such as the currency-deposit ratio, bank borrowing ratio, adjusted reserve ratio etc) on the pre-

supposition that the components approach being based on more disaggregated information Hafer and Hein (1984) contradicted this supposition with an empirical demonstration wherein aggregate approach fared as well as the components approach, but failed to offer any analytical explanation of this paradoxical phenomenon;

4. In India a great debate centring on the money multiplier was seen in the mid during 1976-78; supporters of money multiplier approach like Gupta (1976a, 1976b) and Swamy (1978) challenged the traditional RBI viewpoint on this approach that the latter had little bearing on the operational aspects of monetary policy; the RBI viewpoint was well articulated in Mujumdar 1976, Shetty, Avadhani and Menon (1976); RBI finally had to accept the multiplier approach in January 1978; there was resurgence of interest in the money multiplier approach on part of RBI as evidenced by two RBI works Singh, Shetty and Venkatachalam (1982) and Rangarajan and Singh (1984), and an independent work by Chitre (1986); notwithstanding, there were two formidable limitations: (a) the lag pattern in the impact of reserve money on money stock did not receive the attention it deserved, which was particularly surprising because an accurate assessment of the lag structure was the *sine qua non* of successful monetary management, failure to estimate the money multiplier with reasonable limits of statistical precision might have undesirable destabilizing influences on money market conditions, most of the studies discussed above simply ignored the money multiplier lag, and even in those studies like Rangarajan and Singh (1984), which introduced lags the choice of the lag length tended to be arbitrary, (b) the implicit assumption of unidirectional causality in the sense of Granger (1969) from reserve money to money stock was not always true, but, empirical studies often indicated possibilities of feedback from money stock to reserve money like Chitre (1986) in the Indian context; the presence of feedback was caused by the presence of the common component currency both in money stock and reserve money and by some other variable(s) affecting both of reserve money and money stock; the former effect would manifest itself as money stock (Granger) causing reserve money, the latter effect operated more subtly and could be inferred if the innovations in the two time-series displayed a contemporaneously correlated structure; in presence of such feedback a model could probably generate misleading conclusions, e.g. the dependence of money multiplier on the monetary base in Singh, Shetty and Venkatachalam (1982) was suspected to be an outcome of the failure to model this feedback;

5. Empirical study on money-income and money-price causality in India, was still in its infancy till the nineties. Studies conducted on India like Sharma (1985), Singh (1989), and Verma and Kumar (1994) had major methodological deficiencies; most of these studies were mainly anchored upon dealing with causal relationship in a bivariate framework; because these studies included only two variables in the model they had omitted variables bias; these causality tests therein disregarded the possible influence of other variables on money and prices; some of the studies included more than two variables though they claimed the tests they conducted as multivariate tests, actually those were bivariate causality tests in a multivariate framework, because they considered lagged coefficients of a particular variable in a single equation of the system not the other equations of the model; only a likelihood ratio test could do this job; the extension of single equation approaches to feedback models of interdependent variables was carried to an

extent some by Sims (1972); researchers in the 1970s began developing two-variable causality models; in the SAARC countries, however, the use of bivariate causality models could be traced back to mid 1980s; as an alternative to traditional econometric system of equations in which variables were arbitrarily labelled as endogenous or exogenous, Vector auto-regression (VAR) models emerged as powerful multivariate models since the early 1980s. Above are the studies in the pr-crisis period.

Regarding the econometric tools applied in the above works, it was found that Jha and Donde (2002) and Ahmed (2003) employed vector auto regression (VAR) models accompanied by error correction mechanism (ECM) and Johansen-Juselius procedure; others like Rangarajan and Arif (1990) employed simulation models containing regressions equations of variety of forms simple linear function and double logarithmic function, and also autoregressive equations of first order (AR_1) and only Ray and Namboodiri (1988) employed filters for pre-whitening purpose i.e. making a non-stationary series stationary. The filter technique did not seem to be popular. Even Jha and Donde (2002) employed ADF test in order to detect the level of integration of the series and accordingly took measures to ensure stationarity.

8. THE ISSUE OF ENDOGENEITY

The literature on endogenous money supply in India described how the issue of endogeneity of money supply was born when RBI relied on credit control on banks in 1970s, but found it ineffective because banks managed to take advantage of loopholes in the definition of deposits or credit, use cash credit, and mobilize non-deposit resources. It was also described how, with the acceptance of money multiplier approach RBI moved towards closer monitoring of reserve requirements, which were also blunt instruments. It was further narrated how automatic financing of the budget deficit endogenized the base money though the link was weakened by onset of financial reforms in 1991 but banks demonstrated their ability induced by financial reforms to circumvent controls to satisfy profit motive.

In the above literature (a) endogeneity of money supply is attributed to the lending activities of the banks and (b) the theoretical propositions by and large belong to the post Keynesian school.

Without credit finance it is not feasible to obtain positive netput (net output) in the economy given the feedback from price to output via money. This result is in line with Dash and Goyal (2001). They found that during the credit liberalization regime the banks were circumventing the RBI control and expanding credit. Again Rangarajan and Arif (1990) found price level to have been determined by money supply also. Again during post liberalization regime banks got more autonomy in extending credit. It seemed that bank credit had influenced prices, which in turn had influenced output. Thus GDP responded strongly to price.

In the relationship between nominal GDP and broad money the residuals are purely stochastic, i.e. white noise. The economics of the above result lies in the fact that true nominal GDP growth is backed by real GDP growth. Increase in volume of goods and services need be accompanied by increase in the volume of money supply in order to lubricate the exchange processes and facilitate transactions. Again it is also true that endogenous money supply in the form of bank credit increases in the wake of increase in planned output. Further, rise in nominal GDP leads to rise in factor payments which are made by checks or drawing upon the banks. In such a situation banks often need to knock the door of the Central Bank for more reserves so much so that money supply rises.

Another explanation can be in the context of exchange rate of rupee vis-à-vis other currencies. When domestic output increases transaction demand for money increases and hence total demand

for money increase. This makes rupee appreciate ceteris paribus vis-à-vis other currencies like US dollar or the reference basket of currencies. Too much of such appreciation may create undesirable quantum of foreign exchange outflow. So the Central Bank might require to increase money supply to the extent sufficient to make the value of rupee reduce to the target level or it has to buy US dollars sufficient in exchange for rupee to make US dollar appreciate vis-à-vis rupee or do both in order to maintain a the desired level of rupee/ US dollar rate.

From the above relationships involving commercial bank credit, industrial output index and wholesale price index Das (2010) found that individually commercial bank credit and wholesale price index have strong influences on industrial output. But jointly they do not influence industrial output perhaps because wholesale price index is correlated to commercial bank credit. Thus one can say that because their correlation coefficient between is as high as 0.976, commercial bank credit raises the real cost of production which has an adverse effect on industrial output. This goes against Rangarajan and Mohanty (1997).

9. FORECASTING MONEY SUPPLY IN INDIA IN THE POST CRISIS PERIOD: EMERGING ISSUES

In the post crisis period the studies like Sharma, Kumar and Hatekar (2012) and Mishra, Mishra and Mishra (2012) worked with cointergration, VAR, ECM, and Granger Causality involving money, price and output in short run and long run and are improvements over others like Asra, Chattopadhyay and Choudhury (2004) and Das (2003) who worked with causality analysis over long run involving the same variables with the similar methodologies.

Bose (2011) demonstrated the inflation in the post crisis period in India that originated out of price shocks in international commodities and domestic agriculture and foods. Hence the knowledge of mainstream monetary economics and orthodox monetary policy revolving around, *inter alia*, the relationship between money supply and price may not work here to solve the problem.

There are following cases regarding money supply as independent and dependent variable, which are not taken into account in any of the above studies. After the start of economic liberalization, there is massive forex inflow. They add to the forex assets of the banks. Net forex assets constitute a source of money stock. So liberalization might have an impact on money stock. But availability of data on such flow of foreign exchange is meagre. RBI then published such data in annual figures under three heads since 1990-91:

- NRI deposits outstanding,
- Inflows/outflows under various NRI deposit schemes, and
- Foreign investment flows.

The volume of data is not compatible with any kind of model building process, because of scanty degrees of freedom. However this point is missing in above studies especially those which were conducted in the post liberalization period. Sarma (1982) is a study in this respect on the pre-liberalisation period. Secondly repo is a monetary policy tool for injection of liquidity in the financial system. In a floating exchange rate regime the RBI has often to intervene in the foreign exchange market in order to prevent any untoward movement in the value of rupee vis-à-vis dollar[1]. Dollar is the reserve currency of India[2]. An increase in the RBI's purchase of foreign currencies in exchange for rupee ceteris paribus depreciates rupee and vice versa. The RBI was not disclosing the information on its foreign exchange market operation till the early part of 2000s. An increase in money supply in the country leads, ceteris paribus, to a decrease in the equilibrium interest rate in the money market and increase in liquid money in the hand of public. The term

'public' includes individuals as well as corporate entities save for government. A decrease in rate of interest ceteris paribus decreases cost of capital incurred by business and hence increases profits of business. Some of the increased profits are invested further in US dollar assets among other assets. This means people want to buy more of US dollars in exchange for rupees. So price of dollar vis-à-vis rupee increases, i.e. price of rupee vis-à-vis dollar falls. Thus an increase in money supply leads to a decline in the external value of the domestic currency. Further, the theory of floating exchange rate insists the Central Bank to prevent any unwanted movement of the home currency. Here the shift from net domestic assets to net foreign assets on resources side of the monetary base mentioned in Soumya and Murty (2005) should be remembered. This is another instance of theorization of empirical evidences. Following this line of argument one can envisage in the context of India a strong possibility of presence of a link between net foreign exchange assets of the banking sector including RBI (NFEA) and the rupee value of the currencies in the reference basket of currency. Because of the importance of US Dollar in international trade tracing back to the Breton Woods System, dollar is taken as the representative of the basket.

10. SOLUTIONS AND RECOMMENDATIONS

When there is rise in the cost of production as mentioned in Bose (2011), the manufacturing firms approach the banks for short term credit reported by Dun and Bradstreet (2012). This bank credit via money multiplier process may expand money supply. So structuralism as an approach remote from multiplierism may not work alone.

In monetary modelling involving foreign currencies the globally evolving currencies from emerging economies like offshore Chinese Yuan should not be neglected because banks are expanding their operations in the Asian offshore currency market more than before because of higher return on funds than gives the domestic market, i.e. CNY is now competing with US$ as an avenue for parking offshore the banks' investible funds.

11. FUTURE RESEARCH DIRECTIONS

In a struggling emerging economy like India, by and large only the economists employed in industries, Central Banks and educational institutions understand the money supply process, it has very little relevance to daily banking businesses unless it is linked to interest rate forecasting from the view point of liquidity management in the banks and financial institutions. There is a strong case for linking the interest rate volatility facing the dealers in the treasury front office and members of the risk management group on the one hand with numerous operations in domestic and foreign currency markets by banks like offering long term cheaper infrastructure loans and by Central Banks like purchasing and selling foreign currencies on the other. Hence a model involving time series data on values at risk of interest rate products and components of money stock may be built up such that banks may knowingly participate in the monetary administration of the country.

12. CONCLUSION

This chapter covered different aspects and parts of modelling, analyzing and predicting money supply. It encompasses modelling money supply in India by both official and independent economists. In the theoretical discourses backing the models it distinguished traditional literature of monetary economics and policy from the emerging approaches towards accommodating structuralism. From statistical side it distinguished between classical and time series models and also between

the works on bi-directional and uni-directional causalities. Finally it pointed out certain issues around inapplicability of the pre-crisis period approaches in the post-crisis period and made some recommendations along with further research directions.

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KEY TERMS AND DEFINITIONS

Co-Integration: If an exogenous variable is regressed on an endogenous variable both having the same order of integration, and the error terms turn up to be perfectly stationary, these two variables are called to be cointegrated.

Error Correction: When two variables are cointegrated, there may be short term deviation from their long run equilibrium values. Then the short term value of one variable changes depending on the short term value of the other variable as well as the error term, and gradually move towards its own long equilibrium value. This process is known as error correction.

Granger Causality: When an exogenous variable depends in statistically significant manner on an endogenous variable and the lagged values of both, the latter variable is said to Granger-cause the former variable.

Inflation: Rise in prices measured by wholesale prices (WPI).

Money: There are four definitions of money out of which is used mostly for econometric exercises is the broad money or M_3 = currency with public + demand deposits with the banking system + other deposits with RBI + time deposits with the banking system.

Money Supply: Synonymous with 'money'.

Output: Production in the country measured as Gross Domestic Product (GDP). Sometimes it indicates industrial output measured by IIP also.

Price: Here wholesale price index (WPI).

Stationarity: The property of a time series variable to have constant mean and variance at different points of time. Violation of this property makes the variable non-stationary. In order to make it stationary differences are taken, e.g. difference between the values of current period and previous period or second previous period. Accordingly the variable is called to be integrated of first order or second order.

Vector Auto Regression (VAR): Regression of one endogenous variable upon another and

their lagged values – both having the same order of integration and the equations are without any identification problem, i.e. there are unique equilibrium values of each variable – is called VAR.

ENDNOTES

1 Standard international economics literature like Krugman and Obstfeld (2003) described four following reasons behind Central Bank intervention in exchange rate movement: (a) Current Practice: The present monetary system of the world is a mix of fixed and flexible exchange rate systems. A country following an unmixed fixed/flexible exchange rate system is a rare instance. (b) Regional Agreements: There are pacts/agreements among different countries, whereby they try to maintain a mutually agreed level of exchange rates amongst themselves, but allow exchange rates to fluctuate against outsider countries. (c) Countries in Transition: Nearly half of the countries of the world are going through economic transition towards a more capitalist system from a less capitalist system. (5) Experts Opinion: There is a debate among economists and policy makers regarding which of the fixed and the flexible exchange rate systems is better. So the governments cannot decide which system is more beneficial.

2 Reserve currency system is a fixed exchange rate system. In this system, the Central Bank of each country singles out one foreign currency as reserve currency and holds the reserve currency in its international reserves. The Central Banks in this case are ready to sell/buy the reserve currency in exchange for the domestic currency in the foreign currency market, whenever required, with a view to maintaining the fixed exchange rate between reserve and home currencies. US dollar has been the reserve currency between 1939 and 1973 and by and large all countries of the world peg their currencies to US dollar. The reserve currency system gives an advantage to that country (henceforth called the reserve currency's country RCC) whose currency is considered reserve currency. The RCC need not intervene in the foreign currency, because other countries maintain the exchange rate between RCC and their countries. Secondly the reserve currency system puts the RCC in a privileged position because it can control other countries' monetary policies through it's own monetary policy by means of influencing the exchange rate between the reserve currency and other countries' currencies. If USA increases it's own money supply then *ceteris paribus* value of Indian rupee appreciates. This may cause a balance of payment problem for India, because imports become cheaper and exports become costlier. So India has to increase her money supply in order to devalue Indian rupee vis-à-vis US dollar.

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Chapter 24
A Conceptual Framework for Online Stock Trading Service Adoption

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ABSTRACT

Globalization and recent advancement in the deployment of Internet and related technologies, have significantly transformed all sectors of the modern economy. For instance, electronic service has enabled the application of Internet platform in stock trading, thereby empowering individuals across diverse location to engage in trading activities. As established by extant theories on technology acceptance, individuals are expected to exhibit different attitude and behaviour towards new technology. This study aims to develop a conceptual model, which can explain the antecedents of individual investors' intention to adopt online stock trading service. Specifically, this study identifies three new constructs (trust perception, investors' knowledge and economic value) by integrating theory of planed behavior (TPB) and technology acceptance model (TAM), with perspective from transaction cost theory (TCT).

INTRODUCTION

Technological evolution in the last two decades has greatly impacted business service processes and practices across various sectors of the modern economy (Allameh et al., 2010). Such advancement has transformed the operation of commercial and financial activities, with the wide deployment and growing acceptability of electronic commerce and financial applications. Most business activities and competitive global practices are driven by electronic platforms, which have contributed in enabling cost efficient, faster and innovative development and delivery of products and services (Gopi et al.,

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2007). Electronic commerce, especially online stock trading service enjoys a top priority in financial and stock brokerage firms' strategic goals (Kalakota & Whinston, 1996; Lee, Partridge & Ho, 2002).

Online stock trading service was introduced in 1994, with initial apathy across the globe (Gatigon & Robertson, 1999). According to Internet World Stats (2006) Internet usage in North America appreciated by 110.3% between year 2000 and 2005. During the same period, Europe and Asia recorded a rise of 177.5% and 218.7% respectively. Yet online stock trading accounted for about 30% of the total stock trading transactions executed all over the world (Lee-K & Chung, 2000). According to Allameh et al (2010) apathy of both individual investors and investment institutions to online stock trading is one of the major causes of inconsistency in the growth of online stock trading service. Nevertheless, very little is known about the specific factors that impact investors lack of interest in online stock trading service. Likewise, the implication of the adoption of online stock trading in investors' trading performance has not yet been empirically validated. Thus, there is need for empirical investigation on the key factors that influence investors' intention to adopt online stock trading, as well as the implication of the adoption on their trading activities performance.

The sustainability of online trading service is contingent on the attraction and retention of online trader service. Few researchers have examined the various antecedents of online stock trading service; however most have focused on only selected factors, while subsequent attempts have been independent of earlier ones. Therefore, the need to integrate such factors and empirically validate the ensuing model has become imperative. Indeed, online trading service holds tremendous benefit for investors and investment institution, as a result this study will advance understanding on the theoretical model for explaining the adoption of online application in stock trading domain. In doing this, the present study will explicate the specific effect of these factors as well as their interaction effects on online stock trading adoption. For instance, the adoption of online stock trading has been found to be affected by interaction among factors like infrastructures, environmental, and behavioral attributes (Abroud et al., 2010). Specifically, this study aims to advance extant knowledge by developing a conceptual framework, which integrates the effects of the various antecedents for investors' intention to adopt online stock trading platform.

LITERATURE REVIEW

Extensive research works on stock market have been done in field of financial science and information systems. Scholars have identified the factors that influence the individual's decision to adopt e-commerce platform for transaction. To this online trading service has been described as more of an information system phenomenon (Gefen et al., 2003a; Kolekofski et al., 2003). Consequently recent studies on online financial trading have employed technology adoption model as their theoretical framework. As Pavlou (2003) noted information technology adoption and usage model has found wide application in the field of electronic finance, which is an integration of technology adoption with finance concepts. Specifically, technology adoption model has been employed in studying the adoption of online financial trading. A review of relevant literatures to the study's objectives will be presented on technology acceptance theories and models.

This study will critically examine extant literatures on eight (8) influential technology acceptance models as follow: Innovation Diffusion Theory (IDT), Social Cognitive Theory (SCT), Theory of Reasoned Action (TRA), Decomposed Theory of Planned Behavior (DTPB) Technology Acceptance Model (TAM), Technology Acceptance Model 2 (TAM2), the Unified Theory of Acceptance and Use of Technology (UTAUT) and Theory of Planned Behavior (TPB). Table 1 presents a brief discussion on this:

Table 1. Summary of theories of technology acceptance

Theory	Founder	Constructs	Theory Core
IDT	(Rogers,1950)	1. Knowledge,(Socioeconomic, Characteristics, Personality variables, Communication, Behavior), 2. Persuasion (Relative advantage, Compatibility, Complexity), 3. Decision 4. Implementation 5. Confirmation	IDT has been used to describe the Innovation-decision process.
SCT	(Bandura, 1986)	1. Behaviour, 2. Perseption Factors, 3. Environmental Factors	SCT deals with man's manner of inferring his/her behavioral outcomes that enlightens and modifies his/her environment and personality leading to changes in subsequent behaviors.
TRA	(Fishbein et al., 1975)	1. Behaviour, 2. Intention, 3. Attitude Toward Behavior 4. Subjective Norm	The basis of existing research related to the relationship between attitude and behavior is found in this model..
TAM	(Davis 1986b)	1. Behaviour, 2. Behavior Intention, 3. Attitude Toward Behavior, 4. Percived usefulness 5. Percived Ease of Use, 6. External variables	TAM, which forms the base that explains the relationship between PU and PEU, on the one hand, with the user's intent and actual behavior in using the computer, On the other.
TAM2	(Venkatesh et al., 2000)	1. Behaviour (Actual Usage), 2. Behavior Intention 3. Attitude Toward Behavior, 4. Perceived Usefulness 5. Perceived Ease of Use, 6. Voluntariness, Experience, 7. Image, 8. Subjective, 9. Result Demonstrability	TAM 2 aims to present a theoretical explanation to PU and the user's intent based on his/her social and cognitive influences.
DTPB	(Taylor & Todd, 1995b)	1. Actual Behavior, 2. Behavioral Intention 3. Attitude Toward Behavior, 4. Subjective Norm, 5. Percived behavioral control, 6. Percived Usefulness 7. Percived Ease of use, 8. Compatability,	This model investigates the roles of mannerism, principles, society and perceived behavioral control by classifying them into various belief divisions.
UTAUT	(Venkatesh, et al., 2003)	1. Performance Expectance, 2. Effort Expectancy 3. Social Influence, 4. Facilitating conditions	UTAUT was found to provide a clear comprehension of the gradual evolution of the determinants of intention and behavior. Also, it should be notable here that a large part of the main associations in this model are moderated.
TPB	(Ajzen, 1985)	1. Actual Behavior, 2. Behavioral Intention, 3. Attitude toward Behavior(behavioral beliefs) 4. Subjective Norm (Normative Beliefs) 5. Percived Behavioral control	The literature review revealed that this theory (TPB) was implemented in extensive empirical research works relating to behavioral science in order to forecast and comprehend man's behavior in diverse circumstances.

The technology acceptance and behavioral adoption model has been the main theoretical model underpinning extant works, in predicting factors influencing individual's intention to adopt new technology. Of significance are the Theory of Reasoned Action (TRA) (Ajzen et al., 1980), Theory of Planned Behavior (TPB) (Ajzen, 1985), and Technology Acceptance Model (TAM), which has emerged to be the most important and pertinent model. TAM primarily considers the effect of perceived ease of use and perceived usefulness in predicting individual's intention to adopt new technology (Davis, 1989a; Davis et al.,1989b). A brief description of these intentional models is as follows.

Theory of Reasoned Action (TRA)

Fishbein and Ajzen (1975) developed the theory of reasoned action (TRA) by studying attitudinal and normative influences on behaviour. The theory demonstrates how individual's intention is transformed to an act that is behaviour. Ajzen (1991, p,116) stated that "Intentions are assumed to capture the motivational factors that influence a behavior; they are indications of how hard people are willing to try, of how much of an effort they are planning to exert, in order to perform the behavior."

Also, TRA has found wide application across diverse field. For example, researchers in social psychology have drawn on it in analyzing and comprehending individuals' social behaviour. Basically, the theory reveals that an individual's Behavioral Intention (BI) ascertains his specific behavior. Thus, an individual's Attitude (At) along with the Subjective Norm (SN) ascertains the Behavioral Intention:

$$BI = At + SN \quad (1)$$

As Ajzen (1985) asserts, an individual's intention to behave in a certain way is a linear function of two factors, which are the attitude towards behavior (At) and the subjective/social norm.

Technology Acceptance Model (TAM)

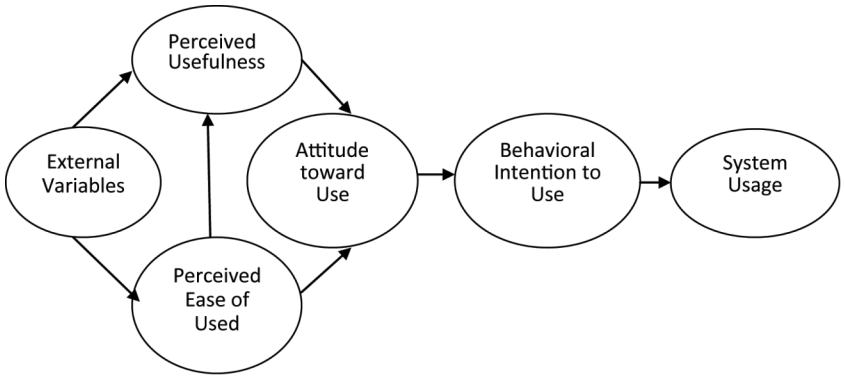
Technology Acceptance Model (TAM) was conceptualized to explain individuals' behaviour when working with computers (Davis, 1989). The model offers clarification on the factors which lead to the acceptance of computer, by providing a clear account on the behaviour of the users towards adopting diverse computing technologies. TAM is actually an extension or modification of the Theory of Reasoned Action (TRA), which has been the fundamental to most studies on the adoption of Information systems (IS). Researchers have employed the model in examining the behaviour of individuals towards adopting Internet platform (Davis, 2000).

The main concept behind the model is that 'attitude predicts intention, while intention predicts behaviour' (Davis, 1989a). Davis also went further to state that the behaviour of a user of a system is influenced by his or her intention to use it, which in turn affect his or her attitude (see Figure 1). Two main factors are identified as below;

1. Perceived usefulness of the system (PUS).
2. Perceived ease-of-use of the system (PEU).

Perceived Usefulness (PUS) explains how the use of a technology could enable and enhance a person's performance on the job. On this, some researchers argue that there exists a direct link between the rate of employing an application and the successful outcome in facilitating a better performance on the job (Davis et al., 1989b; Pavlou, 2003).

Figure 1. TAM model by Davis (1989a)



Although perceived ease of use (PEU) measures the user's evaluation on whether an application can be used in his or her work, yet, Davis et al.(2000) suggested an alternative measure. They explained that PEU is actually the user's perception on how easy it was to use a given application when performing his or her work. Equally, the model also recognized the effect of external variables on the perceived ease of use (PEU) and perceived usefulness (PUS). These variables include users support, training, system attributes and documentations (Davis, 1989a).

Most of the studies on Technology Acceptance Model (TAM) have been in the field of information systems, especially in investigating the adoption of Internet, e-finance and e-commerce. Findings have also confirmed both PUS and PEU as strong predicators of attitude, while the latter has been found to be influenced by the former, as well as other extrinsic factors. On the other hand, only the extrinsic factors have been discovered to influence PUS.

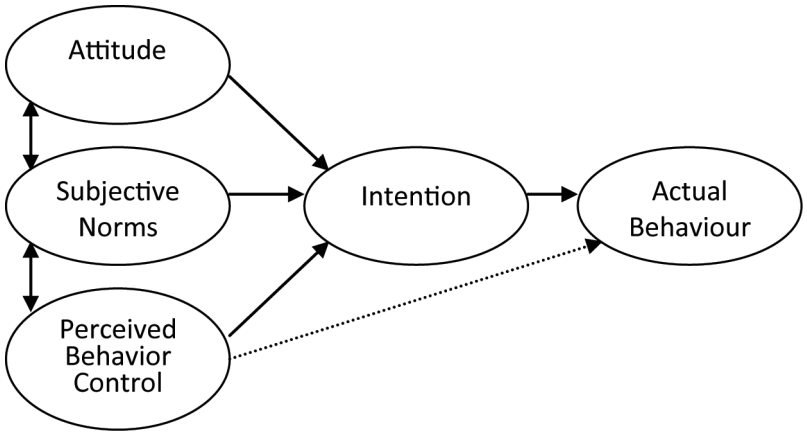
TAM's uniqueness is in the application of fewer numbers of theories to make predictions on user's intention (Agarwal & Prasad, 1999). Several scholars have deployed the model in an attempt to identify and explain the factors, which influence user's intention to accept/adopt technology (Siriluck, 2006; Chi- Shing et al., 2007; Jeanette-Taft, 2007). Venkatesh et al. (2003) underscored the need to clarify the difference between user's intentions to adopt and behaviours towards adopting a technology.

Theory of Planned Behaviour (TPB)

Theory of Planned Behavior (TPB) gained prominence in the 1980s, as the most pertinent cognitive model to analyze and forecast individual's distinctive behavior (Ajzen, 1985). Even though it originated from the field of social psychology, however, it has received significant attention across various fields. Fishbein & Ajzen (1975) described it has a comprehensive version of the TRA, which has contributed in resolving the latter's limitation in explaining the spontaneous behavior of individual. TPB is based on the assumption that people behave according to their intentions, which are the result of their personal thoughts, standards and their behavioral control.

Behavioral intention is expressed in terms of attitude, subjective norm and perceived behavioural control. Succinctly, a positive attitude and favorable subjective norm along with increased perceived control are expected to exert a positive influence on a person's intention to behave in a certain way. Thus, a combination of attitude, SN, and PBC will constitute an individual's behavioral intention, which in turn shapes behaviour. The TPB model is shown in Figure 2:

Figure 2. Constructs of TPB (adapted from Ajzen, 1985)



Based on the relationship among attitudes, SN, PBC, intention and actual behaviour, Ajzen (1985) suggests the following equation to capture TPB;

$$B \sim BI = w1\ At + w2\ SN + w3\ PBC \quad (2)$$

Accordingly, TPB (Ajzen, 1985, 1991) proposes that intention and PBC determine human behaviour, while intention is in turn affected by AT, SN, and PBC. TPB has been employed in studying the behaviour of consumers towards online platform (Bhattacherjee, 2000a; Joo Enget al., 2003; Ramus et al., 2005; Shim et al., 2001).

Application of TAM and TPB Theories in Prior Research

Extant works on Information Systems within the financial domain have drawn from TPB and TAM in order to explain investors' behaviours and attitudes, relating to the adoption of online stock trading, word processing application, intentions to use Internet in financial transaction, as well as adoption of IT outsourcing (Ajzen, 2005; Lee-Pi et al., 2003; Michelle, 2005). Studies on the adoption of online services have also employed either TAM or TPB, in order to forecast and understand user's insight on the choice guiding the intention to use a system (Lina Zhou, et al., 2007; Chi-Lee, 2009b). TAM and TPB have been leveraged in attempts to observe and analyze the likelihood of using the Internet for executing trading transactions (Lee & Turban, 2001; Tebboune, 2003). A brief summary on prior studies related to these theories is presented in Table 2.

Based on the comprehensive review of literature, the need to clarify the effect of diverse factors on investor's intention to adopt online trading service has been less explored. For instance, limited or no attempt has been made within the e-finance domain to develop an integrative model, which can be applied in assessing the effect of diverse factors in predicting user's intention to adopt online stock trading. Specifically, this study aims to bridge the gap in knowledge on the antecedents of individual's adoption of online stocking trading.

CONTRIBUTION OF STUDY

Based on detailed theoretical exposition, the present study will suggest a comprehensive conceptual model, which can offer a broader view on the adoption of online stock trading. The proposed model places emphasis on the intention of the investors and their acceptance of technology. Furthermore, the influence of some crucial factors in influencing both the investor's intention and behaviour

Table 2. Summary of literature related to online trading and e-finance based on technology acceptance

Context	Authors & Years	Constructs	Theory of Using
stock exchange	Joo Eng Lee et al. 2003	Experience, security, social factors, Attitude, behavioral, government support, perceived, perplexity, subjective norm, information, quality	DTPB
stock exchange	(Siriluck, 2006)	Intention, behavior, attitude, securities, PEU, and PUS, Information quality, accessibility.	TAM
stock trading	Kim et al., 2004	customers' skills, price sensitivity, transaction capacity, repetition in transactions, intention, environmental conditions, subjective norm, attitude	TPB
Adoption online stock trading	Adela, Jerome, et al., 2001	Intention, Attitude, PUS, PEU, Relative Advantage, SN, PBC, technology for trading, facilitating Condition, Research Facilitating, Conditions	DTPB
Online stock trading	Gopi et al., 2007	BI, AT, SN, PBC	TPB
Online stock trading	(Michelle, 2005)	Skills of management and employers, computer knowledge, preparedness for adopt new technology.	TRA
Online stock trading	(Seongcheol 2000)	Perceived service quality, overall satisfaction, attitudinal loyalty, actual retention, price sensitivity, access capacity, and frequency of order.	TPB
Online stock trading	Ramayah et al., 2009)	BI, AT, SN, PUS, PEU, injunctive norm, descriptive norm.	TRA
Online stock trading	(Ming -Chi 2009a)	Perceived benefits, Attitude, PEU, PUS, PBC, SN.	TPB
Online stock trading	Thompson et al., 2004	BI, Attitude, Relative Advantage, Trust, Compatibility, complexity, normative in flounce, facilitating conditions.	TRA
Online Banking	Chi-Shing, et al., 2007	Attitude, PUS, PEU, Presided risk, innovativeness	TAM
Online Banking	Tan & Teo, 2000	Intention, PBC, Attitude, SN, Self-efficacy, Risk., Government support, compatibility and trial ability	DTPB
Online Banking	Jeanette-Taft, 2007	self-efficacy, prior training in electronic banking, perceived ease-of-use of electronic banking technology and locus of control	TAM
Online Banking	KhaliL, 2005	Attitude, Relative advantage, Compatibility, Ease of use, Trial ability, self efficacy, PBC,SN, Intention	TPB
Internet Banking	Sohail et al., 2003	Ease of use, Internet accessibility, Attitude, computer and Internet access costs, Trust in bank, Security concerns and convinces.	TAM
Online Financial	Jihyun-Lee, 2003	Attitude, Intention, PBC, SN, Demographic variables	TPB
Online shopping	Vijayasarathy, 2004	Usefulness, Compatibility, privacy security, normative, Intention, Attitude and self efficacy.	TAM
Online Banking	Guriting et al 2006	PUS, Ease of use, Strong determinants of behavioral intention, computer self-efficacy and experience	TAM
Online Trading	Athiyaman 2002	Attitude, Intention, social factors SN, and perceived behavioral control	TPB
E-commerce	Anol-Bhattacherjee, 2000)	Usefulness, Ease of use, interpersonal influences, External influence, Self efficacy, Facilitation conditions, attitude, SN	TPB
Online Banking	Ming chi-Lee 2009b	PUS, PEU, Risk, Perceived Benefit, Attitude, SN,PBC and Intention	TAM& TPB
Online stock trading	Lee & Kim, 2002)	Loyalty, Satisfaction, Convenience, Delight, firmness.	TPB
Online stock trading	Arwinder, et al., 2010	Intention, Demographic variables (Age, experience, gender, education), attitude.	TPB

continued on following page

Table 2. Continued

Context	Authors & Years	Constructs	Theory of Using
Online Shopping	Lina Zhou, et al., 2007	Intention, normative belief, shopping orientation, shopping motivation, Personal traits risk.	TAM& TPB
E-Commerce	Davis, et al., 2000	PUS,PEU, Intended inquiry, Intended purchase	TAM
Internet Purchasing	Joey-F-George, 2004	Attitude, normative structure, Internet trustworthiness beliefs, unauthorized use beliefs, efficacy, PBC, SN and Intention.	TPB

towards accepting the technology are identified. Experimental evidence was conducted in order to evaluate the relationship among the identified factors and online investor's intention. Also, the interaction effects of these factors were recognized, with the analysis supporting prior related studies and offering further clarification on conflicting or contradicting findings.

The proposed model is based on the integration of the theory of planned behavior (TPB), technology acceptance model (TAM), and transaction cost theory (TCT). It advances the independent models by conceptualizing a single model, by identifying and modifying the relationships among their constructs. These constructs include the effect of trust perception based on TAM, and the economic value of e-commerce based on TCT and investor's knowledge based on TPB. Also, the relationship between perceived usefulness and investors' intention is proposed to be mediated by investor's attitude. By proposing these constructs, the study has developed a more comprehensive model, which can help in conducting further empirical investigation on the adoption of online stock trading platform.

The proposed model is expected to offer a more comprehensive explanation on the behavioral aspect of online stock trading, by recognizing the multiple effects of the external behavioral beliefs. Accordingly, it will advance understanding on the factors that influence investors to adopt online trading service platform as well as their implications for the investors and e-commerce vendor. The model offers a practice oriented framework for assessing investor's adoption of online platform and suggests the pertinent factors that are most likely to influence investor's behavioural intention.

Online Stock Trading and How Trust is Perceived

Trust is one of the most important construct in any business and social relationship, where risk or uncertainty are prevalent (McKnight et al., 2002). To this end, Mayer and Davis (1995) argue that trust exists whenever a person is prepared to be vulnerable to another person. Trust is defined as a person's willingness to exposure him/herself to risk in the hands of another person, based on the conviction that the other person would sincerely perform his/her role without supervision (Mayer et al., 1995).

Ming-Chi (2009b) demonstrated trust as an antecedent for the conduct of business and sustenance of online transaction by investors. In the absence of trust, business relationship is hampered. Trust is a fundamental factor in building healthy business relationship across diverse domain including stock exchange (Gefen et al., 2003). Consistent with TAM, the present study recognized trust as the set of belief which influence investor's attitude towards adopting online stock trading. The concept of trust can be considered as the extent to which the investors believe in the adeptness of the online platform in the performance of required transactions as well as the extent to which the transactional information can be safeguarded.

Investors' Knowledge to Online Stock Investment

Scholars have confirmed the existence of a relationship between user's prior knowledge and experience in online platform and his/her intention to adopt/accept online trading service (Konana et al., 2000; Zeithaml et al., 1983). According to Li (1999) the actual use of online stock exchange trading application, requires the prior acquisition of knowledge related to the Internet or "Internet literacy." Basically, two components critical to an investor's adoption of online platform are his/her knowledge about Internet trading and online platform (Konana et al., 2000). Accordingly, it is reasonable to expect that the investor will be more likely to use the online trading service platform, when he/she possesses sufficient knowledge on the electronic channels, stock market and trading transactions. Consequently, the construct for investors' knowledge was operationalized as respondents' knowledge about stock trading and electronic channels used for in conducting online stock trading.

Economic Value for Online Stock Trading

Earlier research in e-finance established cost reduction, time saving and convenience as the main antecedents of customer's intention to use online platform for transaction (Teo et al., 2004). These factors encompass the significant values which e-commerce offer to the customers (Keeney, 1999). Both cost reduction and time saving are the fundamental elements of transaction cost theory (TCT) in micro-economics, and constitute the economic value of e-finance.

This study offers an initial attempt to integrate TAM; transaction cost theory and service quality into a single research model, so as to empirically investigate the quantifiable advantages of cost reduction and time saving. Liang & Huang (1998) had proven that both variables are positively related to user's satisfaction with online trading service and thus are important antecedents of consumer's behaviour to use online platform. Consequently, this study aims to incorporate the effects of cost reduction and time saving, which constitute the economic value of e-finance, in addition to other antecedents of intention to adopt in the TAM model. Thus, the study offers an approach to identify and compare the different individual level antecedents for the adoption of technology. Succinctly, drawing from transaction cost theory (Williamson, 1975), this study suggest economic value of e-finance as a factor, which can influence the adoption of technology and hypothesize the model to test such effect.

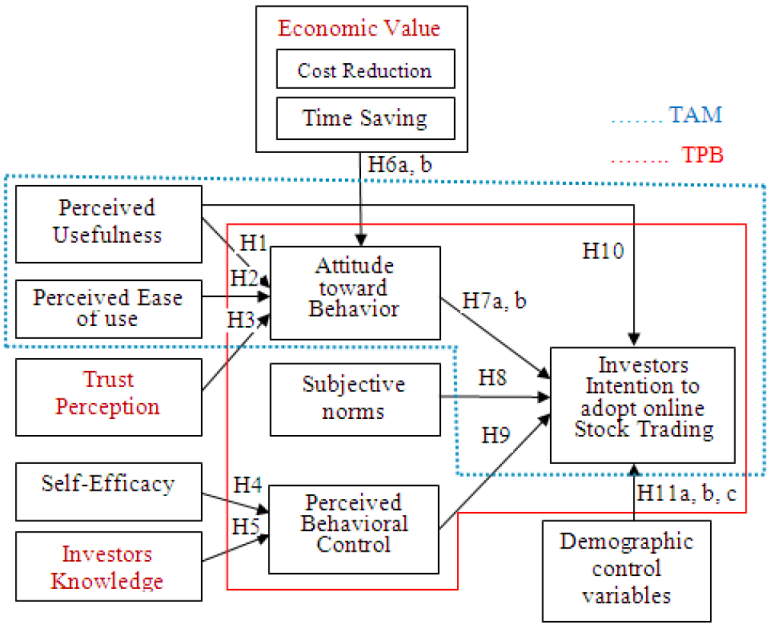
PROPOSE RESEARCH MODEL AND HYPOTHESES

This section examines the proposed conceptual framework and defines the associated factors, as well as hypothesized relationships. Figure 3 illustrates the Conceptual model for online stock trading based on TPB and TAM (Figure 3 illustrates the research model):

Perceived Usefulness (PUS)

Perceived Usefulness can be defined as "the degree to which an individual believe subjectively that using a particular IT device would enhance his or her job performance" (Davis, et al., 2000, p.98) Also, it can be expressed in terms of investor's belief about using Internet stock trading, as having beneficial impact. An individual's perception on the extent to which the use of a particular system would improve his/her performance, is referred to as perceived usefulness (Davis et al. 1989). Empirical studies have confirmed perceived usefulness as a significant antecedent for user's attitude towards online stock trading (Ramayah et al., 2009; Gopi et al., 2007; Ming, 2009a). Thus, it is hypothesized that:

Figure 3. Proposed conceptual framework



H1: Investors' perception on the usefulness of online stock trading will be positively related to their attitude towards online stock trading.

Perceived Ease of Use (PEU)

PEU is "the degree to which a person believes that using a particular system would be free of physical and mental effort" (Davis 1989, p.214.). It is the extent of effortlessness a user perceives concerning a system (Davis et al., 2000). In the online trading service domain, it can be considered as the simplicity of the process required in learning, comprehending and using the online platform (Siriluck, 2006). Consequently, a system that is easy to operate, in turn leads to improve performance (Davis, 1989; Venkatesh et al., 2000). Ramayah et al (2006) demonstrated that the perception of ease about a system has a direct effect on attitude towards adopting the system.

H2: Perceived ease of use of online stock trading will be positively related to attitude towards online stock trading.

Trust Perception

Researchers (Gefen et al., 2003a; Pavlou, 2003; Ming-Chi, 2009b) have investigated the nature of relationship between trust and attitude towards online applications in banking and finance domains. Additional research conducted, revealed that

Equally, Ming-Chi (2009b) and Williams (2008) found significant positive relationship between trust and the confidentiality of online trading services. This study also proposes that an investor might be more willing to perform trading transactions via the online platform, when he/she places a high level of trust on the security of his/her transactions. Therefore, it is hypothesized that:

H3: Investors' trust perceptions in online stock trading will be positively related to their attitudes towards adopting online stock trading.

Perceived Self -Efficacy (SE)

A person's belief in his or her ability and cognitive skills as adequate enough to cope with a given events

is termed 'Perceived self-efficacy'. According to Ajzen (2002) PBC evaluates the extrinsic factors, which influence the performance of behaviour based on one's capability, while perceived self-efficacy evaluates one's behaviour with respect to a variety of extrinsic variables. Basically, individuals' with high self-efficacy are expected to possess better cognitive ability and excel under various situations, which demand quick decision making and motivation (Bandura, 1997). The effect of self efficacy has been realized in earlier studies on the acceptance of computer technology. For instance, researchers have confirmed the existence of a positive relationship between self efficacy and intention towards technology adoption (Bandura, 1997; Chou, Lee, et al., 2004; Eastin et al., 2000; Hsu et al., 2004; Taylor & Todd, 1995b). Consequently, this study proposes that:

H4: Investors self-efficacy on online stock trading service will be positively related to their perceived behavioural control.

Investors' Knowledge for Investment

Perceived knowledge can be described as an individual's perception on his or her capability to understand new technology (Michelle, 2005). Knowledge is expected to have an influential impact on a person's decision to use online trading service (Ramayah et al., 2009). Based on the extension of the TPB model, the level of consumer's knowledge was shown to have a significant effect on PBC, and can also be considered as a good indicator of intention (Abroud et al., 2010). In essence, an individual who lacks confidence in handling a new challenge might resent change. Conversely, an investor who is confident in his/her ability in conducting online transaction will exercise control over the use of online platform.

H5: Investors perception of their knowledge in online stock trading is positively related to PBC to use online stock trading service.

Economic Value (Time Saving and Cost Reduction)

Keeney (1999) describes cost reduction and time saving as functions of economic value of e-finance as well as the two important components for transaction costs in micro-economics. Transaction cost theory (TCT) proposes that a buyer will continue to obtain information until the point where the average cost of attaining extra information is equal to or more than the average benefit expected (Steiger, 1990; Urbany 1986). Expressing this in the light of economic theories of consumer behavior, it could be suggested that the economic value of e-commerce has a positive influence on online consumer behavior. Also, research model based on TAM, considers both cost reduction and time saving as the external belief which direct consumers' attitude towards online trading service. Following the above, it is hypothesized that:

H6a: Investors perception on cost reduction will be positively related to their attitude towards online stock trading.

H6b: Investors perception on time saving will be positively related to their attitude towards online stock trading.

Attitude towards Online Stock Trading

Individual's attitude towards technology is the only common variable across the three theories of TRA, TAM and TPB. According to Fishbein et al, (1975, p.77) attitude represents "a person's general feeling of favorableness or unfavourableness towards some stimulus object." This variable has been established to have a direct effect on behavioural intention as well as indirect effect on the actual behaviour (Fishbein & Ajzen, 1975; Ajzen, 2001; Davis et al., 1989). Further studies have proven the significant effect of investors' attitude on their intention to adopt online trading

service (Fan, 2001); Kim et al., 2004; Park et al., 2003; Ramayah et al., 2009). Accordingly, the below hypothesis is suggested.

H7a: Investors attitude toward using Internet stock trading will be positively related to their intention to accept Internet stock trading platform.

Attitude as a Mediator

This study considers attitude as the mediator of the direct relationship between the PUS and the behavioral intention. Attitude may be considered as a mediator to the extent to which it has an influence on the effect which the independent variable (i.e. intention) has on the dependent variable (i.e. PUS). Cheng, Lam, and Hsu (2004) confirmed the mediating effect of attitude on the relationship between past behavior and customer dissatisfaction. Prior works in electronic learning, competency management have also revealed that the relationship between perceived usefulness and behavioural intention is mediated by individual's attitude. (Hanneke Heinsman, Hoogh, & Koopman, 2007). Therefore, the hypothesized relationship is stated as:

H7b: Attitude towards online stock trading mediates the relationship between the perceived usefulness and investors' intention to adopt online stock trading.

Subjective Norms (SN)

This construct is actually related to the social pressure that directs an individual to exhibit certain behaviour as well as the individual's perception of this pressure. It is based on the philosophy that the behaviour of an individual is affected by his/her attitude as well as idea on the social group to which he/she belongs (Ajzen, 1991). For the purpose of this research, subjective norm is defined as the extent to which the family, friends, competitors and peers acknowledge the use of online trading service. Several empirical research have confirmed the effect of subjective norm on the intention to use online trading (Ruben, Gerard, & Roberto, 2010; Ramayah et al., 2009). Thus, it is hypothesized that:

H8: Investors subjective norm regarding Internet stock trading will influence their intention to adopt Internet in stock trading.

Perceived Behavioural Controls (PBC)

Ajzen (1989) expressed behavioural controls as the perception of one's belief about the capability to exhibit a specific behaviour. Generally, it can be defined as, 'the extent to which an individual has the ability to perform (how much of the behaviour is under his control) a specific behavior'. This research recognized the control of perceived behaviour based on the level of difficulty that is involved in order to execute trading transactions over the Internet. Extant literature suggests that perceived behavioural control will have positive effect on the intention to use online stock trading (Gopi et al., 2007; Hsing, 2005; Lau, 2002). Thus, it is hypothesized that:

H9: Investors perceived behavioural control will be positively related to their intention to use online stock trading.

Perceived Usefulness and Intention

Individual's intention can be defined as "the degree to which a person has formulated conscious plans to perform or not to perform some specified future behaviour" (Davis et al., 1992,p.134). Prior studies did not find any evidence to support the relationship between perceived usefulness and intention to use online stock trading service, however studies in other context like Internet banking, e-service, and online shopping (Liao et al., 2001; Venkatesh

et al., 2000; Ming-Chi, 2009b) have confirmed this relationship. Consequently, as usefulness is one of the main elements of attitude, the present study further proposes the possibility of a direct relationship between investors' PUS and their intention to use online stock trading platform. The related hypothesis is presented as follows:

H10: Investors' perceived usefulness of online stock trading will have a positive effect on their intention to adopt online stock trading.

Demographic Variables

Demographic analysis examines the effect of differences in gender and age on individual's intention to adopt technology, like e-commerce (Morris et al., 2000). Apparently, differences in gender, age, and education will likely have significant influence, as the determinants of individual's behavioural intention. Prior studies revealed that customers demographic can be deployed in understanding their needs and effectively delivery offering to meet such specific needs (Bellman et al., 1999; Bhatnagar et al., 2000; Chan et al., 2004). Consequently, it is hypothesized that:

H11a: The Age of investors will have positive relationship with their intention to adopt online stock trading platform.

H11b: Investors gender will have positive relationship with their intention to adopt online stock trading platform.

H11c: The educational level of investors will have positive relationship with their intention to adopt online stock trading platform.

CONCLUSION

Both TAM and TPB have been utilized as independent research model to predict and understand user perceptions about the useful of a given system and the probability of adopting such system. Further to this, the present study proposed an integration of TAM, TPB and TCT, in order to develop a more comprehensive model for explaining the adoption of online trading service platform. Specifically, the proposed model identified ten main antecedents, which were further delineated into six different components, as follow: perceived usefulness and perceived ease of use (Attitude); trust perceived (Trust); cost reduction and time saving (Economic value); Self-efficacy, investors knowledge (Control); subjective norms; and demographic factors (Age, Gender and Education).

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Chapter 25
Structural Models for E-Banking Adoption in Vietnam

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ABSTRACT

E-banking is seen as the newest delivery channel for banking services in many developed countries and is believed to have a significant impact on the bank market. E-banking is providing numerous opportunities for banks and non-bank financial institutions to add a low cost distribution channel to their existent distribution channels. Little research on factors influencing the adoption of e-banking has been implemented in countries with very high economic growth rates (such as Vietnam) that are emerging as new potential markets. Thus, this study has, based on an extensive literature review on e-banking benefits for both banks and their customers and relevant theories on innovation adoption, proposed alternative models (including both moderator and mediating effects) of e-banking intention to use by customers in Vietnam. Furthermore, a set of model hypotheses presenting relationships among factors influencing e-banking intention to use have been set up. Practical implications and future studies were also discussed.

INTRODUCTION

Banking can be considered an intensive information activity based on communication and information technologies for the purpose of gaining, processing and distributing information to users involved (Keramati et al., 2012; Srinivasan, 2010; Sufian, 2010). Such technologies play an important role not only in the three stages of information (Smolander, 2010), but also in creating favorable conditions for banks to differentiate their products and services from their rivals (Yan et al., 2012). In order to be successful in a highly competitive banking market, it is required that banks innovate and update their products/services offered in an attempt to retain their demanding and discern-

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ing customers (Pham, 2010). Facing challenges related to gaining a larger share of the banking market, a number of banks have been making significant investments in building more brick and mortar branches to expand their geographical penetration, while others have been utilizing the Internet to distribute banking products/services (Schubert et al., 2011). In the 1990's, the Internet rapidly gained popularity as a potential medium for electronic commerce (Crede, 1995). Rapid growth of the Internet has brought about numerous new opportunities as well as threats to businesses (Cruz-Cunha & Putnik, 2009). Today, the Internet is believed to be a full-fledged delivery and distribution channel supporting consumer-oriented applications (Mouakket, 2010; Pham & Teich, 2011; Varajao et al., 2009), including those aimed at effectively and efficiently providing financial products and services to customers in the banking sector (Pham, 2010).

In the US, banks have been offering their services/products to customers via the Internet and a number of Internet banks, such as Bank of Internet, have emerged. In addition, the Internet is viewed as a strategic weapon that is expected to bring about new comparative advantages for banks, especially when competitive advantages of traditional branch networks are rapidly eroding (Seitz & Stickel, 1998) and brick and mortar only banks may largely disappear.

Indeed, the emergence of e-banking has induced many banks to rethink their information technology strategies in order to stay competitive (O'Connor & Arteaga, 2008). It should be noted that customers are today increasingly demanding with respect to the quality of banking services. They want better levels of convenience and flexibility with banking products and services that traditional retail banking could not offer (Lagoutte, 1996). E-banking has made favorable conditions for banks and other financial institutions to offer such products and services by taking advantage of an extensive public network infrastructure (Ternullo, 1997). However, in spite of such potential benefits, there still exist a number of problems that need to be dealt with before e-banking can become widely adopted (Pham, 2010).

Up to now, a great deal of literature has identified key factors influencing the adoption of e-banking in developed countries – North America and Europe and to a lesser extent in other regions including a mix of developed and developing countries, such as Singapore, Taiwan, Malaysia, and Thailand (Pham, 2010). However, little research on factors influencing the adoption of e-banking has been implemented in countries that are emerging as new potential markets with very high economic growth rates. Among these countries is Vietnam where its average economic growth rate (GDP) was over 7% during the 1990s and early 2000s, and more than 8% in 2006, which made it one of the highest growing economies in the World (World Bank, 2006). Together with Vietnam's entry into the World Trade Organization dated on 7 November 2006, its banking sector is increasingly being deregulated in accordance with the requirements set up by the World Trade Organization. These moves create the opportunity for fierce competition among local banks and foreign banks, and Vietnamese banks may have to adopt the Internet as a primary service delivery channel in order to survive. Thus, the objectives of this study are as follows:

1. Investigate e-banking benefits for both banks and customers;
2. Conduct an extensive review of literature on relevant theories on adoption of an innovation; and finally;
3. Construct alternative structural models based on integration of the tenets of innovation theories, trust, perceived risk, bank image, and perceived benefit for e-banking adoption in Vietnam.

BACKGROUND

E-Banking

E-banking can be considered as a high-order construct comprising several distribution channels. E-banking is a larger concept than just banking conducted by the Internet. Nonetheless, the most popular kind of e-banking is today believed to be banking through the Internet - Internet banking. In its simplest sense, e-banking is viewed as the provision of information or services by a bank to its customers based on a computer, television, telephone, or mobile phone (Daniel, 1999). For instance, under the view of Jun and Cai (2001), Internet banking is seen as an electronic connection between banks and customers aimed at preparing, managing, and controlling numerous financial transactions. By utilizing e-banking, it is very convenient for consumers to access their banks and accounts to implement their banking transactions. In a more sophisticated view, e-banking is named transactional online banking due to the fact that it embeds the provision of facilities, such as accessing accounts, transfer of funds, and buying financial products or services online (Sathye, 1999). In this paper, without loss of generality, the terms e-banking and online banking (or even Internet banking) are used interchangeably.

E-banking is seen as the newest delivery channel of banks in many developed countries and is believed to have a significant impact on the banking market (Jayawardhena & Foley, 2000). Nehmzow (1997) contends that e-banking is providing numerous opportunities for banks and non-bank financial institutions to add a low cost distribution channel to their existent distribution channels in order to better serve their customers. However, he further contends that e-banking also brings about challenges to traditional banks because it neutralizes competitive advantages rooted in a traditional banking network.

It is predicted that e-banking will continue mushrooming and this trend may impact the future of traditional banks (Pham, 2010). According to Wah (1999), it is not reasonable to say that such traditional banks are likely to disappear in the near future. Rather, they will be placed on a new level of banking services/products with the support of new and modern distribution channel technologies. Furthermore, Wah (1999) argues that traditional banks can take advantage of new and modern technologies and they are very likely to effectively and efficiently serve their customers. Finally, Wah (1999) concludes that e-banking is really beneficial to customers and that e-banking and traditional banking can coexist.

E-Banking's Benefits

For Banks

Cost savings, efficiency, gaining new segments of customers, improvement of the bank's reputation and better customer services and satisfaction are primary benefits e-banking may bring to banks (Jayawardhena & Foley, 2000). Booz-Allen and Hamilton (1997) argue, based on their global survey, that setting up a specialized e-banking infrastructure costs about US$1 – 2 million, which is much lower than setting up a banking branch. In addition, the authors conclude that costs for running a traditional bank account for 50% to 60% of its revenues.

According to Robinson (2000), costs for conducting a banking transaction online are much lower than at a brick and mortar branch. Moreover, Sheshunoff (2000) contends that one of the most important factors influencing the adoption of e-banking by banks is the need to build up strong barriers to customer exiting. According to Sheshunoff (2000), once customers become familiar with the utilization of full service e-banking, it is unlikely that they will change to another financial

institution. Such an argument can be supported by the consumer behavior theory that switching costs (e.g., time and effort) are often very high. Finally, the author emphasizes that the implementation of e-banking can bring about many competitive advantages for banks in today's highly competitive banking market.

Research on e-banking has been carried out in Denmark by Mols (1998). The author argues that e-banking can play an important role in enhancing cross-selling and price differentiation. E-banking allows banks to provide customers numerous services 24 hours a day and 7 days a week and so can improve customer satisfaction. This in turn makes customers less price sensitive, improves their intention to repurchase, increases customer loyalty and results in more positive words of mouth.

For Customers

E-banking not only brings about benefits to banks but also to their customers. Thanks to the emergence of the Internet, banking transactions are no longer limited to time and geography. It is very easy for consumers throughout the world to have access to their bank accounts 24 hours per day and seven days a week even from the privacy of their own home. Customers can enjoy a variety of services, including services not provided by traditional bank branches. It is argued that one of the greatest benefits of e-banking is that e-banking products/services are inexpensive or may even be free and that customers save even more money as well as time because they do not have to travel to or from a bank branch (Pham, 2010). However, some people believe that prices appear to be one factor that impedes the diffusion of e-banking (Sathye, 1999). The price debates revolve around geographical differences between costs of Internet connections and telephone call pricing.

STRUCTURAL MODELS FOR E-BANKING ADOPTION IN VIETNAM

International Studies of Consumer Adoption of E-Banking

Banks implementing e-banking services may benefit by better understanding their customers' attitudes towards technology. If banks are successful in doing so, they may be able to positively impact and even determine consumer behavior, thereby gaining a competitive advantage. There have been so far a significant number of discussions in the literature about the adoption process of e-banking services. The Appendix summarizes the results of such studies. These research studies utilized theory of planned behavior (TPB), theory of reasoned action (TRA), technology acceptance model (TAM), and decomposed theory of planned behavior (DTPB) to investigate the e-banking adoption construct. However, such studies have not examined any moderating effects on the relationship between perceived benefit and intention to use.

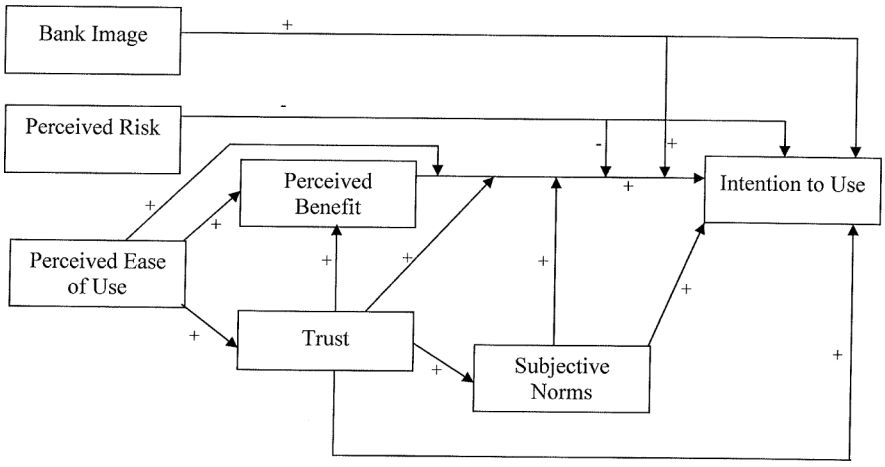
A Conceptual Model for E-Banking Adoption in Vietnam

Based on an integration of the innovation theories, trust, perceived risk, bank image, and perceived benefit, a conceptual model for e-banking adoption in Vietnam is built in Figure 1.

The following are theoretical support and resulting hypotheses that elicit causal relationships postulated in the model.

Corporate image refers to the extent to which reputational knowledge of an organization has been accumulated and developed by customers. Such a reputational knowledge is rooted in the minds of the customers. Specifically, reputational knowledge can be represented by a distinctive reputation

Figure 1. A conceptual model for e-banking adoption in Vietnam



by a firm in offering products/services with very high quality (Olavarrieta and Friedmann, 1999). Gronroos (1984) argues that corporate image is very likely to make significant contributions to the development of service quality. Image is believed to function well to overcome complexities generated by distinct attributes of service and when small problems occur from functional and technical aspects of quality. In addition, the results of a study conducted by Kang and James (2004) revealed that corporate image plays as a mediator between service quality dimensions and the overall service quality, and the overall service quality is positively related to customer loyalty.

Furthermore, corporate image can be understood as customers' affective preconceptions towards the service provider, accumulated and developed via continuous service experiences (Zins, 2001). Based on this definition, a bank image plays a vital role in the adoption of e-banking. Thus, under Vietnam's e-banking setting, we hypothesize that:

Hypothesis 1: Bank image will have a positive direct relationship with intention to use e-banking.

An e-banking transaction is considered as a mode of trusting behavior due to the fact that customers are themselves engaging in vulnerable situations regarding such e-banking transactions. Customers are willing to utilize e-banking as long as they believe that e-banking functions well and performs what they expect it to do.

In e-settings, people from almost everywhere in the world are easily to get access to documents stored on computers and in the same vein, information is easily to be transferred through e-technologies with computer networks. That is why under the security perspective, e-banking is considered as being risky. In addition, e-banking is characterized by highly uncertain transactions since people who make such transactions very often come from different places in the world. The utilization of e-banking can be considered as a new information and communication technology and under the marketing perspective, it is also viewed as a new distribution channel technology based on which customers can easily contact with their bank. In the marketing field, a number of empirical studies have been conducted to show that perceived risk is a very important construct (Gefen, 2004). In such studies, perceived risk is

shown to have significant effects on customer loyalty. Thus, under Vietnam's e-banking setting, we hypothesize that:

Hypothesis 2: Perceived risk will have a negative direct relationship with intention to use e-banking.

Perceived benefit is, in the literature of technology acceptance, defined as an individual's positive or negative evaluation of performing a type of behavior (Chau & Hu, 2001). Hansen et al. (2004) found a significantly positive association between perceived benefit and behavioral intention to use online shopping for groceries. Similarly, other prior research has indicated that perceived benefit has strong impacts on behavioral intention to utilize an innovation, for example, word processing software (David et al., 1989) or spreadsheet software (Mathieson, 1991). If someone has a feeling that utilizing e-banking will bring about positive outcomes, then such a person may have more intention to adopt e-banking. In contrast, if someone has a negative feeling of outcomes resulting from utilizing e-banking, he or she may have a lower adoption intention. Thus, under Vietnam's e-banking setting, we hypothesize that:

Hypothesis 3: Perceived benefit will have a positive direct relationship with intention to use e-banking.

Subjective norms refer to the person's perception that most people who are important to him think that he should or should not perform the behavior in question (Ajzen & Fishbein, 1980). Several theories suggest that subjective norms are important in shaping user behavior. For example, TPB suggests that subjective norms influence a person's behavioral intention. Venkatesh and Davis (2000) explain the effect of subjective norms on behavioral intention to use in the way that potential users may choose to use the technology if the people who are important to them say that they should use it. Thus, under Vietnam's e-banking setting, we hypothesize that:

Hypothesis 4: Subjective norms will have a positive direct relationship with intention to use e-banking.

Trust has been shown to have a mediating role in IS adoption models (Gefen et al., 2003; Ribbink et al., 2004; Chen & Dhillon, 2003; Jarvenpaa et al., 2000; Rotter, 1971). Trust plays an important role in many transactional buyer-seller relationships, especially in settings containing risks (McKnight et al., 1998). It is argued that trust serves a critical role under online business settings where it is impossible to have face-to-face interaction with staff. In general, trust can be defined as an expectation one has that others will not behave opportunistically. Alternatively, trust can be defined as one's belief that others are going to behave in a dependable, ethical, and socially desirable manner (Rousseau et al., 1998). Moreover, trust can be conceptualized as a combination of such factors as trustworthiness, integrity, honesty, and benevolence of e-vendors that are expected to escalate behavioral intentions via reduced risks among potential but inexperienced customers (Jarvenpaa & Todd, 1996; Gefen et al., 2003). Thus, under Vietnam's e-banking setting, we hypothesize that:

Hypothesis 5: Trust will have a positive direct relationship with intention to use e-banking.

The relationship between trust and perceived benefit has been widely discussed in a variety of contexts including online based business settings (Gefen et al., 2003; Pavlou, 2003; Saeed et al., 2003; Gefen, 2004). Specifically, trust and TAM is well integrated in the online shopping setting (Gefen et al., 2003). Such an integration showed that trust is an antecedent of perceived benefit.

Trust is contended to serve as an important determinant of perceived benefit, especially in the online environment due in part to the guarantee that consumers expect the perceived benefit from the website with the sellers behind it. Furthermore, trust is strongly believed to have positive impacts on perceived benefit on the ground that trust makes favorable conditions for consumers to be vulnerable to e-vendor to ensure that they achieve expected useful interactions and services (Pavlou, 2003). While consumers initially trust their e-vendors and have a feeling that online service adoption is efficient to their job performance, they intend to believe that such online services are useful (Gefen et al., 2003). Thus, under Vietnam's e-banking setting, we hypothesize that:

Hypothesis 6: Trust will have a positive direct relationship with perceived benefit.

Many studies have been conducted and found that there is a strongly positive correlation between users' and IS units' mutual trust and mutual influence (Nelson & Cooprider, 1996). Moreover, it is elicited by Decomposed TPB that users can be influenced by their peers and superiors in determining subjective norm towards the IS utilization (Taylor & Todd, 1995). To put it another way, it is very possible that trust in peers and superiors regarding their beliefs of the IS utilization plays an important role in determining subjective norm. In a similar vein, trust in e-vendors regarding their reputation, brand name, and service might have positive impacts on subjective norm over online transactions' behavior. Additionally, aspects of reputation, brand name, and service might elicit certain relationships between trust in peers and superiors and trust in vendors. Hence, whatever types of trust are with direct and indirect impacts on subjective norm, they are all serving as important antecedents of subjective norm in the online setting. Thus, under Vietnam's e-banking setting, we hypothesize that:

Hypothesis 7: Trust will have a positive direct relationship with subjective norms.

The relationship between perceived ease of use and perceived benefit can be explained in the manner that if other things are equal, the easier the technology is to use, the more beneficial it can be (Venkatesh & Davis, 2000). If using the technology is easy, potential users do not have to spend too much time to learn how to use the technology; this may influence the performance of the user. Besides, TAM has verified the effects of perceived ease of use on perceived benefit (David, 1989; David et al., 1989). Extensive research has shown significant effects of perceived ease of use on perceived benefit (e.g., Chan & Lu, 2004). Thus, under Vietnam's e-banking setting, we hypothesize that:

Hypothesis 8: Perceived ease of use will have a positive direct relationship with perceived benefit.

Perceived ease of use is, in many studies, found to have positive impacts on trust since perceived ease of use is very likely to escalate customers' favorable impressions towards e-vendors in the online service initial adoption and lead customers to be willing to make investments and commitments in buyer-seller relationships (Gefen et al., 2003). Under the view of social cognitive theory, perceived ease of use is strongly contended to have positive impacts on an individual's favorable outcome expectation towards an innovative technology adoption (Bandura, 1986). Such a contention is based on the fact that cognition-based trust, as mentioned above, is primarily constructed on the first impression of the individual towards a certain behavior. Specifically, perceived ease of use under the online service setting is viewed as the first feeling or expectation set up for continued online transactions. Thus, under Vietnam's e-banking setting, we hypothesize that:

Hypothesis 9: Perceived ease of use will have a positive direct relationship with trust.

Theories of reasoned action (TRA) and planned behavior (TPB) and their derivatives have been utilized to predict possible adoption of information technology (Benbasat and Barki, 2007). While such studies have escalated our understanding of how the theories' main contructs have effects on IT adoption, they ignore nonlinear relationships among the constructs. The fact that ignoring the nonlinear effects is very likely to either understate or overstate the main effects which might lead to erroneous, partial, or incomplete interpretations (Ping, 2002). That is the reason Ping (2002) strongly argue that investigating complicated and contingent relationships among the main constructs will bring about finer grained knowledge about determinants of individual IT adoption. Thus, under Vietnam's e-banking setting, we hypothesize that:

Hypothesis 10: The relationship between perceived benefit and intention to use e-banking will be positively moderated by perceived ease of use.

Hypothesis 11: The relationship between perceived benefit and intention to use e-banking will be positively moderated by trust.

Hypothesis 12: The relationship between perceived benefit and intention to use e-banking will be positively moderated by subjective norm.

Hypothesis 13: The relationship between perceived benefit and intention to use e-banking will be negatively moderated by perceived risk.

Hypothesis 14: The relationship between perceived benefit and intention to use e-banking will be positively moderated by bank image.

Formal Representation of the Conceptual Model

The research hypotheses can be integrated to form a set of structural equations. Since the moderator effects of perceived ease of use, trust, subjective norm, perceived risk, and bank image on the relationship between perceived benefit and intention to use have not been clearly tested in the literature, we create six competing structural models from the conceptual model illustrated in Figure 1. Model A is without any moderator effects. Model B is Model A plus the moderator effect of perceived ease of use on the relationship between perceived benefit and intention to use. Model C is Model B plus the moderator effect of trust. Model D is Model C plus the moderator effect of subjective norm. Model E is Model D plus the moderator effect of perceived risk. Model F is Model E plus the moderator effect of bank image. The following abbreviations are used for simplicity: bank image (BI), perceived risk (PR), perceived ease of use (PEU), perceived benefit (PB), trust (T), subjective norm (SN), and intention to use (IU).

Model A can be represented by Equations (1)-(5):

$$IU = \beta_1(BI) + \beta_2(PR) + \beta_3(PB) + \beta_4(SN) + \beta_5(T) + e_1 \quad (1)$$

$$PB = \beta_7(PEU) + \beta_8(T) + e_2 \quad (2)$$

$$T = \beta_9(PEU) + e_3 \quad (3)$$

$$SN = \beta_{10}(T) + e_4 \quad (4)$$

To represent Model B, we modify Equations (1):

$$IU = \beta_1(BI) + \beta_2(PR) + \beta_3(PB) + \beta_4(SN) + \beta_5(T) + \alpha_1(PEU*PB) + e_1 \quad (5)$$

Equations (2)-(4) are kept unchanged.

Model C can be represented:

$$IU = \beta_1(BI) + \beta_2(PR) + \beta_3(PB) + \beta_4(SN) + \beta_5(T) + \alpha_1(PEU*PB) + \alpha_2(T*PB) + e_1 \quad (6)$$

Equations (2)-(4) are kept unchanged.

Model D can be represented:

$$IU = \beta_1(BI) + \beta_2(PR) + \beta_3(PB) + \beta_4(SN) + \beta_5(T) + \alpha_1(PEU*PB) + \alpha_2(T*PB) + \alpha_3(SN*PB) + e_1 \quad (7)$$

Equations (2)-(4) are kept unchanged.

Model E can be represented:

$$IU = \beta_1(BI) + \beta_2(PR) + \beta_3(PB) + \beta_4(SN) + \beta_5(T) + \alpha_1(PEU*PB) + \alpha_2(T*PB) + \alpha_3(SN*PB) + \alpha_4(PR*PB) + e_1 \quad (8)$$

Equations (2)-(4) are kept unchanged.

Model F can be represented:

$$IU = \beta_1(BI) + \beta_2(PR) + \beta_3(PB) + \beta_4(SN) + \beta_5(T) + \alpha_1(PEU*PB) + \alpha_2(T*PB) + \alpha_3(SN*PB) + \alpha_4(PR*PB) + \alpha_5(BI*PB) + e_1 \quad (9)$$

Equations (2)-(4) are kept unchanged.

We suggest that these alternative structural models (Model A, Model B, Model C, Model D, Model E, and Model F) need to be tested independently and their results need to be compared and contrasted.

CONCLUSION AND DIRECTIONS FOR FUTURE RESEARCH

Up to now, a great deal of literature has identified key factors influencing the adoption of e-banking in developed countries – North America and Europe and to a lesser extent in other regions including a mix of developed and developing countries, such as Singapore, Taiwan, Malaysia, and Thailand. To put it another way, little research on factors influencing the adoption of e-banking has been implemented in countries that are emerging as new potential markets with very high economic growth rates. Among these countries is Vietnam where its average economic growth rate (GDP) was over 7% during the 1990s and early 2000s, and especially more than 8% in 2006, which made it one of the highest growing economies in the World (World Bank, 2006). Together with Vietnam's entry into the World Trade Organization dated on 7 November 2006, its banking sector is increasingly being deregulated in accordance with the requirements set up by the World Trade Organization. These moves seem to indicate that fierce competition among local banks and foreign banks in Vietnam have been occurring, and Vietnamese banks have to adopt the Internet as a primary service delivery channel in order to survive. However, there are no comprehensive models or frameworks to explain the e-banking adoption by customers in Vietnam.

This study has, based on an extensive review of literature on e-banking benefits for both banks and their customers, trust, perceived risk, bank image, and relevant theories on innovation adoption, proposed alternative structural models (including both moderator and mediating effects) for e-banking adoption in Vietnam. Furthermore, a set of model hypotheses presenting relationships among the factors influencing e-banking adoption have been set up.

The next step in the development of such models is to statistically test the aforementioned hypotheses in the Vietnamese setting. Each of the factors identified in the previous discussion will form the basis for analysis in the empirical study of e-banking adoption in such a new context. The models presented in this paper are unique as at present, there are no comprehensive theoretical and practical models for analyzing e-banking adoption in newly emerging countries such as Vietnam. None of the prior models have taken into account the interactions between innovation theories, trust, perceived risk, bank image, and

intention to use e-banking. These models can provide an impetus for future research, structuring them along the lines of interactions between such above theories and factors that will expand the frontiers of knowledge in e-banking adoption.

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APPENDIX

Table 1. International studies on e-banking adoption

References	Name of Study	Models Utilized	Determinants
Hussein and Zolait, 2010	An examination of the factors influencing Yemeni bank users' behavioral intention to use Internet banking services	TPB (theory of planned behavior) TRA (theory of reasoned action)	+ Attitude + Subjective norm +Perceived behavioral control + Ease of use + Awareness + Advantage + Media
This study, based on a self-administered survey involving a convenience sample of 369 Yemeni bank customers, investigates the potential prominent factors relating to the adoption and use of the financial services of Internet banking in Yemen. The authors of this study show that the overall prominent predictors include Relative Advantage/Compatibility, User's Informational-Based Readiness, Attitude, Observability, Technology Facilitating Condition, Perceived Behavioural Control and Self-efficacy. The model accounted for 75 per cent of the variation of an individual's behavioural intention to use IB.			
Ozdemir and Trott, 2009	Exploring the adoption of a service innovation: a study of Internet banking adopters and non-adopters	TAM (technology acceptance model) Diffusion of Innovation Theory of perceived Risk	+ Socioeconomic factors + Situational factors + Perception factors related to Internet banking use + Related experiences
Findings: The authors show that Internet banking adopters and non-adopters have different perceptual, experience-related, socioeconomic and situational characteristics. In addition, besides the perceptual factors related to Internet banking use, perceptual factors in relation to the banks in Turkey have significant impacts on Internet banking adoption.			
Alhudaithy and Kitchen, 2009	Rethinking models of technology adoption for Internet banking: the role of website features	TAM TRA TPB	+ Website features
Findings: The authors show that website features have significant impacts on technology adoption, and specifically Internet banking.			
Yousafzai, Pallister and Foxall, 2009	Multi-dimensional role of trust in Internet banking adoption	Model of trust for Internet banking	+ Trust + Perceived risk
Findings: The authors show that trust and perceived risk are direct antecedents of intention, and trust is a multi-dimensional construct with three antecedents: perceived trustworthiness, perceived security, and perceived privacy.			
Ndubisi and Sinti, 2006	Consumer attitudes, system's characteristics: an internet banking adoption in Malaysia	Decomposed TPB	+ Banking needs + Compatibility + Complexity + Trainability + Risk + Utilitarian orientation + Hedonic orientation
Findings: The authors show that attitudinal factors play an important role in explaining the e-banking adoption. In addition, utilitarian orientation of the website, not hedonic orientation, has significant impacts on adoption.			
Fink et al., 2005	Internet banking adoption strategies for a developing country: the case of Thailand	Decomposed TPB	+ Features of the web + Perceived usefulness + Risk and privacy + Personal preference + External environment + Culture
Findings: The authors reveal that the attitudinal factors, such as features of the website and perceived usefulness, are very likely to have positive impacts on the e-banking adoption in Thailand, while the most salient impediment to the e-banking adoption is a perceived behavioral control, or external environment. Besides such above factors, the important moderating factors are gender, educational level, income, internet experience and internet banking experience, but not age.			

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Table 1. Continued

References	Name of Study	Models Utilized	Determinants
Eriksson, Kerem and Nilsson, 2005	Customer acceptance of internet banking in Estonia	TAM	+ Trust + Perceived usefulness + Ease of use + Use
Findings: The authors indicate that the utilization of e-bank is very likely to elevate if customers perceive e-banking as useful. Specifically, the perceived usefulness is very important due to the fact that it determines if the perceived ease of use of e-bank results in increased use of e-bank. In other words, e-banking services which are well-designed and easy to use might not be realized if they are not perceived as useful. Hence, the authors conclude that the perceived usefulness of e-banking plays an important role in motivating customer usage. Moreover, the authors contend that technology acceptance models need to be redesigned with more emphasis placed on the importance of the services' perceived usefulness offered by the technology.			
Pikkarainen et al., 2004	Consumer acceptance of online banking: an extension of technology acceptance model	TAM and focus group	+ Perceived usefulness + Perceived ease of use + Perceived enjoyment + Information on online banking + Security and privacy + Quality of internet connection
Findings: The authors conclude that perceived usefulness and information on online banking of the Website are viewed as the primary factors that are very likely to have impacts on the acceptance of online banking.			
Wang, Lin and Tang, 2003	Determinants of users acceptance of internet banking	TAM	+ Trust/Perceived credibility + perceived usefulness + Ease of use + Computer self-efficacy + Intention
Findings: Based on the results of the study, the authors conclude that individual difference variables such as computer self-efficacy have significant effects on behavioral intention via perceived ease of use, perceived usefulness, and perceived credibility. In addition, the authors show that users with a higher computer-self efficacy are likely to have more positive usefulness and ease of use beliefs, but have more negative credibility beliefs in e-banking. Such results are in line with that of the prior studies which have indicated that there is a significant direct e-banking relationship between computer-self efficacy and perceived ease of use of e-banking. Finally, the authors show that computer-self efficacy has a negative impact on perceived credibility; however, its total impact on behavioral intention is positive.			
Shih and Fang, 2003	The use of decomposed theory of planned behavior to study internet banking in Taiwan	TPB and Decomposed TPB	+ Behavior intention + Actual usage + Attitude + Subjective norms + Perceived advantage + Relative advantage + Compatibility + Complexity + Normative influences + Efficacy + Facilitating
Findings: It is, based on the decomposed TPB model, shown in this study that only relative advantage and complexity are related to attitude, but compatibility is not related to attitude. In terms of subjective norm, the causal path starting from subjective norm to intention is not statistically significant. Nevertheless, self-efficacy is found to be a significant determinant of PBC. Finally, the authors show that facilitating conditions do not have impacts on perceived behavioral control.			
Suh and Han, 2002	Effects of trust on customer acceptance of internet banking	TAM	+ Trust + Perceived usefulness + Ease of use + Attitude + Intention to use
Findings: It is shown in this study that trust plays the most important role in explaining a customer's attitude towards utilizing e-banking. In line with TAM, in this study, customer perception of the usefulness and ease of use also have significant impacts on attitude. Moreover, behavioral intention to use e-banking is significantly related to attitude, perceived usefulness, and trust. Such findings elicit that trust is much emphasized by customers in e-environments with a lot of sensitive information.			

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Table 1. Continued

References	Name of Study	Models Utilized	Determinants
Karjaluoto, Mattila and Pento, 2002	Factors underlying attitude formation towards online banking in Finland	TAM	+ Prior computer experience + Prior technological experience + Prior banking experience + Reference group influences
Findings: It is shown in this study that prior computer experience, prior technology experience, personal banking experience, reference group and computer attitudes have significant impacts on attitude and behavior towards e-banking. In addition, there is a significantly positive relationship between personal banking experience and attitude.			
Black et al., 2001	The adoption of internet financial service: a qualitative study	Decomposed TPB	+ Relative advantage + Compatibility + Trainability + Observability + Complexity
Findings: The authors of this study concentrate on innovations related to delivery of financial services via the e-channels and on reassessment of Rogers' (1983) model's applicability. The data was colleted via the focus group members based on their usage of the internet. There are differences between people who utilize the internet to buy financial services (S3) and people who utilize the internet to buy goods/services (not financial services) (S2) in terms of income and the utilization of information technology (higher levels for S3). When S2 is compared with S1 (people who utilize the internet without buying anything over the internet), there are also differences in terms of income and the product related environment (higher levels for S2). Based on such comparisons among the three groups, it is shown that considering factors of Rogers' model, similar attitudes exist in S1 and S2 regarding their perceived advantages by utilizing e-banking compared to utilizing bank branches and risks involved. S1 and S2 attitudes are much less positive than that of S3. In addition, compatibility with a person's values and previous experience with the product category is proved to be one of the most important factors affecting the adoption of the internet to carry out financial transactions. Trialability is considered important for the future adoption, but its availability needs to be better communicated. In spite of the fact that Rogers' model utilized to assess an innovation's perceived attributes is thought of as a useful starting point, there are still other issues emerged that should be taken into consideration, such as societal issues and the sense of fatalism. It seems that the former may have a negative effect on the adoption, while the latter may have a positive effect on the adoption.			
Tan and Teo, 2000	Factors influencing the adoption of internet banking	TPB and Diffusion of Innovation	+ Relative advantages + Compatibility with values + Internet experiences + Banking needs + Complexity + Trialability + Risk + Self efficacy + Government support + Technology support + Social norms
Findings: The findings from the study uncover that factors such as attitudinal and perceived behavioral control factors, not social influence, have a significant role in influencing the intention to adopt e-banking. Specifically, perceptions of relative advantage, compatibility, trialability, and risk towards utilizing the internet have impacts on intentions to adopt e-banking services. Furthermore, the confidence in utilizing e-banking services and perception of government support for e-commerce also have impacts on intentions to adopt e-banking services.			

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Table 1. Continued

References	Name of Study	Models Utilized	Determinants
Liao et al., 1999	The adoption of virtual banking: an empirical study	TPB and Diffusion of Innovation	+ Attitude + Relative advantage + Ease of use + Compatibility + Result demonstrability + Perceived risks + Subjective norms + Belief of image + Belief of visibility + Critical mass + Perceived behavioral control + Voluntariness + Trialability + Support + Learning
Findings: In this study, TPB is partially utilized for the prediction of the adoption of e-banking. Nevertheless, there are four major relationships of TPB presented as the four hypotheses and three of them were tested. The first hypothesis stated that attitude towards virtual banking was dependent on relative advantage, compatibility, ease of use, result demonstrability, and perceived risk. Reliable measures on perceived risk could not be obtained and only the first four constructs were tested. The hypothesis was supported but the two factors found were not clear cut. One of them was a combination of ease of use, compatibility and result demonstrability whereas the other was a mixture of relative advantage, compatibility and result demonstrability. The explanation power of this relationship is 0.56. The second hypothesis claimed that subjective norms about virtual banking were dependent on image, visibility and critical mass. Visibility was not used as no reliable measure was available. The hypothesis was also supported. However, the R square value was only 0.29, which meant that image and critical mass alone could not provide a powerful explanation of subjective norms. The third hypothesis was that perceived behavioral control about virtual banking was dependent on voluntariness, trialability, support and organizational learning. However, this hypothesis could not be tested in this study due to an unavailable reliable measure. The last hypothesis stated that intention to use virtual banking was determined by attitude, subjective norms and perceived behavioral control. Dependency on subjective norms could not be tested due to the absence of reliable measure. Dependency on the other two factors was founded statistically significant. Nevertheless, the low R square value of 0.056 indicated very low explanation power.			
Sathye, 1999	Adoption of internet banking by Australian consumers	TPB and Diffusion of Innovation	+ Security concerns + Ease of use + Awareness of service and its benefits + Reasonable price + Resistance to change + Availability of infrastructure
Findings: The author of this study reveals that security concerns and lack of awareness about e-banking and its benefits are considered as the main impediments to the adoption of e-banking in Australia.			

Chapter 26
International Stock Investment Portfolio Management Strategies for Emerging Economies

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ABSTRACT

People or companies canalize their money to consumption or retain it for the future. Their desire to use their savings to obtain extra income gave birth to the concept of investment. They do this in a frame of expectations about the future. Expectations are the foundation of all investment decisions. This chapter focuses on how an investment and portfolio management process should be and explains different portfolio management strategies. It also includes different types of stock investments. The chapter intends to teach how one can choose a stock and manage money effectively. For this aim, the chapter includes value investment style, growth investment sytle, technical investment style, momentum investment style, fundamental investment style, and beyond. It is very important to know which strategy best fits your aims and your characteristics, so you will be able to learn this through this chapter. In addition, it is important to know how these strategies can used together effectively. In this chapter, an investor will find answers to questions about stock investment.

THE CONCEPT OF INVESTMENT AND INVESTMENT PROCESS

People either canalize their money to consumption or retain it for the future, and their desire to use their savings to obtain extra income gave birth to the concept of investment. In this context, investment can be defined as superseding present consumption with other consumption opportunities in the future (French, 1989, p. 4). The concept of investment has different forms varying from individuals to companies and state

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policies. In its broadest sence, investment refers to all types of instrument supplies executed with the expectation of rise in value or positive return, and these instrument supplies are performed by the means of savings and idle funds (Gitman & Joehnk, 1988, p. 4). In other words, investment is sacrificing a certain present value for an uncertain future value (Sharpe & Alexander, 1990, p. 1).

Basically, there are two investment options in which savings can be directed: *financial assets* and *real assets* (Strong, 2007, pp. 2-3). Financial assets are intangible such as bonds, stocks or derived products, but real assets refer to tangible things such as estates, machines, and buildings. While real assets are income-creating properties, financial assets are the properties providing the income shared among the investors (Bodie, Kane, & Marcus, 1996, p. 11). In this regard, investments are further divided into two categories; real investments and financial investments. While real investments include tangible assets such as estates, machines, or factories, financial investments refer instead to intangible properties which provide holding or sharing rights such as stocks or bonds (Sharpe & Alexander, 1990, p. 1; Karan, 2004, p. 3). Today, financial investment rates have reached very high levels, so increasing investment alternatives have brought about the necessity of making better informed investment decisions.

Most investment decisions have three characteristics in common (Dixit & Pindyck, 1994, p. 3):

- Investments cannot be taken back either partly or completely. In other words, the startup cost of an investment, at least partly, is sunk cost and it cannot be reclaimed.
- There is uncertainty concerning to the prospective gains. Thus, the best thing to do is to take all the alternative outcomes (the maximum and minimum profit and loss) into consideration hypercritically.
- The investors can make the investment whenever they want. They can delay the investment decision to collect more information about the future.

The procedures investors must follow in order to make decisions about their investments is called the *investment process*. From a portfolio perspective, this process includes three steps (Stowe, Robinson, Pinto, & McLeavey, 2002, pp. 5-6):

- **Planning:** In this initial stage, the investor clearly defines the investment purposes (including the outcomes concerning to both risks and profits) and constraints (both internal and external).
- **Process:** The portfolio manager associates the investment strategies with the expectations on portfolio selection (portfolio selection decision), and the portfolio decisions are put into effect (the decison of portfolio's putting into effect).
- **Feedback:** The created portfolios are evaluated to determine if they reach the desired goals or not. If not, the necessary arrangements are completed.

Basically, the investment process can be conducted under two categories: securities analysis and portfolio management. The rational investor seeks to gain the maximum profit with minumum risk. Minimizing the risk is possible through a correct portfolio choice and management.

THE PORTFOLIO CONCEPT

A portfolio has various definitions, but in general terms a portfolio is the total value realized from the owned assets' being invested into at least two different instruments which either share the same features or are inherently different from each other. (İstanbul Securities Exchange [İMKB], 2008, p. 7). In the field of finance, portfolio is a mixture including various investments (i.e., bonds, treasury bills) held by a person or an organization. The

underlying idea of a portfolio is to minimize the risks. Having various instruments, some sort of risks can be avoided.

Practically speaking, nearly everybody possesses a portfolio. These portfolios may include real assets (e.g., cars, houses or estates) or financial assets (i.e., bonds or bills) (Elton & Gruber, 1995, p. 2). It is possible to create a portfolio through random decisions or via very detailed plans, and creating a highly profitable portfolio requires a deep understanding of the principles underlying rational portfolio selection and successful portfolio management.

THE PORTFOLIO MANAGEMENT PROCESS

Portfolio management is a process in which securities are collected in a portfolio considering the investors' needs and choices and the perfomance of the portfolio is evaluated (Bodie, Kane, & Marcus, 1996, p. 2). In simple terms, portfolio management, also known as the investment management, is the process of money management (Sharpe & Alexander, 1990, p. 711). The first goal of portfolio management is to earn higher – or at least equal – rates from the the awkwardly chosen portfolios having equal risks. The second goal is to make a full diversification compared to a benchmark portfolio (Reilly & Brown, 1999, p. 1153). In other words, the portfolio manager's aim is to get profit above the avarage level while minimizing the risks. Factors such as upgrading asset pricing models, increasing institutionalization of the market, monitoring the volatility of the financial markets, and increasing the use of computers to collect and analyze data caused the theoretical and practical form of portfolio management to develop into broader dimensions (French, 1989, p. 487). Therefore, portfolio management process has become a very dynamic process requiring great caution and care.

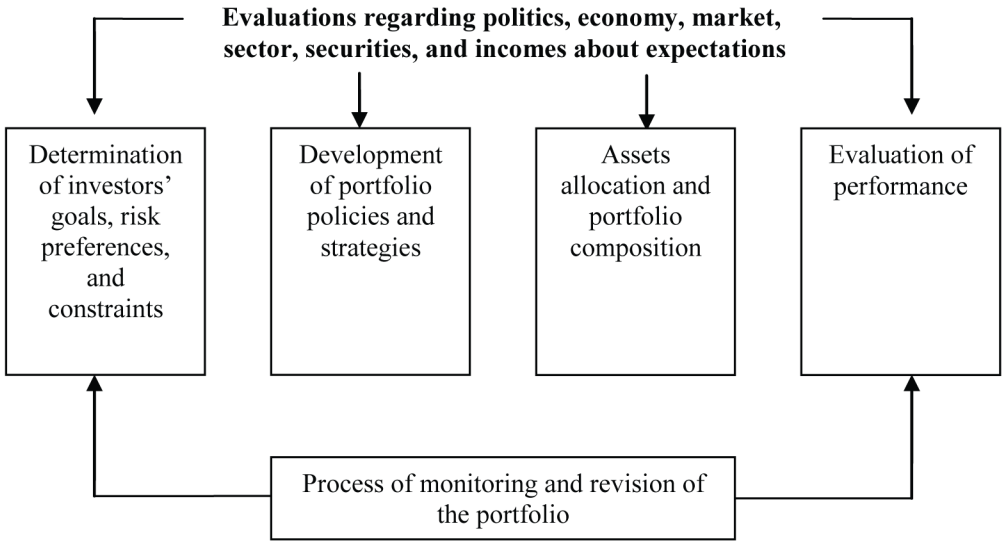
The portfolio management process consists of the following five steps (Sharpe & Alexander, 1990, pp. 9-12):

- **Setting Investment Policy:** This involves determination of the instruments and the amount of accumulations (potential investment portion) to be canalized into the investment. It begins by determining the appropriate profit and risk combination and ends with defining financial assets which will be included in the portfolio.
- **Performing Security Analysis:** This step involves careful scrutiny of the securities in financial asset categories which include Technical Analysis and Fundamental Analysis. The goal is to detect under-valued stocks.
- **Constructing a Portfolio:** This is the step in which it is decided what portion of money will be invested on which asset by estimating future price movements and diversification (risk minimization).
- **Revising the Portfolio:** This is the revision of the previous three steps. The portfolio is arranged according to changes in various factors (e.g., investor's goals, increase/decrease in security prices, changes in transaction costs or economic conditions).
- **Evaluating Performance:** Refers to the portfolio's periodical evaluation in terms of profit and risks.

Each step of portfolio management requires the designated manager to create a delicate observation and analysis system. The portfolio management process is shown in Figure 1.

As can be seen in Figure 1, the portfolio management process requires vital decisions at each stage. Being continuous, the process is circular in nature which allows an investor to return to previous steps when necessary and make remedial changes in order to reach optimal portfolio creation and subsequently resume the process.

Figure 1. Overview of the portfolio management process
Source: French, D. W. (1989) Security and Portfolio Analysis: Concepts and Management, Merrill Publishing Company, p. 488.



STOCK PORTFOLIO MANAGEMENT STRATEGIES

Stock portfolio management strategies are divided into two categories: *passive* and *active management strategies* (O'Shaughnessy, 2005, p. 1). Portfolio managers decide between these strategies according to the volume of the fund they govern and customer demands (Karan, 2004, p. 533).

Passive Portfolio Management

Passive portfolio management is based on the Separation Theorem which accepts all forms of the Efficient Market Hypothesis (Mittra & Gassen, 1981, pp. 599-600). This Hypothesis accepts that the market is so efficient it is nearly impossible to create another portfolio superior to it because in an efficient market the share prices provide all necessary information. Therefore, it is perfectly clear there cannot be any single under-valued share and the the investors cannot obtain additional profit through insider information. Consequently, passive portfolio management argues that the investor cannot do anything better than to hold the market portfolio. Therefore, passive portfolio management essentially follows the principles of *buy* and *hold*. (French, 1989, p. 505). In this strategy, the profits of portfolios are monitored through comparisons with some particular market indexes (e.g., İMKB 100, S&P 500). In this strategy, surpassing the market is not considered. Passive portfolios have lower rate of turnover, transaction and administrative costs, and nonsystematic risk. However, this strategy does not permit an investor to take advantage of various markets and instruments which would provide additional profit.

Investors preferring passive portfolio management usually possess two types of passive management styles (Uludağ, 2007, pp. 1-2):

- Buy and Hold Method.
- Indexing (Indeks Funds.)

Buy and Hold

In this method, the investors choose and buy assets (i.e., stocks and bonds) meeting their requirements which they hold for an extended period. They

also consider the maturities of the securities, so the maturity period is equal to the timeframe for which the investor wishes to hold. Using this strategy permits investors to obtain a relatively moderate profit with minimum risk instead of maximizing profits, so they do not change their portfolio compositions. According to the Efficient Market Hypothesis, share prices reflect all relevant information available, so it is meaningless to sell and buy the securities very often as this will not increase the portfolio's performance; however, the action will increase transaction costs. Consequently, it is not reasonable to change the portfolio composition. In this context, the buy and hold strategy is usually preferred due to its lower tax liability and transaction costs (Uludağ, 2007, p. 2). An additional advantage with this strategy is that investors do not contend with possible concerns of portfolio management (Strong, 2007, p. 431).

Indexing

In this practical passive investment strategy, a market Index is selected (e.g., S&P 500) and the securities which will be included in the portfolio are decided according to that particular Index. The investment goes to the equity shares according to their percentage within the Index (İMKB, 2008, 8). The goal is to obtain a profit which is equal or close to the one in the market Index. Because a certain Index is followed throughout the process in this strategy, it is called "Indexing" (Uludağ, 2007, p. 2). Index funds are big portfolios created via buying a diversified share portfolio (French, 1989, p. 505).

The supporters of this strategy argue that when the market is efficient, the best estimated price of a security will be its own price, thus allowing the best diversification and eliminating nonsystematic risk. (Karan, 2004, p. 537). In the passive share portfolio management strategy, revaluation and rebalancing are performed only when the profit shares are intended to be reinvested, market portfolios, the investor's utility function or risk preferences change, the selling is inevitable as there is a primary need for cash (Mittra & Gassen, 1981, pp. 599-600; French, 1989, p. 505; Reilly & Brown, 1999, p. 653). Of course, a passive investment strategy is not the only method. Many investors (particularly professional fund managers and institutional investors) believe the active investment strategies are the best alternative to beat the market (Mittra& Gassen, 1981, p. 603).

In passive portfolio management strategies, reevaluation and rebalancing are performed only when the following conditions are in the question (Mittra & Gassen, 1981, pp. 599-600; French, 1989, p. 505; Reilly & Brown, 1999, p. 653):

- Dividends are intended to be reinvested.
- The market portfolios, the investor's utility function and the risk preferences change.
- The selling of shares for a primary need for cash.

Active Portfolio Management

Active portfolio management strategies are based on the idea that the portfolio should be monitored closely to make value raising arrangements possible at anytime. From collecting information to the application process, the active management process requires constant and consistent observations as well as feedback concerning the performance of the investment (Grinold & Kahn, 2000, p. 8). The supporters of this strategy assume the market is not always efficient and there might always be under-valued equity shares. Thus, they believe that through systematic buying and selling it is possible to realize profit which is higher than that of the market (Bodie, Kane & Marcus, 2003, p. 597). The basic idea behind effective active management strategies is that of estimating the future well.

The primary goal of active portfolio management is to earn profit above that of the market portfolio profit (Reilly & Brown, 1999, p. 660), meaning the investor assumes higher risk as well as

additional transaction costs. Therefore, active portfolio managers should possess unique skills such as forecasting the future accurately on a consistent basis, correctly estimating under-valued shares, and precisely determining risk-profit positions. An investment manager uses security analysis to create an active portfolio (Bodie, Kane, & Marcus, 2003, p. 712), employing the following 7-step process (Mittra & Gassen, 1981, pp. 604-612):

- **Construct the Stock Universe:** Stock universe refers to the group of all stocks being traded in the market. Investors first select the desired sector(s) which the portfolio manager will then administer by determining the stocks that will be added to the portfolio through analysis.
- **The Expected Return:** The present values of stocks are identified before employing basic analysis techniques regarding the economy, sector(s), companies, and estimated future profits. The holding period profit is also calculated.
- **Stock Beta:** Presently many financial institutions publish their stocks by calculating their stock beta. A stock analyst collects and subsequently calculates the beta of the stocks from available sources.
- **Security Market Line Construction:** Stocks are first divided into two categories from lowest to highest risk. Then, the stocks are spotted on a grap according to their risk level. The dots are then merged forming a line called the Stock Market Line (SML). This method permits detection of under- and over-valued stocks.
- **The Decision Band:** SML is actually used as a decision line. An active portfolio manager includes the under-valued stocks while excluding over-valued ones.
- **Investor's Risk Preference:** The portfolio manager identifies the investor's risk preferences before constructing the portfolio by classifying the investor as a risk taker or as risk averse according to the investor's income, psychological structure, and risk preferences. Considering these facts allows the manager to decide which stocks will be added to the portfolio. For better diversification, it is necessary to examine the stocks from different sectors.
- **Portfolio Construction:** In this final stage, the manager constructs the portfolio considering the investor's resources and preferences by randomly selecting stocks or via special computer software.

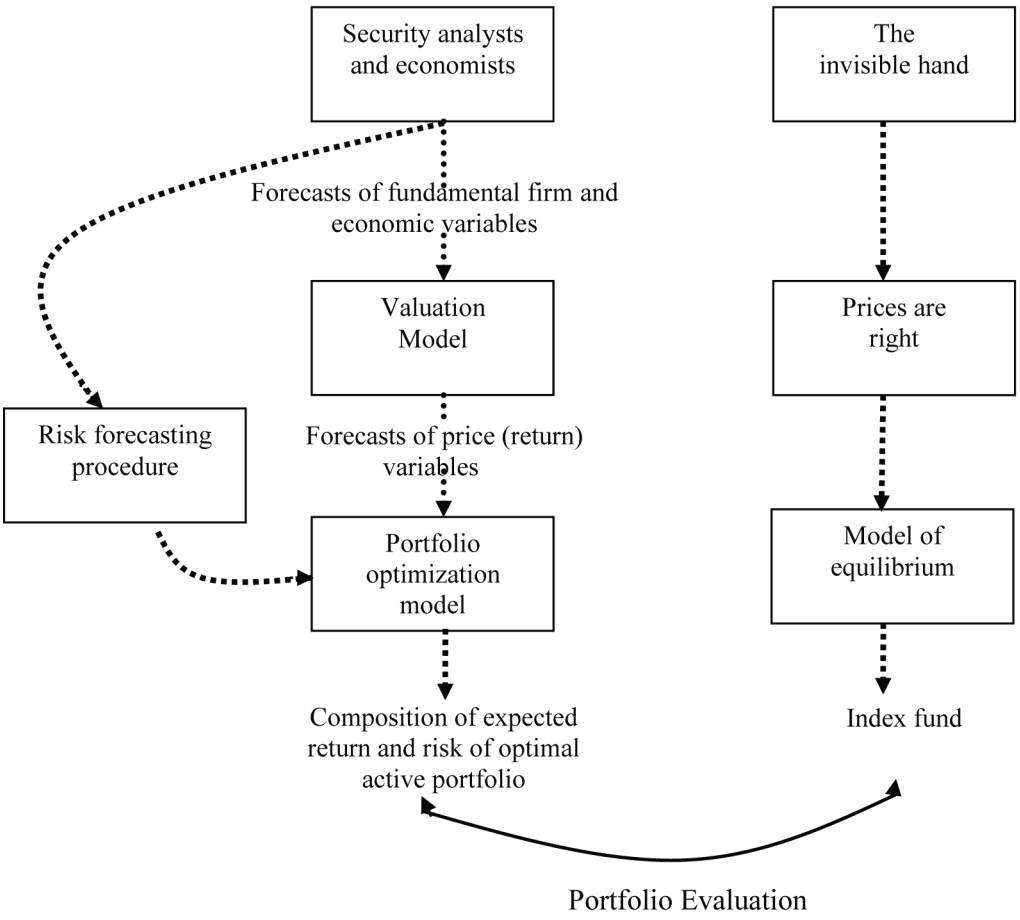
Active portfolio managers are inclined to construct riskier portfolios to obtain higher profits than those of the market portfolio by increasing portfolio performance through timely detection of under-valued stocks. Recently, one of the most remarkable changes in portfolio management was the development of Value and Growth-focused investments (Uludağ, 2007, p. 2). The overview structure of portfolio management is shown in Figure 2 (Elton & Gruber, 1995, p. 688):

Investors should decide between Indexing inherently possessing lower costs and risks with active portfolio management inherently possessing higher costs and returns (Reilly & Brown, 1999, p. 653). The most important factor in selecting the most appropriate method is the portfolio managers' decision making skills. Passive management strategies are preferred less often when management skills are high (Sorensen, Miller, & Samak, 1998).

STOCK INVESTMENT STYLES

Stocks constitute a considerable part of investment portfolios. Thus, high importance should be placed on stocks and stock investment styles before choosing a particular portfolio investment strategy. Deciding on the correct stock investment style is regarded as the most critical step of investment decision procedures.

Figure 2. Stock portfolio management strategies
Source: Elton, E. J., & Gruber, M. J. (1995) Modern Portfolio Theory and Invesment Analysis, Fifth Edition, p. 688. New York: John Wiley and Sons Inc.



The concept of investment style refers to the goals of a portfolio manager and the types of assets held in the portfolio (Rao, 2006). Investment style might also refer to the categorization of stock managers according to their performance. An investment manager's performance within the market is closely related to the investment style employed (Bailey, Richards, & Tierney, 2007, p. 780). Different investment styles were developed near the end of the 1960s. In his 1966 study, William Sharpe defined investment style as the stock investors' tendency to invest on some particular stock groups[1]. Stock investment styles became widespread in various Indexes in following years. Later, Wilshire Associates and the Frank Russel Company created their own stock investment style Indicies in 1978 and 1979, respectively (Ahmed, Gallo, Lockwood, & Nanda, 2003, p. 294).

To express an investment, descriptive terms such as *growth, income, momentum* and *value* are often used. The most widespread investment style categories are *value* and *growth* investments. In addition to these categories, there are various investment styles in which portfolios are splitted into different sub-categories (e.g., small-cap, mid-cap, and large-cap) according to their market capitalizations. The core idea of stock portfolio investment styles is to hold the stocks sharing the

same characteristics under the same style category. The stocks within the same categories have similar risk and profit characteristics while they show different risk and profit characteristics than the stocks in different categories in time (Ahmed, Gallo, Lockwood, & Nanda, 2003, pp. 293-294).

Value vs. Growth Investing

The concepts of "value" and "growth" have a long history in the field of stock investment management, and both concepts are widely used in defining investment management funds and classifying stocks (Michaud, 1999, p. 1). With the rise of institutional investments, security analysts have been separated into two groups since the 1960s; *value investing* and *growth investing* (Speidell & Graves, 2003, p. 172).

Growth stock portfolio strategy was first introduced by two professional investors, David L. Babson and T. Rowe Price, during the period following World War I when there was remarkable economical growth (Bauman, Conover, & Miller, 1998). Babson (1951)[2] and Price claimed that investing in firms with above-average growth provides very high portfolio performance (Bauman & Miller, 1997). In the following years, value stock portfolio strategy attracted attention as another alternative to growth strategy. In fact, the value stock portfolio strategy was first championed in the early 1930s by Benjamin Graham and David Dodd, the pioneers of Fundamental Security Analysis (see also Graham & Dodd, 1934).

Value Investment Style

The roots of value investment style date back to the book, *Security Analysis*, written by Graham and Dodd in 1934. In this method, stocks which are under-priced or priced correctly have an ascending potential (Shi & Seiler, 2002). Value investing is based on choosing less expensive stocks compared to some particular variables which include the following:

1. Profits-per-stock or price/profit ratios;
2. Cash flows per stock or price/cash flow ratios;
3. Books values per stock; and
4. Market price/book value ratios (Estrada, 2005).

Fund managers preferring value investing strategies usually detect solid companies although they may not be very popular[3]. The fund managers then buy these companies' stocks at bargain prices. Most investors preferring value investing strategy believe the majority of the value stocks arise from misvaluations of risk and profit potentials or over reactions given to negative events (Gastineau, Olma, & Zielinski, 2007, p. 432). The basic idea behind this strategy is that when the real values of the companies' stocks are finally noticed, the value of those stocks will increase (Wilkens, Heck, & Cochran, 2006). Nonetheless, sometimes investors do not notice the real values for an extended period of time or it never occurs. Therefore, value investors are those investors who are eager to wait and be patient for a long time to obtain their reward (Sincere, 2004, p. 72; Strong, 2007, p. 156).

The typical characteristics of value investing can be summarized as follows (Little, 2007):

- The profits of the companies per share are above average.
- The profit shares of the companies are high.
- Sectors in which companies operate are well-grounded.
- Stock holding period is usually longer than that of growth stocks.

However, while value investment is defined as the investments on under-valued stocks which have lower Price/Profit (P/P) and Market Price/Book Value (MP/BV) ratios, this definition is not adequate to reflect varying investor behaviors. When classifying under-valued stocks, some value

investors consider specific criteria and make long term investments on stocks, while others believe the best time to buy stocks is when there are big sales and the prices decrease. However, some value investors behave more actively and purchase great quantities of stocks of firms they believe are under-valued, and they believe the values of such stocks will increase. Therefore, they begin pressing companies to make changes so the values will increase sooner (Damodaran, 2003, p. 219). The common principle behind the value investing style is the idea that the best investments are those made from companies having internal or sectoral problems and are otherwise out of favor.

Growth Investing Style

Another active portfolio management approach is the Growth Investing Strategy. The main idea of the growth investing is focusing on the growing or potentially growing stocks (Shi & Seiler, 2002). In other words, growth investing strategies focus on firm having considerable growing potential and higher prices compared to profits, cash flows, book values, bonuses, or other factors (Estrada, 2005). Low current return levels and high MP/BV and P/P ratios are the typical features of the growth investing portfolios (Bodie, Kane, & Marcus, 2003, p. 290).

Managers preferring growth investing seek companies with strong performance, are of high quality, and have important achievements such as patents. The investors are ready to pay high prices for those progressive company stocks in hopes of selling them for even higher prices in the future. The risk here is that the value of such companies' stocks could decrease sharply due to negative rumors about them[4]. Another risk is the prospective profits expected per share might not be realized (Gastineau, Olma, & Zielinski, 2007, p. 433).

The typical characteristics of growth investing can be summarized as follows (Little, 2007):

- The companies show higher ratios than their average growth ratios of return and profit.
- The companies serve in expanding sectors.
- The companies do not pay profit shares.
- High growth companies usually go beyond their expected profits.
- The length of the stock holding periods is determined by the growth regularity of the company.

Growth stock managers concentrate on identifying stocks for which growing expectation is high (Michaud, 1999, p. 1). Additionally, they tend to make investments on large and progressive sectors such as technology, health care, and consumer goods (Gastineau, Olma, & Zielinski, 2007, p. 433). In summary, growth investors make investments on the companies which are growing and whose profits are increasing, while value investors make investments on firms being traded at lower prices or having small earnings. Table 1 presents the strategies for value and growth investors.

Table 1. Preferences of value and growth investors

Value Investors	Growth Investors
Prefer the companies reporting sank profit margins.	Prefer healthy and ascending margings.
Seek companies with descending gains or with no gain at all.	Search for companies having sharply increasing profit ratios.
Search companies whose recent profit reports have caused disappointment within the market	Determine the companies having positive surprises with their profits.

Source: Domash, H. (2006). Fire Your Stock Analyst: Analyzing Stocks on Your Own. *Financial Times*, p. 262. New York: Prentice-Hall Inc.

Widespread use of value and growth investing strategies in active portfolio management is one of the most significant developments of recent years (Reilly &Brown, 1999, p. 670).

Value and Growth Investing Strategies as Mutual Complementaries

Growth and *value* investing strategies are not opposites; instead, they are different approaches to the same basic matter. Both strategies guide the investors through the choice of stocks. Though it is not possible to say exactly which strategy will bring more profit in the long-term, some studies argue that value investing strategies showe better performance than growth investing strategies. For example, Capaul, Rowley and Sharpe (1993) examined both strategies in different countries, suggesting that value investing portfolios bring higher profits. Similarly, Arnott and Luck tested the performance of both strategies between January, 1975 and July, 2001 in Canada, England, Japan, Germany, and the USA to discover that value portfolios showed better performance than growth portfolios, except during the global technology bust which is also referred to as the Dot.com bubble of 2000.

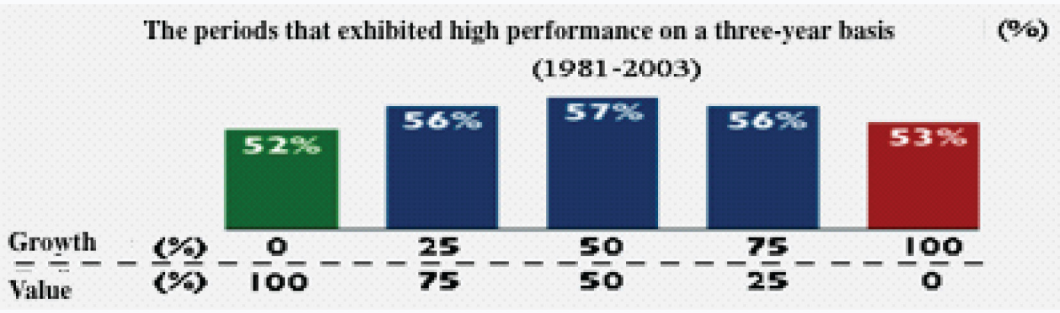
The changing nature of value and growth investing, which often overlaps with each other, pushes investors to seek new ways to solidify their positions. Some investment advisors state the best investment strategy is to construct half of a portfolio using the value approach and the other half using the growth investing approach. For example, the long-standing investment advisory firm Bernstein Global Wealth Management reported that the investing strategy having the best risk/profit profile is multi-style investing:[5]

…multiple investing style requires the investors to split the capital into the best bergains and best companies of the market. When either of those investments shows a bad performance, the other will balance it. The investor will get higher and more consistent profits comparing to any single style.

Figure 3 shows the result of the study conducted by Bernstein Global Wealth Management

Figure 3 shows the longest lasting high performance is achieved through multi-style investing. Beyond equal sharing of the two styles, any mixture of value and growth investing at any ratio shows higher performance than does that of their single use. Another solution for the fluctuation problem in value and growth investing strategies is to switch a poorly performing investing style with the other one immediately (Tengler, 2003, p. 3; Arnott & Luck, 2003, pp. 55-58), which also called the "active style switching strategy." Arnott and Luck (2003) attempted to clarify which

Figure 3. Different compositions of value and growth investment strategies
Source: Mercer Investment Consulting, Standard & Poor's and Bernstein, Bernstein Global Wealth Management, "Multi-Style Investing: A Tale of Two Investment Styles."



approach has higher performance by calculating the total return of US$1.00 invested in the value, growth, and active switching strategies. They limited their study in between January, 1975 and February, 2002.

Table 2 shows the growth of 1 US dollar invested using the value, growth, and active style switching strategies. When an active style switching strategy based on correct estimations is employed, it is obvious profit will be much higher than that of the value and growth investing strategies. The biggest challenges of the active style switching strategy are the high transaction costs and the difficulty of making correct estimations. In the very right column of Table 2 are the percentages of the months the growth strategies showed higher performance than value investing strategies. This supports the view that the value investing strategies are more efficient than growth investing strategies.

Momentum Investment Style

The concept of momentum is based on the movement of the speed of prices. Stocks with fast and continuous price movements are called "momentum stocks" (Uludağ, 2007, p. 9). The investors adopting this style believe the stocks with high price performances will retain their high performance for an extended period of time. In other words, they prefer buying and selling the stocks for high prices. Typical characteristics of momentum stocks are as follows (Mitchell, 2007):

- Daily, weekly, or monthly relative price changes in high percentages.
- Sharp ascending from low volume range to high volume range.
- High profit development in short terms (e.g., 3-month periods.)
- Increase-oriented changes in the estimations of analysts.
- High cash flows addressing stocks which signal the institutional investors' purchases.

Momentum investors purchase stocks having the highest dynamism in the market in the belief that the current increase will continue (Gastineau, Olma, & Zielinski, 2007, p. 433). The risk of this style is the possibility that investors might fail in selling the stocks before their increasing performance gets weaker. The momentum strategy, which is based on the idea that past tendencies will continue in the future, can be divided into two sections: price momentum and earning momentum (Reilly & Brown, 1999, p. 665). The

Table 2. Performance comparison of the value, growth, and active style switching strategies

	Yearly Growth of 1 US Dollar in 26 Years (1/75-2/02 Returns)			The Percentage of the Months in which Growth> Value
Countries	**Value**	**Growth**	**Active Swithing***	
America	51	33	231	45
England	102	57	465	45
Japan	16	3	74	42
Canada	31	10	768	46
Germany	29	13	186	48
* It was assumed the money was invested on the better one of value and growth strategies and the transaction cost equalled one percent.				

Source: Arnott, R. D., & Luck, C. G. (2003). The Many Elements of Equity Style: Quantitative Management of Core, Growth, and Value Strategies. The Handbook of Equity Style Management, Third Edition, Edited by T. D. Coggin and F. J. Fabozzi, p. 58. New York: John Wiley & Sons Inc.

price momentum strategy is briefly defined as buying the high performing stocks and selling the poorly performing stocks by observing their recent performances (Bird, Casavecchia, & Woolley, 2008). The earning momentum strategy is a type of active investing strategy which focuses on the companies showing high profit growth during 3-month periods during the year (Maginn, Tuttle, McLeavey, & Pinto, 2007, p. 870).

Technical Investment Style

The methods used in most investment strategies are techniques labeled technical analysis by market actors (French, 1989, p. 362). The technical analysis approach assumes the best way to estimate the stocks' future is to scrutinize the past actions of interest rates, stock prices, and other market variables (Reilly & Brown, 1999, p. 408). Beyond the matter of which stocks to select, investors using technical analysis specialize on when to buy those stocks as well. In this style, investors examine the early trends of companies and stocks, but do not concern themselves with internal activities such as fundamental investors do (Kiyosaki & Lechter, 2000). Instead, technical investors believe all factors concerning a company are already reflected in the stock prices and therefore largely ignore factors such as financial tables, fiscal policies, economical climates, or sectoral tendencies (Dourraa & Siy, 2000). They make use of price graphics, formations, and market indicators to analyse stock markets.

Market indicators are generally divided into three categories (Dourraa & Siy, 2000):

- **Monetary Indicators:** These are the economic data such as interest rates and signal the economic climates in which the companies serve. Such external factors directly affect the profitability and stock price of the company.
- **Sentiment Indicators:** Indicators concerning investors' expectations.
- **Momentum Indicators:** Signs such as price/trading volume indicators, the correlations between the number of ascending and descending stocks, and comparisons of changing trading volumes.

The technical investment style is advantageous as it is easy to learn and practice because it does not require subjective judgement or financial wisedom and all necessary information is easy to obtain (French, 1989, p. 372). However, there are some criticisms regarding this style (Reilly & Brown, 1999, p. 629). First, the idea that stock prices reflect all the needed information and it is easy to obtain implies the existence of a weak form of market activity. Furthermore, empirical studies support the active market hypothesis. Therefore, it does not seem possible any investor can profit above the market line. In addition, when all investors use the same information to make identical investment decisions, it is not possible for any investor to have a gain as the stock price will then gravitate towards a new balance. However, once the technical investing method is successful, all other investors will practice this method and will no longer be advantageous anymore.

Income Investing

Income investors act on those stocks which exhibit high, reliable, and continuous profit. These so-called income stocks belong to firms earning higher profit compared to the stock prices (Mittra & Gassen, 1981, p. 24). The profits belonging to these stocks are usually above that of average stocks and possess the potential to compete with debt securities. In addition, a sound and standing profit policy provides reliable information about the companies' future performance and income stream (Tengler, 2003, p. 24). It is very important for these investors to estimate income streams. Income investors deal with the current return of the stock prices rather than their appreciation (Mittra & Gassen, 1981, p. 24). Income investing is a

long-term and low risk investing style (Mitchell, 2007), and income-focused portfolios usually have lower risk levels are often composed of fixed yield securities like bonds (Bronson, Scanlan, & Squires, 2007, p. 35).

Fundamental Investing

Fundamental investing strategy is based on the ideas of fundamental analysis. While fundamental analysis is a combination of methods assessing future gains potential and making deductions through the examination of the financial condition of the companies, the fundamental investing strategy is a tool using the findings obtained from fundemantal analysis (French, 1989, p. 362). In this strategy, investors focus on macro-economic events, sectoral developments, and basic information about the companies (e.g., financial statements). The executives of fundamental investing have a pretty long term perspective and they ground their investment decisions on the comparison of the intristic value which is reached through the stock's current price and long term assessment of the company (Koller, Goedhart, & Wessels, 2005, p. 538). They argue the stocks should be purchased for a price below their intristic value.

Fundamental investors believe there are intristic values which depend on the economic conditions of prices, and that these values should be assessed by examining factors such as current profits, cash flows, interest rates, and risk variables (Reilly & Brown, 1999, p. 198). Considering the sector and the overall economy, investors can analyze financial statements of companies in detail. Providing the market value of a stock is lower than the intristic value and the difference covers the sanction costs, they then purchase that particular stock (Bird, Casavecchia, & Woolley, 2008). Fundemantal investing is superior to technical investing as the former is based on facts about the company and are more practical according to the efficient market hypothesis. Nonetheless, this strategy is criticized because the company data and analysis results can reach investors late; in addition, sometimes the balance sheets distract investors from actual conditions (Karan, 2004, p. 439).

Market Capitalization Investing

Market capitalization is the value obtained by multiplying the market value of a company's stocks with the number of outstanding stocks. Market capitalization is a criterion of a company's magnitude (Dow, 1998; Faerber, 2008, p. 216). It is also an important criterion for investors when choosing stocks. Stocks belonging to small companies provide fast developing potential and small research areas to investors, while stocks belonging to large companies provide stability, diversified returns, presumable profits, and a parallel position to the market index[6] (Mitchell, 2007).

Company magnitude is among the variables which are widely used to measure long term abnormal gainings in the extant financial literature[7]. When studies were conducted, it was seen that small companies sometimes exhibited better performance than big companies or vice versa. However, in the long-term, it was proven that companies with small market capitalization showed better performance than those companies with high market capitalization. Banz (1981) and Reinganum (1981) showed in their study that small companies provide higher rates of return than do large companies. They found that even after making necessary arrangements on the stocks against risk there were systematic differences in average returns.

Fama and French (1992) stated that variables of company magnitude and the book value/ market value could successfully explained the differences in the average stock returns in the period of 1963-1990. They reached that the high returns that the small companies provided were the counter balance of the high risks they have. On the other hand, since the size effect[8] could not explain much in the period 1977-1990, they

concluded that size effect is not explanatory in some periods. Reinganum (1983) studied on long term portfolio strategies and he found that the small companies' rates of return are considerably high even without daily rebalancing. Accordingly, the value of 1 dollar invested on the smallest company at the end of 1962 became higher than 46 dollars at the end of 1980. On the other hand, during the same period, the portfolio composed of big companies provided a growth of 4 dollars only; and medium- sized companies provided a growth of 13 dollars. As a whole, it was observed that the portfolios composed of small companies showed higher performance. It is always stated by professionals or academics that there should be a systematic approach in choosing stocks. There exist many studies and sources which are full of recommendations on stock choosing and portfolio construction.

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KEY TERMS AND DEFINITIONS

Active Portfolio Management: Active portfolio management objects passive portfolio management and accepts markets are not effcient in all form of efficiency. Therefore, a portfolio manager can get abnormal return on markets by using different investment strategies and tactics.

Growth Investing Style: Growth investing style focuses to find stocks that has a growth potential in future.

International Stock Investment: Selecting worldwide-based investment instruments such as foreign stock, emerging markets stock etc. as part of an investment portfolio.

Passive Portfolio Management: Passive portfolio management defends, markets are efficient and and investor can't get abnormal return. Thus, an investor should hold market portfolio instead of holding single stocks. Buy and hold strategy and indexing strategy are passive portfolio management stragies.

Portfolio Management Strategies: Portfolio management is about maximazing the return of portfolio at a given risk level. In portfolio management process, assets are allocated among different investment instruments.

Stock Investment Styles: Portfolio managers can choose stocks by using different types of investment styles such as growth investing style, value investing style, momentum investing style, technical investing style, income investing style, fundamental investing style and market capitalization investing style.

Value Investing Style: Value investing style focuses to find mispricing and qualified stocks.

ENDNOTES

1 Sharpe, W. (1966) "Mutual Fund Performance," Journal of Business, 39, 119-138.

2 See also, Babson, D. L. (1951) "The Case of Growth vs. Income Stocks on a Yield Basis," David L. Babson and Company Inc., Weekly Staff Letter, September 17, 1951.

3 Value investors had significant profits in the past. For instance, oil stocks, having very high values in 70s, decreased dramatically and some investors bought these pretty cheap stocks in 1980s and they got great profits afterall. Similarly, after Clinton's fail in his effort to reform the health policies, the stock values of health sector decreased and some investors made investments on those stocks and they got considerable profits in return (Tengler, 2003: 1).

4 TDAmeritrade, "Growth vs. Value: Two Approaches to Stock Investing," <http://planning.tdameritrade.com/sites/client/tda/tdap/article.vm?siteContent=5222&topic=5054&c_name=#001#001>

5 Bernstein Global Wealth Management (2004), "Multi-Style Investing: A Tale of Two Investment Styles," http://www.bernstein.com/public/story.aspx?cid=744&nid=185.

6 As the companies having high market capitalization are bigger than the companies having low capitalization they can be assumed to have a safer structure. Nonetheless, the companies having very low capitalization values have bigger growing potential as they are small in present.

7 See also.: Banz, R. W. (1981) "The Relationship Between Return and Market Value of Common Stocks," Journal of Financial Economics, 9, 3-18; Reinganum, M. R. (1983) "Portfolio Strategies Based on Market Capitalization," The Journal of Portfolio Management, Winter, Vol: 9, No: 2, 29-36; Horowitz, J. L., T. Loughran ve N. E. Savin (2000) "The Disappearing Size Effect," Research in Economics, 54, 83–100.

8 Size effect is the term which is used to express the tendency that the small companies have higher returns than the big companies (Horowitz, Loughran, & Savin, 2000: 97).

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Chapter 27
Monetary Policy Instruments and Bank Risks in China

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ABSTRACT

The authors use a panel data regression model to examine the effects of main monetary policy instruments on commercial bank risks in China from 1998 to 2011. The interest rate has a positive effect on bank risk while the interest rate margin, the reserve requirement ratio and open market operation have a negative effect. Among the three monetary policy instruments, the reserve requirement ratio has the greatest effect on bank risk, the interest rate (the interest rate margin) the second largest and the open market operation the weakest. Their findings provide guidance to the monetary authority and regulatory authorities in monetary policy and banking regulation in China.

1. INTRODUCTION

After the burst of the dotcom bubble, many central banks have adopted a low interest rate regime over an extended period to ward off recession. Persistently low real interest rates can fueled a boom in asset prices and securitized credit and lead financial institutions to take on increasing risk (Nicolò et al., 2010). It is likely that banks' risks will be increased. Although it is difficult to state that monetary policy has been the main cause of the 2008 international financial crisis, it could have contributed to its build-up. Thus, how monetary policy affects bank risks has become a hot issue and a focal point of the debate in both academic circle and practice circle, especially after the 2008 international financial crisis (Ma & Sun, 2010; Chang, 2010).

The theoretical research in the literature suggests several channels that monetary policy (mainly interest rate) affects bank risks. First, interest rate policy of the central bank affects the bank's risks through asset valuation, business income, and cash flows, and the interest margin (Adrian & Shin, 2009; Borio & Zhu, 2008). Second, monetary policy affects bank risks through portfolio reallocation and risk transfer. As a result, the risk of the bank's investment portfolio and

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asset pricing will be affected. More importantly, the effect of monetary policy changes on bank risks may not be uniform across time, banking systems, or individual banks (Nicolò et al., 2010).

The empirical research shows some conflicting findings. First, loose monetary policy leads to an increase in bank risk and tight monetary policy can prevent the accumulation of bank risk (Angela & Peydró, 2010; Ioannidou et al., 2009; Delis & Kouretas, 2011; Yu & He, 2011),while others (Lucchetta, 2007; Tan & Su, 2011) indicate that loose monetary policy may reduce bank risks and tight monetary policy may increase bank risks. Interestingly, Thakor (1996), Jiménez et al. (2009) and Martha et al. (2010) document an uncertain effect of monetary policy on bank risks. The interest rate has a smaller impact on the risky assets of the banks with more capital, but a bigger effect on the banks with more business outside statement. Different banks can make the heterogeneous reaction on monetary policy shocks, and banks with high capital adequacy rate and income diversification perform more radical in taking risk.

In China, the objective of the monetary policy is to maintain the stability of the value of the currency and thereby promote economic growth. To achieve the objective, China utilizes synthetically and extensively the administrative monetary policy instrument (mainly reserve requirement ratio) and market-oriented monetary policy instruments (mainly the interest rate and open market operation). The time series of reserve requirement ratio, interest rate and open market operation are reported in Table 1. During 1998-2011, the People's Bank of China (China's Central Bank) had raised or decreased the 1-year benchmark deposit rate for twenty-two times continually with fifteen times since 2007(six times in 2007,four times in 2008, two times in 2010 and three times in 2011). At the end of 2011, the 1-year benchmark deposit rate is 3.50 percent. RMB open market operation resumed trading on May 26, 1998, and expanded the scale gradually. In particular, since 2006, turnover of trading of T-Bond in total(spot trading and repo. trading included) had been lifted continually from 1063.35 billion Yuan in 2006 to 20084.133 billion Yuan in 2011(see Table 1). Because the interest rate is not fully market-oriented in China and the effects of the open market operations are partly constrained by weaker purchasing willingness on the part of commercial banks, the PBC increased the use of the reserve requirement ratio as a policy instrument. From 1998 to 2011, the People's Bank of China had adjusted the reserve requirement ratio for thirty-nine times, which is rarely seen in the world and brought it from 8.0 percent in March 1998 to 21.0 percent for the large financial institutions and 17.5 percent for small and medium-sized financial institutions in December 2011. Especially, since 2007, the

Table 1. The time series of reserve requirement ratio, interest rate and open market operation

Year	Reserve Requirement Ratio (%)	Interest Rate (%)	Open Market Operation (100 Million Yuan)
1998	9.08	5.03	22322.7
1999	7.77	2.92	18191.4
2000	6.00	2.25	18891.2
2001	6.00	2.25	19600
2002	6.00	1.98	33128.32
2003	6.17	1.98	58755.96
2004	7.29	1.98	47053.08
2005	7.50	2.25	26401.8
2006	8.04	2.25	10633.5
2007	11.35	3.33	19545.66
2008	16.34	3.65	26391.17
2009	15.5	2.25	37560.99
2010	16.84	2.38	67539.44
2011	19.89	3.28	200841.33

Note: The reserve requirement ratio is the ratio for the large financial institutions. The interest rate refers to the 1-year benchmark deposit rate. The open market operations are measured by the turnover of trading of T-Bond in total (spot trading and repo. trading included). As the reserve requirement ratio and the interest rate may be changed for several times within one year, the daily weighed means of the both is used.

reserve requirement ratio had been changed frequently for thirty-two times with ten times in 2007, nine times in 2008, six times in 2010 and seven times in 2011.The above three instruments have played a significant role for managing liquidity, to facilitate efforts to normalize money and credit growth, and to handle inflationary expectations, which contributes to achieve the stable price level and economic growth.

As for China's stability of banking industry, the financial system is bank-based in China and the Chinese commercial banks directly affect financial stability of the whole economy. Though the financial stability is not included in the objective of China's monetary policy, the People's Bank of China attaches much importance to financial stability in practice and China's banking industry is in good condition. Since July 2003, the People's Bank of China has carried out the self-assessment on China's financial stability and released *China Financial Stability Report*. In August 2009, China officially started the Financial Sector Assessment Program (FSAP), which was jointly launched by the IMF and World Bank in May 1999. On April 19, 2011, Dagong Global Credit Rating Co. Ltd. released the report-*2011 Credit Risk Guideline for Chinese Banking Industry* that gave a latest evaluation on the major banks' credit risk in China and a "stable" prospect to the basic situations of the credit of China's banking industry. On May 25, 2011, Standard & Poor's said that China's slower economic growth would likely cause the problem that Chinese banking industry experienced credit losses in the next 2 to 3 years. However, Standard & Poor's maintained a "stable" rating on the prospects of China's banking industry.

It seems that the above three monetary policy instruments have worked to make policies better-targeted and more flexible and a balance has been achieved between stable price level and stable banking industry in China. Hence, the financial stability implication of monetary policy actions should be thought much of. Are monetary policy actions helpful for bank stability in China? Is there a policy trade-off between price stability and financial stability, or can a single policy instrument achieve both at the same time in China? What should the relationship between monetary and regulatory authorities be? The key of the answers of the above questions is to explore how monetary policy affects banks' risk in China.

Our study uses a panel data analysis to examine effects of the monetary policy on banks' risk in China from 1998 to 2011. We differ from other studies in several ways. First, in the US and European countries, interest rate is the major monetary policy instrument. Thus, they focus primarily the effect of interest rates on bank risks. The Chinese government has the flexibility of using three policy measures that are considered to be critically important. In addition to the interest rate, the People Bank of China can utilize the reserve requirement ratio and open market operation effectively to monitor the Chinese economy. We investigate several policy instruments in our study: interest rate, reserve requirement ratio and open market operation. Second, we evaluate and compare the different effects of price-based monetary policy instrument through interest rate and the quantitative monetary policy instruments (mainly reserve requirement ratio) on bank risks. Our study thus provides meaningful policy guidance in implementation in China. The results also provide useful information to policymakers in emerging markets in designing their monetary policy.

2. HYPOTHESES

In this paper, we will test the effects of the monetary policy on banks' risks in China. Our hypotheses concern the impact of interest rate, reserve requirement ratio and open market operation on banks' risks in China. Our hypotheses are different from the results of the present mainstream research. In view of the fact that interest rate is the major monetary policy instrument, the US and European countries focus primarily the effect of interest rates

on bank risks. The representative and mainstream study is the work of Delis and Kouretas (2011). They presented strong empirical evidence that low-interest rates indeed increase bank risk-taking (measured by the ratio of risk assets to total assets) substantially. In China, the representative study is the work of Yu and He (2011). They found that the RMB 1-year benchmark deposit rate the reserve requirement ratio are all negatively correlated with bank risks (the ratio of risk assets to total assets) and the effect of the former on bank risks are larger than that of the latter. However, it is a pity that Yu and He (2011) did not focus on the effect of the open market operation on bank risks and explain the difference of the effects of the interest rate and the reserve requirement ratio on bank risks.

2.1. The Interest Rate

From the results of Table 2, the ratios of risk assets all banks basically increase (decline) in high (low) interest rate regime in China[1]. The possible reasons are as follows. Low interest rate implies the economy is down. As the economy goes down, banks would not like to take risk in engaging in the more risky asset business, which is also unnecessary for banks with the reason that low interest rate regime basically means high interest rate margin regime that implies high earnings on condition that loan-to-deposit spread is the main source of profits of the banks in China from 2000 to 2006, which can be seen in Table 2, Table 3 and Table 4. Therefore, banks face a lower risk of default. Furthermore, when the interest rate is low, commercial banks have a low cost of the liabilities (deposits or borrowings) to the residents, the firms, the interbank or central bank, which demonstrates that liquidity risks faced by banks are likely to be small. On the contrary, the high interest rate means the economy is up, banks would like to take risk in engaging in the more risky asset business to make large earnings, which is also necessary for banks with the reason that high interest rate regime basically means low interest rate margin regime that implies declining earnings on condition that loan-to-deposit spread is the main source of profits of the banks in China. From Table 2, Table 3 and Table 4, during 1998-1999 with a high interest rate and low interest rate margin, risks of all banks are high while the earnings are low because of low management efficiency and many non-performing loans. In 2011 with a high interest rate and low interest rate margin, risks of all banks are high while the earnings are high, which is in accord with the rule-"the higher the risk is, the higher the earning." Moreover, when the interest rate is high, commercial banks have a high cost of the liabilities (deposits or borrowings) to the residents, the firms, the interbank or central bank, indicating that liquidity risks faced by banks are likely to be high.

The reason that the effect of the interest rate on bank risks differs in China and in USA lies in the fact that the degree of the interest rate marketization and the banking sector's attitude towards risk varies in China and in USA. In China, banks are not risk-lovers and have no fully right to make the interest rate of loans and deposits float while banks are risk-lovers and the interest rate is fully

Table 2. The ratio of risk assets of all banks in different interest rate regime

	High Interest Rate Regime			**Low Interest Rate Regime**	
	1998-1999	**2007-2008**	**2011**	**2000-2006**	**2009-2010**
All Banks	0.860	0.844	0.845	0.841	0.840

Note: The interest rate is the 1-year benchmark deposit rate. All Banks refer to the nineteen State-owned and Non State-owned banks. State-owned banks include the Industrial and Commercial Bank of China (ICBC), the Agricultural Bank of China (ABC), the Bank of China (BOC) and the China Construction Bank (CCB). Non State-owned banks include Bank of Communications (BOCOM), CITIC Bank, Everbright Bank of China, Huaxia Bank, Guangdong Development Bank, Shenzhen Development Bank, China Merchants Bank, Shanghai Pudong Development Bank, Industrial Bank, China Minsheng Banking Co., Evergrowing Bank, Beijing Bank, Shanghai Bank, Nanjing Bank and Ningbo Bank.

Table 3. The ratio of risk assets of all banks in different interest rate margin

	1998-1999 (Low Interest Rate Margin)	2000-2008 (High Interest Rate Margin)	2009-2011 (Low Interest Rate Margin)
All Banks	0.860	0.842	0.844

Table 4. The ROA of all banks in different interest rate margin

	1998-1999 (Low Interest Rate Margin)	2000-2008 (High Interest Rate Margin)	2009-2011 (Low Interest Rate Margin)
All Banks (%)	0.363	0.587	1.029

Note: ROA means Return On Assets and is calculated by dividing net profit by the average balance of total assets at the beginning and at the end of the reporting period.

market-oriented in USA. Therefore, when the interest rate declines that means loose monetary conditions, banks in China have less freedom in the changes in the interest rate and take less risk than banks in USA.

Table 3 shows that risks of all banks are high (low) as the margin is low (high). The probable reasons are listed below. High (low) interest rate margin implies high (low) earnings on condition that loan-to-deposit spread is the main source of profits of the banks in China. Thus, banks in China with high (low) earnings would like to engage in less (more) risky businesses.

Hypothesis 1: The interest rate has a positive effect while the interest rate margin has a negative effect on bank risks in China.

2.2. The Reserve Requirement Ratio

In China, bank risk increases when the reserve requirement ratio is low while bank risk declines when the reserve requirement ratio is high. The possible reasons are listed below. The low reserve requirement ratio implies the increase in the available funds of the banks. As an administrative command, the low reserve requirement ratio is a strong signal of stimulating the expansion of the banks' loans and other asset business, which may make banks relax their vigilance to engage in some high-risk businesses to make high earnings and may cause higher bank risks. When the reserve requirement ratio is high, the available funds of the banks decline. As an administrative command, the high reserve requirement ratio is a strong signal of inhibiting the expansion of the loans and other asset business, the banks have high vigilance to decrease the probability of engaging in high-risk businesses to make high earning, leading to a decline in bank risks.

Hypothesis 2: The reserve requirement ratio has a negative effect on bank risks in China.

2.3. The Open Market Operation

In China, open market operation mainly relates to the commercial banks' business of trading government bonds which is a relatively risk-free asset. The lower bank risk is, the larger the scale of open market operation is in China.

Hypothesis 3: The open market operation has a negative effect on bank risks in China.

3. METHODOLOGY AND DATA

3.1. Method

We construct a panel regression model to study the effects of price-based and quantitative monetary policy instruments on bank risks as follows:

$$RK_{it} = \beta_0 + \beta_1 ResRatio_t + \beta_2 IR_t + \beta_3 \ln\ Open_t + \beta_4 GDPG_t + \beta_5 INF_t + \beta_6 \ln(PRI_t + \beta_7 \ln(SIZE_{it}) + \beta_8 ER_{it} + \beta_9 Ownership_i + \beta_{10} \ln(Regulation_t) + \varepsilon \quad (1)$$

where the risk variable, *RK*, of bank i at time t is a function of monetary policy instrument variables (ResRatio, IR and Open); a set of macroeconomic, regulatory control variables(GDPG, INF, RPI and Regulation) and a set of bank-level control variables(SIZE, ER, and Ownership). β_0 represents the constant term. $\beta_j(j=1,2,\ldots,10)$ denotes the parameters. ε means the random disturbance. Before carrying out the empirical analysis, we should discuss the variables used and the dataset.

Table 5 provides descriptive statistics for all the variables used in the empirical analysis. Table 6 reports correlation coefficients between these variables. According to Damodar N.Gujarati(2000),if zero-order correlation coefficient of each two regressors is over 0.8, the multi-collinearity problem will be a severe problem. Correlations in our study are acceptable levels as shown in Table 6. In what follows, we analyze the choice of our dependent and explanatory variables.

We proxy the risk behavior of banks using *RiskAsset, LoanRatio and InvRatio*. *RiskAsset*, a dependent variable, measures banks' risks and is defined as the ratio of risk assets for bank *i* to total assets at time *t*. Bank risk assets are the assets that fluctuate with the money market or credit market and include all bank assets except cash, the deposits with Central Bank, the deposits with banks and interbank lending. Naturally, an increase in *RiskAsset* demonstrates a more risky position of banks. Since 2006, the mean of *RiskAsset* has basically maintained a declining trend.

ResRatio represents the reserve requirement ratio, a main quantitative instrument used in China. We adopt the reserve requirement ratio for the large financial institutions with the reason that large financial institutions is the majority of Chinese banking industry and the reserve requirement ratios for the large, small and medium-sized financial institutions have a basically uniform trend. As the reserve requirement ratio and the interest rate may be changed for several times within one year, the daily weighed means of the both is used. Since 2000, *ResRatio* has kept a rising

Table 5. Descriptive statistics

Variable	Mean	Standard Deviation	Maximum	Minimum
RiskAsset	0.8498	0.041	0.907	0.692
ResRatio	10.269	4.510	16.84	6.000
DIR	2.699	0.868	5.030	1.980
Margin	3.304	0.290	3.610	2.518
Ln (Open)	10.363	0.732	12.210	9.272
GDPG	10.480	1.715	14.200	7.600
INF	2.1600	2.150	5.900	-0.800
Ln (RPI)	4.661	0.025	4.695	4.605
Ln (SIZE)	27.884	1.274	30.231	25.512
ER	4.312	1.633	8.412	1.465
Ownership	0.417	0.495	1.00	0.000
Ln (Regulation)	0.024	0.403	0.405	-0.693

Note: *RiskAsset* is the ratio of risk assets for bank *i* to total assets at time *t*. *ResRatio* represents the reserve requirement ratio. *DIR* denotes the RMB 1-year benchmark deposit rate. *Margin* equals the RMB 1-year benchmark loan rate less *DIR*. *Open* means open market operation, measured by the turnover of T-Bond trading (including spot trading and repo.trading). *GDPG* means real GDP growth rate and *INF* denotes inflation rate, mesured by CPI growth rate. *RPI* demotes real estate price index. *SIZE* represents size of the bank. *ER* denotes equity ratio that is defined as the ratio of shareholders' equity and total assets. *Ownership* represents the bank ownership. *Regulation* denotes the banking regulation intensity. Ln means the natural logarithm.

Table 6. Correlation matrix

	ResRatio	DIR	Margin	Ln (Open)	GDPG	INF	Ln (RPI)	Ln (SIZE)	ER	Ownership	Ln (Regulation)
ResRatio	1										
DIR	-0.587	1									
Margin	0.391	-0.672	1								
Ln(Open)	0.230	-0.303	0.625	1							
GDPG	0.028	0.358	0.097	-0.435	1						
INF	0.417	0.747	0.255	-0.012	0.429	1					
Ln(RPI)	0.179	0.227	0.057	0.232	0.503	0.748	1				
Ln(SIZE)	0.436	0.223	-0.471	0.084	0.142	0.186	0.152	1			
ER	0.420	0.319	-0.255	-0.024	0.089	0.182	0.035	0.572	1		
Ownership	0	0	0	0	0	0	0	0.743	0.401	1	
Ln(Regulation)	0.794	0.542	-0.461	0.195	0.441	0.576	0.439	0.426	0.303	0	1

trend from 6.0 percent in 2000 to 21.0 percent for the large financial institutions and 17.5 percent for small and medium-sized financial institutions in December 2011.

IR denotes the variables that relate to interest rate, the price-based instrument. We use two variables: *DIR* and *Margin*. *DIR* denotes the RMB 1-year benchmark deposit rate. *Margin* equals *LIR* (i.e. the RMB 1-year benchmark loan rate) less *DIR*. Figure 1 and Figure 2 shows the changes of *DIR-LIR* and *Margin*. The years of 1998-1999, 2000-2006, 2007-2008, 2009-2010 and 2011 are respectively high interest rate regime, low interest rate regime, high interest rate regime, low interest rate regime and high interest rate regime. The years of 1998-1999, 2000-2008 and 2009-2011 are respectively the periods of low interest rate margin, high interest rate margin and low interest rate margin.[2]

Open means open market operation, another main quantitative instrument in China. We use the turnover of T-Bond trading (including spot trading and repo.trading) to measure open market operation. Since 2006, total turnover of trading of T-Bond had been rising continually from 1063.35 billion Yuan in 2006 to 20084.133 billion Yuan in 2011.

We have chosen several control variables for our regression analysis. These variables are defined and discussed below, while summary statistics are reported in Table 5.

GDPG (real GDP growth rate) and *INF* (inflation rate, denoted by CPI growth rate) is used to measure the macroeconomic situation that may have an impact on bank assets and debts, thus affecting bank risk.

RPI, real estate price index, is used to measure the situations of real estate market. The real estate loans account for a large proportion of Chinese bank credits. Too much bank credits are input into the real estate market, which may give reasons to the potential risk.

SIZE represents size of the bank, which is measured by total asset of the bank. Banks with

Figure 1. The changes of the interest rates: Changes of LIR and DIR

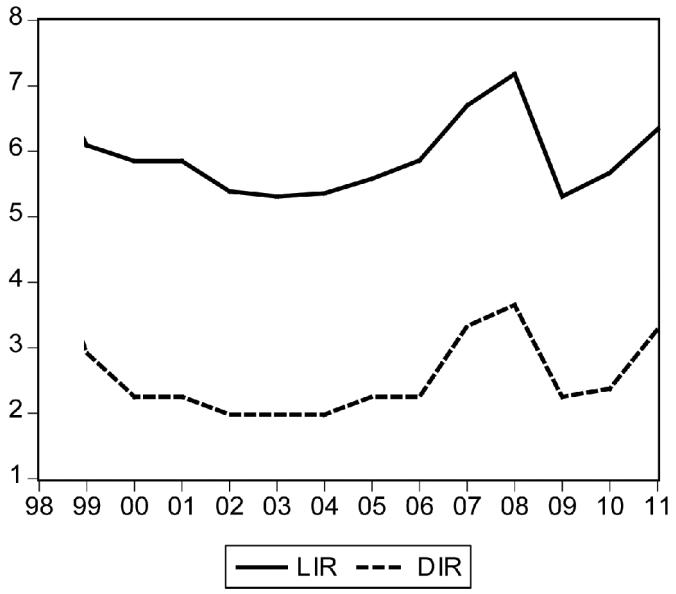
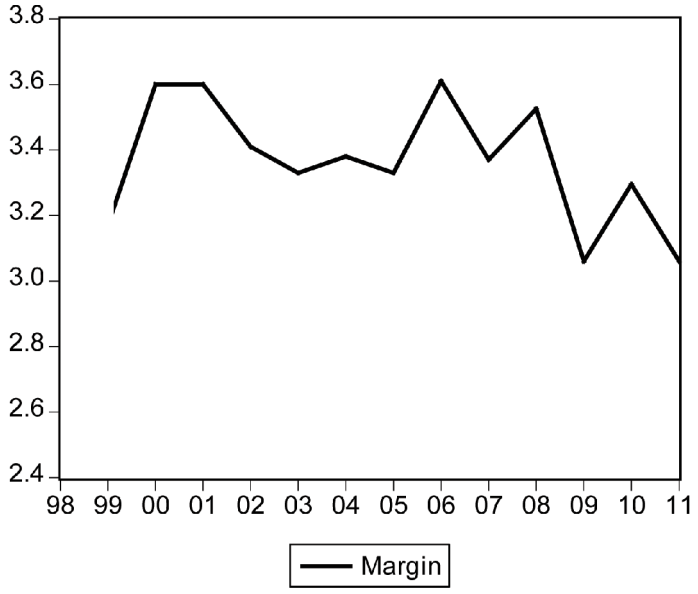


Figure 2. The changes of the interest rates: The changes of Margin



the different sizes may have distinct motivation to engage in risky activities.

ER denotes equity ratio that is defined as the ratio of shareholders' equity and total assets, which represent banks' asset-liability structures. Banks with the different asset-liability structures face different risk.

Ownership represents the bank ownership. Considering the differences of risk-taking behaviour between state-owned banks and non-state-

owned banks, we construct a dummy variable BD on behalf of bank ownership. If the bank is state-owned (Industrial and Commercial Bank of China, Agricultural Bank of China, Bank of China, China Construction Bank and Bank of Communications), the value of BD is 1; if not, the value of BD is 0.

Regulation denotes the banking regulation intensity that is also an important factor that has an impact on bank risk. The value of the banking supervision intensity from 1998 to 2002 is 0.5, because China's banking regulation was carried out by the People's Bank of China before 2003 and separated regulation wasn't implemented as well, which made the regulation relatively weak. The value of the banking regulation intensity between 2003 and 2006 is set at 1.0 with the reason that the China Banking Regulatory Commission was established in 2003, which strengthened banking regulation. The value of banking regulation intensity during 2007-2011 is 1.5, since the third national financial work conference in 2007 reaffirmed the importance of strengthening financial regulation.

3.2. Data

We use annual data of nineteen Chinese banks whose assets account for over 64% of the assets of Chinese banking industry from 1998 to 2011. The sample contains the five large commercial banks, ten joint-stock commercial banks, and four city commercial banks. Among those, the large commercial banks include the Industrial and Commercial Bank of China (ICBC), the Agricultural Bank of China (ABC), the Bank of China (BOC), the China Construction Bank (CCB) and Bank of Communications (BOCOM); the joint-stock commercial banks include CITIC Bank, Everbright Bank of China, Huaxia Bank, Guangdong Development Bank, Shenzhen Development Bank, China Merchants Bank, Shanghai Pudong Development Bank, Industrial Bank, China Minsheng Banking Co., and Evergrowing Bank; the city commercial banks include Beijing Bank, Shanghai Bank, Nanjing Bank and Ningbo Bank.

The banks' data of risk assets, total assets, loans, investments, equity ratio and the data of real estate price index, real GDP growth rate, inflation rate measured by CPI growth rate come from DRCNET Statistical Data Database System, *Almanac of China's Finance and Banking* and the website of very bank. The data of the RMB 1-year benchmark deposit rate, the reserve requirement ratio, the total turnover of T-Bond trading comes from the website of *People's Bank of China*.

4. ANALYSIS AND RESULTS

Based on the results of the Hausman test, we use the random effects model for the panel data to estimate Equation (1). The results are reported in Table 7.

4.1. Effects of Monetary Policy Instruments on Bank Risks

From the results of regression I, the interest rate has the second largest effect on bank risk among the three monetary policy instruments, and it has a significant (at 10% level) and positive effect (0.699) on bank risks, which is in accord with Hypothesis 1.

As for the reserve requirement ratio, its effect on bank risk is the greatest among the three monetary policy instruments, which supports Hypothesis 4. But it has a negative effect (-1.320) on bank risks and is significant at the 1% level, which verifies Hypothesis 2.

The effect of open market operation on bank risk is the weakest among the three monetary policy instruments. Open market operation has a negative effect (-0.339) on bank risks and is significant at the 10% level, which supports Hypothesis 3.

Table 7. The random effects regressions for the panel data

	I		II	
	Coe	**Std. Coe**	**Coe**	**Std. Coe**
C	-3.860** (-1.993)		-1.049 (-0.924)	
ResRatio	-0.012* (-4.804)	-1.320	-0.009* (-4.974)	-0.990
DIR	0.033*** (1.674)	0.699		
Margin			-0.089** (-2.002)	-0.630
Ln(Open)	-0.019*** (-1.848)	-0.339	-0.032** (-2.569)	-0.571
GDPG	-0.010** (-2.101)	-0.433	-0.007*** (-1.761)	-0.293
INF	-0.013** (-1.999)	-0.684	0.001 (0.252)	0.052
Ln(RPI)	1.029** (2.369)	0.630	0.518*** (1.918)	0.316
Ln(SIZE)	0.032* (3.021)	1.008	0.033* (3.076)	1.025
ER	-0.002 (-0.667)	-0.073	-0.002 (-0.646)	-0.080
Ownership	-0.046*** (-1.876)	-0.561	-0.047*** (-1.927)	-0.567
Ln(Regulation)	0.077* (3.104)	0.757	0.032 (1.333)	0.315
F-statistic	6.185		6.367	
p-Value	0.000		0.000	

Note: The table reports coefficients and t-statistics (in parentheses). In regressions I and II, the variables that relate to the interest rate are respectively *DIR* and *Margin*. The explanatory variables are as follows: *ResRatio* represents the reserve requirement ratio. *DIR* denotes the RMB 1-year benchmark deposit rate,.*Margin* equals the RMB 1-year benchmark loan rate less *DIR*. *Open* means open market operation, measured by the turnover of T-Bond trading (including spot trading and repo.trading). *GDPG* means real GDP growth rate and *INF* denotes inflation rate, measured by CPI growth rate. *RPI* demotes real estate price index. *SIZE* represents size of the bank. *ER* denotes equity ratio that is defined as the ratio of shareholders' equity and total assets.*Ownership* represents the bank ownership.*Regulation* denotes the banking regulation intensity. The F-statistic and its associated p-value denote the significance of the regressions. C denotes the constant term. Coe represents coefficient. Std. Coe means the standardized coefficient that can eliminate the impact of the dimension and equals Coe* (standard deviation of the explanatory variable/standard deviation of the dependent variable). *, ** and *** denotes respectively the statistical significance at the 1%,5% and 10% level.

Obviously, the effect of the reserve requirement ratio on bank risks is the largest among the three monetary policy instruments.

The effect of the interest rate on bank risk is smaller than that of the reserve requirement ratio on bank risk. The reason may lie in the different features of the effects of the interest rate and the reserve requirement ratio. Changes of the interest rate affect not only the amount of banks' available fund, but also the cost of banks' liabilities. Facing the changes of the interest rate, banks must consider not only the allocation of funds, but also the cost of the liabilities, which makes decision-making of banks complex. As for the freedom in decision-making, banks are free to some extent, such as the right of making loan rate float, but the

risks of bank are more restricted by the residents, companies, the interbank and the central bank. The reason is that the changes of the interest rate may affect the cost of bank's liabilities to residents and companies and the costs of banks' financing from the interbank or the central bank. The effects of the interest rate may be slow and complex.

However, the effects of the reserve requirement ratio are very obvious and it has a direct impact on the amount of the available funds of the banks instead of the cost of banks' liabilities. Facing the changes of the reserve requirement ratio, banks are easier to make decisions and the allocation of funds is banks' priority. The reserve requirement ratio is an administrative command that banks must comply with it unconditionally. The reserve requirement ratio directly reflects the monetary authority's intent and its effect is the most direct and rapid. As a result, the effects of the interest rate and the reserve requirement ratio on bank risk may be different in the sign and intensity.

As for the effect of the open market operation, it is partly constrained by weaker purchasing willingness on the part of commercial banks while the reserve requirement ratio gives the central bank greater initiative in managing liquidity and has the capability to freeze an enormous amount of liquidity to normalize money and credit growth. Hence, the effect of the open market operation on bank risks is smaller than that of the reserve requirement ratio.

The results of regression II are derived by substituting the explanatory variable, *Margin*, for *DIR* in regression I. The reserve requirement ratio has still a negative effect (-0.990) on bank risks and is significant at the 1% level, which further affirms the larger effect of the reserve requirement ratio on bank risks. The interest rate margin has a significant (at 5% level) and negative effect (-0.630) on bank risks, which verifies Hypothesis 1. The sign and significance of the effect of open market operation on bank risks have not been changed, compared with the result of regression I.

4.2. Effect of the Control Variables on Bank Risks

From the results of regression I, the effects of real GDP growth rate and inflation rate on bank risk are all significance at 5% level. The coefficient of real GDP growth rate is -0.433, indicating that a fast pace of economic development will reduce bank risk, probably due to the fact that the banks' business operation is good and the revenue is stable under an up economic environment and the banks do not need to take risks to achieve a higher income. The coefficient of the inflation rate is -0.684, showing that the banks have lower risks when facing a higher level of inflation. The possible reason is as follows. In the circumstance of high inflation, banks do not dare to take risks to retain the high-risk assets, thereby reducing the bank risk.

The real estate price index has a positive effect (0.630) on bank risks at 5% significance level. The probable reason is that China's real estate market is relatively hot in recent years, which attracts banks to loan a lot to the real estate market to aim at a high yield, causing an increase in bank risk.

The banks' total assets has a positive and significant (at 1% level) effect (1.008) with the probable reason that the banks with a larger size have a stronger motivation to engage in risky activities, leading to the greater risk faced by banks.

The equity ratio is not statistically significant on bank risks. The possible reasons are that in order to satisfy the requirement of the regulatory authority, the ratio of the shareholders' equity to total assets in Chinese banking industry is relatively reasonable, which has no significant effect on bank risks.

The bank ownership has a significant (at 10% level) and negative effect (-0.561), showing that the risks of state-owned banks are lower than those of other commercial banks to a certain extent with the probable reason that the implicit guarantee of government for state-owned banks is relatively high.

The banking regulation intensity has a positive effect (0.757) on bank risks at 1% significance level. The probable reason is as follows. The regulation of banking restricts the flexibility of adjusting strategy of the banks, which causes the continuity of bank risks (Borio & Zhu, 2008).

The results of regression II show that most control variables are significant and their effects on bank risks have the same sign while the inflation rate and the banking regulation intensity have been insignificant, compared with the results of regression I.

5. CONCLUDING REMARKS AND POLICY IMPLICATIONS

We use panel data regression model to study the effects of main monetary policy instruments on commercial bank risk in China. The empirical findings are as follows. The effects of the interest rate, the reserve requirement ratio and open market operation on bank risks are all statistically significant. The interest rate is positively correlated with bank risks, while the interest rate margin, the reserve requirement ratio and open market operation are both negatively correlated with bank risks. Among the three monetary policy instruments, the reserve requirement ratio, the interest rate (the interest rate margin) and open market operation have respectively the greatest, the middle and the smallest effects on bank risks. The effects of the interest rate and the reserve requirement ratio on bank risks are different with the probable reason that the interest rate affects not only the amount of banks' available funds but also the cost of banks' liabilities and the effect is slow and complex while the reserve requirement ratio as an administrative command directly and mainly impacts the amount of banks' available funds and the effect is rapid and obvious.

Considering the different effects of the interest rate (the interest rate margin), the reserve requirement ratio and open market operation, and the significant effect of the reserve requirement ratio on bank risks, the following policy implications can be obtained. First, applying the administrative and market-oriented monetary policy instruments simultaneously and synthetically is helpful for achieving price stability and financial stability synchronously. About the relationship between price stability and financial stability, there are two conflicting viewpoints. One is "synergy" viewpoint that monetary policy aiming at price stability will be conducive to financial stability (Schwartz, 1995).The other is "trade-off" viewpoint that monetary policy aiming at price stability is not necessarily helpful for financial stability and a trade-off relationship exists between price stability and financial stability (Borio & Lowe, 2002; Schinasi, 2003). From China's experience, on the one hand, price stability can be achieved by enhancing the interest rate and reserve requirement ratio at the time of high inflation. On the other hand, the increase in the interest rate leads to the increase in bank risk while the rise in the interest rate margin or the reserve requirement ratio results in the decline in bank risk. What's more, the effect of the reserve requirement ratio on bank risks is greater than that of the interest rate or the interest rate margin. Utilizing mainly the reserve requirement ratio rather than the interest rate or the reserve requirement ratio, the interest rate and the interest rate margin are applied at the same time will contributes to achieve price stability and banking stability simultaneously. Therefore, the reserve requirement ratio(an administrative instrument) sometimes may play a more major role than the interest rate(a market-oriented instrument) and the market is a good but not necessarily a best choice, which is important for those countries that take the interest rate as a principal instrument and ignore the use of the reserve requirement ratio. Second, the following measures should be taken to ensure the financial stability. To begin with, banks ought to pay much attention to the impact of the changes in monetary policy on bank risks and establish a comprehensive early warning

system of risk. Next, the monetary authorities should improve its reaction function and take the bank sector into macroeconomic decision-making model, and strengthen the monitoring and analysis of bank risks and thus guard against financial imbalances. Again, the monetary authorities ought to focus on the effects of the interest rate margin more than the interest rate per se on bank risks with the reason that the interest rate has a positive effect on bank risks on the premise that low interest rate regime means the high interest rate margin in China in our empirical study. To keep a reasonable interest rate margin is more important than to focus on the level of the interest rate alone. Then, monetary and regulatory authorities must take into account the different effects of the interest rate (the interest rate margin) and reserve requirement ratio on bank risks and strengthen coordination and cooperation so that some effective steps can be taken in advance to prevent the possible risks.

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ENDNOTES

1 The interest rate is the RMB 1-year benchmark deposit rate. *Margin* equals the RMB 1-year benchmark loan rate less the RMB 1-year benchmark deposit rate.

2 We do not use *LIR* as the explanatory variable with the reason that *DIR* and *LIR* have the same trend and their correlation is as high as 0.953. If *DIR* or *LIR* less its mean is more(less) than zero in some year, the year is high (low) interest rate regime. If *Margin* less its mean is more(less) than zero in some year, the year is the period of high (low) interest rate margin.

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Chapter 28
ICT Infrastructure Framework for Microfinance Institutions and Banks in Pakistan:
An Optimized Approach

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ABSTRACT

Information and communication technology (ICT) can be termed as a reagent for the microfinance sector. It has contributed significantly for the growth of this sector, which is clearly depicted from the reviewed literature as well as the market evaluation. The paper analyzes the impact of technological advancements within the microfinance industry from academic as well as practitioner's point of view. The true advantage of that advancement in the technology is yet to be realized by this sector. The paper proposed that ICT components on an optimized approach can be beneficial for a new as well as an experienced microfinance player for the efficient and cost effective delivery of its services to the masses without any major hindrance.

1. INTRODUCTION

The ICT infrastructure framework for microfinance institutions can be seen in two perspectives–global and local.

1.1. Global Perspective

ICT is an enabler and catalyst of economic and social development in the third-world nations (Dewan & Riggins, 2005). At the global level, United Nations (UN) and the World Bank are consorting with government and non-government institutions of the less resourceful and developing countries to promote ICT with the target of bringing them up to a certain conventional level in technology by making the requisite grant funds available to promote economic development (Kauffman & Rigging, 2010). This objective is perceived in the United Nation's commitment

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towards the global development. One of UN's goals is to create a harmonized global platform for development (Kauffman & Rigging, 2010). This includes liaising with the private and public sector for the provision of benefits of information and communication technologies (Kauffman & Rigging, 2010).

Microfinance services have emerged as an effective and responsive mechanism for the economic development in the last couple of decades. Microfinance can be defined as "the availability of financial services to unbanked or poor or lower income clients or lesser privileged sector of the society" (Ledgerwood, 2000). Microfinance institutions give small loans to such clients who are not being provided any services from conventional sector and are willing to opt it for setting up their own business. This sector provides the services like loans, savings mobilization, remittance, insurance and capacity building for business setup. The Nobel peace prize laureate and the founder of Grameen Foundation brought the industry into limelight. There are about four billion unbanked people around the world which is more than two third of the population of low and middle income developing countries around the world (2010). Conventional financial institutions such as commercial bank are still unable to reach poor population, because of high cost for constructing and sustaining the branch network.

Microfinance Providers (MFPs) i.e., microfinance institutions (MFIs) and microfinance banks (MFBs) are considered as the best apparatus for alleviating poverty, as it helps reduce risk and increase income of the poor household. Several MFIs were converted into the full-fledged microfinance banks over a period of time. This transition has never been easy for such institutions to become a regulated bank under the supervision of the regulatory body of that country. The conventional banks are also looking into the feasibility to venture into this market as well. These types of conventional players are entering into the microfinance sector with diverse ICT background and facilities.

ICT is being stimulated as a technological instrument to help MFIs being placed at a better position in a modest environment. ICT has been recognized as a preferred investment within the banking industry, especially in the conventional sector. Operational efficiency, risk analyzing and controlling/mitigation, getting new customers and retention of existing customers has been enhanced significantly through the use of ICT. The MFIs have followed the same pattern to remain buoyant to compete in the banking sector. The use of ICT by conventional lending institutions and MFIs is driving the closeness and coordination between the two sectors of the banking arena. This is also dictating MFIs/MFBs into an economically more competitive business domain. The third-party websites such as the Consultative Group to Assist the Poor (www.cgap.org), Microfinance Information Exchange (MIX Market, www.mixmarket.org) and Banking With The Poor (www.bwtp.org), which creates healthy competition among MFIs for technological advancements, consultant pools, real success stories, strategy guidance and donor funds. This gives the benefit to bring more efficiency and performance in the overall business key indicators. Whether the ICT has provided an edge to the overall microfinance sector or not, is it really competitive to the conventional sector and has certainly raised the standard of the sector.

1.2. Local Perspective (Pakistan)

The microfinance is a specific sector within the banking industry that functions through the provisions set out in the microfinance ordinance approved by the State Bank of Pakistan. The industry is focused to serve the specific impoverished segment of the society which is un-served by the commercial banking. This sector provides the services like loans, savings mobilization, remittance, insurance and capacity building of clients for business setup. The conventional banking has flourished quite a lot in Pakistan from the technological aspects covering core banking so-

lutions, communication and infrastructure in the last decade or so. Usually, the conventional banks are provided with the deep pockets to make huge investments in the technology area, but this is not the case of the microfinance banks.

The concept of microfinance is relatively new and emerging in Pakistan. The State Bank of Pakistan states its mission in this regard as "Transformation of microfinance into a dynamic and integrated industry through the provision of services to unbanked population within a regulatory and governance framework" (2011). The industry has its own challenges and issues, which are of varied nature and quite different from the conventional banking industry. The good aspect is that it is provided with certain platform/forums like Financial Inclusion Program (www.sbp.org.pk) and Pakistan Microfinance Network (http://www.microfinanceconnect.info) to assist in the technological areas, so that it helps the industry in a better way. Those forums help the microfinance banks and institutions to build their capacity by sharing the mutual experiences in an organized manner. The innovation in a technological area with coordination to business addresses all these challenges in a better way.

Pakistan is the fifth largest country in terms of using mobile phone services. There are around 95 million mobile users, including the remote mountainous areas (like Gilgit, Baltistan) and there are 26 million banking accounts within the country which indicate inherent potential for mobile banking in Pakistan (2010). The prominent MFIs working in Pakistan are (Ahmed, 2006):

- Khushali Bank;
- Kashf Microfinance Bank;
- NRSP Microfinance Bank;
- Bank of Khyber;
- The First Microfinance Bank Ltd.;
- Orangi Pilot Project (OPP);
- Sungi development Foundation;
- Taraqee Foundation MFI;
- Thardeep MFI;
- Rozgar Microfinance Bank;
- Tameer Microfinance Bank;
- Asasa MFI;
- Pak Oman Microfinance Bank;
- Waseela Microfinance Bank.

To expand financial system access and usage, the innovation in the institutional processes and technology is a requisite program to opt for. To reduce the capital expenditure cost, the microfinance institutions are moving towards the adoption of latest technologies like virtualization, cloud computing, outsourcing model and managed services, as this approach requires less upfront investment for them. Mobile phone technology and agent network (2011) help reduce the operational cost and increase banking footprint. Indeed, inadequate research has been made under the ICT influence over the microfinance sector. This paper is an attempt to extend the work carried out by Robert Kauffman and Frederick Riggins (2011) in the microfinance sector. Rest of the paper is organized as follows: Section 2 provides a literature survey about the ICT advancements in different areas of the microfinance sector which have set the lasting impressions. These imprints were also replicated in a more or less the same manner in other parts of the world. Section 3 elaborates the key findings; Section 4 covers our proposed framework that has been developed based on the usage of ICT advancements. Section 5 explains components of the proposed framework. Section 6 delineates a case study based discussion and, finally, we conclude in the last section.

2. LITERATURE REVIEW

Ahmed (2006) discussed the importance of ICT for microfinance institutions and highlighted the difficulties in getting the right technology because of certain issues like human-resource skills, suitable core banking application, business process diversity, geographical outreach, vendor capacity

and higher cost of solutions. The author presented a strategy comprising a) strong IT department, b) short term Core Microfinance Application, and c) long term Core Microfinance Application to address all the areas of business, including the alternate delivery channels. The research focus in this area is on the importance of the Core Microfinance Application which is a backbone of any institution for all kinds of transactional flow. The right selection of the solution by keeping in mind the future vision of the organization and cost-benefit analysis could place an organization in a better position to go on with the market pace.

Robert *et al.* (2010) identify the challenges faced by the microfinance institutions as: efficiency in operations, risk mitigation, financial sustainability and growth. These areas can be better addressed by the help of right selection of technologies. The authors emphasize the impacts of IT in better economic development and efforts to cover the digital gap. The microfinance technology ecosystem can be developed with the integration of the ICT drivers, stakeholders including the customers, microfinance institution, donors, regulatory bodies and the microfinance industry as a whole. The focus is on the effective coordination of all the stakeholders to reap the benefits of the ICT. In view of this, it is imperative to understand in detail the influence of ICT facilities at the donor, MFI, customer and the microfinance industry. The specific weightage has been assigned to the usage of Internet banking and mobile banking, which can produce benefits to the sector by reducing the distances and proving facility to the customers of the far-flung areas.

Malia *et al.* (2011) examine factors that positively influence users to adopt latest banking services, which are technology-driven, i.e., Internet banking, phone banking and auto-teller machine (ATM). Such an approach necessitates a technology acceptance model to support the usage of these services by the customers due to factors like trust, perceived ease of usage, reliable connectivity and best service quality. These services are provided with better quality, and customers can rely on them based on their own convenience. The technology has particular leverage to the banking sector for swift and reliable execution of all types of transactions.

Nobert *et al.* (2011) provide the ICT roadmap for the future based on; user access, availability of ICT services, user expectations and future projects. The roadmap basically guides the development of such applications and services which can serve the current needs as well as the forthcoming expectations to some extent. However, the applications should be developed keeping in view of the scalability, usability and flexibility aspects in mind. Contrary to that, such applications would not be able to keep up the pace of business opportunities and development.

Victor *et al.* (2012) recommend a service-based Mobile Collection System in order to establish a better system with no redundancy, lower error probability and lesser fraud rate. The system shows that not all of dependable attributes are satisfied to the same degree. Reliability, confidentiality and safety have the highest degree level; availability and integrity share the medium degree level; and maintainability has the lowest degree level. So, using the mobile technology could add a value to it and provide a convenience to the customer to avoid the commuting time and cost required to physically visit the bank branch.

Parikh (2006) discusses three important aspects faced by the rural microfinance service providers, which are: remote clients data exchange, data processing for the institutional and the payment system to distant rural areas. The abovementioned three challenges can be amicably addressed to a great extent through adopting the following procedures:

- The usage of handheld technologies/device to collect the data;
- Provision of a strong microfinance banking application for centralized and quick processing;

- Introducing the electronic banking, i.e., ATM for collection and delivery.

The benefits achieved from the introduction of these services are far-reaching and can bring long-term sustainability to the sector.

Vikas *et al.* (2011) observe that mobile penetration, the ease of usage of voice interface and reasonable acceptability of mobile related technologies, all bring us to the convergence of mobility and innovative collaboration technologies that can help in crafting a system for the masses. A system is proposed that uses voice as medium to reach the larger population and crosses the thick layer of illiteracy and establishes an effective interaction with the MFI. This reduces the cost to a considerable extent without compromising any information and also enforces the active participation of the illiterate sector of the unbanked population, which in itself is a remarkable achievement. The voice medium is the best medium to approach that segment of the society as a certain kind of transactions can be carried out through it.

Nabila *et al.* (2010) provided an account of the influence of IT-related technologies over the work efficiency, risk management and customer relationship, which proved to be quite positive. By the efficacious implementation of ICT based services, the work efficiency along with the customer experience can be enhanced notably. In order to make it more effective, the user awareness level should also be improved.

Eduardo *et al.* (2008) discussed a particular model of correspondent banking, which created an ICT based business edifice for banks to downscale financial services out of the conventional branches such as small retail shops, supermarkets, mobile franchises, drugstores, post offices, and so on. This concept is known as the branchless banking which has revolutionized the banking sector in general and microfinance sector in particular. The upfront cost for the MFI/MFB to set up a branch premise has reduced to a considerable extent and using the other mediums benefited a lot. The writer has also focused upon the use of point of sale machines, ATMs and other handheld devices to do the microfinance-related transaction in the correspondence banking model.

Radhika *et al.* (2008) explain that the underlying principle behind ICT in gaining importance in developmental projects is that it contributes considerably to the accretion in human wellness by enabling economically and socially marginalized sections of the society to exercise their right of choice through enriched community participation. In this context, the authors present the concept of digital ecosystems for using ICT as a means of information delivery to the masses. A digital mechanism describes an ICT enabled network that displays associative and autopoietic properties capable of self-sustenance and of expansion through heightened inclusion and growth.

Saket *et al.* (2006) explain that credit risk assessment system can be carried out using the mobile technology, and this can be done by sending officers into the field to get the approval for processing of micro loans. This approach can reduce the commuting time for the officer to execute such a process in the office.

Parikh (2005) presents a mechanism in which the cell phone camera is used to scan all the documents, which are subsequently transmitted to the central repository for further processing. This mechanism can be used in the developing world to support the existing manual document submission process. This can really benefit the microfinance industry as the loan office can fill the data while in the field and then submit it through the mobile which will be processed accordingly at the central site.

Adeel *et al.* (2010) elaborate that the technological innovation can be attractive when it is combined with measures to support learning and community building. Outsourcing is one of

the better aspects to be used by the MFI/MFB as making huge upfront technological investments are quite expensive. There is enough room to use the ICT for the empowerment and education of customers within the microfinance sector as it would help uplift the standard of life among the masses.

The financial inclusion (Olga *et al.*, 2010) in numerous parts around the world has been made on the basis of technology enabled branchless banking services. This service is increasing the spectrum for the provision of microfinance banking services to the customers near to their doorstep. Not only, the customers are facilitated, but it also reduces the operational expense of the microfinance provider. The technology is instrumental in providing better and cheap access to the customers.

The technology has changed the face of the microfinance sector (Jaijit & Richa, 2007) especially reaching out to the masses and enhancing the scalability and sustainability of it. Rao *et al.* (2010) examined the impact of a different framework on the use of the mobile services and felt the need of having uniformity across the board.

3. KEY FINDINGS

During the literature review, we observed a number of issues and challenges being faced by the microfinance sector that encompasses both the global as well local perspective. The key challenges viz-a-viz the cited literatures are highlighted in Table 1.

To conduct this research, besides undergoing an extensive literature review, we visited central and regional offices of the different microfinance institutions and banks. From the practitioners' angle, the participation from the key stakeholders is essential for undertaking any research study. Therefore, in this study, the practitioners were involved by interviewing representatives (through physical visits or over the voice) from Branch Operations, Business, Risk Management and IT departments. The challenges pinpointed by the practitioners help us to formulate an appropriate IT response to overcome these challenges.

The ICT solutions for some of the major areas viz-a-viz the challenges identified during the study are highlighted in Table 2. Table 2 also highlights the suggested tool, techniques and solutions for those challenges.

Table 1. Issues/challenges w.r.t. microfinance sector

Issues/Challenges	[1]	[2]	[12]	[14]	[15]	[16]	[18]	[19]	[20]	[21]	[22]	[23]	[24]	[25]	[26]
Manual Work/ Information Capturing and Extraction	√			√		√		√		√		√	√		
Geographical Outreach		√			√	√	√		√			√	√	√	√
Alternate Delivery Channels		√	√		√	√	√		√		√		√	√	√
Operational Risk		√			√			√			√				
Service Accessibility/ Delivery		√	√	√	√	√		√				√	√	√	√
Customer Relationship		√			√		√	√						√	
IT Management	√									√			√	√	
IT Investment Cost/ Donor	√	√								√			√		

*Table 2. Solutions (ICT/non-ICT) against issues/challenges**

Issues/Challenges	Solutions (ICT or Non-ICT)
Manual Work/Information Capturing and Extraction	Centralized Core Microfinance Application, Mobile Applications, Other applications like office automation and collaboration
Geographical outreach	Branchless Banking, Outsourcing Model, Handheld Technology (Mobile, POS, PDA)
Alternate Delivery Channels	Automated Branches, Branchless Banking Units, Internet, Phone, Mobile, ATM
Operational Risk	Better controls through Centralized Core Microfinance Application, Document Scan through Handheld devices (Mobile, PDA)
Service Accessibility/Delivery	Mobile Technology linked with Centralized Core Microfinance Application
Customer Relationship	Customer Relationship Management Application
ICT Management	Outsourcing Mechanism, Virtualization of resources, Cloud Computing, Shared Services, Managed Services
ICT Investment Cost/Donor	Active Donors (World Bank, Asian Development Bank and other State Driven Banks and International Financial Institutions) available for funding of ICT projects provided that it place major impact over the microfinance sector

*(The institutions considered from the practitioners' angle include: Khushali Bank, Kashf Microfinance Bank, Asasa MFI, The First Microfinance Bank Ltd, NRSP Microfinance Bank – Interviews were conducted either through physical visit or over the voice)

Some of the solutions discussed in Table 2 are being practiced by the microfinance banks and institutions and have been proven to be beneficial to the industry to a considerable extent as they can help make it a more viable, promising and financially sustainable sector.

4. GUIDING PRINCIPLES: PROPOSED ICT FRAMEWORK

The challenge is an opportunity in disguise, which provides a direction for growth, expansion, efficiency and sustainability. Based on the academic and practitioners' angle and keeping in view the challenges and opportunities along with the availability of ICT solutions, we propose an ICT framework for microfinance institutions and banks. This is a logical framework as the components suggested are not only archetypes for a new microfinance operator, but it can also help enhance the overall functional efficiency of an experienced one as well. This will help the institutions to devise their ICT strategy keeping in view the past practices and the new techniques to be adopted. The institutions need not to re-invent the wheel as they can adopt the components in a phase-wise approach as per their own business strategy.

The proposed framework is divided into two major components: *IT Management* and *IT Services*. The "IT Management" component is linked to the management of the overall IT infrastructure covering all the relevant areas while "IT Services" is the area which will provide the specific services which are the need of the business. It will also serve as an enabler of business through the use of IT infrastructure.

The approaches which are best suitable for the microfinance sector (to be adopted) have been mentioned against each component. The proposed approaches are basically the way for managing or monitoring the respective component. Three main approaches have been identified i.e., in-house management (management within the Institute), outsourcing (management by a service providing company) and third-party piggybacking (using the existing infrastructure of any other key player).

4.1. Outsourcing

In this case, the specific part of the IT infrastructure is being taken care of or maintained by an outside specialized company or group having a service level agreement in place for the continued availability of that service for the client (MFI).

4.2. In-House Management

In this case, the specific section of the IT infrastructure is being developed or serviced or maintained by the owner (MFI) itself.

4.3. Third-Party Piggy Backing

In this case, the specific part of the IT infrastructure owned by a third-party company (who is specialized to do it) which is being used by the institution (MFI). In this case, the client needed not to place its own infrastructure instead using that of service providers at a certain cost on an agreed formula.

Table 3 shows the identified ICT domains having their respective components; and the approaches to be adopted in the implementation of those components.

5. COMPONENTS AND ITS ASSOCIATED APPROACH

Table 4 provides a detailed overview about the component together with d its approach that should be adopted for its effective implementation.

A mix and match of these can be adopted for specific type of MFI as it varies from institution to institution. Nowadays, the availability of such vendors/service providers to offer the services are quite good for MFI's who cannot make such huge upfront investments in the IT domain.

6. USAGE IN LOCAL ENVIRONMENT: A CASE STUDY-BASED DISCUSSION

Based on the above work, we carried out an exercise to check an important aspect of the above-mentioned components, i.e., application software for business operations, which is also called as the Core Microfinance Application. This usage clearly depicts that the local environment is needs to follow the best practices and standard frameworks which are essential to stay

Table 3. ICT framework components with its preferred approaches

ICT Domains	Components	Approach
IT Management	Asset Management (hardware and software)	Outsourcing
	Human resource Management	Outsourcing
	Data/Information Management	In-house management
	Information security Management	In-house management
	Maintenance/Warranty services	Outsourcing
	Information systems development management	Outsourcing
	Network management (Communication links)	Outsourcing
	Web services Management	Outsourcing
IT Services	Office automation	In-house management
	Application software for business operations	In-house management
	Internal and External Communication	In-house management
	Outreach and expansion	Third-Party piggybacking
	Online services	In-house management
	ATM/POS/Handheld services	Third-Party piggybacking

Table 4. Descriptive information against the components

Component	Approach	Descriptive Information
Asset Management (hardware and software)	Outsourcing	It is an administrative cost (with respect to management of hardware and software assets) and overhead to the business, hence, it should be handed over to a third-party.
Human resource Management (HR)	Outsourcing	Instead of managing the whole HR within the organization, it should be outsourced to avoid the cumbersome process of hiring and firing manpower.
Data/Information Management	In-house management	As information/data is the critical part of any organization so it should be managed by the organization itself for all kind of reporting to stakeholders and regulators.
Information security Management	In-house management	The organization is the custodian of its data, so it should have absolute control over the right information for the right person and need to be managed within the organization.
Maintenance/Warranty services	Outsourcing	It is an administrative cost, so proper service level agreements (SLA) should be maintained with the vendors to provide all the maintenance related activities.
Information systems development management	Outsourcing	Proper SLA should be maintained with the vendors to provide the information systems development related activities.
Network management (Communication links)	Outsourcing	It is an administrative cost; therefore, proper SLA should be maintained with the vendors for the availability of communication/network links at the desired level of the organization.
Web services Management	Outsourcing	Being an administrative cost, proper SLA should be maintained with the vendors to provide the web related services.
Office automation	In-house management	Adopt open source technologies and manage it within the house to have control over the sharing of data/information.
Application software for business operations	In-house management	As it pertains to the information/data relevant to the organization, so it should be managed in-house and SLA should be in placed with the vendor for any changes or further developments in the system. In addition, it should be centralized for better management and control.
Internal and External Communication	In-house management	Prefer to adopt the open source technologies and it needs to be managed within house to have control over the sharing of data/information.
Outreach and expansion	Third-Party piggybacking	The footprint of the institution can be taken up to any level by the adoption of piggyback model for getting the benefits of agents or branches network of other institutions like post offices, mobile franchises, etc.
Online services	In-house management	As information/data is the critical part of any organization, so it should be managed by the organization itself for all kinds of online services by the effective coordination of different functions.
ATM/POS/Handheld services	Third-Party piggybacking	In this case, the institution can tie up with any other bigger banking player having strong presence in the country to use their ATM/POS network and can introduce its services through it.

competitive in the market. Table 5 highlights the core microfinance applications being used by the different MFIs/MFBs in Pakistan.

This is one of the validations carried out against one of the main components within the ICT framework which shows that the sector in local environment is moving in the right direction for the adoption of such trends, which are expected to produce numerous advantages.

The placement of centralized Core Microfinance Application is the backbone of the IT infrastructure as most of the other services can only be opted once they are placed on strong footings. As the institutions that have such components in place can move forward to provide for better services to their customers by using different distribution channels as technology is facilitating the businesses to achieve their objectives.

Table 5. Usage of Core Microfinance Application and its advantages

S#	MFI	Core Microfinance Application (Business Application)	Features Comparison/Competitive Analysis				
			Real Time Online	ATM Enabled	Centralized A/C Opening	Centralized Loan Process	Branchless Banking Model
11	Tameer Microfinance Bank	Centralized	√	√	√	√	√
22	Kashf Microfinance Bank	Centralized	√	√	√	-	-
33	Pak Oman Microfinance Bank	Centralized	√	-	√	-	-
54	Network Microfinance Bank	Centralized	√	-	√	-	-
55	Waseela Microfinance Bank	Centralized	√	√	√	√	√
66	Khushali Bank	Centralized	√	-	√	√	-
77	NRSP Microfinance Bank	Centralized	√	-	√	√	-
88	The First Microfinance Bank	Distributed	√	-	-	√	-

The proposed ICT logical framework was developed on the basis of data obtained from academic and practitioner resources. The approach against each component is a real driver for those components as it can guide an institution to opt for it as evident from the research. The adoption of right approach is critical as all the remaining things really depend on it. The proposed approach could benefit the organizations in a number of ways as it is extracted from the aforementioned components from certain pertinent angles such as: a) Wider geographical access to customers, b) Low transactional cost, c) Less capital expenditure cost, d) Better customer relationship and satisfaction, e) Reduced administrative efforts, and f) Focused approach towards business.

7. CONCLUSION AND FUTURE WORK

This paper focuses on the influence of ICT on different areas of the microfinance sector. We have tried to include the practitioners' angle from the local microfinance sector into the proposed framework. Thus, this research covers both the angles which are quite aligned with each other and indicate that the local industry in Pakistan is also on the footpath of international market to follow the ICT advancement and its benefits.

ICT has become an enabler to the business for the launch of innovative products and services for the under-served segments of the society. The components along with the specified approach

can be taken as an ICT roadmap or guidance tool for the new or experienced microfinance players to give leverage to the business. We have validated one of the components from the local environment, which clearly indicates its direction towards the adoption of centralized microfinance application. Further, it is also suggested that the local market should take the benefit of the ICT practices and approaches being followed globally. These practices are basically facilitating the functioning of these microfinance institutions and banks to enhance their performance in terms of efficiency and business goals.

Based on the above work, a new dimension is available for further work as well i.e., development of a consortium for getting the true benefit of that technological advancement. The need for that consortium is because of high cost technological facilities and resources which is a quite difficult ask for the banks/institutions in the microfinance sector.

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Chapter 29
ICT Investments and Management for Organizations

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ABSTRACT

Developing the Information and Communication Technologies (ICT) strategy that supports the overall organization's business strategy is critical for generating business value. Recognizing the inadequacy of traditional quantitative cost-benefits analysis for evaluating and managing ICT investments, researchers suggest multi-criteria analysis, integrating quantitative and qualitative modeling. This chapter introduces the Balance Scorecard (BS) decision analysis framework and combines it with Real Options (ROs) analysis, in a qualitative and quantitative perspective, for modeling the business flexibility as well as for evaluating and controlling the ICT investments strategy. The multi-criteria ROs modeling applies to all perspectives of the BS framework providing a holistic decision-making model for ICT business.

INTRODUCTION

In a competitive business environment, it is necessary for organizations to take advantage of every opportunity to reduce cost, improve quality and provide service. Information and communication technologies (ICT) constitute a strategic asset for organizations. Organizations rely on ICT for both their technology infrastructure and their specific applications to conduct their core business. ICT markets all over the world recently have been, and still are, undergoing drastic changes, fuelled my market reforms and technological progress. Organizations find ICT compelling due to improved customer satisfaction, reduce operations cost, increased organizational productivity, and rapid application development.

The valuation and management of ICT business activities is a challenging task because it is characterized by high-level uncertainty and tangible and intangible effects. Gomez et al. (2010) argued that it is not sufficient to focus on the easily measurable tangible and quantifiable benefits of ICT. They motivated that the intangible benefits of ICT on

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development such as empowerment, self esteem and social cohesion are more important from a developmental perspective. In addition, Zehir et al. (2010) analyzed the relationship between information technology (IT) investment level, IT usage, IT perception, IT at decision making process, future orientation, technology orientation and firm performance in the comprehensive competitive environment.The findings of their study showed that IT investments are vital component of firm performance and if firms manage IT investments successfully, they will enhance firm performance.

Also, Lin et al. (2007) examined the relationship between the levels of IT maturity and the use of IT investment evaluation and benefits realization methodologies via case studies and survey in the service sector. The findings indicated that IT maturity has a positive impact on the adoption of IT investment evaluation and benefits realization approaches. In risk management perspective, Otim et al.(2012) examined the effect that investments in information technology (IT) have on downside risk profiles of companies that made public announcements of their investments in technology. They found evidence that IT investments and their timing influence organizational downside risk. In addition, transformational and informational IT investments lead to a reduction in downside risk only if they lead to strategic IT investments in the industry.

In overall, although a vast array of methodologies for ICT investments evaluation present in the literature, some argued that a multi-perspective or integrated approach is needed combining specific decision analysis techniques, such as Delphi and Analytic Hierarchy Process (Azadeh et al., 2009; Gunasekaran et al., 2006).

ICT investments should consider operational, management and strategic perspectives. Particular, ICT investments in operational management are related to processes that embody the execution of tasks comprising the activities of an organization's value chain. Investments in the area of management may include processes and activities related to the administration, allocation and control of resources within the organization. Also, investments in strategic perspective could include processes such as planning, forecasting and strategy implementation.

In parallel, ICT can have four distinct but complimentary effects on business evaluation. It is through the following four effects on business processes that ICT creates value. First, automotive effects refer to the efficiency perspective of value coming from the role of ICT as a capital asset being substituted for labor, deriving productivity improvement, and cost reductions. Second, Information effects are related to ICT capacity of collect, store, process, and disseminate information. Following these effects, business value (i.e. Return on Investment) accrues from improved decision quality, and enhanced organizational effectiveness. Third, transformative effects refer to the value of business process reengineering and redesigned organizational structures. Finally, growth effects are related to organizations core business expansion in other business fields based on existing ICT infrastructure indicating growth business opportunities.

The aforementioned analysis concerns quantitative and qualitative measures and applies to organization's internal processes, customers, overall economic and growth business perspectives.

The valuation of ICT investments and the management of their implementation and exploitation require multi-attribute analysis adopting multi-criteria analysis and combination of quantitative and qualitative measures.

This work discusses all these issues and includes them in a multi-attribute perspective providing a holistic methodology and model for ICT investments managements for business strategy formulation, evaluation and implementation. It adopts the balance scorecard (BS) technique and combines it with real options (ROs). The proposed analysis provides a better understanding, for an

organization, of the ICT investments strategy formulation, the risks and the various qualitative factors inherent in such investments, enabling these investments to be deployed more optimum and valued with higher accuracy.

The main contributions of this chapter are the following:

- Adoption of the BS for strategy formulation, evaluation and implementation monitoring under ROs analysis,
- Introduction of quantitative and qualitative analysis adopting ROs,
- Risk management and the organizations flexibility modeling to implement and exploit such investment activities.

The aim is to the define strategy for ICT investments, analyze and evaluate it in a multiattribute perspective and find the business deployment that achieves a balance, for organizations, between risk control, investment's flexibility exploitations and performance maximization.

The rest of the chapter is organized as follows. In Section 2, we provide background of the involved techniques. In Section 3, we provide the proposed methodology and model. In Sections 4, we discuss suggest possible future research. Finally, in Section 5 we conclude.

BACKGROUND OF THE PROPOSED TECHNIQUES

Balance Score Card

The Balanced Score Card was introduced in the late 1980s and early 1990s as a method to help companies manage their increasingly complex and multi-faceted business environments. It was developed by Kaplan and Norton as a framework that helps top management to select a set of measures that provide an integrated look at a company (Kaplan and Norton, 1992).

They suggest four perspectives.

1. The financial scorecard contains the traditional financial performance measures. The company should set financial goals and select a limited set of financial measures.
2. The customer scorecard deals with the question ''how do customers see us?'' Again, goals are set and measures are selected.
3. The internal business scorecard provides goals and measures concerning the internal operations. The underlying question here is ''What should we excel at?''.
4. The fourth scorecard deals with the innovation and learning perspective. Can we continue to improve and create value?

Each perspective can be explained by a key question with which it is associated. The answers to each key question become the objectives associated with that perspective, and performance is then judged by the progress to achieving these objectives. There is an explicit causal relationship between the perspectives: good performance in the Learning and Growth objectives generally drives improvements in the Internal Business Process objectives, which should improve the organization in the eyes of the customer, which ultimately leads to improved financial results.

Though there are four basic perspectives proposed, it is important to understand that these perspectives reflect a unique organizational strategy.

Objectives, Measures, and Initiatives

Objectives are desired outcomes. The progress toward attaining an objective is gauged by one or more measures. As with perspectives, there are causal relationships between objectives. In fact, the causal relationship is defined by dependencies among objectives. So, it is critical to set measurable, strategically relevant, consistent, time-delineated objectives (Bloomfield, 2002).

Measures are the indicators of how a business is performing relative to its strategic objectives. Measures, or metrics, are quantifiable performance statements (Milis and Mercken, 2004). As such, they must be:

- Relevant to the objective and strategy.
- Placed in context of a target to be reached in an identified time frame.
- Capable of being trended.
- Owned by a designated person or group who has the ability to impact those measures.

An organization is likely to have a variety of types of measures. Some will be calculated from underlying data. Others will be aggregated index measures that assign different weights to multiple contributing measures. Some are frequently measured and others may only be measured on a quarterly or annual basis.

It is important to balance lagging indicators–which includes most financial measures–with leading indicators–areas where good performance will lead to improved results in the future.

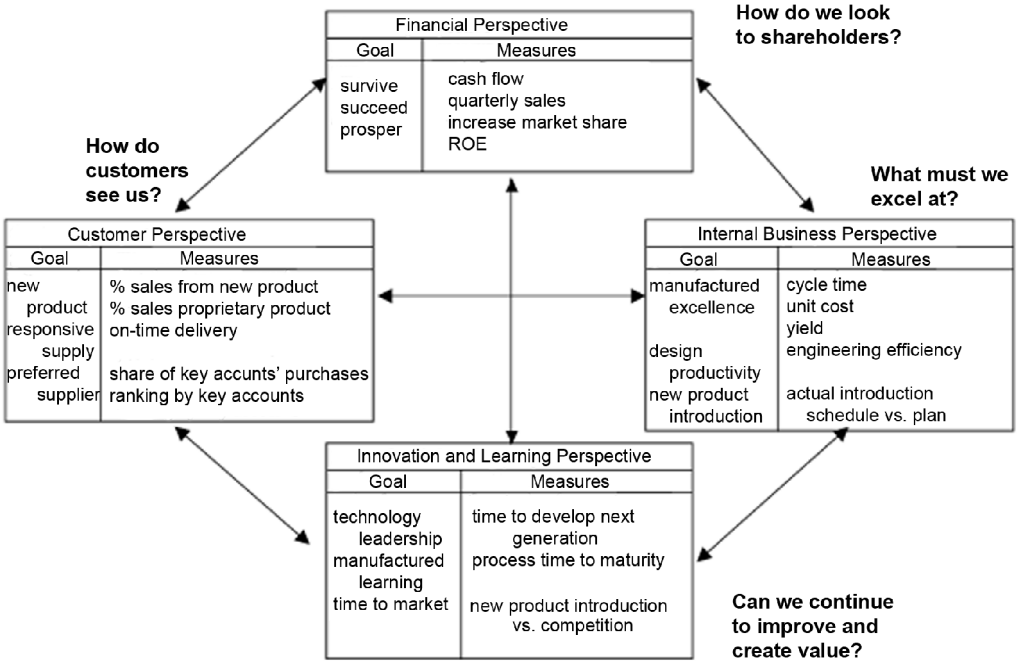
It is also important to balance internal measures, such as cost reduction, injury incident rates, and training programs, with external measures like market share, supplier performance, and customer satisfaction.

Finally, initiative is a change process, activity or project designed to achieve one or more objectives. The initiative is what will move a measure toward its target value. Initiatives, projects may be large or small in scope.

To illustrate the use of the BS, Kaplan and Norton (1992) presented an interesting example (Figure 1). An IT-company used the balanced scorecard framework to select a number of metrics and to set a number of targets for top management.

It is relative easy to formulate the BS framework to the needs of ICT business evaluation and imple-

Figure 1. Example of the balanced scorecard framework for an ICT company (Kaplan and Norton, 1992)



mentation. Willcocks and Lester (1994) presented an ICT-company that used the BS framework to select a number of metrics and to set a number of targets for top management (Figure 2).

When looking at this method more closely, one can conclude that this framework is a mixture of (traditional) quantitative decision analysis methods and new evaluation methods. In particular, the (traditional) finance based evaluation techniques are not abandoned (financial perspective) but are combined with qualitative analysis (Willcocks and Lester, 1994; Kaplan and Norton, 1992).

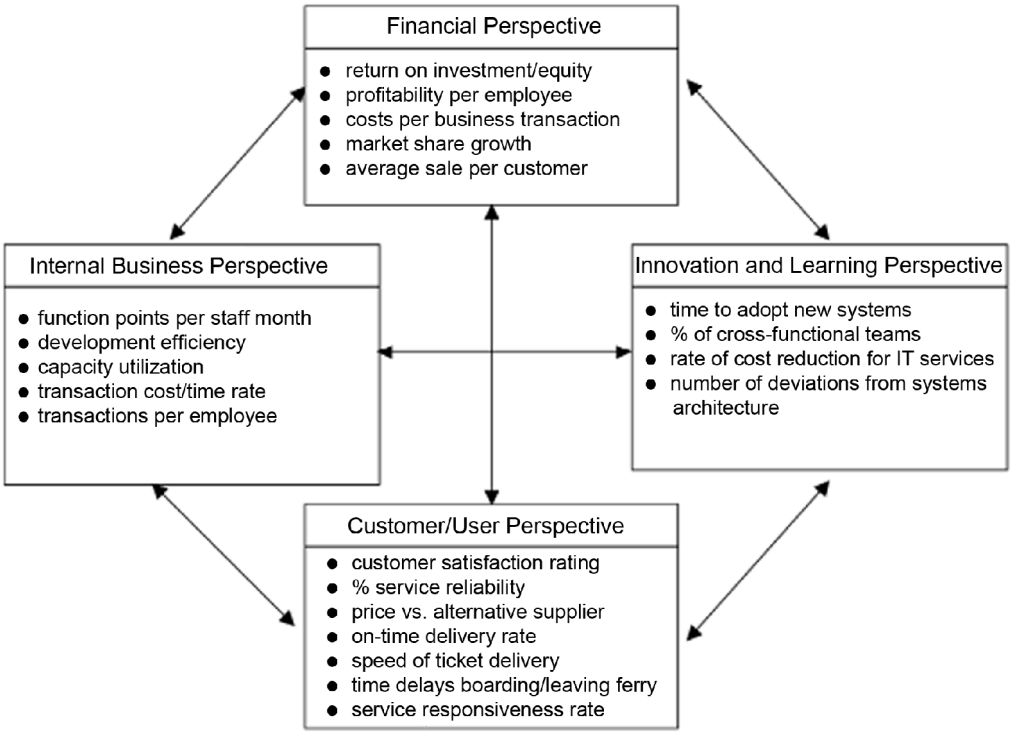
The BS encourages a shift from financial based evaluation techniques to strategy and vision. This is as a result of the BS need for substantially more input from the top management than does the traditional techniques. Traditional techniques in most cases are designed and overseen by financial experts (Kaplan and Norton, 1992). The BS forces management to take a broad view on ICT investments. This is one of the main advantages of this method. Another advantage is that many different evaluation techniques can be integrated into the framework. A further advantage is that the framework can be used for the feasibility evaluation as well as for the follow up and ex-post evaluation.

In this chapter, the aforementioned perspectives are enhanced by adopting the ROs philosophy. ROs constitute mainly a quantitative technique; however, the need for their integration with qualitative analysis has been already discussed in the literature (Angelou and Economides, 2008, 2009, 2013).

Real Options

An option gives its holder the right, but not the obligation, to buy (call option) or sell (put option) an underlying asset in the future. Financial options are options on financial assets (e.g. an option to buy 1000 shares of Nokia S.A. at the pre-agreed price 10 € per share on January 2015). The ROs

Figure 2. ICT performance indicators example (Willcocks and Lester, 1994)



approach is the extension of the options concept to real assets (Trigeorgis, 1996). For example, a telecommunication investment can be viewed as an option to exchange the cost of the specific investment for the benefits resulting from this investment. An investment embeds a RO when it offers to the management the opportunity to take some future action (such as abandoning, deferring or expanding the investment) in response to events occurring within the firm and its business environment (Trigeorgis, 1996).

Trigeorgis (1996) provided an in-depth review and examples on different real options. Lee et al. (2009) established a dynamic model under real options analysis to analyze the optimal timing decision of IT investments when the output price for firms is stochastic and benefits of IT investments are arisen from the increasing output price, increasing sale, and cost savings. They found that increasing (decreasing) price volatility will delay (advance) the timing of IT investments. Increasing IT investments, however, may not delay the timing of IT investments. In addition, the decreasing (increasing) efficiency and increasing (decreasing) depreciation of IT investments will delay (advance) the timing of IT investments. Also, Benaroch et al. (2006) focusing on IT projects argued that managerial intuition ought to be supplemented with the use of formal real option models, which allow for better quantitative insights into which risk mitigations to pursue and combine in order to effectively address the risks most worth controlling. For more practical issues the reader is referred to Mun (2002). Finally, Angelou and Economides (2005) provided an extended survey of ROs applications in real life ICT investments.

Real Options Limitations and Need for Quantitative and Qualitative Analysis

In business practice, several conceptual and practical issues emerge when trying to use options theory as proposed in the current ICT literature. It is accepted that all ROs models provide approximate valuations of ROs values (Renkema, 1999).

Existing models for ROs valuation assume a certain distribution of the resulting cash flows, based on an efficient market. However, this is rarely the case in the context of investments in the ICT business field, which is known for its uncertain and unpredictable conditions. It has also been recognized that finance-oriented option valuation models are too complex for managerial decision-making practice, when real life business conditions are considered (Fichman et al., 2005). In particular, after the liberalization of the telecommunication market, the required competition modeling has increased the complexity of existing options models. It is very difficult for senior managers to accurately estimate the parameters of a statistical distribution of outcomes and mainly volatility since they do not really have a "gut feel" for the estimation of the volatility, even though they understand its technical definition as a statistic. Options theory in its present state does provide a conceptual decision framework to evaluate technology investments but, in many cases, cannot be considered as a fully operational tool for management. If it is expected that practitioners and senior managers will resist the use of formal options pricing models, then the qualitative option valuation can be an alternative analysis process. This is based more on the intuition of decision makers and forecasting for risks profiles, and less on sharply quantified prediction for parameters used in the formal options models.

Overall, these issues suggest that even quantified ROs analysis could produce only approximate valuations, which in some cases can cause serious mistakes in investment decisions (Fichman et al., 2005). For these reasons, although ROs enhance quantitative financial analysis, by modeling investment flexibility, they also require a wider view of qualitative perspective.

Hence, a multi-criteria decision analysis framework can be extended including typical tangible factors from financial perspective and intangible

ones from qualitative ROs thinking. This framework is built based on the BS technique, adopting the later as the strategy definition, evaluation and implementation decision taken tool.

THE PROPOSED MODEL-METHODOLOGY

Here, a methodology is presented that helps to address the question:

How do we define and implement the firm's business strategy, in the ICT field, in such a way so that to minimize the risks and increase the performance?

The proposed models contain both tangible and intangible perspectives. The current chapter introduces the BS framework. BS provides to the firms' upper management the ability to define business strategy, performance indicators, as well as evaluate the business.

The proposed steps are the following:

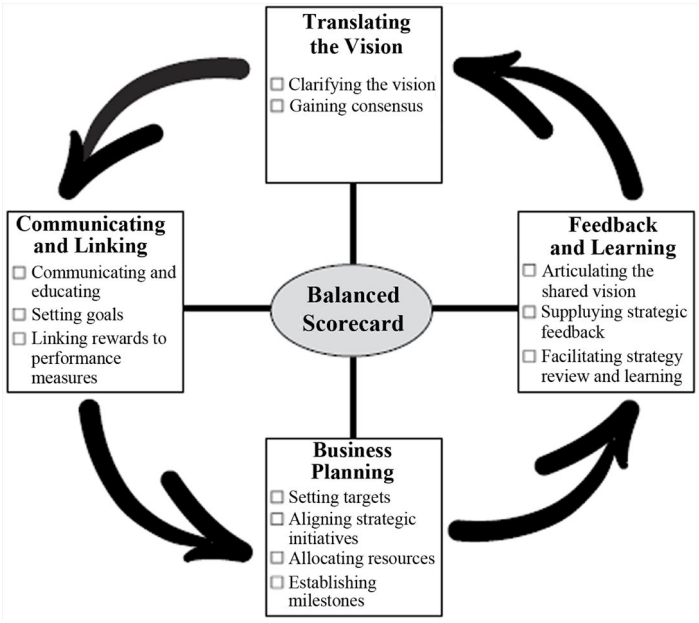
1. Define the strategy (using the BS).
2. Evaluate the strategy (build ROs philosophy on BS framework).
3. Implement the strategy.
4. Monitor and correct the strategy.

This chapter focuses mainly on the first two steps providing the overall framework of combining the ROs philosophy with the BS technique.

Define the Strategy

Particularly, there exist four processes in using the BS for defining and managing the ICT business strategy (Figure 3). The first process is to translate the vision of the firm. It helps managers to build a consensus around the firms' vision and strategy. The second process is to communicate the managers' strategy up and down of the firm's structure and link it to the departmental and individual objectives. The third process is the business

Figure 3. Defining and managing strategy in ICT business, (Kaplan and Norton, 2007)



planning based on quantitative and qualitative analysis enabling the firms to integrate financial results with intangible pay offs. Finally, the fourth process is the learning by the implementation of the strategy and the reformulation of it during this period. All the aforementioned processes may be implemented around the BS framework (Kaplan and Norton, 2007).

Evaluate the Strategy using the BS Enhanced by ROS Philosophy

The target is to evaluate the strategy adopting various implementation alternatives. In particular, the ROs philosophy is applied to the four perspectives of BS adopting specific characteristics of ROs, either quantitative or qualitative (Figure 4).

Financial Perspective

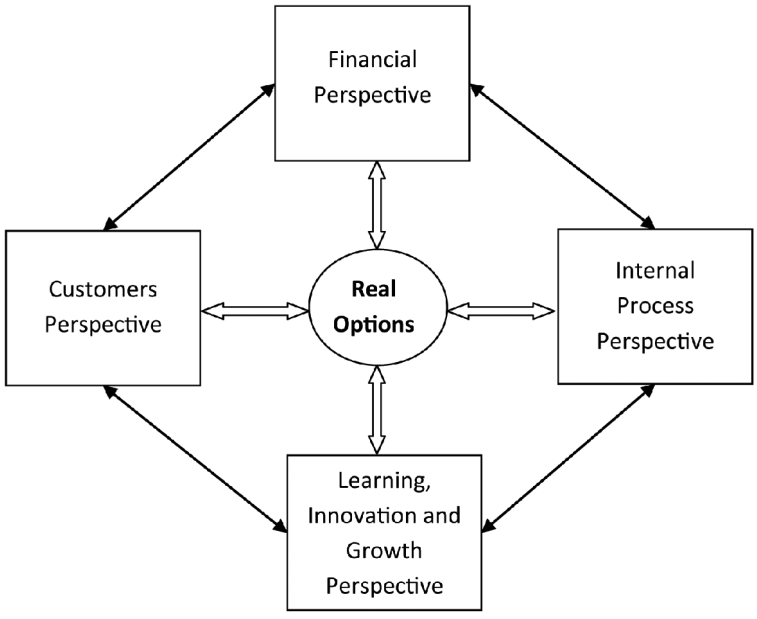
As with the traditional methodologies, measuring needs financial data. However, the critical point is that the current emphasis on financials leads to the "unbalanced" situation with regard to other perspectives. Timely and accurate funding data will always be a priority, and managers will do whatever necessary to provide it. In fact, often there is more than enough handling and processing of financial data. There is perhaps a need to include additional financial-related data, such as risk assessment and cost-benefit data, in this category.

The financial perspective evaluates how a company is meeting though financial measures. For the valuation of financial perspective we may adopt traditional accounting techniques such as Net Present Value (NPV), Return on Investment (ROI) and Internal Rate of Return (IIR), or even the Expanded Net Present Value (ENPV), which is the business value as estimated by the quantitative ROs analysis (Trigeorgis, 1996).

Learning, Innovation, and Growth Perspective

This perspective includes employee training and corporate cultural attitudes related to both individual and corporate self-improvement. In the current climate of rapid technological change, it is

Figure 4. Evaluating and implementing business strategy by applying ROs to four BS perspectives



becoming necessary for knowledge workers to be in a continuous learning mode. The importance of learning and growth has to be considered. Metrics can be put into place to guide managers in focusing training funds where they can help the most. In any case, learning and growth constitute the essential foundation for success of any knowledge-worker organization.

In addition to the aforementioned operational perspective, growth may concern with business knowledge and adoption of new business options based on this specific knowledge. This last is the core idea of the ROs philosophy in strategic perspective, and these growth options may be estimated under quantitative and qualitative perspective (Angelou and Economides, 2009).

Internal Process Perspective

This perspective refers to internal business processes focusing mainly on the operational and management level. Internal process may refer to ICT projects implementation and mainly to ICT systems exploitation. Metrics based on this perspective allow the managers to know how well their business is running, and whether its products and services conform to customer requirements and fulfills the mission. These metrics have to be carefully designed by those who know these processes most intimately. Considering that the business missions are unique and specialized, this definition can not entirely be developed by outside consultants.

In addition to the strategic management process, two kinds of business processes may be identified: 1) mission-oriented processes and ICT systems supported, and 2) support processes and ICT support systems. Mission-oriented processes and systems are business-related special functions, and many unique problems are encountered in these processes. The support processes are more repetitive in nature, and hence easier to measure and benchmark using generic metrics.

Customers Perspective

Recent management philosophy has shown an increasing realization of the importance of "customer focus" and "customer satisfaction" in any business. These are leading indicators: if customers are not satisfied, they will eventually find other suppliers that will meet their needs. Thus, poor performance on these indicators is a red flag of future decline, even though the current financial picture may look good. In order to develop metrics for customer satisfaction, the firm should analyze its customers in terms of their characteristics and the types of processes for which the firm provides its product or service to those customer groups.

For the evaluation and policy implementation of the specified strategy, Angelou and Economides (2008, 2009) proposed ROs under a multi-criteria analysis. In the following, some general guidelines are provided, while the interest reader is referred to the afore mentioned works.

ROs Multi-Criteria Analysis

Furthermore, intangible factors are difficult, if not impossible, to quantify in absolute monetary terms, but they are still important to the decision making process. Particularly, ROs analysis itself brings to the "surface" a number of factors that cannot be quantified, at least easily, by existing ROs models and methodologies. Fichman et al. (2005) called them potential pitfalls of option thinking for risk management and investment evaluation. We integrated some of them in our analysis, in order to achieve a balance between risk control achieved by options adoption and other issues influencing the overall investment's deployment strategy and limit the options thinking applicability.

Among others, not all investments can be divided into stages implementing stage and expand options. Sometimes a firm should consider an investment as a whole entity, such as when external funds must be raised or when co-investment

from other parties is required. Another issue is that stakeholders may prefer all at once funding to obtain maximum control of the investment and have so more time to get a troubled investment back on track before facing a next track of justification. We introduce this possibility in our analysis by considering the intangible factor "*Capability-Interest of staging the investment*" (CSI).

In ROs literature, investment opportunities that are known in advance, based on initial infrastructure investments, are treated as growth options, while for the estimation of their values compound option models are utilized. However, in reality, telecommunication growth investment opportunities can be hardly defined during the decision phase (Benaroch, 2002). For this reason, we model qualitatively the existence of growth investment opportunities, which are based on investments in previous phases of a firm's business activity and cannot be defined quantitatively in advance.

Concerning growth options, the main challenge is the difficulty of estimating their values (due to ambiguity of future cash flows) and uncertainty about the appropriate value for option model parameters. We name this intangible option factor as *no clarified growth options* (NCO). Also, building in option to abandon or contract operation may concern intangible costs related to credibility and morale. We model this possibility by the intangible factor *cost of scaling down operation* (CSO). Finally, a potential pitfall of switch-use option is that it can add extra time and expense to the development of the initial information communication technology platform in order to change from shadow to real option. Creating this option (making it real) usually involves making the ICT platform more generic and modular in order to let higher flexibility, experiencing however higher cost. We model this issue as intangible factor named *cost of systems flexibility-modularity* (CSF).

Internal processes efficiency and customers' satisfaction are strongly related risks inherent to ICT systems implementation and running. ROs have been already applied for ICT projects risk management. Risk management strategies are oriented towards identifying different types of risks, assessing their relative importance for the project, and implementing strategies for managing risks (Kumar, 2002). Risk management actions can be viewed as being of two types. The first type is oriented towards reducing the degree of risk; for example, a major source of uncertainty in IT projects is the uncertainty regarding the scope or specifications of the project. This can be partially resolved by interviewing multiple stakeholders. However, since risk cannot be completely eliminated, a second type of strategy, oriented towards hedging risks is important. Risk hedging strategies are insurance-like ones oriented towards minimizing the negative impact of risk, when the associated uncertainty is resolved over time. For example, specification uncertainty in ICT projects may be due to uncertain business conditions that may be resolved as the project progresses. ICT risks can be placed into three categories (Benaroch, 2002; Bräutigam and Esche, 2002).

- **Firm-specific risks:** Are due to uncertain endogenous factors (endogenous or technical uncertainty). They could be the result of uncertainty regarding the ability of the firm to fully fund a long-term capital-intensive investment, the adequacy of the firm's development capabilities to a target investment, the fit of the target application with various organizational units, etc. These factors affect the ability of the investing firm to successfully realize an investment opportunity.
- **Competition risks:** Are the result of uncertainty about whether a competitor will make a preemptive move, or simply copy the investment and improve on it. These risks give rise to the possibility that the investing firm might loss part or all of the investment opportunity.
- **Market risks:** Are due to uncertain exogenous factors that affect every firm consid-

ering the same investment (exogenous or market-related uncertainty). These risks could be the result of uncertainty about customer demand and prices for the products or services, a target investment yields, potential regulatory changes, unproven capabilities of a target technology, the emergence of a cheaper or superior substitute technology, and so on. These factors can affect the ability of the investing firm to obtain the payoffs expected from a realized investment opportunity.

Research on technology investment's evaluation and risk management recognizes that the ROs thinking emphasizes the sources of risks inherent in such investments and contributes to risk control.

For controlling these risks managers can adopt a number of investment modes:

- **Defer investment:** To learn about risk in the investment recognition stage. If we don't know how serious some risk is, the option to *defer* investment permits learning about the risk by acquiring information passively (observe competitor moves, review emerging ITs, monitor regulatory actions, etc.) or actively (conduct market surveys, lobby for regulatory changes, etc.). Such *learning-by-waiting* helps to resolve market risk, competition risk, and organizational risk. Apparently, the greater the risk, the more learning can take place, and the more valuable is the deferral option.
- **Partial investment:** With active risk exploration in the building stage. If we don't know how serious some risk is, investing on a smaller scale permits to actively explore it. Three options facilitate *learning-by-doing*, that is, enable gathering information about the firm's technological and organizational ability to realize the investment successfully. The option to *stage* investment supports learning via a sequential development effort, and the options to *pilot* and *prototype* support learning through the production of a scaled down operational investment. The last two options compress the investment lifecycle, thus allowing to learn early how competitors, customers, regulatory bodies and internal parties will react to the investment initiative. Put another way, these options permit market risk, development risk and organizational risk to be transferred to earlier parts of the full scaled investment lifecycle. Similarly, the *stage* option divides the investment realization effort into parts, thus permitting to transfer risk across parts within the building stage. For example, implementing the riskiest parts of the realization effort as early as possible helps to reveal up-front whether the entire realization effort can be completed successfully (e.g., within schedule and budget).
- **Full investment with reduction of the expected monetary impact of risk in the building and operation stages:** Here, options help to lower the value consequences of risk and/or the probability of its occurrence. An example of the former is the option to *lease* development resources, which protects against development and market risks by allowing to kill an investment in midstream and save the residual cost of investment resources. A way to lower the probability of risk occurrence is the option to *outsource* development. This option lowers the risk of development failure by subcontracting (part or all of) the realization effort to a third party that has the necessary development capabilities and experience. In essence, both these options permit *transferring risk* (partially or fully) to a third party.
- **Dis-investment/Re-investment with risk avoidance in the operation stage:** If we accept the fact that some risk cannot be

actively controlled, two options offer contingency plans for the case it will occur. The option to *abandon* operations allows redirecting resources if competition, market or organizational risks materialize. The option to *alter scale* allows contracting (partially disinvest) or expanding (reinvest) the operational investment in response to unfolding market and organizational uncertainties.

Based on the logic of these investment modes, the mapping of specific risks to specific options that control them can be refined to fit any class of IT investments. Examples of ROs thinking in the basis of the aforementioned investment modes are provided by Benaroch (2002) and Angelou and Economides (2007). Particularly, they apply ROs thinking based on the aforementioned investment modes for analyzing information technology investment opportunities. ROs analysis can control different sources of risks existing in the various stages of the investment life-cycle.

Strategy Matrix Presentation

The strategy matrix may be a useful visualization and summarization tool. It displays objectives, measures, targets, and initiatives in one table. The strategy matrix can point to areas where scorecard elements might be out of balance. For example, there may be a cluster of initiatives around one objective, while other objectives have no supporting initiatives. This can be useful when prioritizing spending for projects. Typically, the strategy matrix will reflect a strategic theme, so one matrix is prepared for each theme. Table 1 presents an example of BS template formulation including ROs philosophy.

Evaluate and Implement Strategy

For the evaluation of the defined strategies multicriteria decision analysis ROs models may be adopted such as provided in Angelou and Economides (2009) work.

Monitor and Correct Strategy

During the implementation of the selected strategy there is a continuous monitoring for comparing for the defined measures, (i.e. performance indicators) the ex ante and ex post data analysis.

In overall, the aforementioned analysis can be summarized as following:

Summary

The proposed methodology involves four main steps that must be repeated over time as more information is collected concerning the overall business environment. These steps help to optimally configure, evaluate before, during and after implementation the business strategy under the information set available initially, but as time passes they must be re-applied in case that some risks get resolved or new risks surface. In particular, the formulation of the BS is the first main step. Implementation of the scorecard generally begins at the corporate level, but is useful at all levels of an organization. The scorecard is not only an executive information system for corporate management but should form the basis for promoting behavioral change in the organization to conform with the vision and strategy. Often this means pushing the scorecard methodology down through the organisation. Analytically, the proposed steps are given in Table 2.

DISCUSSION AND FUTURE TRENDS

Business vision translation to more practical aspects concluding to specific strategy actions is the first step for defining business strategy, not only in ICT field but in overall business generally. This work proposes BS for connecting organizations vision to specific business stragegy. BS provides

Table 1. Example strategy matrix under ROS analysis

	Strategy Formulation Example Combining BS and ROs				
	Objective	**Measure**	**Target**	**Initiative (action)**	**ROs analysis - Implementation Policy**
Financial	Increase profitability	Expanded Net Present Value (Trigeorgis, 1996)	> 2 M€ year 1 > 5 M€ year 3	New Projects implementation	Quantitative ROs analysis (Angelou and Economides, 2009)
		Avg. # of days to breakeven	< 180 days year 1 < 130 days year 3	Operations review and new monitoring systems implementation	Quantitative ROs analysis (Angelou and Economides, 2009)
	Increase sales	Revenue per customer	> $ X year 1 > $ Y year 3	Self-service checkout pilot	Quantitative ROs analysis (Angelou and Economides, 2009)
Customers	Domination in the market	Avg. # daily new customers	> X in first 6 mos., > Y in first year, > Z by year 3	Local marketing/Web portal implementation for customers support.	Multicriteria ROs (Angelou and Economides, 2009)
		Avg. € customer purchase	> $ X year 1 > $ Y year 3		
Internal Processes	Increase customers support processes efficiency	Days lag between new customers applications and finally customers connection	< 30 days year 1 < 10 days year 3	GIS system integration with Enterprise Resources Planning (ERP)	Multicriteria ROs (Angelou and Economides, 2009)
	Improve procurement processes efficiency	% of procurements outsite from yearly procurement program	< 30% year 1 < 10% year 3	Web-based procurement process	Multicriteria ROs (Angelou and Economides, 2009)
Learning & Growth	Use business intelligence systems	% eligible employees trained	>90% year 1 >99% year 2	In-house system training	Multicriteria ROs (Angelou and Economides, 2009)
	Integrated knowledge management	# projects documents included	< 10 year 1 < 20 year 2 < 40 year 3	Corporate data warehouse system	

Table 2. The steps in the proposed analysis

Identify Vision	Create a Balanced Scorecard: You have to identify a vision. Where is the organization going?
Identify Perspectives	By identifying strategies you tell how you will get there. Define perspectives, which means you have to ask what do we have to do well in each perspective.
Identify Performance Indicators	Identify the Performance Indicators - when enough is enough, and when not. Thereafter ask how do we measure that everything is going the expected way?
Identify Strategies Alternatives	Define alternatives to be analyzed under ROs multicriteria analysis.
Evaluate Strategies Alternatives	Now it is necessary think of the evaluation of your Scorecard under. multicriteria ROs analysis. Consider how do secure that the right things are measured?
Implement Selected Strategy – Create Action Plans	Based on this work you should create action plans and plan reporting and operation of the Scorecard.
Follow Up and Manage	Monitor strategy implementation and take corrective ations

a framework in four perspectives crossing through operation, management and strategic level of the organization. It may include both quantitative and qualitative analysis. This work combines this framework with ROs philosophy for defining, evaluating and implementing business strategy by exploiting business flexibility. In particular, business flexibility may concern investment time, deployment scale, and products characteristics in a way that the involved uncertainties become more clear and being at least partially resolved.

ROs support managers to evaluate and manage risky ICT investments. Also, senior finance executives are becoming increasingly aware of the need to view major risky capital investments as options.

ROs have already applied in the literature for investment management and evaluation of ICT investments. In practice managers identify risks and formulate strategies that can control these risks in the most efficient way. These strategies may contain option analysis and the target is to map options to risks and find the optimum combination of them in order to achieve the optimal value for the investment opportunity. However, the option analysis experiences criticism concerning the need for the parameters quantification of the option models. The issue becomes even more complicated in ICT markets. Particularly, after the markets liberalization competition intensity has been increased dramatically and the players are usually so many that oligopoly models are becoming very complicated to be used in practice. Hence, the quantitative analysis of competition influence in telecom investment opportunities is a very difficult task that requires high-level of mathematical modeling and high number of assumptions while managers and practisians quite often do not "feel comfortable" to adopt it.

Instead, we provide qualitative option thinking. The proposed analysis requires from the management and business analysts to recognize qualitatively the options, during the lifecycle of an investment opportunity that can at least partially control specific risks. Sometimes deferring an investment may be optimum, while some other times the immediate implementation is the best solution adopting afterwards a step-wise deployment strategy during building and operation period. In our analysis, we are not only based on qualitative option thinking but also integrate financial tangible and intangible factors coming by both the nature of the telecommunication investments and the options analysis itself.

However, ROs are not a tool for defining strategy in a common methodological decision analysis "platform." For this purpose, BS technique is adopted for translating the vision to specific strategy.

The proposed framework seem quite generic. If can be also applied in information technology (IT) service management (e.g. ITIL) and IT governance (e.g. Cobit). Particularly, they deal with issues such as how to provide a good service at the good price. People combine these approaches to the maturity concept. Indeed, one can map ITIL process onto the perspective of the standard IT Balanced Scorecard (BSC) as presented below (Mingay and Bittinger, 2002).

- **IT BSC Business Contribution:**
  - Financial Management
- **IT BSC User Orientation:**
  - Service Level Management
  - Availability Management
  - Continuity Management
  - Incident Management
  - Financial Management
- **IT BSC Operational Excellence:**
  - Problem Management
  - Service Level Management
  - Change Management
  - Service Level Management
- **IT BSC Future Orientation:**
  - Service Level Management
  - Capacity Management
  - Change Management
  - Financial Management

CONCLUSION

There is a large consensus among academics and practitioners that ICT investments should be carefully justified, measured and controlled. The fact that most decisions on ICT investments are still taken by the financial department might add to the choice for these traditional techniques. Nevertheless, serious doubts about the fitness of these techniques in an ICT environment arise. ICT investments have special characteristics (high risk, large proportion of intangible/hidden costs and benefits) which makes the use of these techniques very difficult and the reliability of the outcome most uncertain. This work suggests using a multi-layer evaluation process or an evaluation process derived from the balanced scorecard for the appraisal of ICT investment projects. Particular, the current work provides a decision analysis framework, based on BS and ROs integration, for defining, evaluating and implementing ICT business strategy adopting quantitative and qualitative analysis. It is the first time in the literature, to our knowledge, where BS and ROs are combined in a common framework of analysis offering a multicriteria strategy definition and evaluation model. A limitation of the proposed work is the lack of real world application. In addition, it can be further analyzed based on more ICT factors related.

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KEY TERMS AND DEFINITIONS

Balance Score Card: The balanced scorecard (BSC) is a strategy performance management tool - a semi-standard structured report, supported by design methods and automation tools, that can be used by managers to keep track of the execution of activities by the staff within their control and to monitor the consequences arising from these actions.

Investment Cost: The amount of money spent for the investment, investment expenditure required to exercise the option (cost of converting the investment opportunity into the option's underlying asset, i.e. the operational project).

Multi-Criteria Business Analysis: Analysis of business under multicriteria perspective for finding the optimal deployment strategy and estimating its overall performance.

Real Option: It is the extension of financial options concept to real assets.

Risk Management: The process of identifying different types of risks, assessing their relative importance for the project, and implementing strategies for managing risk.

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Chapter 30
Multi-Agent Financial Network (MAFN) Model of US Collateralized Debt Obligations (CDO): Regulatory Capital Arbitrage, Negative CDS Carry Trade, and Systemic Risk Analysis

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ABSTRACT

A database driven multi-agent model has been developed with automated access to US bank level FDIC Call Reports that yield data on balance sheet and off balance sheet activity, respectively, in Residential Mortgage Backed Securities (RMBS) and Credit Default Swaps (CDS). The simultaneous accumulation of RMBS assets on US banks' balance sheets and also large counterparty exposures from CDS positions characterized the $2 trillion Collateralized Debt Obligation (CDO) market. The latter imploded at the end of 2007 with large scale systemic risk consequences. Based on US FDIC bank data, that could have been available to the regulator at the time, the authors investigate how a CDS negative carry trade combined with incentives provided by Basel II and its precursor in the US, the Joint Agencies Rule 66 Federal Regulation No. 56914, which became effective on January 1, 2002, on synthetic securitization and Credit Risk Transfer (CRT), led to the unsustainable trends and systemic risk. The resultant market structure with heavy concentration in CDS activity involving 5 US banks can be shown to present too interconnected to fail systemic risk outcomes. The simulation package can generate the financial network of obligations of the US banks in the CDS market. The authors aim to show how such a Multi-Agent Financial Network (MAFN) model is well suited to monitor bank activity and to stress test policy for perverse incentives on an ongoing basis.

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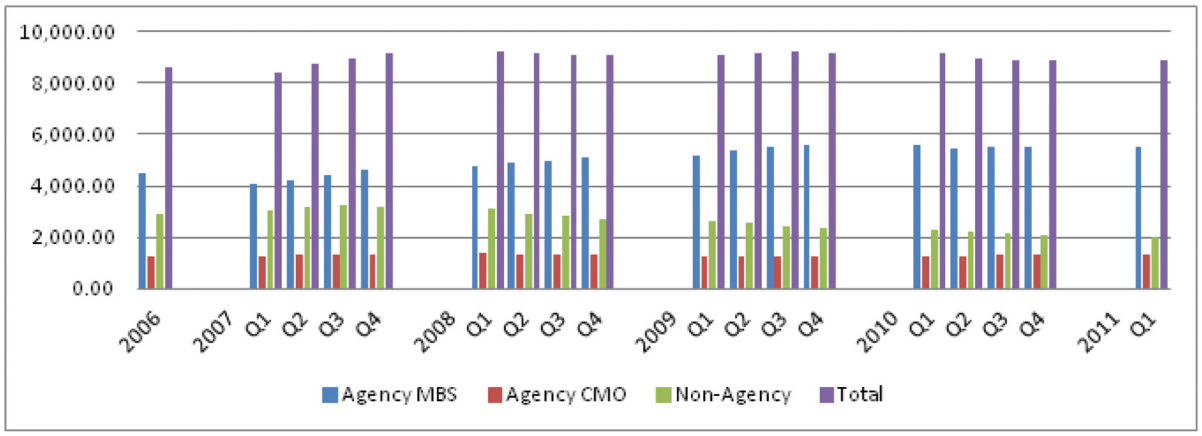
1. INTRODUCTION

The 2007 financial crisis which started as the so-called 'sub-prime' crisis in the US has had severe global repercussions. There has been a contraction in output and employment, bank bailouts[1], increased tax burdens, and accelerated fiscal austerity to levels not previously recorded since the Great Depression. The crisis has exposed shortcomings of monetary economics (Buiter, 2009) and the regulatory framework of Basel II (Brunnermier, et al., 2009; Hellwig, 2010; Markose, 2011). Eichengreen (2010) has concluded that "fundamentally, the [2007] crisis is the result of flawed regulations and perverse incentives in financial markets." Macroeconomic modeling and its use in policy analysis have come under heavy criticism. Critics have accused macroeconomists of an insidious reliance on a particular class of macroeconomic models that has abstracted away institutional details and financial interconnections in the provision of liquidity, capital adequacy and solvency (Wieland, 2010; Colander, et al., 2009). Most of all, what is prominent is the absence of a framework to deal with regulatory and market failure arising from the negative externalities from excessive credit creation and leverage. On the operational front, serious deficits remain in the economics curricula in not providing integrated quantitative tools for holistic visualization and monitoring of the financial system to identify systemic risk threats from activities of financial firms. Further, central tenets of the regulatory framework were and continue not to be stress tested in an ongoing way to see if they are prone to creating perverse incentives. The main objective of this chapter is to provide an exemplar of a quantitative integrative financial framework using multi-agent modeling, which can monitor and analyse systemic risk from activities of financial intermediaries within the context of the regulatory incentives and prevailing market conditions.

The specific institutional propagators of the 2007 crisis involved Residential Mortgage Backed Securities (RMBS), which had grown to over $8.5 trillion in the US alone by 2006 (Figure 1), surpassing US securities and corporate bonds. This whole asset class suffered considerable impairment of market value with the collapse of US house prices. Except for government agency issues, post 2008, new issuance of MBS has dropped to almost zero. The buildup of systemic risk occurred in two distinct phases. In the first 'originate and distribute' phase of securitization of bank loans, banks followed an aggressive strategy of loan portfolio expansion by overcoming restrictions placed by the size of a bank's deposit base by reissuing the capital released from securitization into new mortgages/loans. This regulatory arbitrage which placed securitized assets off balance sheet in Special Purpose Vehicles (SPV) in order to reduce the 8% minimum capital requirement of the Basel I Accord has been found by many (see, Goderis, et al., 2007) to enable banks to achieve 50% higher loan target levels and reduce equity capital to asset ratio to about 5.3% as opposed to the 9.8% for those that did not. The second phase of the crisis involved an accelerated growth of RMBS, especially in its subprime form, as collateral in structured Collateralized Debt Obligations (CDO)[2] held as bank assets and in bank liabilities in conduits such as Asset Backed Commercial Paper (ABCP) in short term repo markets. The liquidity crunch is seen as a run on the repo market. As noted by Gorton and Metrich (2009), outdated models of money and banking prevented central banks and supervisory bodies from seeing the $12 trillion procyclically sensitive collateralized securities in the repo and shadow banking system as being part of the fractional system of private credit creation which will suffer convertibility problems vis-à-vis central bank regulated funds and reserves for which the tax payer remains liable.

Emphasizing the problem of how the above individually rational activity of financial institutions aimed at expanding their loan market share will undermine system stability, Jones (2000), from the Division of Research and Statistics of the

Figure 1. US mortgage-related securities outstanding (US$ billions) 2006-2011 (Source: Securities Industry and Financial Markets Association (SIFMA). Note: CMO:Collateralized Mortgage Obligations; Non-Agency MBS includes RMBS and CMBS.)



Board of Governors of the Federal Reserve System, stated "absent measures to reduce incentives or opportunities for regulatory capital arbitrage, over time such developments could undermine the usefulness of formal capital requirements as prudential policy tools." Jones noted that regulatory capital arbitrage has attracted scant academic attention, or for that matter as a key aspect of regulatory design, and appears to think that this is due to a lack of sufficient time series data, which impedes econometric analysis of regulatory capital arbitrage. If econometric models are not up to the task of modeling regulatory capital arbitrage due to limited data points, are there no other tools to test bed regulatory systems?

About the second phase in RMBS developments, the question that has often been asked is, in a period, which started with the 'originate and distribute' model of remote securitization and regulatory focus on Credit Risk Transfer (CRT), how did so much RMBS assets and their credit risk accumulate within banks themselves? Indeed, the extraordinary transfer of $1.5 trillion MBS from balance sheets of US financial intermediaries directly on to that of the Federal Reserve in March 2010 to purge the system of toxic assets marks an ongoing fallout from the crisis[3].

Acharya and Richardson (2010) state that "what made the current crisis so much worse than the crash of 2000 was the behaviour of many of the Large, Complex Financial Institutions (LCFIs). These LCFIs ignored their own business model of securitization and chose *not* to transfer the credit risk to other investors" (italics added). While Acharya and Richardson (2010) appear to acknowledge that LCFIs by retaining RMBS securities on their balance sheets along with CDS[4] guarantees allowed banks to save capital, they neither attribute this to the regulatory incentives in place nor show how profitable this was for banks in the short run, a matter that is the key to any myopic business model. Stultz (2010, p. 80) admits to the regulatory incentives in place with the onset of the ratings based risk weighted and CRT orientation of Basel II which marked the development of synthetic securitization. By and large, there seems to have been a fundamental misunderstanding among a number of economists about the advanced state of the adoption of reduced capital requirements for retained RMBS on bank balance sheets with synthetic securitization and CRT in US banks following from the Joint Agencies Rule 66 Fed. Reg. 56914 and 59622, which became effective on January 1, 2002[5].

Blundell-Wignall and Atkinson (2008) quite rightly state: "understanding causality is a precondition for correct policy making" in their attempt to assess the impact of the Basel II incentives for capital reduction by banks and the CDS negative basis carry trade for the critical build up in 2006-7 of RMBS and CDS on US banks' balance and off balance sheets that brought the US financial system to the brink of collapse. While they bring a wealth of evidence on regulatory incentives for the acceleration of RMBS assets on banks' balance sheets, they do not attempt to develop a methodological framework to study causality. Extant statistical and econometric models fail to identify the threats to stability from such incentives for capital arbitrage among financial firms that lead to topological fragility of the CDS based risk sharing institutions. There has been growing *structural* concentration in the provision of credit risk guarantees often referred to as *too interconnected to fail* arising from the high concentration of financial links between a few key players. Using the US FDIC bank data on RMBS and CDS and holdings we will develop a multi-agent model for the US financial firms to see how regulatory authorities can monitor and assess the systemic risk implications from such a toxic build up.

This chapter addresses the need to develop new computational and simulation based methodologies to track bank balance sheet and off balance sheet activity of financial intermediaries in response to changes in regulatory policy and also due to competitive co-evolutionary pressures to grow market share. Markose (2005) has advocated the use of a complex adaptive system perspective, the *sine qua non* of which is strategic innovation or novelty production within a Red Queen type arms race between participants. Traditional policy related models, often in the stochastic control or dynamic programming framework ignore this facet of competitive co-evolution. As in other complex adaptive systems such as biological ones, the Red Queen competitive co-evolution is known to be rampant among market participants and between regulators and regulatees. The implications of this for regulatory arbitrage endemic to the current financial crisis should be noted. Indeed, the nail in the coffin of large scale macro-econometric models came with the Lucas Critique on the capacity of a rule breaking private sector which can anticipate policy and negate policy or jeopardize the system by a process of regulatory arbitrage (see, Markose, 2005, Sections 3 and 4). Such strategic behaviour results in a lack of structural invariance of the equations being estimated, highlighting the restrictiveness of econometric modeling for policy analysis.

Agent based computational economics or ACE using the acronym coined by Leigh Tesfatsion (see Tesfatsion & Judd, 2006) is based on object oriented programming that can produce agents that are both inanimate (e.g. repositories of data bases) as well as behavioural agents capable of varying degrees of computational intelligence. These range from fixed rules to fully adaptive agents representing real world entities (such as banks or consumers) in artificial environments, which can be replicas of, for instance, the financial system. Recently, many have emphasized the uses of ACE simulation platforms for digital mapping of the financial system, stress testing policy and for institutional design (see, Buchanan, 2009; Markose, 2011). These artificial environments can depict real time orientation, institutional rules, and also complex interactions. For the simulation framework to be useful for assessment of policy, financial firm level responses must be modeled in the context of prevalent market conditions and with automated access to balance sheet and off- balance sheet data to anchor the financial decisions being simulated. Further, the interactions of agents produce system wide dynamics that are not restricted to pre-specified equations, which have to be estimated using past data in econometric or time series approaches. In an agent-based model, each agent follows explicit rules or

strategies under specified market conditions and a 'probe' monitors causal internal workings and also aggregates outcomes. In contrast, the main drawback of estimation based equation analyses is that structure changes from strategic behaviour and tracing of causal links are almost impossible to do. Finally, we aim to represent CDS financial obligations of the US banks in a financial network format to identify systemic risk consequences of topological structures showing concentration of interaction between a few highly interconnected banks.

To our best knowledge the IBM MIDAS project (see, Balakrishnan, et al., 2010) and the EC grant FP6 -034270-2 project of Markose and Giansante (see *ACEfinmod*.com) are the only known software technologies being developed for (US centric) large scale firm level financial database driven models for systemic risk analysis. The advantages of agent based financial models where agents and their interconnections are empirically determined by data bases is that they can give structural snap shots of the situation without needing large time series that statistical and econometric models need. In recent assessments of network analysis for systemic risk,[6] this framework has been found to be useful in operationalizing the study on the propagation of financial contagion as a result of failure of counterparties, Haldane (2009). However, the pre 2007 financial networks literature has yielded mixed results. Firstly there were few studies on financial networks based on empirical bilateral data between counterparties that could establish 'stylized' facts on network structures for the different classes of financial products ranging from contingent claims and derivatives, credit related interbank exposures and large value payment and settlement systems. Where bilateral data on financial exposures was not available, both simulated and theoretical models assumed network structures to be either uncorrelated and random, Nier *et al.* (2007) or complete networks (see Upper & Worms, 2004; Upper, 2011). These approaches crucially do not have the *too interconnected to fail* characteristics which imply a highly sparse core-periphery network structure. Only Craig and von Peter (2010) and Fricke and Lux (2012) who use empirical bilateral interbank data have highlighted the core-periphery network structure in financial systems. Markose *et al.* (2010) were among the first to show how such structures propagate contagion in a radically different way to random networks. Thus, while the stability of financial networks has been usually investigated using the classic Furfine (2003) algorithm, it is only recently that economists have renewed efforts to understand and quantify how contagion propagates in highly tiered and clustered financial networks which imply sparse matrices with heterogeneity in connectivity and exposures that can be modeled by power law distribution (see Moussa, 2011). Finally, the idea that nodes in the network which constitute financial intermediaries and other financial actors are themselves intelligent 'agents' operating within constraints and incentives provided by the markets and regulations has not been fully operationalized yet. Markose (2011) has referred to models that aim to digitally map the financial system from large firm level data bases as Multi-Agent Financial Network (MAFN) models.

This chapter will focus extensively on the decision problem confronting the US FDIC banks involved in both CDS and RMBS markets in the 2006-7 period. We then show, on the basis of market shares of US banks in the CDS market, that it implies a *too interconnected to fail* network topology which is a source of systemic risk. The structural weakness in modern risk sharing institutions arising from too much concentration of market share among a few broker-dealers is a matter which was first raised by Darby (1994) in the case of derivatives markets in general. Many have since noted (see Persuad, 2002; Lucas, et al., 2007; Das, 2010; Gibson, 2007) that the benefits of CRT will be compromised by the structural concentration of the CDS market. Using financial

network modelling we have dealt with these issues in Markose *et al.* (2012) in the case of the US CDS market and for the global derivatives markets in Markose (2012). This chapter will show how a MAFN simulation platform based on the US FDIC data base will combine both the stress tests for perverse incentives of Basel II CRT regulation and also the systemic risk from the financial network that arises from the CDS obligations of US banks. We note that in the repertoire of agent based models, the potential for systemic risk from regulatory incentives are the easiest to simulate. In the case for policy incentives for capital reduction, we set the banks to minimize capital as far as it is permitted by the rules of synthetic securitization and the market conditions given by the sub-prime ABX-HE index.

The rest of the chapter is organized as follows. Section 2 will set out regulatory conditions for capital reduction and also the costs of credit risk mitigation from CDS. The synthetic CDO structure referenced on the ABX-HE tranches, which will be replicated in the strategies of the bank agents, will be discussed. The questions being asked are as follows: could the US banks that were simultaneously involved in both CDS purchases and RMBS assets, have accumulated the quantities of these assets over the period of 2006 to 2007 Q 3 when the holdings of these peaked, solely through a process of capital arbitrage permitted by the regulatory framework? How much did market conditions and CDS carry trade exacerbate the situation? How much leverage was involved in the context of CRT using CDS in the 2006-07 period?

In parallel, the key policy exercise is to see by how much US bank balance sheet holdings of RMBS and CDS may have been attenuated in the absence of Basel II type regulatory incentives in the 2006-7 period. In the spirit of investigating perverse incentives of a given regulatory framework, each bank's initial position in these assets is taken as the starting point for the algorithms reflecting the terms and conditions of the regulation being implemented by bank agents. Then the capital saved and profits from the CDS carry trade are reinvested, revalued, and cumulated quarter by quarter under prevailing market conditions. In Section 4, the FDIC bank data on RMBS holdings and market data on bond yields and the CDS spreads from ABX-HE index is discussed. The equivalent CDO yield spreads are obtained from the weekly CDS/CDO Update Reports published by the Fixed Income Research team at the Japanese bank Nomura and based on the bank's weekly CDO pricing pipeline between 2006Q1 and 2007Q3. The reason why the simulation is confined to the 2006-7 period is that the ABX-HE index, which gave market information for sub-prime RMBS CDO activity and CDS valuation, was operational only in this period. Section 5 gives the simulation results. We find that around 2006 Q1 the US FDIC banks saved some $20bn capital from Basel II CDS based CRT. What is remarkable is that the simulation results show that unless substantial leverage is applied, the $100bn increase in banks' holdings of RMBS and structured CDO products over the 2006-07 period is unlikely to have happened. Further, substantial CDS purchases averaging about $300bn for each quarter of the 2006-7 for capital reduction was amassed on banks' balance sheets for purposes of capital reduction on RMBS. CDS on RMBS was the fastest growing segment of the CDS market and failures to meet obligations arising from these derivatives led to the major taxpayer bailout of financial intermediaries in 2008 on grounds of being *too interconnected to fail*. Section 6 gives a brief discussion of the empirical network characterization of the CDS market and its systemic risk implications. This is followed by a concluding section on the future work needed to extend the scope of MAFN models beyond the example exercise conducted in this chapter to one of full automation of access to financial firm level data and as a computational platform for monitoring of systemic risks.

2. THE REGULATORY AND MARKET CLIMATE (2005-2007)

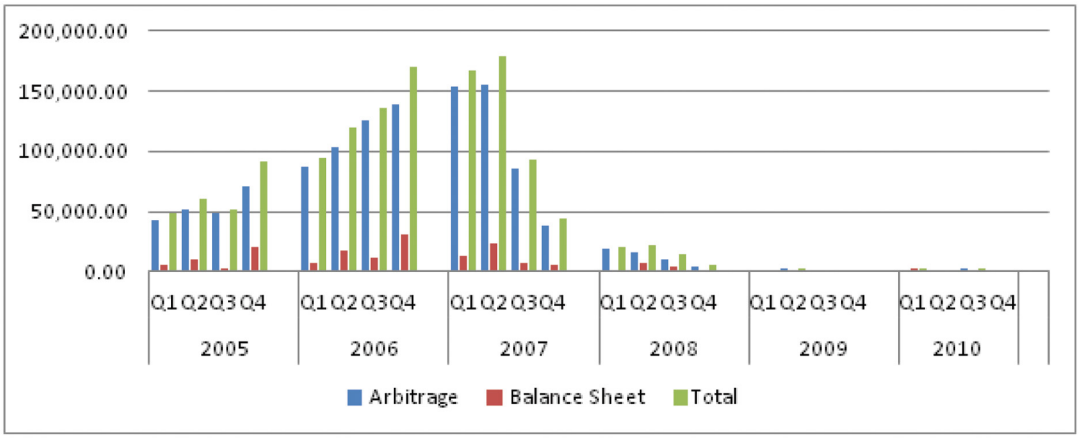
2.1. Capital Reduction for US Banks from Synthetic Securitization

In synthetic securitization and CRT, an originating bank uses CDS or guarantees to transfer the credit risk, in whole or in part, of one or more underlying exposures to third-party protection providers. In the typical synthetic securitization, the underlying exposures remain on the balance sheet of the originating bank, but the credit exposure of the originating bank is transferred to the protection provider or covered by collateral pledged by the protection provider. Under Basel I, since 1988, a standard 8% regulatory capital requirement applied to banks with very few exceptions for the economic default risk of assets being held by banks. In the run up to Basel II, and its precursor in the US which set out the capital treatment in the Synthetic Collateralized Loan Obligations guidance published by the OCC (OCC 99-43) and the Joint Agencies Rule 66 Fed. Reg. 56914 and 59622 which became effective on January 1, 2002, the 50% risk weight which implied a capital charge of 4% on residential mortgages could be reduced to a mere 1.6% through the process of synthetic securitization and external ratings which implied 5 times more leverage in the system. This strongly incentivized the use of CDS by banks, which began to hold more MBS on their balance sheets and also brought AAA players such as AIG, hedge funds and erstwhile municipal bond insurers called Monolines into the CDS market as protection sellers[7].

Figure 2 shows the growth of arbitrage and balance sheet CDOs in the period of 2006-2007 from about $50bn in 2005Q1 to over $160bn at its peak in 2007 Q2. In particular, the demand for subprime synthetic CDOs proved lucrative as their high yields contrasted well with the low cost of securing credit risk guarantees from insurers who had little regulatory capital in place. In 2006-2007, the opportunity for negative CDS basis trades has also been singled out (see Deng, et al., 2010; Hu, 2007) for the growth of arbitrage and balance sheet CDOs. Under conditions of a negative CDS basis, banks in particular enjoyed not only savings in capital from reduced risk weights; they also received a positive net return from a joint CDO and CDS position.

It is important to note is that as early as 2003 it became mandatory for FDIC banks and trusts to report their securitization activity with explicit breakdowns for financial structured products and also their CDS positions. Indeed, US Joint Agencies Rule 66 Fed. Reg. 56914 and 59622 did en-

Figure 2. CDO issuance (USD millions) 2005Q1-2010Q4 (Source: SIFMA)

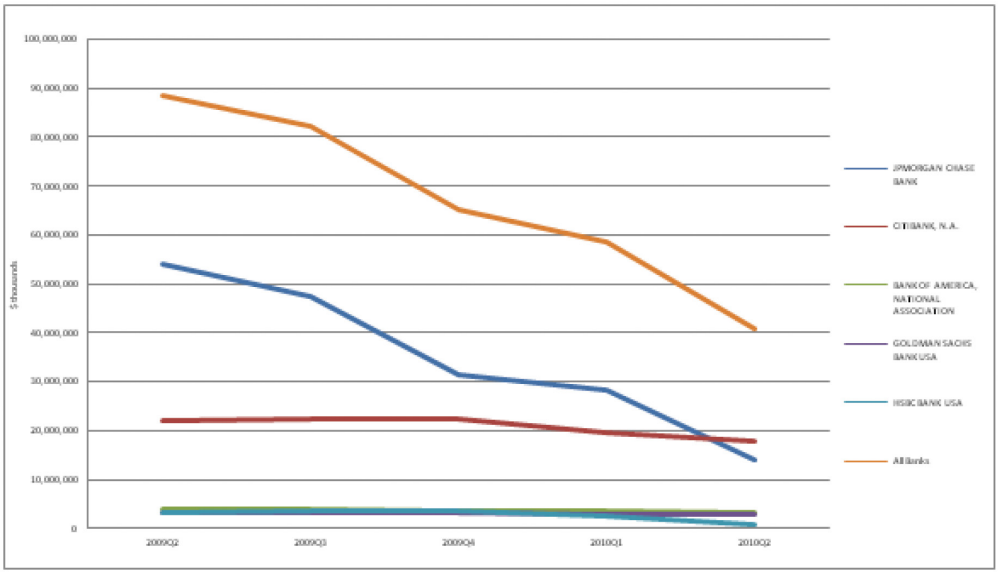


dorse the need for the capital reduction sought by banks through the use of CDS to be made public and transparent. However, the data in response to the question pertinent to assess policy incentives as to the amount of CDS protection taken out by banks and recognized as a guarantee for regulatory capital purposes has been reported in the FDIC Call Reports only from 2009 Q2. As seen from Figure 3, even in 2009 Q2 a substantial sum of £88.56 bn of CDS protection was purchased for regulatory capital purposes by reporting FDIC US banks.

By our calculations, which will be explained, this implies capital savings of a minimum of $2.13 bn.[9] Note, JP Morgan was claiming the giant share of this, followed by Citibank. Also the RMBS assets on the balance sheets of these same banks in 2009 Q2 was about $510 bn making the underlying RMBS for which CDS protection was being purchased at about 17%. This was found to fall to about 4% by 2010 Q4.

Unlike remote SPV sales of RMBS, it is far from the case that synthetic securitization and CDS activity of banks was to escape capital regulation. Indeed, it was fully in compliance with the regulation. For instance, Part V Sections 7 and 43 on synthetic securitization in the Federal Reserve Board Basel II Capital Accord Notice of Proposed Rulemaking (NPR) and supporting Documents (2006) [10] encourages the three following features that mark the 2007 crisis, as best practice in banks on how to reduce risk based capital. There was encouragement to use external ratings by so called Nationally Recognized Statistical Rating Organization (NRSRO) agencies so that securitizations can be retained on the bank's own balance sheet with reduced risk capital requirements. The mainstay of the ratings based assessment of risk in banks is to assign the risk weight for claims against an obligor or reference assets according to (1) the credit rating of obligors or the reference assets based on at least two external ratings given by NRSROs, or (2) the credit ratings of the credit risk protection providers primarily in the context of credit default swaps. In fact, as seen from 1999 documents on the capital treatment described in the *Synthetic Collateralized Loan Obligations guidance* published by the OCC (OCC 99-43)

Figure 3. Purchased CDS protection that is recognized as a guarantee for regulatory capital purposes by the top 5 banks and all reporting banks 2009Q2 to 2010Q2[8] *(Source: FDIC Call Reports)*



and the Board (SR 99-32) in November 1999 and the extent to which it is affected by the 2002 Final Rule 66 Fed. Reg. 56914, it is clear that the latter expressly permits "inferred" ratings to apply to senior synthetic CMO tranches retained by banks[11]. In other words, as stated in Fed Reg. 59614, "the sponsoring banking organization no longer is required to purchase protection on the senior loss position in order to assign a 20 percent risk weight to that position. Rather, it can assign a 20 percent risk weight based on the inferred rating of the subordinate credit linked notes."

2.2. Synthetic RMBS Structure for Capital Arbitrage

Based on the above discussion, we aim to determine the capital saved through the process of using CDS for capital arbitrage in the context of the rules for synthetic securitization. Consider the generic partially funded synthetic CDO structure depicted in Figure 2 based on an example in the 1999 *OCC Bulletin 99-43a* whereby, the originating bank's reference portfolio consisting of $5bn in residential mortgage assets is divided into an unfunded $4.55bn (91%) super-senior position, a $400m (8%) funded mezzanine position and a retained $50m (1%) first loss/equity position. Note that a transaction of this form enables the sponsoring bank to significantly reduce its regulatory capital requirements. Using the 2002 Final Rule 66 Federal Regulation No. 56914, we assign a 20 percent risk weight to the super senior position based on the inferred rating of the subordinate credit linked notes. This follows from the assumption of the secure funded nature of the mezzanine tranche. The credit exposure on the $400m mezzanine tranche is insured by buying protection in form of CDS from the SPV or CDO trust, which funds the exposure by issuing Credit Linked Notes (CLN) to investors. The CDS on each of the obligors in the reference portfolio are structured to pay the average default losses on all senior unsecured obligations of defaulted borrowers. The notional value of the credit linked notes issued typically is set at a level sufficient to cover some multiple of expected losses, but well below the notional amount of the reference portfolio being hedged. The proceeds from the sale of these notes are then invested in high-grade government securities or other eligible collateral as defined under the Basel Accords. This collateral is pledged to the originating bank in exchange for the $400m reference exposures should a credit event occur.

If the funding behind the mezzanine tranche involves Treasury bonds or cash then it has zero capital weight though the bank incurs the cost of the CDS spread. This may be sufficient for the senior tranche to be allowed a 20% risk weight reduced from either a 50% or 100% without the bank having to incur CDS purchases on the senior tranche. The final $50m first loss exposure is retained and requires a 100% risk weight as it is assumed to be unrated.

In what follows we will assume a 20% risk weight for the senior tranche and a zero risk weight for the funded mezzanine tranche. However, as we aim to replicate the ABX-HE index structure, the reference assets of the senior tranche is assumed to be 40% and that of the mezzanine one to be 60%[13]. The mezzanine tranches will follow sub-indexes with ratings of AA, A, BBB, and BBB–of the ABX-HE index. The bank will optimize ownership of those sub-indexes that yield the largest CDS basis return. This will be explained below.

3. SIMULATION MODEL FOR REGULATORY CAPITAL REQUIREMENTS WITH CDS CREDIT RISK MITIGANT

3.1. CDS Capital Arbitrage Model

Let ε and θ_i, respectively, denote the 8% regulatory capital requirement and the regulatory risk weight on the CDO tranche i without the Credit Risk Mitigant (CRM) and θ_i^{CRM} is the risk weight

commensurate with credit risk mitigant. The latter is assumed to be issued by an AAA rated company in the form of CDS cover. The savings in risk capital given by $\varepsilon(\theta_i - \theta_i^{CRM})$ in basis points must in principle exceed the net cost of purchasing CDS and acquiring the CDO tranche. For this the CDS spread λ_{it} at time t has to be contrasted with the CDO bond spread given as the yield minus the risk free rate $(y_{it} - r_t)$. This condition for the profitability of CDS based capital reduction for structured RMBS reference assets is as follows:

$$\varepsilon(\theta_i - \theta_i^{CRM}) > (\lambda_{it} - (y_{it} - r_t)) \quad (1)$$

λ_{it}: CDS spread at time t given as the annual cost of protection over a N-year period is defined as λ_{it} = [(100-CDS price at time t of ith ABX-HE subindex)/N*100] + fixed premium

θ_i: Risk weight on ith CDO tranche without credit risk mitigant

θ_i^{CRM} : Risk weight on ith CDO tranche with credit risk mitigant

y_{it}: CDO bond yield to maturity on the ith tranche at time t

r_t: Risk free rate at time t

Capital saved with CDS based CRT from an AAA guarantor on the senior RMBS tranche is 240 basis points (which is 400 basis points less 160 basis points) and on the mezzanine tranche with zero risk weight, all of the 400 basis points is saved. In a period of zero to negative yields on bonds and high interest rates, the regulatory capital arbitrage via CDS activity may be naturally curtailed as the CDS basis becomes positive. Indeed, Equation (1) suggests that the regulatory capital saving incentives are so strong that only in the case of the CDS basis exceeding over 400 basis points will this activity be curtailed.

3.2. CDS Carry Trade: Mechanism Explained

The market for a credit derivative and the cash market for the underlying bond of the same maturity need to be aligned to avoid mispricing and arbitrage opportunities. In principle, the CDS spread which reflects the price of credit risk of the bond, as an initial approximation, should be equal to the bond spread for a bond with a given maturity (Duffie, 1999; Hull, et al., 2004). The bond spread defined as the yield to maturity minus the risk free rate $(y_t - r_t)$ includes the price of credit risk of the issuer of the bond while the CDS spread could also include counterparty risk of the CDS protection seller. The so called CDS basis given on the right hand side of (1) is the difference between the CDS spread, λ_t and the bond spread $(y_t - r_t)$. Under conditions of negative basis, viz. $y_t - \lambda_t > r_t$, an investor in a self-financing strategy buys the bond and the CDS cover on it by borrowing at a risk-free rate. In so doing he locks in the carry trade profit equal to $((y_t - r_t) - \lambda_t)$. If this strategy is widely adopted, the bond price increases, leading to a fall in its yield and an increase in the price of CDS protection, which ultimately cancels out the observed divergence. Conversely, if $y_t - \lambda_t < r_t$, the investor should sell the bond (if possible), sell the CDS and invest at a risk-free rate, which ultimately restores equilibrium[14].

It is clear from (1) above that under conditions of a negative CDS basis, banks that seek to reduce capital on RMBS assets on their balance sheet through synthetic securitization have an added bonus in the form of the carry trade profits. The exceptional growth of arbitrage CDOs in 2006 and early 2007 is because the CDO tranches offered more yield than cash assets such as corporate bonds with the same ratings while the CDS spreads on the CDO tranches were underpriced. The latter

was specially the case for BBB and BBB- tranches. Hamerle et al. (2009) maintain that the demand for CDO tranches arose because investors were guided solely by the tranches' rating and ignore the increased systematic risk for pricing.

3.3. Agent-Based Model of Capital and CDS Basis Arbitrage Trade Implementation

The regulatory climate, the ensuing rise in CDS market liquidity and the creation of numerous CDS indices provide the underpinnings of the CRT gaming of banking regulation. This regulatory gaming allows banks to benefit on two fronts, firstly from leverage based on reduced capital charges against assets held on their balance sheets as defined in Equation 1. Secondly, as holders of the credit exposures, banks are also able to gain additional per-tranche basis or carry-trade income from holding such assets and buying credit protection against them. Using Equation (1) we derive the initial per-tranche gain or loss, π_{it}:

$$\pi_{it} = [\varepsilon(\theta_i - \theta_i^{CRM}) - (\lambda_t - (y_{it} - r_t))]\ X_{it}. \quad (2)$$

Here X_i is the $ value of the underlying tranche. It is assumed that the strategy of capital reduction using CDS risk mitigant and the negative CDS carry trade proceed simultaneously when conditions for both overlap. When a negative basis does not prevail but the capital arbitrage is still lucrative, then (2) above becomes the net income from the strategy. Setting i= 1 to be the senior tranche and i= 2 to be the mezzanine tranche, we assume that at time t the net profit from t-1is reinvested between the 2 tranches in terms of 40% and 60%.[15] The mezzanine tranche is then invested in the ABX-HE ratings band that provides the greatest return in terms of CDS basis at time t. Positions are assumed to be held to maturity where the maturity dates follow the vintage of the selected ABX-HE tranche. In the simulation, two factors will affect the growth of banks' holdings of RMBS assets. These are ABX-HE prices and the use of leverage. The baseline growth in balance sheet holdings of RMBS in the case of no leverage is given by the following:

$$No\ Leverage:\ RMBS_t = RMBS^{\#}_{t-1} + \pi_{t-1}. \quad (3)$$

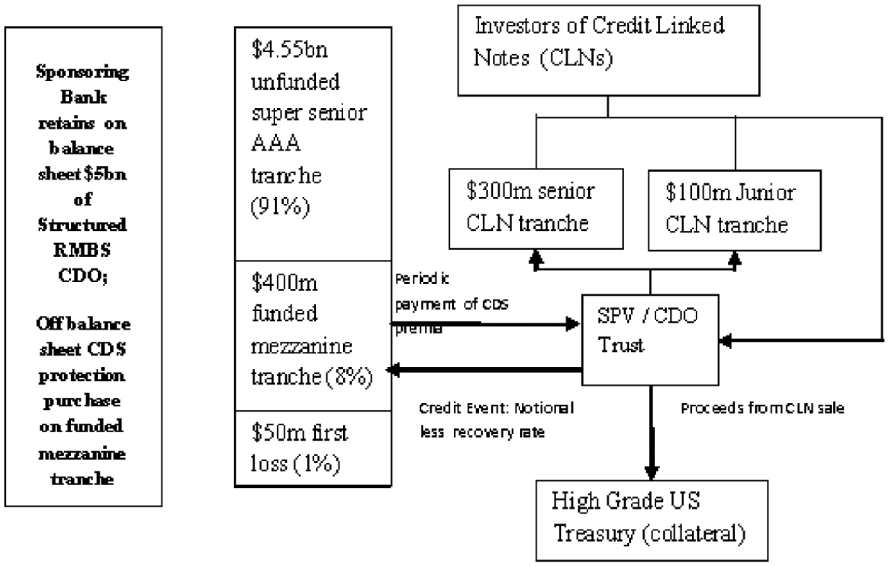
Here, $\pi_{t-1} = CapSave_{t-1} + CDS\ Basis\ Income_{t-1}$ where the first term is the capital savings over all tranches $_{t-1}$) and likewise for CDS basis income. Note, the term $RMBS_t$ in Equation (3) include both RMBS which form part of a bank's synthetic securitization (as in Figure 4) as well as CDOs issued by other financial intermediaries. A quarter by quarter revaluation of banks' RMBS structured assets is done and the # term in $RMBS^{\#}_{t-1}$ signifies marking to market of tranches using the ABX-HE prices for the relevant vintage and tranche.[16] If $(\lambda_t - (y_{it} - r_t)) < 0$, we will consider a leveraged reinvestment strategy of the t-1 CDS carry trade profits (only if latter was positive at t-1) that will fulfil a self-financing strategy to lock in the risk free "carry" at t. The maximum amount to borrow or leverage up so that the borrowing and regulatory capital costs are self-financed is given by:

$$Lev_t^{\ max} = (CDS\ Basis\ Income_{t-1}/US\$\ Libor^{+} + \varepsilon\theta^{CRT}) \quad (4)$$

Note this implies that the interest rate and capital cost of buying the underlying bonds with face value $Lev_t^{\ max}$ will equal $(US\$\ Libor^{+} + \varepsilon\theta^{CRT})$ $Lev_t^{\max}$. The latter will exactly be financed by the CDS basis income at t-1. We use the 3-month *US$ Libor* and typically in 2006, 180 basis points over Libor was charged for the BBB sub-index (Lucas, et al., 2006). The capital charge being applied is 160 basis points. Note all of the funds generated from $Lev_t^{\ max}$ is invested solely in the mezzanine tranche. The growth of RMBS assets in the case of leverage is given as:

$$With\ Leverage:\ RMBS_t = RMBS^{\#}_{t-1} + \pi_{t-1} + Lev_t^{\ max}. \quad (5)$$

Figure 4. Partially funded hybrid synthetic CDO RMBS structure ($5 bn) (Source: Adapted from OCC Bulletin 99-43a: Capital Interpretations Synthetic Collateralized Loan Obligations[12])



4. DATA USED FOR SIMULATION

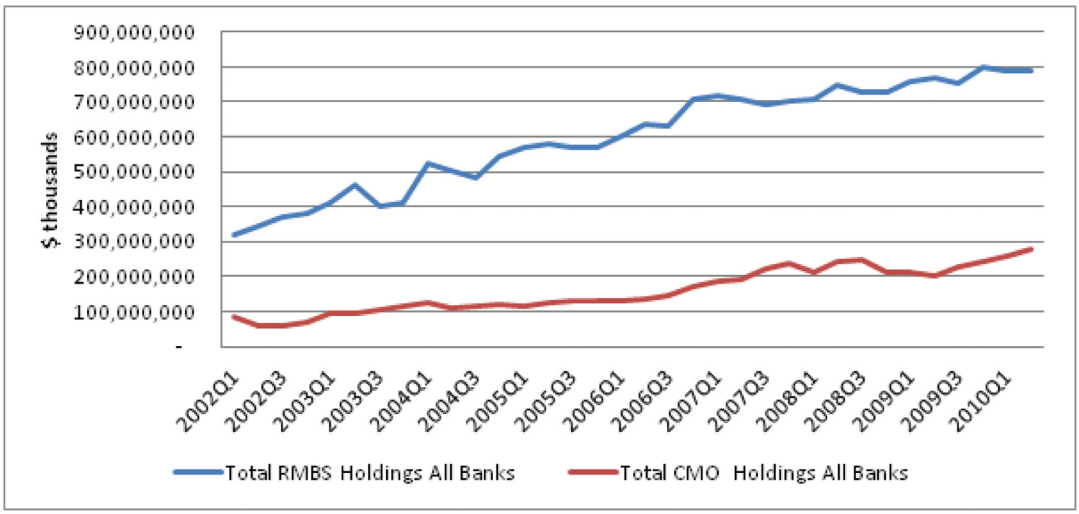
4.1. The FDIC Bank Data

The bank data used in the model presented here is taken from the Thrift/Call Reports of FDIC insured banks most active in CDS market, as reported by US operating banks to the Federal Deposit Insurance Corporation (FDIC). This data is available to the public either in form of individually submitted reports or in form of quarterly bulk reports collected into tab delimited CSV files. For each reporting quarter between 2002Q1 and 2010Q2 these tab delimited CSV files were imported into a single MySQL database from which the agent data is extracted based on CDS market participation conditions. In particular, the criteria used to determine the banks for which data is extracted is that they have a record of CDS credit protection purchases at any point during the 2002Q2 and 2010Q1 period. The RC-Codes for the Thrift/Call report items corresponding to mortgage backed securities held on balance sheet, credit default swap protection purchases and mortgage backed securitisation activity of the banks are then extracted (see Figure 5)[17].

At the individual bank level, wide variations can be observed in the FDIC data on RMBS holdings over the 2002Q1 and 2010Q2 decade. However, for the period 2006- 2007 Q3, all banks in our sample with the exception of Bank of America showed a steady and in some cases very large increase in balance sheet holdings of RMBS. The largest RMBS holder, Bank of America, saw a rapid growth in its holdings from US$62.4bn in 2002Q1 to US$211.9bn by 2005Q2. From which point its holdings fell to US$146.6bn by 2007Q1.

Also, note that increase of Citibank's RMBS holdings from a negligible amount in 2006 Q1 to over $100bn in 2007 Q1 coincided with its strategic restructuring of 2006[18]. JPMorgan from an initial decline in its holdings of US$56bn in 2003Q2 to US$21.18bn by 2005 Q4, substantially increased its holdings over the next 2 year period reaching US$79bn by 2007Q2. This dipped to US$66.7bn in 2007Q4 before rebounding to a height of US$195.4bn by 2009Q3. For banks outside of the Top 12, holdings declined from

Figure 5. Total balance sheet holdings of RMBS vs. structured MBS by all banks in sample (2002 Q1 – 2010Q1) (Source: FDIC Call Reports)



the 2004Q1 peak of US$167bn to US$111.9bn in 2006Q2, then witnessed an increase to US$172bn by 2007Q3 before falling back to early 2006 levels by 2008Q1.

4.2. The Bond Spread and CDS Spread Data

The data relating to the structured finance bond spread is extracted from the weekly CDS/CDO Update Reports published by the Fixed Income Research team at the Japanese bank Nomura and based on the bank's weekly CDO pricing pipeline between 2006Q1 and 2007Q3. Of these, only those CDOs consisting of 50% or more residential mortgage or home equity backed notes are considered and factored for a spread over the appropriate USD 3month LIBOR rate. CDS spreads are taken as those implied in the five sub-indices based on the benchmark rating levels (AAA, AA, A, BBB, and BBB-) of reference obligations of the ABX.HE index launched by Markit in January of 2006. In the ABX.HE index, for each year 2 vintages were constructed on selected reference subprime RMBS issued 6 months prior to date of the vintage. The reinvestment strategy given in Section 3.3 for capital saved and profits from carry trade strategies at the end of each quarter is based on a time series of CDS spreads constructed in the following way: 2006Q1 and 2006Q2 CDS spreads are based on the ABX.HE 2006-01 indexes, 2006Q3 and 2006Q4 spreads are based on the ABX.HE 2006-02 indexes and the 2007Q1, 2007Q2 and 2007Q3 spreads are based on ABX.HE 2007-01 indexes. The resulting CDS-spreads, CDO-bond spreads and CDS-basis are plotted in Figures 6 and 7. Table 1 gives the CDS basis of all ABX.HE tranches for the sample period.

Over the period of this simulation, the trend was to move from a negative CDS-basis toward a positive CDS basis. Spreads on the BBB-rated tranche of the ABX.HE, for instance, had risen from 121bps in 2006Q1 to 1929bps by 2007Q2, whereas the spreads on the underlying RMBS-CDOs had only risen from 351bps to 602bps over the same period, resulting in a CDS-basis change from -230bps at 2006Q1 to 1326bps at 2007Q2.

What can be seen in Figure 8 and Table 1 is that in 2006 Q1and Q2, the BBB tranche has the largest negative basis of about 240 and 200 basis points while in 2006 Q3 and Q4 the BBB- tranche yielded the largest negative basis of over a 100

Figure 6. RMBS assets top 5 FDIC banks (Source: FDIC Call Reports)

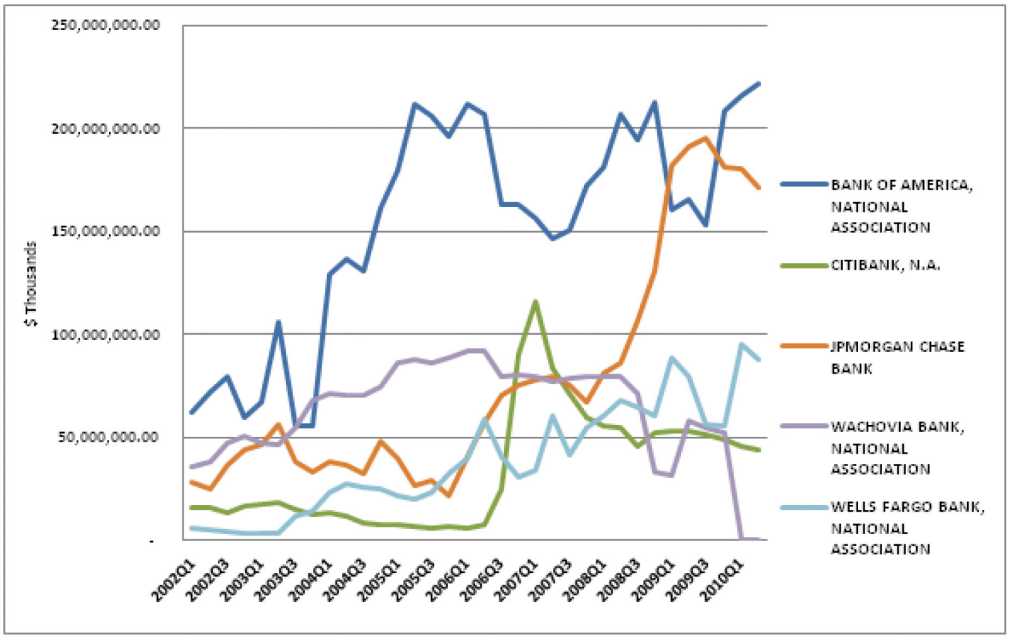


Figure 7. ABX.HE index vs. RMBS-CDO bond spread (2006Q1 to 2007Q3) (Source: Nomura, Markit [assumes 35% Constant Prepayment Rate])

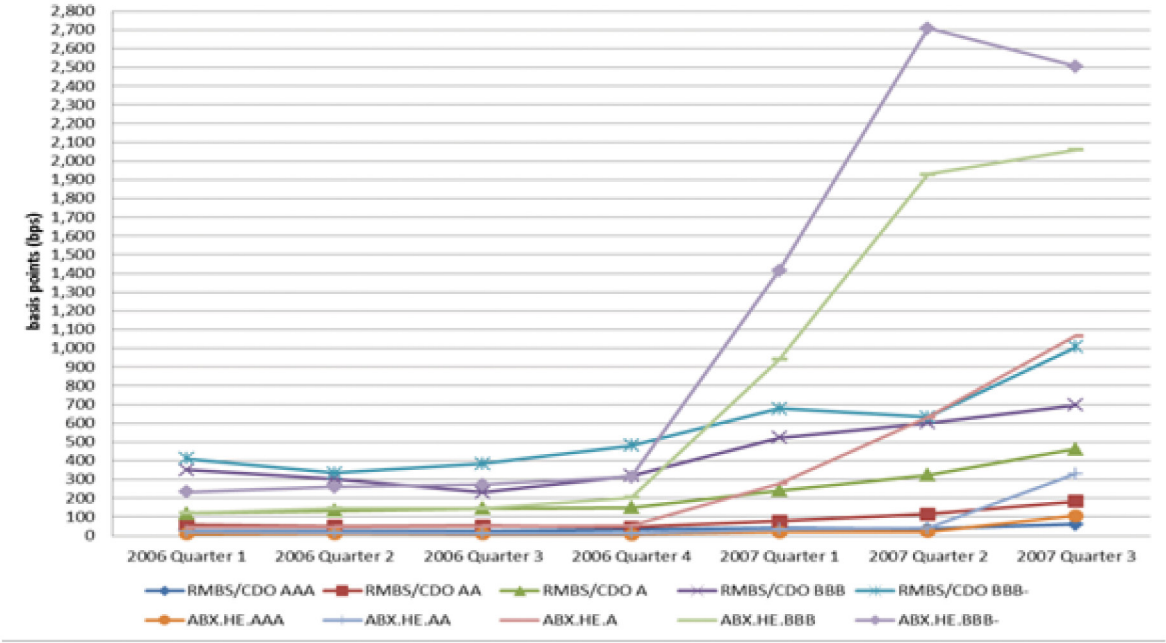
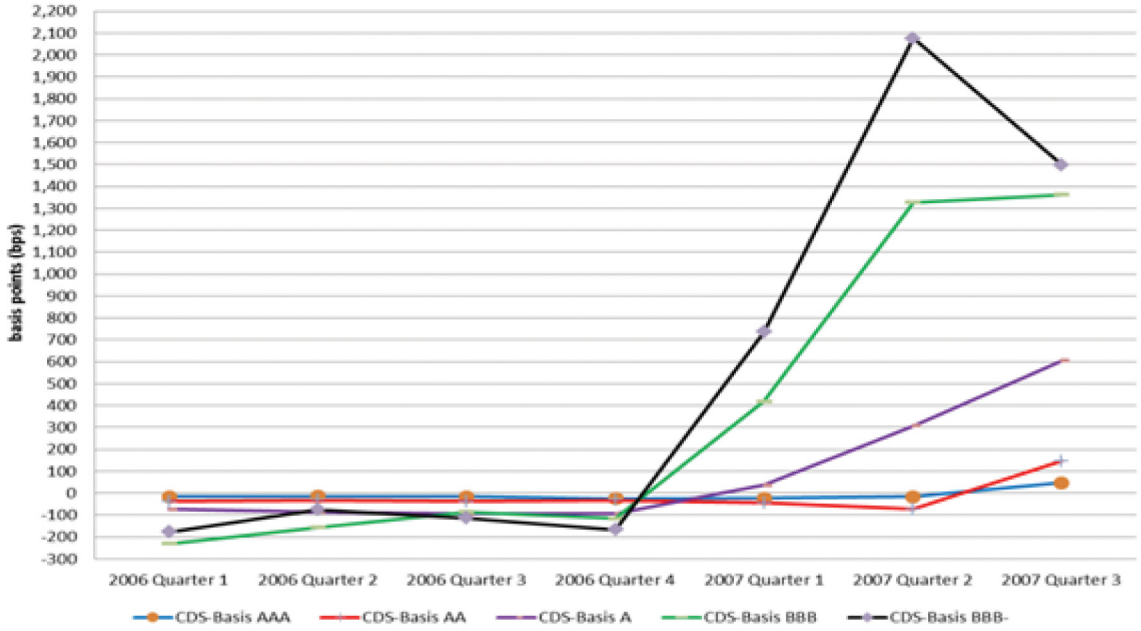


Table 1. CDS basis estimated as CDS spreads minus CDO bond spreads

	AAA	AA	A	BBB	BBB-
Q1 2006	-15.8	-37.9	-73.52	-230.05	-177.84
Q2 2006	-14.46	-33.31	-86.15	-156.86	-74.82
Q3 2006	-17.19	-38.47	-94.29	-84.81	-113.08
Q4 2006	-24.79	-31.16	-91.02	-86.22	-101.96
Q1 2007	-23.21	-44.52	36.42	419.21	736.22
Q2 2007	-15.92	-73.92	307.47	1,326.93	2,075.43
Q3 2007	46.6	145.97	604.87	1,362.99	1,498.71

Source: CDS Spreads ABX-HE Index and CDO Bond Spreads from Nomura Fixed Income Research

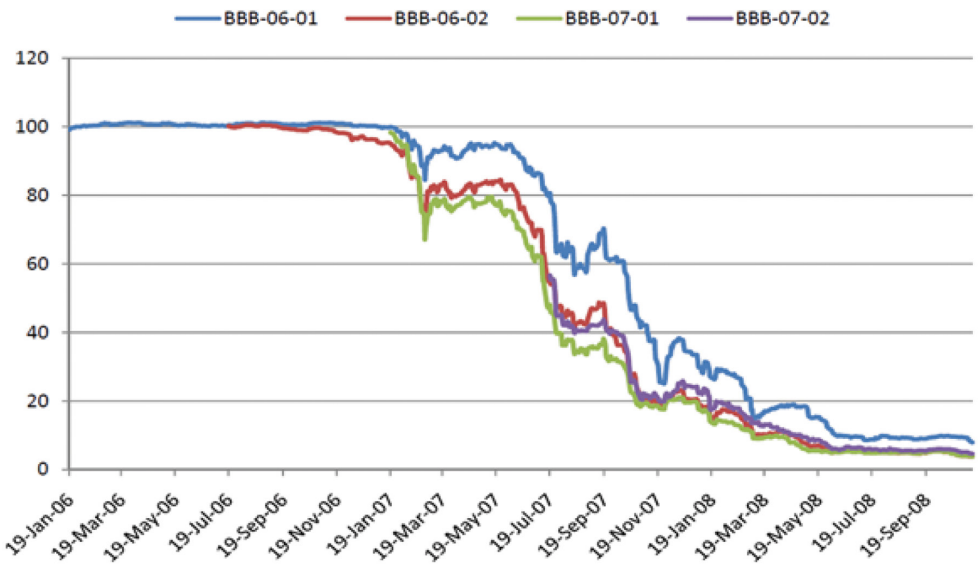
Figure 8. CDS basis (2006Q1 to 2007Q3)



basis points. Finally, in 2007, the AA tranche yielded in small negative basis before CDS basis turned positive.

The revaluations of banks holdings of RMBS assets in this period are primarily governed by the behaviour of the prices for the BBB and BBB- tranches for the ABX-HE indexes, which started falling from November/December 2006. Up until 2006 Q4, the price of subprime synthetic RMBS was trading slightly above and close to par for the ABX.HE 2006-01 Index for all sub-indexes, after which there were substantial markdowns going forward, and the ABX-HE vintages for 2007-01 and 02 started with deep discounts for the lower tranches. This has been discussed at length by many (see, Gorton, 2009; Stanton & Wallace, 2009). The ABX-HE index prices for the BBB tranche that dominated as the most lucrative one for purposes of carry trade in 2006 is given in Figure 9. In the simulation, from 2006 Q4 end, we will apply the downgrades on the mezzanine tranches as needed.

Figure 9. The ABXE-HE index prices for BBB tranche 2006 Q1- 2007 Q4 (Source: Markit)



5. AGENT-BASED SIMULATION RESULTS

5.1. Growth of RMBS Holdings by FDIC Banks from Capital Arbitrage

The multi-agent micro-simulation methodology that aims to see how banks will respond to regulatory incentives and other well known arbitrage opportunities given market conditions starts the simulation off at an initial date at which their balance sheet data anchors their strategies. At 2006Q1, the 26 banks that the FDIC data base presents as having both RMBS and CDS activities were found to have $602.34 bn RMBS assets. Thereafter, the agents are only given the market related costs of leverage and the CDS basis and price data at the end of each quarter (items 8-9 in Table 2). The rule based strategies given in Section 3.3 are implemented for each bank at the beginning of the each quarter. The simulation outputs such as the returns/profits of the strategies are tallied up at the end of the same quarter and so are the banks' balance sheet RMBS holdings and off balance sheet demand for CDS purchases. Where applicable the balance sheet RMBS holding are revalued as dictated by the ABX-HE index prices. This is set out in row 3 of Table 2. Using no extraneous assumptions except those driving capital arbitrage and CDS negative carry trade, we see in Figure 10 that the simulation in the case with leverage almost exactly mirrors the actual RMBS build up on bank's balance sheets.

The breakdown of the results is reported in Table 2. We find that the initial realized aggregate capital savings of $20.23 billion in 2006 Q1 from capital arbitrage which corresponded to CRT rules, helped kick start the CDS carry trade which netted $8.31 billion at the best negative basis for the BBB sub index of the mezzanine tranche. What is clear is that a leveraged self-financing reinvestment of the carry trade profits of $8.31 billion produced a total of $114.367 billion of funds generated in sequence (see Table 2 row 6), for the duration of the negative basis. In other words, substantial leveraging is needed for the US banking sector to grow their RMBS assets from $0.6trillion in 2006 Q1 to about $0.7 trillion in 2007 Q2. Without leverage, there is no explosive growth as seen in Figure 10. The down ward trend in RMBS hold-

Table 2. Breakdown of simulated results 2006Q1 to 2007Q3 ($bns unless otherwise stated)

	2006Q1	2006Q2	2006Q3	2006Q4	2007Q1	2007Q2	2007Q3
1.FDIC Total RMBS	602.335	635.666	628.525	705.147	719.629	709.676	692.162
2.SimulatedTotal RMBS Bank Assets Unleveraged Leveraged (#)	602.335 602.335(#)	622.574 622.574(#)	631.566 631.845(#)	631.595 728.136(#)	631.596 745.487(#)	631.596 724.452(#)	631.596 680.573(#)
3.Price Revaluation RMBS Leveraged case only	NA	NA	NA	NA	-5% BBB 06-01 = - 18.96	-10% BBB 06-01 = - 37.91	-20% BBB 06-01 = 75.82
					-25% on BBB-06-02 = -4.29	-10% BBB-06-02 = 6.22	-40% BBB- 06-02 = 13.96
							-10% AA 07-01= 0.03
					Total Loss = -23.24	Total Loss = -44.13	Total Loss = -89.81
4.Gross Capital Savings at Quarter End	20.238[19]	0.680	0.023	0.0008	0	0	0
5.Profit Negative CDS-Basis Unleveraged Leveraged (#)	N.A	0.279 8.312[20](#)	0.0064 1.503(#)	0.0002 0.194(#)	0 0.0223(#)	0 0.001(#)	0 0
6.Leveraged funds from Negative CDS-Basis	NA	NA	94.759[21]	17.156	2.187		
7.CDS buy on [22]mezzanine Tranche (outstanding)	361.401	373.544	379.107	436.881	447.292	434.824	408.34
8.Tranche on which CDS purchased in carry trade	BBB (vintage 2006-01)	BBB (vintage 2006-01)	BBB- (vintage 2006-02)	BBB- (vintage 2006-02)	AA (vintage 2007-01)	AA (vintage 2007-01)	AA (vintage 2007-02)
9.CDS-Basis (bps)	-230.05	-156.86	-113.08	-101.96	-44.52	-73.92	145.97
10.US $ 3 month Libor + 180 bp +160 bp capital charge	8.39%	8.91%	8.77%	8.76%	8.87%	8.76%	9.02%

ings in the simulated data in 2007 Q1-Q2 come entirely from the downgrades primarily on the BBB and BBB- subindexes, which were the most lucrative in the CDS trade in the earlier quarters of 2006. Table 2 row 3 explains this.

When considering how each of the banks fares, two typical cases stand out. Banks that were well established as holders of RMBS prior to 2006, such as Bank of America, suffer large downgrades in 2006 on their pre-2006 holdings, as shown in

Figure 10. Actual (FDIC data) and simulated results for banks' holdings of RMBS assets (2006Q1-2007Q3)

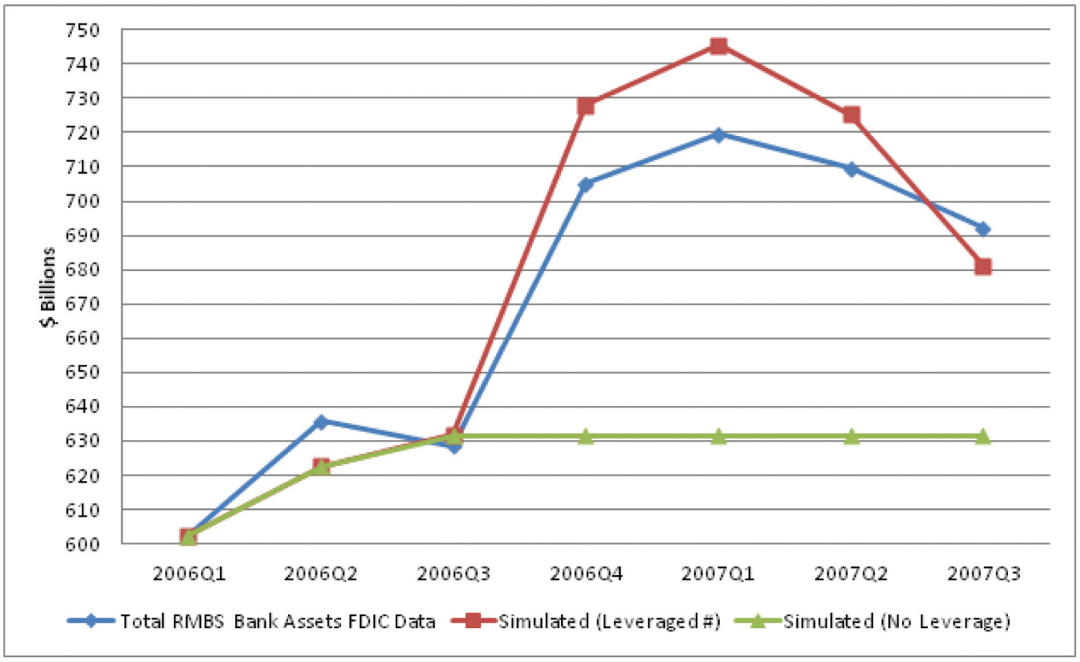
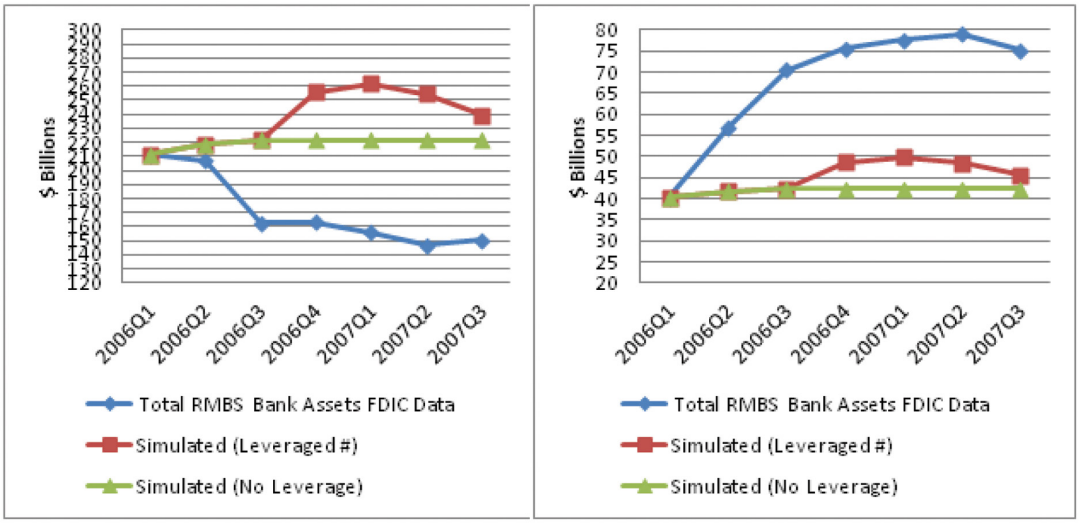


Figure 11a. This cannot be accounted for in the model that only has access to the ABX-HE price data. In contrast, JP Morgan, in Figure 11b, which aggressively doubles its holdings from $40 billion to $75 billion by 2007Q1, the leverage being applied exceeds the one used in the simulation.

Figure 11. a) Bank of America RMBS holdings; b) J.P. Morgan RMBS holdings



5.2. Simulated Growth of CDS Demand for Capital Reduction and Network of CDS Obligations of US Banks

In Figure 3, we saw that even in 2009 Q2 FDIC banks reported quite substantial demand for CDS for purposes of capital reduction from CRT. The upshot of the simulation above is that the US banks accumulated in each quarter between $361.4 billion in 2006 Q1 to $448.6 billion in 2007 Q3 (see Table 2, row 7) of gross notional of CDS purchases in the form of credit risk mitigants to reduce capital. Note, the majority of the CDS gross notional outstanding in each quarter is bespoke and arising from pre 2006 synthetic securitization. Only about $100 bn of CDS, in keeping with our carry trade strategy, is on the ABX-HE index per se[23]. Remarkably, the revaluation item in Table 2 row 3 shows that in 2007Q3 a loss of $80 bn on underlying RMBS implies that all of the RMBS assets worth around $157 bn that the banks took on its balance sheets in the period 2006-07Q3 using CRT had lost all of its value. This must have triggered CDS contracts, at a minimum, with a similar net fair/market value. Of all the CDS market participants, because of the CRT scheme, banks faced threat of insolvency from double failure of both the reference RMBS assets on their balance sheets and that of their CDS protection sellers. It was the inability to meet CDS obligations by key CDS protection sellers on subprime related MBS and CDOs that led to implicit or explicit taxpayer bail-outs on the premise that these financial entities were *too interconnected to fail.*

As already noted, only a few, 26-32, FDIC US banks were involved in the US CDS market and the FDIC data gives their activities in their capacity as national associations rather than as global banks. Our simulations (See Table 2 row 7 and Table 3 row 2), show that CDS on RMBS contributes to only 13% of gross notional of CDS in 2006Q1 which then fell to 7% in 2007Q2.

Table 3. CDS gross notional 2006 to 2007 actual ($ 000s)

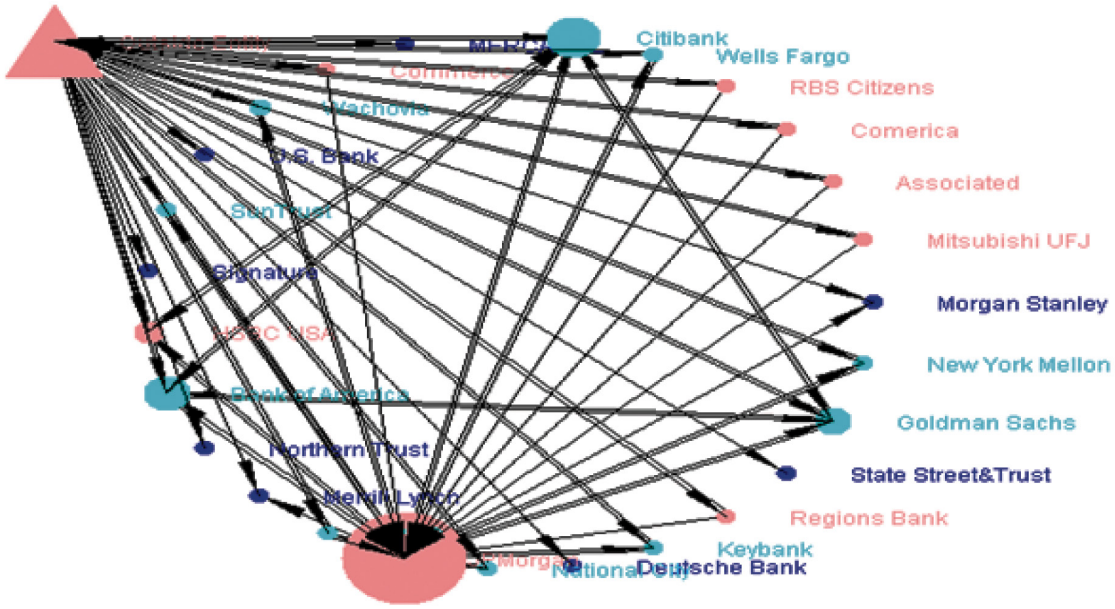
	2006Q1	2006Q2	2006Q3	2006Q4	2007Q1	2007Q2	2007Q3
Gross Notional CDS Protection Purchased by Top 5 Banks	2,504,417,017	3,052,400,980	3,683,156,963	4,232,328,400	5,236,739,940	6,191,517,817	7,476,739,120
Gross Notional CDS Protection Purchased by All 26 FDIC Banks	2,645,092,207	3,166,999,117	3,840,306,007	4,417,891,799	5,422,924,381	6,389,251,797	7,663,403,829

Source: FDIC Call Reports

With CDS on RMBS being the fasted growing segment of credit derivatives which had gross notional valued for FDIC US banks at $2. 645 Trillion in 2006 Q1 and rising to $7.663 Trillion in 2007 Q3 (see Table 3), we will complete our analysis by coming to the heart of the rationale of CDS based CRT in Basel II and its US precursor in the Joint Agencies Rule 66 Federal Regulation No. 56914. The premise was that credit protection is spread across those better placed to do this and hence AAA financial institutions primarily in the US began to get involved in this activity. However, similar to the argument made by Darby (1994) about derivatives markets in general, many (see Lucas, et al., 2007; Das, 2010; Gibson, 2007) have noted that the benefits of CRT will be compromised by the structural concentration of the CDS protection providers. Few have provided the empirical evidence for the systemic risk consequences of what is called *too interconnected to fail* which arises from the heavy concentration of CDS market activity of upwards of 95% in 2006 Q3 to over 97% in 2007 within the same set of only 5 counterparties.

We will use the Markose *et al.* (2010, 2011)[24] CDS network simulator which runs on the FDIC data base. The CDS network in Figure 12 is for the post Lehman 2008 Q4 period, when the network concentration was even greater than in 2007 Q4. In the empirical mapping of the CDS network based on the 26 FDIC US banks involved in the US CDS market along with the non-bank Monoline and hedge fund CDS market participants (given a calibrated 30% market share as net protection sellers), we see that the concentration of CDS market share in 5 top banks imply very high density of network connections among these banks in terms of bilateral interrelationships and the triangular clustering among them highlights a tiered structure. This can be seen in Figure 12[25]. The highly asymmetric nature of the empirical CDS network is manifested in the large kurtosis or fat tails in degree distribution which is characterized by a few (two banks in this case) which have a relatively

Figure 12. Empirically constructed CDS network for US banks and US non-banks(triangle): Empirical small world initial network (FDIC call report data of 2008 Q4) (Source: Markose et al. (2010))



large number of in degrees (up to 17) while many have only a few (as few as 1). In Figure 12, we have colour coded the net sellers (pink), the net buyers (light blue), and sole buyers (dark blue).

These networks manifest very different propagation of systemic risks from counterparty default than do random graphs which have been mistakenly been used for financial network modelling (see Nier, et al., 2007, for an example of simulations using random networks; and see Craig & von Peter, 2010, for an empirical study of the presence of tiered financial networks with market share concentration).

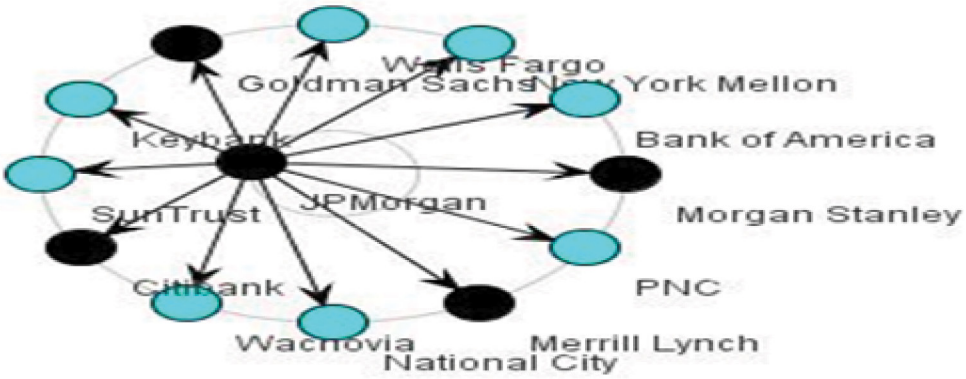
Using the Tier 1 capital reported by these banks in the FDIC call reports, we find that default of any of the top 5 banks based on their bilaterally netted fair value CDS obligations will result typically in the failure of those banks that are highly interconnected amongst themselves. The contagion stops at this point with it being confined to the top hierarchy (as shown in Figure 13) but in the spirit of being too interconnected to fail, the top banks (black nodes in Figure 13) are brought down when any other member of this group collapses. Clearly, the implicit socialized losses of capital from bank failure with such a topological concentration of counterparties with high CDS market share is very large as top banks also account for some 43% of Tier 1 capital ($430 bn) of the 26 banks in the sample.

6. CONCLUSION

This chapter has provided an exemplar of how publicly available financial firm level FDIC type data bases are to be accessed and 'fed' into Multi-Agent Financial Network (MAFN) models to help monitor perverse incentives from policy and systemic risk from a topological perspective especially in risk sharing derivatives institutions.

We fully concur with the Blundell-Wignall and Atkinson (2008) dictum that "understanding causality is a precondition for correct policy making." The question is what methodologies can investigate causality especially in the context of the impact of policy incentives? We have argued that in the design of robust financial regulation a more rigorous 'wind tunnel' testing platform and also a means of monitoring policy for perverse incentives in an ongoing way is needed over and above what extant macro or cross sectional econometric models can achieve. In the latter equations have to be estimated, while in ACE the cost benefit

Figure 13. Instability propagation in clustered CDS network (NB: Black nodes denote failed banks with successive concentric circles denoting the q-steps of the knock on effects. Here q is 1. Source: Markose et al. (2010))



calculations are algorithms for banks to implement. Permissible capital arbitrage refers to the least amount of regulatory capital that a bank can hold given market conditions and the myopic cost benefit analysis. At least since the BCBS paper of Jackson et al. (1999) on the impact of the Basle Accord capital requirements on bank behaviour, numerous empirical studies based on econometrics or simple charts and graphs have been undertaken. Few if any of these papers make assessments, in any joined up way, of the impact of regulatory incentives for banks to reduce capital from 8% to 1.6% through the use of CDS. Certainly, the development of large-scale computational agent based models that can directly access data from the financial databases was not considered. From a data stand point MAFN models could have been set up for the US banks from 2003 when FDIC Call Reports had publicly available data on all RMBS holdings (broken down in some detail) and CDS activity (not broken down into product classes). However, the data on the crucial question on *purchased CDS protection that is recognized as a guarantee for regulatory capital purposes* (FDIC Call Report code RCFDG404) did not get reported till 2009 Q2.

In agent-based models, rule following behaviour as in complying with the regulation and the conduct of carry trade activity are relatively easy to implement. This is because unlike fully-fledged adaptive behaviour, agents' strategies, intelligence, and autonomy are limited to following the letter of the law and strictly verifying conditions for which the most profitable arbitrage applies. The modeler, however, faces the challenge of understanding the regulation, provide market conditions for the triggers that need to be followed in a carry trade and then implement the agents' strategies in an algorithm. We have confined the simulation to the 2006-07 period and restricted the maximum of capital savings in the context of replicating the ABX-HE index. We reiterate that the pursuit of CDS negative carry trade was not the main objective of the banks' strategy but the side effects of the pursuit of capital reduction from the CRT scheme of Basel II. There is clear evidence that the bonanza of the rapid growth of banks' holdings of RMBS and CDS purchases during the 2006-7 period required capital savings from CRT, which we estimate to be about $20bn. The simulation shows that with the application of leverage, RMBS assets for the 26 FDIC banks (viz. those that also reported CDS purchases) peaked at about $750bn in 2007 Q1 (see Table 2 row 2). Maximizing capital savings and minimizing risk-weighted assets are two sides of the same coin. The $750bn or so of banks' RMBS assets in 2007 Q1, which we simulated given the regulation on risk weighting, implies risk weighted assets of $60 bn and a meagre Tier 1 capital of $4.8 bn. The fact that $4.8 bn constitutes 8% of risk weighted assets is highly misleading when it is less than 1% of total assets. The latter, ofcourse, corresponds to the buffer needed to cover for probable losses from AAA assets.

Gibson (2007) said: "One fundamental reality of credit derivatives is that they do not eliminate credit risk. They merely shift it around. As a result, when the credit cycle turns and default rates rise, someone, somewhere, will lose money." Basel II and III scheme of CRT suffers from the fallacy of composition in that removing credit risk from banks' balance sheets which is good thing from the perspective of the bank (at least for capital savings and short run asset expansion)–the systemic risk consequences of high concentration of counterparties was not quantitatively modeled and visualized. The automated Markose *et al.* (2010, 2011) network visualizer that uses concentration and market share statistics to calibrate the degree distribution and the actual fair value flows show that Gibson (2007) is far off the mark about who will lose money and the nature of systemic risk. Quite simply a threat to any of the top 5 US banks is an immediate threat to the other four. The network topology where the very high percentage of exposures is concentrated among a few highly interconnected banks implies that they will stand

and fall together. Hence, the implied socialized losses are very large and the CDS network structures cannot be supported by a capital base, which is eroded by CRT leveraged asset growth.

In a data base driven multi-agent model of the US financial sector, a banks' balance sheet and off balance sheet activities is a vector and form multi-level networks. For instance, even for purposes of this simulation, as noted by Gorton (2009a) the leveraged funds used by banks (and non-banks) was raised in the repo market. It will be interesting to see how the FDIC banks' repo data will fit in with the simulated demands for leveraged funds from this exercise. Full developments of large-scale MAFN models as hyper-networks (see, Johnson, 2006, 2011) are only at its infancy. Integration and automation of financial data bases in an ACE framework aims to transform the data from a document or record view of the world to an object-centric view (see Balakrishnan, et al., 2010), where multiple facts about the same real-world financial entity are accessed to give a composite visualization of their interactions with other such entities in a scalable way. Based on the above discussions, for purposes of monitoring impact of policy and to detect perverse incentives, we recommend a financial data base driven, constructive or computational modeling of strategies, regulatory frameworks and the analysis of the stability of financial systems done in terms of network stability.

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ENDNOTES

1 Alessandri and Haldane (2009) have estimated US, UK, and European tax payer bailout of key financial intermediaries since 2007 and prior to the May 2010 Eurozone sovereign debt crisis to have reached unprecedented amounts of over $14 trillion.

2 Of the $8.5 trillion mortgage backed securities (see Figure 1) over 85% of outstanding $2 Trillion CDOs at its peak in 2007 (see, Figure 2) was collateralized by MBS and about half of this was subprime RMBS. Gorton (2009, Table 4) shows how of the total of $2.5 trillion subprime mortgages since 2001, $1.25 trillion was originated in 2005-6 alone and over 85% was securitized.

3 Note this is in addition to the $142 billion of RMBS purchased by the US Treasury Department during October 2008 – December 2009.

4 CDS involve a bilateral contract between a buyer and the CDS protection seller who pays the buyer the gross notional value of the reference asset less the recovery rate at the time of the credit event, which is typically default. The CDS buyer pays periodic premia called the CDS spread.

5 Cannata and Quaglianello (2009) seem to have some misconceptions about the factors behind the genesis of the modifications to Basel I with risk weighted capital requirements and the role of the US in initiating them as early as 1999, as they go on to state: "Basel II, our suspect, was not on the crime scene or, rather, showed up later. In the United States, the epicentre of the financial crisis, the introduction of the new prudential discipline has been postponed (so far) to 2010 and will involve a limited number of banks. In Europe, the actual use of the new rules was very limited in 2007, when the crisis erupted. Indeed, most banks exploited the provisions of the Capital Requirements Directive (which implemented Basel II in the EU) which allowed them to defer to 2008 the application of the new Framework.… The financial turbulence occurred under the "old" Basel framework, making very palpable its shortcomings, particularly its low risk-sensitivity and the scarce adaptability to financial innovation." Lall (2009) and Blundell-Wignall and Atkinson (2008) say banks began to adapt to the new regulatory incentives from 2004.

6 Network models have been scrutinized for their use in financial contagion and crisis management at the recent ECB Workshop on *Recent Advances in Modelling Systemic Risk Using Network Analysis,* 5 October 2009 and at the IMF Workshop *On Operationalizing Systemic Risk Monitoring* 26-28 May 2010. See also the June 2010 Conference Report on *Frameworks For Systemic Risk Monitoring* organized by Alan King, John Lietchy, Clifford Ross, and Charles Taylor. Sheri Markose and Simone Giansante were contributors to the first two workshops and are currently involved in MAFN models for the digital mapping of the Indian financial

system to monitor system risk. See also Markose (2012) which is based on the talk at the IMF on 7 December 2011 on "Systemic Risk From Global Financial Derivatives: A Network Analysis of Contagion and Its Mitigation With a Super-spreader Tax." Here, it is shown how negative externalities in the way of systemic risk from the failure of highly interconnected financial intermediaries can be measured and penalized using the eigenvector centrality measure. These sources can be referred to for details on financial networks, which are omitted in this chapter.

[7] The 2006 Q 4 BIS Report on CDS protection buyers and sellers showed that 49% of protection selling in the CDS market was done by non-bank entities. At the end of 2007, the capital base of Monolines was approximately $20 bn and their insurance guarantees are to the tune of $2.3 tn implying leverage of 115.

[8] The FDIC Call Report code for this is RCFDG404.

[9] Assuming a capital charge of 4% on RMBS assets without CDS cover, the capital charge is 1.6% with AAA CDS cover, the savings are 240 basis points. How much asset accumulation can be leveraged from this capital savings depends on the capital charge and the interest rates. This is discussed in Section 3.3.

[10] Fed Reserve Board Basel II Capital Accord Notice of Proposed Rulemaking (NPR) and Supporting Board Documents Draft Basel II NPR - Proposed Regulatory Text - Part V Risk-Weighted Assets for Securitization Exposures March 30, 2006 http://www.federalreserve.gov/GeneralInfo/basel2/DraftNPR/NPR/part_5.htm. See also Federal Register Vol. 71, No. 247, Dec 2006, Proposed Rules and Basle Committee for Banking Supervision.

[11] The answer to question C regarding US FRB supervisory rule No. SR 99-32 dated 15 November 1999 in its final form which was implemented in January 2002 gives an explanation of the capital treatment of synthetic collateralized loans. This can be found at www.federalreserve.gov/boarddocs/srletters/2002/SR0216a1.pdf.

[12] The related document is *Capital Interpretations Synthetic Collaterized Loan Obligations* at http://www.occ.treas.gov/news-issuances/bulletins/1999/bulletin-1999-43.html

[13] In a Moody's report, Hu (2007) notes that the AAA tranche of the CDO accounts for 85% of the dollar value starting from about 1999.

[14] Choudhry (2004, 2006a, 2006b) provides strong evidence of continuous arbitrage opportunities in the credit risk markets in general. For example as of October 2006, a third of the 150 actively traded US corporate bonds studied had a negative CDS basis of above 10bps with some trading at a basis in excess of 30bps. Choudhry (2005), further notes that whilst positive basis tend to exist in conventional credit markets, prolonged negative basis are prevalent in structured finance and asset-backed securities markets.

[15] This allocation follows the typical ABX-HE tranche allocations at issuance where the senior tranche equates to the AAA rated band. See Table 4 in Stanton and Wallace (2009). This assumption is also made by Nomura Fixed Income Research in the release "The CMBX: The Future is Here" March 23, 2006.

[16] We will only revalue using the ABX-HE prices, the tranches constituted post 2006. The pre-2006 tranches which suffered downgrades especially for the vintages of 1999-2001 (see, Hu, 2007) will not be revalued in the 2006-7 period. This will cause overvaluations of RMBS holding for

early entrants to the structured finance CDO market such as Bank of America and HSBC.

17 In the Appendix, we give the FDIC Schedules and codes from which the data was extracted.

18 Note during this period there was also an explosion in both RMBS issuance and reported residential loan origination by Citibank, N.A. RMBS issuance by Citibank increased from US$1.3bn in 2006Q3 to a peak of US$579.5bn by 2007Q1. The total notional outstanding on residential mortgage loans over the same period rose by over ten times its 2006Q3 level of US$20.2bn to its 2007Q4 peak of US$205.7bn. This coincided with the massive restructuring which commenced in October of 2006 and saw the consolidation of Citibank, FSB, Citibank (West) FSB, formerly California Federal Bank and Golden State Bank, Citibank, Texas, N.A., Citibank Delaware, Citibank Banamex USA formally California Commerce Bank and Citicorp Trust, N.A. (California) into Citibank, N.A. Prior to this restructure Citibank, N.A., the original Citibank, had primarily served New York State and the New York metropolitan area.

19 The $20.238 bn capital is released from use of CDS on the assumption that RMBS is structured in a 40/60 ratio in senior and mezzanine tranches, resulting in a 240 basis point savings in the first and a 400 basis point savings for the second.

20 The carry trade profit is calculated for the mezzanine tranche which is 60% of $602.335 viz. $333.90 bn. The negative basis is on this is -230 basis points (row 10 in Table 2) which gives $8.31 bn as profits at the end of 2006 Q2.

21 $94.759bn is the self-financing leverage generated from the $8.31bn profits (see, row 6 of Table 2) by dividing it by the cost of leveraging which is 8.91%in 2006 Q2.

22 The figures for Table 2 row 6 is obtained by taking 60% of the leveraged RMBS items in row 2.

23 In principle, CDS purchased for CRT by banks replicating ABX-HE tranches should not be offset bilaterally with a mirror CDS sale with their CDS protection seller and hence the gross notional applies. Stanton and Wallace (2009) Table 1 report the total 2006-07 CDS gross notional on the ABX-HE to be around $146 bn.

24 Markose *et al.* (2011) use the same calibration for network connectivity as in Markose *et al.* (2010) based on market shares of CDS gross notional of banks but the bilateral flows between banks are determined by Gross Negative Fair Value for CDS payables and Gross Positive Fair Value for receivables given in FDIC Call Reports for each of these banks.

25 We found empirical the clustering coefficient to be around 92% and the connectivity (i.e. probability of any two banks being connected to be 12%).

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APPENDIX

Items 1 and 2 listed under Schedules RC-B relate to the on balance sheet holdings of RMBS securities by the banks. These are the vanilla pass-through notes as well as the structured notes such as collateralised mortgage obligations held by the banks. Item III Schedule RC-L - Derivatives and Off-Balance Sheet Items starting from RCFDA535 gives the CDS data for the FDIC banks.

1. **Schedule RC-B:** Securities
   Item:
   Item 4: Mortgage-backed securities (MBS)
   Subsection:
   a. Residential mortgage pass-through securities
   Description:
   1. Guaranteed by GNMA
   2. Issued by FNMA and FHLMC
   3. Other pass-through securities

   (Column B) Held-to-maturity Fair Value
   (Column D) Available-for-sale Fair Value
2. **RC-Code(s):** RCFD/RCON1699, RCFD/RCON1702, RCFD/RCON1705, RCFD/RCON1707, RCFD/RCON1710, RCFD/RCON1713
   Subsection:
   b. Other residential mortgage-backed securities (include CMOs, REMICs, and stripped MBS):
   Description:
   1. Issued or guaranteed by FNMA, FHLMC, or GNMA
   2. Collateralized by MBS issued or guaranteed by FNMA, FHLMC, or GNMA
   3. All other residential MBS

   (Column B) Held-to-maturity Fair Value
3. **Schedule RC-L:** Derivatives and Off-Balance Sheet Items
   Item:
   Item 7: Credit derivatives
   Subsection:
   b. Notional amount of credit derivatives on which the reporting bank is the beneficiary (2002Q2 to 2005Q4)

RC-Code(s): RCFDA535

Item:

Item 7: Credit derivatives

Subsection:

a. **Notional amounts:** (2006Q1 to 2010Q2)

Description:

1. Credit default swaps

RC-Code(s): RCFDC/RCONC969

Subsection:

b. **Gross fair values:** Gross positive fair value

RC-Code(s):RCFDC/RCONC221

Subsection:

c. Notational amounts by regulatory capital treatment

Description:

All other positions: Purchased protection that is recognized as a guarantee for regulatory capital purposes

RC-Code(s): RCFDG/RCONG404

Section 3

Organizational and Social Implications

This section considers risk in Banking, Finance, and Accounting, and how the human element of financial decision-making can both support and hinder the process. Ultimately, finance relies on people: the investors and professionals who make everyday decisions that have the potential to change the economies of nations. Only with careful consideration of risk, investor perceptions, and technological integration in portfolio management can international firms thrive in a global, multicultural environment. In these 16 chapters, readers will find an in-depth discussion of some of the most pressing organizational and social implications of Banking, Finance, and Accounting.

Chapter 31
The Global Financial Crisis and Central Bank Speak

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ABSTRACT

Words are critical in how the public perceives the work of central banks and the quality of monetary policy. Press releases that accompany policy rate decisions and, where available, the minutes of central bank committee meetings, are focal points for the media in public discussions about the conduct of monetary policy. Using data from five countries, this chapter examines whether the language used by central banks has changed since the Global Financial Crisis (GFC) began. Briefly, the findings show that concerns about financial stability peaked just as the global financial crisis reached its zenith. However, concerns over uncertainty about the current and anticipated state of the economy have also risen over time. More generally, central bank speak became more aggressive throughout the crisis years. More conventional expressions about the current stance of monetary policy took a back seat to other concerns in central bank policy statements and minutes.

INTRODUCTION

Until the financial crisis, followed soon after by the ongoing sovereign debt crisis in Europe, began to pre-occupy central banks, central bank communication was dominated by an interest rate announcement. This was accompanied by a brief explanation of the outlook for the economy as well as a justification for the current stance of policy set by the monetary authority. To be sure, central banks communicated along many other dimensions. There were inflation or monetary policy reports and, increasingly, financial stability reports, among other publications produced by central banks aimed at both the well-informed and general public.

The push for greater transparency and accountability by central banks, originated in an understanding between them and their governments: monetary policy authority was responsible for its actions and could be held account for its decisions. In many, though not all, cases the agreement between central banks and governments consisted in giving the monetary authority full discretion over short-term monetary policy decisions. Longer term, and more strategic, decisions about the nature

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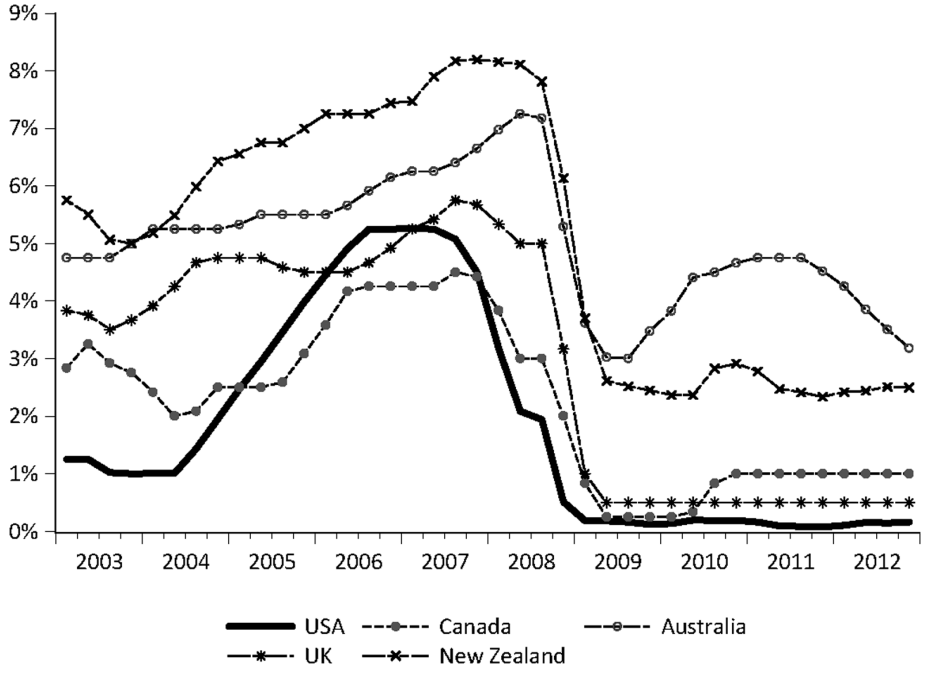
of the monetary policy regime (e.g., formal inflation targeting versus some alternative) would be left for the politicians, preferably in consultation with the monetary policy experts.

However, since at least 2008, monetary policy actions shifted away from interest rate changes to other types of announcements. As shown in Figure 1, three developments in particular characterize the dramatically changed role of the central bank policy rate since the onset of the global financial crisis. First, interest rates fell quickly as central banks, seemingly slow at first to recognize the severity of the financial shock, eventually responded by loosening the stance of monetary policy on a scale rarely seen in recent decades. Second, particularly in the economies most directly affected by the crises (i.e., the US, the UK, and the euro zone), policy rates effectively reached the so-called zero lower bound, that is, a threshold that could not be breached since 'negative' interest rates, even if feasible, are often deemed impractical. Finally, policy rates have remained at, or near their lowest levels, for at least three years; presently, there are few signs that central banks will raise policy rates in the near future.

In this environment, the central banks most affected had few options but to devise new instruments to help their economies recover as well as, arguably, relying more heavily on their policy statements to influence expectations of financial markets and the general public. The new monetary policy tools referred to as 'unconventional', together with greater reliance on verbal aspects of central banks actions, arguably complicated the communications strategy of central banks.

This paper considers whether one can detect a change in the language that five central banks have used to communicate their actions and elements of their outlook since the events of 2008. The environment of historically low interest rates, the introduction of a panoply of actions that served to loosen monetary policy even when the zero lower bound was reached, as well as fending off criticisms from both politicians and the

Figure 1. Central bank policy rates: RBA, BoC, RBNZ, BoE, and Fed



public about whether their policies would stoke future inflation, if not a renewed financial crisis, might be expected to conspire to create a change in the tone of central bank's verbal communications. Of course, this assumes that the shock of a financial crisis on a global scale would influence how central banks communicate their actions to the public. Yet a case can also be made that, to avoid the appearance of panic or an inability to comprehend the seriousness of the situation, as well as convey competence and an aggressive response to the severe economic shock affecting the major advanced economies, central banks may well have chosen to follow a 'steady as she goes' approach in their communications practices. Such a view might be taken as consistent with a more strategic view of central bank behavior wherein the central bank prefers not to fully divulge the underlying truth about the state of the economy as a device to influence expectations in the direction of ending crisis conditions that may pervade thinking, say, in financial markets.

Finally, while the crises had a global dimension, it should be underscored that not all faced the predicament that afflicted, say, the US Federal Reserve or the Bank of England. Several central banks in the industrial world did not engage in unconventional monetary policies nor were unorthodox interventions necessary. Examples include the Reserve Bank of Australia, the Bank of Canada, and the Reserve Bank of New Zealand. Moreover, not all central banks face the same zero lower bound restriction on policy interest rates that currently constrain interest rate actions by the Federal Reserve or the Bank of England. Hence, the 'verbal' instrument in monetary policy might well have taken on a more prominent role in economies subject to the crises the world has endured since 2008.

The rest of the paper is organized as follows. The next section provides some background concerning the role and functions of central bank communication as well as some illustrations of the principal means used to convey monetary policy actions and the stance of policy. Next, the data are described and some stylized facts are presented. The DICTION software is used to generate indicators of changes in the language used by central banks before and since the crisis erupted in 2008. Finally, some simple econometric evidence is presented to examine whether a change in emphasis in monetary policy announcements can be statistically related to a set of macroeconomic determinants. The paper concludes with a brief discussion of the implications from the empirical analysis.

1. CENTRAL BANK COMMUNICATION TACTICS

Over the years, there have been steady improvements in the amount and type of information disclosed by central banks. As noted in the introduction this was, in part, a natural outcome of the autonomy given to central banks as well as a clearer understanding of where accountability for monetary policy decisions lies.

The U.S. experience, for example, is one that is mirrored elsewhere and serves as an illustration of developments that spread around the world since the 1990s. First, central banks began to announce their policy rate decisions immediately, or very soon after, a decision was taken. In the Fed's case, this took place in 1994. In 1997, the Fed began to provide a numeric value for the 'intended' fed funds rate, the policy rate set by the Federal Open Market Committee (FOMC). By 1999 the Fed began to announce, at the time of the press release announcing its policy decision, a 'bias' to provide some guidance for markets and the public about the direction in which the stance of monetary policy was leaning. In 2000, the 'bias' in the policy statement was replaced with an expression of the 'balance of risks'.

More explicit reforms aimed at providing forward guidance about monetary policy actions were spurred, first, by the aftermath of the bursting

of the 'tech bubble' when, in 2003, expressions indicating 'accommodation [in monetary policy] for a considerable period' began to appear in the FOMC's press releases. This would be followed later, at the height of the 'global' financial crisis, by statements indicating that the fed funds rate would remain 'exceptionally low for an extended period of time'. In addition to the various policy actions taken since 1999 to restore the health of the U.S. financial system, and the economy more generally, called quantitative and credit-easing policies, the Fed announced a medium-term inflation objective in 2012, followed by improvements in how the Fed portrays the views of FOMC members about their outlook for inflation and economic growth as well as indications about when the fed funds rate might escape from its current zero lower bound. At the beginning of 2012, the Fed announced a longer-run goal of 2% inflation. Finally, at the end of 2012, the Fed explicitly began to indicate that it would respond to unemployment rate levels, among other economic indicators, before deciding when to exit from the current extraordinary macroeconomic environment.

Changes in the manner in which central banks communicate and the language used was not necessarily as dramatic elsewhere. In some countries (e.g., Australia, Canada, and New Zealand) policymakers stuck with their policy of 'flexible' inflation targeting while seemingly not encountering the same economic effects of the financial crisis as in the U.S. Others, such as the Bank of England, faced the twin crises of financial system instability and inflation rates that regularly exceeded the mandated target. The response to the first crisis was to introduce quantitative easing (QE), that is, measures to further loosen monetary policy when policy rates were near or at the zero lower bound, while the second required the publication of letters, on a regular basis to the Chancellor of the Exchequer (Britain's Finance Minister) explaining why the inflation target was missed and providing assurances that the agreed upon goal for inflation would eventually be met.

Not surprisingly, research into the benefits, costs, and consequences of central bank communication has spawned a new literature that continues to grow over time. Policy makers themselves came to see communication as having practically the same importance as the policy rate decisions made by central banks. As Bini Smaghi (2007), a former member of the Executive Board of the European Central Bank (ECB), noted: "…central bank communication can be as important and effective as the traditional instrument of policy, i.e. the interest rate."

Words, however, as opposed to actions (e.g., a change, or not, in the policy rate) creates at least two sets of challenges. First, communication must be clear to be properly understood. Second, to be effective, communication must support and convince markets and the public about the central bank's thinking. It should only 'surprise' markets when expectations, at least in the minds of the policy makers, are seriously misaligned with prices and other indicators in financial markets and the economy more generally. Not only are these challenges difficult to meet but, in the mere two decades since central bank communication became a critical part of central banks' monetary policy strategy, there has understandably been, and continues to be, a considerable amount of experimentation, a point recently underscored by Yellen (2012), Vice-Chair of the FOMC.

In the realm of economic research on the role and influence of central bank communication, two different strategies have been followed. Some authors (e.g., Dale et.al. 2011) ask whether the impact of central bank communication is determined by the ability of the public to assess the 'quality' of signals emanating from the monetary authority. Clearly, this will be a function not only of clarity but potentially of the quantity of information provided. Therefore, a central bank ought to be concerned about how precisely it communicates, lest too much communication becomes detrimental in welfare terms.[1] In other words, central bank communication needs a strategy much like the

adoption of a particular monetary policy must be thought through in strategic terms.

Results, such as the ones described above, are obtained from stylized economic models rather than relying on examples or empirical evidence. Other results in this vein rely on micro-founded models with or without rational expectations, and these too suggest that information accuracy is a critical element in successful central bank communication because it offers the best way to align the public's expectations with the actual monetary policy strategy being implemented (e.g., see Eusepi and Preston 2010). Therefore, a mere declaration that the central bank will, henceforth, target inflation, is not enough to prevent monetary policy from being de-stabilized. It should be noted, however, that many such models omit a specific financial sector and offer no guidance about how best to combine the various strands of central bank communication activities.

A separate strand of research is empirical in nature and consists of quantifying in a number of ways not only what central banks say (e.g., in press conferences) and write (i.e., policy statements, Reports of various kinds) but also how the media respond to central banks attempts to explain themselves. A few examples serve to illustrate this kind of research: Bulíř et.al. (2012) are interested in the clarity of central bank communication, which is assumed to be a function of the economic environment. The more uncertain the outlook the more difficult it is to clearly communicate, it is claimed. If the hypothesis seems plausible, it is far from obvious why overall economic uncertainty should make clarity more difficult. First, central bank communication is not exogenous. Central banks, as the U.S. experience for example clearly illustrates, adjust their thinking about communication when the underlying economic environment changes. This could well be an attempt to ensure that clarity is maintained. Second, clarity is about the content of the message and there is no reason why this should be held constant as the economic outlook becomes more uncertain. In any event, the authors conclude, based on data from Chile, the U.K., the Czech Republic, the ECB, Poland and Sweden, that clarity does not suffer when the outlook becomes more uncertain. However, they also report that the level of understanding required to interpret central bank communications has increased since the onset of the global financial crisis.[2]

Next, a series of papers attempt to interpret the textual material produced in several forms by central banks, code the results, usually in the form of a dummy variable that may or may not be ordered, to ask whether markets are moved by these attempts by central banks to communicate. Excellent examples of this kind of research include Ehrmann and Fratzscher (2007, 2009), and Berger, Ehrmann and Fratzscher (2010). Essentially, the aim is to ask how a perceived tightening or loosening of policies, as interpreted either by the central bank or certain media outlets, might affect, say, selected asset prices (e.g., stock returns, market interest rates).

For the major central banks (e.g., the ECB and the Fed), the overall evidence points in the direction of both improvements and greater effectiveness in central bank communication in recent years. To be sure, there are differences according to whether monetary policy decisions are carried out in a collegial or individualistic manner. For example, the Fed's FOMC members individually communicate their own views while policy decisions tend to be made in a more collegial atmosphere. The reverse seems to be true at the Bank of England, where members of the Monetary Policy Committee are individually accountable for their actions. With very few exceptions, however (see Bligh and Hess (2013), and e.g., Born, Ehrmann, and Fratzscher (2013), and some sources therein), content analysis of the kind developed by DICTION is not used. Instead, an automated procedure, possibly combined with researchers' interpretation, serves as the basis for quantifying central bank or media releases. Tudor and Vega (in this volume) review a small sample of papers that create quantitative

indicators based on qualitative data and report that, while extremely useful, several problems need addressing. First, the appropriateness of the dictionaries used to create content-type indices is an important question since Loughran and McDonald (2011) demonstrate that some words that may have a negative connotation in one context may be neutral in others. Moreover, whereas some words that might evoke positive or negative sentiment in a general context, are included in standard dictionaries used in content analyses, more recently used terms that have proved important might well be left out as they are uncommon. Arguably, however, a crisis can bring out the usage of new terminology to describe a particular stance or situation.

The bottom line to date, as far as central bank communication is concerned, has produced a consensus of sorts. First, improved predictability in policy has served to raise the effectiveness of monetary policy. Nevertheless, there are a number of potential pitfalls in how much, how frequently, and what information central banks communicate to the public. In particular, when it comes to forward guidance, it appears to be important for the central bank to explain the contingencies of any commitments made about the future stance of policy (e.g., Woodford 2005). This seems to be a lesson that the Fed, as well as other central banks, have tried to take to heart.

More generally, however, research on central bank communication is at a sufficiently early stage so that there remain many issues for future work (e.g., see Blinder et al. 2008). For example, the issue of 'best practice' in central bank communication is largely an unsettled question. The matter is further complicated by the adoption of new central bank instruments and the rise in the number of functions and responsibilities handed over to them in the aftermath of the ongoing crises (e.g., see Born et.al. 2010, Siklos 2012). In addition, there are wide varieties of effects from central bank pronouncements on financial markets. Finally, we are still a long way from understanding how central bank communication can anchor expectations and we are unsure about the role played by institutional considerations in determining how and when central bank communication can be effective.

2. DATA AND ECONOMETRIC SPECIFICATION

Data and Some Stylized Facts

In what follows the author investigates econometrically, at the quarterly frequency, the information content of press releases that accompanies a monetary policy decision, using DICTION, version 6.0. The sample considered is 2003-2012 and five English- speaking central banks are examined. Stylized facts, however, are presented at the monthly frequency.[3] They are: Australia, Canada, New Zealand, the U.K., and the U.S.[4] In addition, three of these countries' central banks, namely, Australia, the U.K., and the U.S., publish the minutes of monetary policy committee meetings. We consider these as well not only because minutes possibly offer deeper insights into the thinking of the individual members of the policy making committee, while the press release is a consensus style document. Moreover, the length of the minutes provides additional material that could be helpful in delineating how central bank communication may have changed over time and between types of published statements. It should be noted that members of the policy committees of central banks where minutes are published are aware that their thinking will be made public although the comments are not always attributed to individuals. Hence, it is likely that the choice of words will play a critical role in what is published.[5]

The contents of press releases and minutes are analyzed according to whether they contain words that convey information about the central bank's concern about the 'stance' of monetary policy, the state of 'financial stability', the level

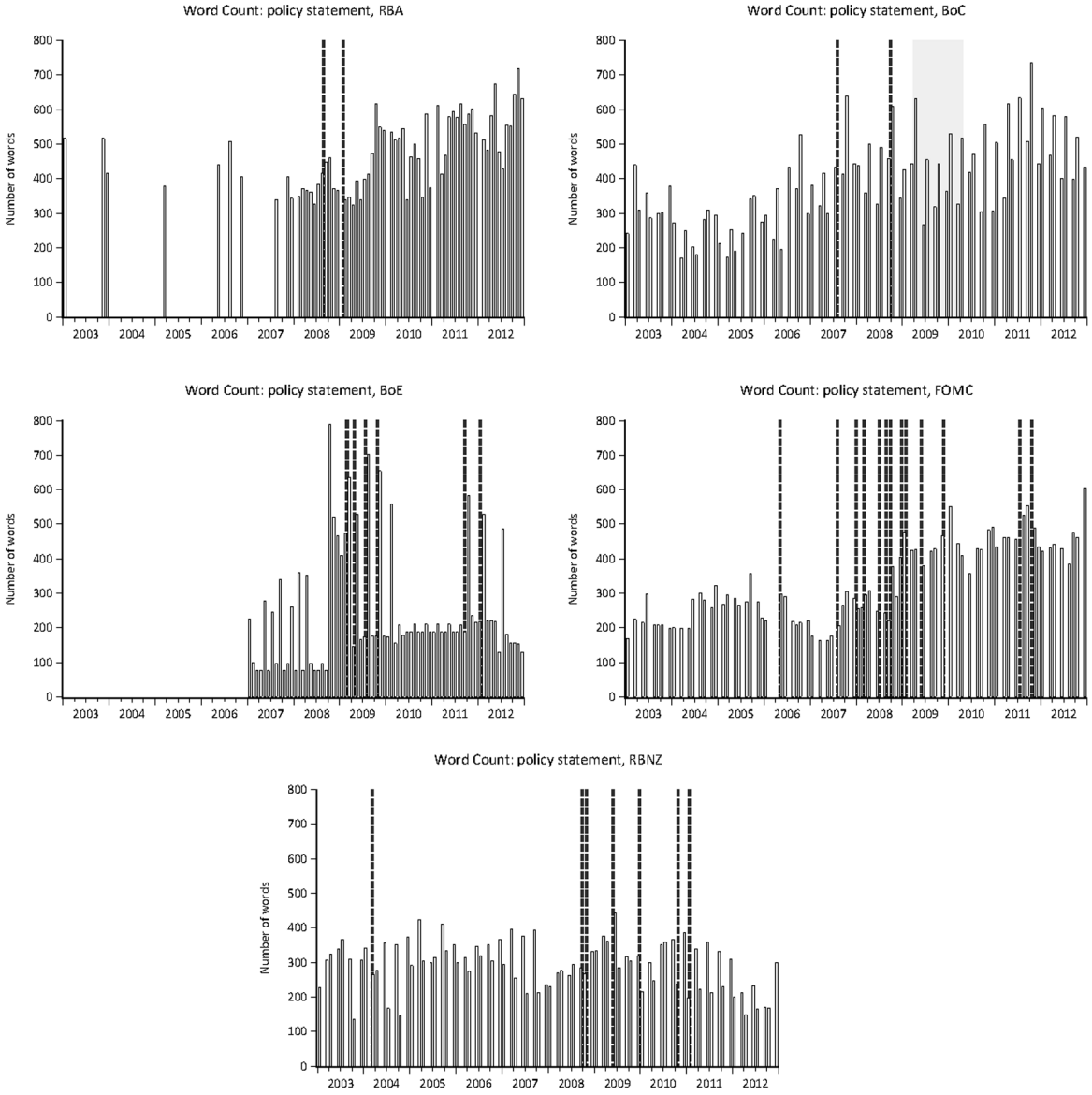
of 'uncertainty' the central bank is admitting to facing about the economic outlook, as well as an indicator of how 'strong' (i.e., aggressive) its monetary policy actions are. The latter was constructed as a sub-set of the indicator of uncertainty. Additional words were added to the dictionary both to ensure that content is adequately measured as well as in recognition that not all aspects of central bank 'speak' may be captured by the DICTION dictionaries. Examples of words that convey the stance of monetary policy are: accommodative, easing, or tightening; for financial stability the relevant words include credit, financial, liquidity, quantitative, unorthodox, stability; uncertainty is conveyed by words such as: crisis, exceptional, headwinds, imbalances, recession (or depression), risk, sluggish, and stress. Turning to strong language, words that are consistent with this sentiment include: crisis, exceptional, recession (or depression), and stress.

It is straightforward to provide some illustrations linking central bank statements and the keywords used to classify them in the manner just described. For example, on 6 November 2008, the Bank of England (BoE) lowered its policy rate from 4.5% to 3%, which constitutes a very large reduction in this kind of interest rate. In the press release that accompanied the statement, the BoE points out that their action was in part justified because "…money and credit conditions have *tightened* considerably."[6] On February 5, 2013, the Reserve Bank of Australia (RBA) did not change its policy rate but goes on to point out in the press release explaining the decision that "[D]uring 2012, there was a significant *easing* in monetary policy…an *accommodative* policy is appropriate." Both statements pertain to an evaluation of the stance of monetary policy. The following two statements from the Bank of Canada (BoC) refer to words associated with uncertainty. In both cases, the policy rate did not change. On June 4, 2009, the BoC stated that "The outlook is subject to considerable *uncertainty*." In January 2013, the BoC's statement suggests that "…global tail *risks* have diminished." Turning to wording that relates to financial stability is an example from statements released by the FOMC of the U.S. Federal Reserve (FED). The policy rate was reduced by 50 basis points. The statement, announcing a reduction of the fed funds rate from 3.5% to 3%, on September 18, 2009, argues that "[F]inancial markets remain under considerable *stress*." Finally, to capture words that indicate a strong or aggressive response to the underlying economic environment, consider the following statement made by the Reserve Bank of New Zealand (RBNZ) on 29 January 2009, announcing a 150 basis point reduction in the policy rate from 5% to 3.5%: "The global economy is now in *recession* and the outlook for international growth has been marked down considerably."

Figure 2 plots the word count of press releases for each of the five central banks considered in this study while Figure 3 repeats the exercise for the three central banks, namely the RBA, the BoE, and the FED, which release minutes of their policy meetings, with a lag that varies but which has become shorter over time. The RBNZ and the BoC do not release minutes because their respective Governors are the sole decision-makers. Nevertheless, the Governors at these central banks do consult with other senior officials in their institutions (e.g., with Deputy-Governors).

The number of words accompanying RBA policy rate decisions has grown steadily over time since 2003. The plot reflects the fact that, until 2008, statements did not accompany all interest rate decisions. Similarly, the word count of policy statements of the Bank of Canada has also risen over time, although there are clear in-year variations. Notice that the word count that accompany decisions by the Monetary Policy Committee of the BoE is similar to that of the RBNZ, the total word count of press releases by the other central banks shown is almost twice as large. Also notable, in the case of the BoE, is that the word count tends to rise when the BoE announces not only an interest rate decision but, since 2008, when a decision

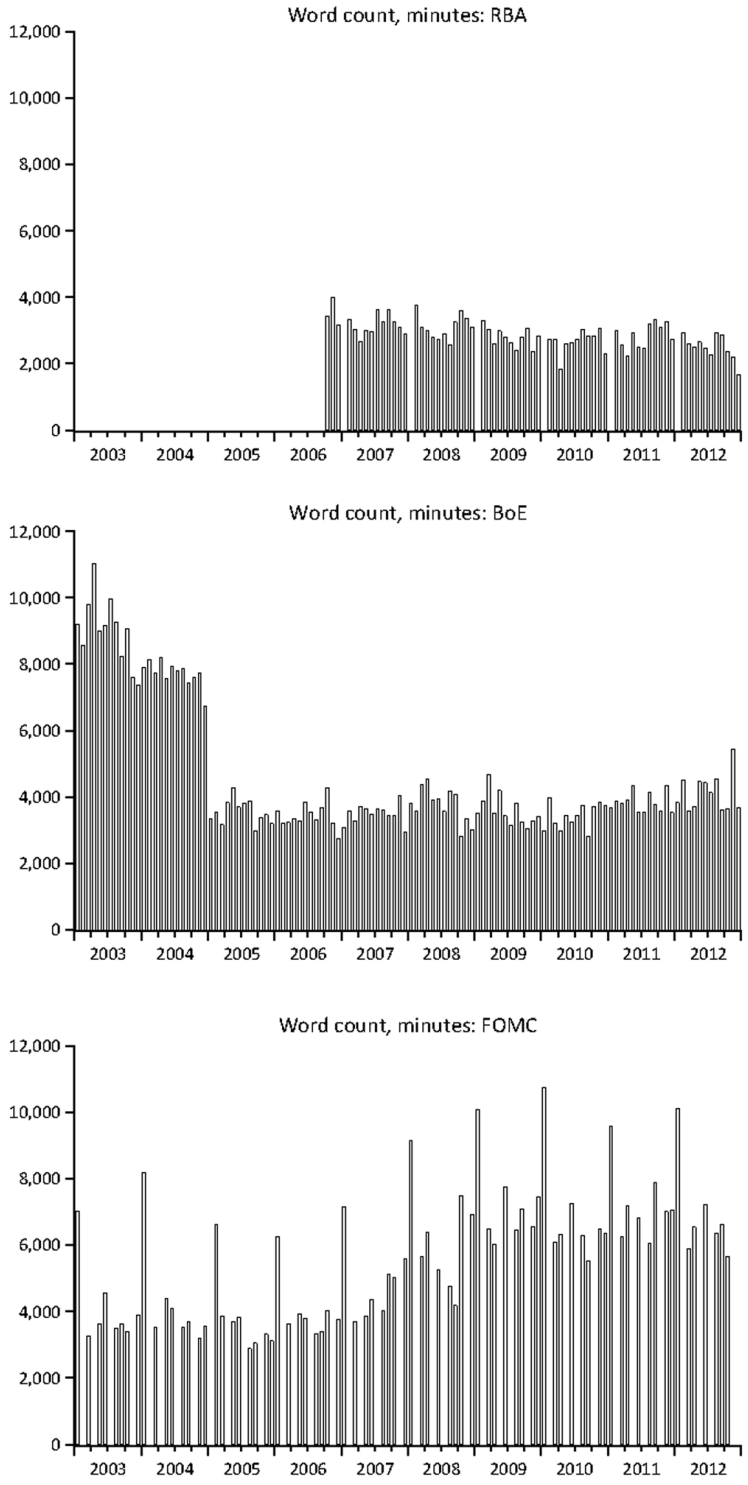
Figure 2. Word count of press releases



about a change in the degree of quantitative easing (QE) is also announced. The vertical dashed lines indicate the relevant cases. Similarly, the Figure also identifies specific episodes when the length of the statement that a central bank issues might be influenced by an additional announcement of some kind. For example, between April 2009 and April 2010, the BoC made a conditional commitment to hold rates at their zero lower bound (see Figure 1) for one year.

Figure 3 displays the word count for the minutes of policmaking committees. Interestingly, and with few exceptions, their length is comparable across the three central banks, in spite of differences in size and structure of the various policy-making bodies. The apparent spike in the word content of

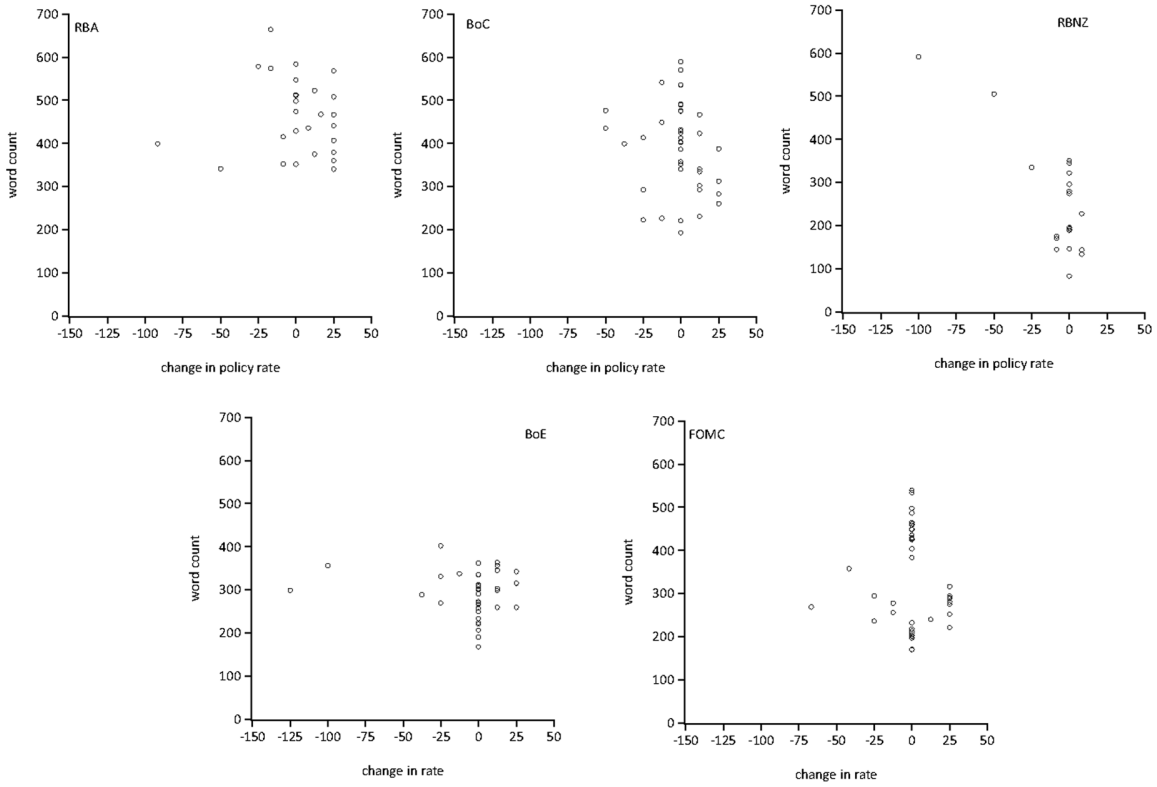
Figure 3. Word count, minutes of policy committees



FED minutes in January reflects the fact that, at the beginning of each calendar year, the FOMC must make a number of authorizations (e.g., open market operations, foreign exchange transactions). Moreover, the January FOMC meeting was scheduled over two days (as is true of the June meeting) and, until recently, the remainder of scheduled FOMC meetings were typically one day long.[7] Another distinguishing characteristic of the recent U.S. experience is the number of 'unscheduled' meetings. Over the 2003-2012 period there were 13 such unscheduled meetings. The minutes of these meeting are typically appended to those of the next regularly scheduled FOMC meeting.

It could be argued that the policy rate decision and the accompanying statement are complements, not substitutes. This is clearly true in some cases. However, as shown in Figure 1, policy rates have been at historic lows for years, if not at their zero lower bound, for years. Hence, it is likely that the content of such press releases have taken on an importance on their own as a critical signal of the near term direction of monetary policy. As shown in Figure 4, there is no obvious connection between the size of changes in central bank policy rates and the content of press releases, as measured by word count. As pointed out above, this has happened in spite of the fact that press releases have grown somewhat longer over time. The most dramatic illustration is, again, the FED's experience. The FED, like the BoE, sharply reduced the policy rate as the financial crisis gathered pace. The working hypothesis is that, while central bankers chose to respond to the extraordinary events since 2008, in part by explaining at greater length what they were doing and why, they may well have chosen to focus on the content of the statement published after a monetary policy decision. Obviously, this is an empirical question.

Figure 4. Word count-policy rate change trade-off



Hence, in Figures 5 and 6, indicators of the content of policy statements and minutes are shown for each central bank examined in this study. To conserve space the data for all central banks are shown together. The height of each portion of the bar charts gives an indication of the relative importance of the content of press releases or minutes that have been chosen for examination.[8]

If we are only interested in the relative importance of each indicator, then it is clear that content dealing with financial stability dwarfs other concerns central banks were willing to make public. It is equally notable that this result holds for both the policy statements and policy meeting minutes. To the extent that the latter is a reflection of the policy-making bodies true concerns about the state of the economy and their future outlook, the policy statements fairly reflect the committee's opinions. Of course, a slightly more cynical view would recognize that members of the policy-making body, aware that the minutes will be published in some form, are careful to choose what they say and how to express their opinion in the policy-making committee. An additional filter not considered here, and one that could not be implemented in all cases where minutes are published, would be to consider the individual committee members' statements in the minutes. This extension is left for future research.

A fairly close second concern of the central banks in our study is uncertainty. This too is not surprising, especially in light of the events of the past five years. Nevertheless, content that pertains to uncertainty is not as consistently expressed in the policy statements, as it appears to be the case in the minutes. Hence, there may well be substan-

Figure 5. Content indicators: Central bank press releases

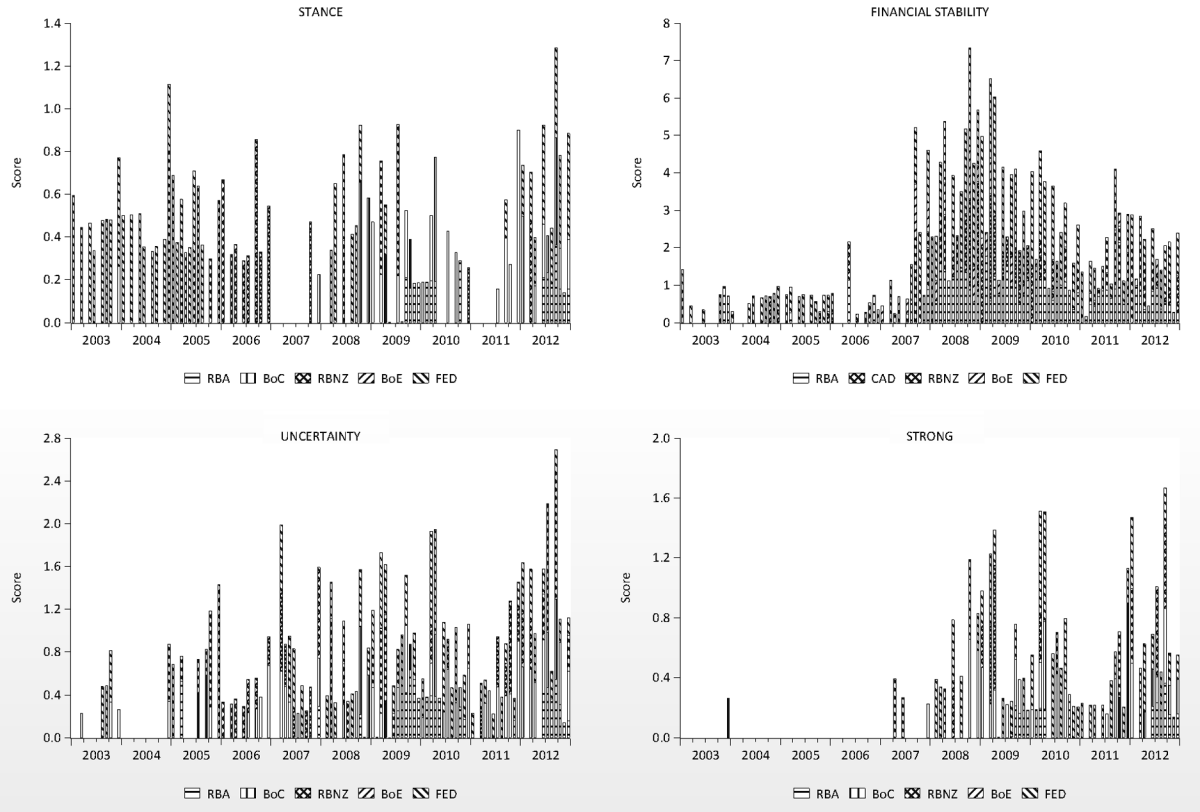
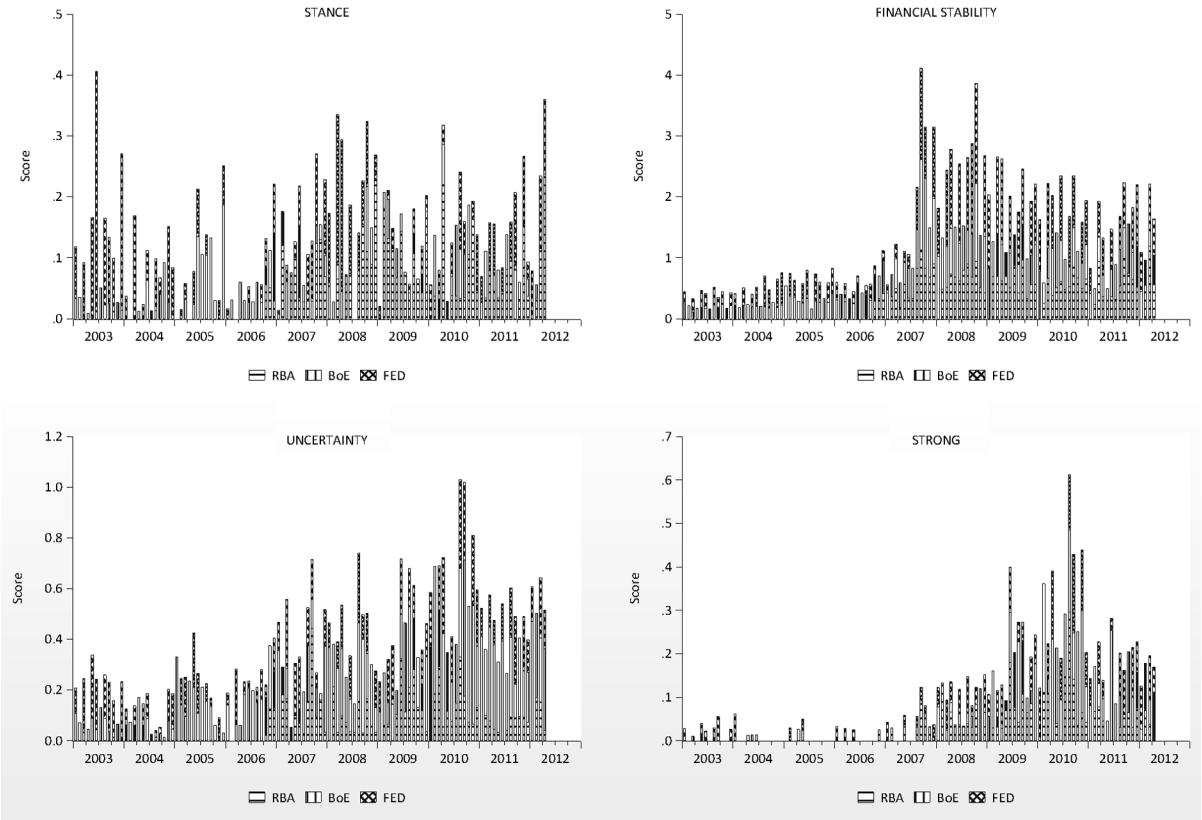


Figure 6. Content indicators: Central bank policy committee minutes



tive differences in the information conveyed in the minutes relative to those that appear in the press release accompanying each policy rate decision. Similarly, there seem to be persistent differences between policy statements and minutes, when it comes to conveying the accommodative stance of monetary policy. Moreover, it is interesting to note that, in most cases, the content of policy statements that relate to policy easing in some form peaks at the height of the financial crisis and then tends to either decline or disappear altogether, presumably in favor of signaling some of the other concerns of policy-makers.

Since the press release issued by a central bank may be likened to a consensus view of the members of a policy-making body, it is interesting to ask, in very general terms, to what extent sentiment in the minutes is reflected in the press releases. One way to address this question is to examine the simple correlation coefficient between these two documents, at least for the three central banks in our study where minutes are available. Similarly, one might expect some of the particular word choices focused on in the period under investigation to be more likely to appear in the same document. In other words, we might expect that concerns over economic uncertainty and, say, financial stability are likely to appear more frequently together than in a random manner. Moreover, it may be of interest to determine whether these types of correlations are sensitive according to whether the economy in question was in crisis or not. In selecting the crisis dates, the dating chronology of Dominguez, Hashimoto, and Ito (2012) has been followed.

Table 1A presents the relevant correlations. In the case of the FED's press releases, all four types of sentiment variables (i.e., stance, financial stability, uncertainty, and strong) are significantly correlated with each other as between press releases and the FOMC's published minutes. Only financial stability and the stance of monetary policy in the press releases and the minutes of the RBA are correlated, while financial stability and the aggressiveness with which statements convey current monetary policy actions are correlated in the case of the BoE.

Turning to the press releases only, the only significant term, before and during the crisis in all five central banks examined, that is correlated with all the other expressions of sentiment is uncertainty. Financial stability and uncertainty are correlated in the case of the FED and the BoE but the correlations largely vanish in the other central banks considered. Of course, the financial crisis directly affected both of these central banks to a greater extent than the others examined here. Finally, once the crisis is underway, the correlation between the stance of monetary policy and any of the other sentiments that might be associated with the crisis, disappears entirely as none of the correlations shown are statistically significant.

Of course, a natural criticism of the correlations is that the dating of the crisis was given and the data were not allowed to speak for themselves. Therefore, Table 1B asks: to the extent that central banks consistently use similar terms over time to convey their views about monetary policy, what would a simple test of a break in such a relationship find? To answer this question, an autoregressive model of order one (i.e., AR(1)) has been estimated and the Quandt-Goldfeld breakpoint test has then been employed.[9] The estimated specification can be written as follows

$$C_t^i = \rho_0 + \rho_1 C_{t-1}^i + \upsilon_t$$

where C^i is the content indicator, with i=1,4, to indicate that four separate indicators, previously defined, are considered. As expected, only the FED and the BoE's statements show any signs of a structural break in the above relationship and, in almost every case, the break takes place during the period of the financial crisis.

Econometric Analysis

In what follows, a very simple specification is considered, namely

$$C_t^i = \alpha_0 + \alpha_1 \mathbf{Z}_t + \varepsilon_t \qquad (1)$$

where C^i was defined above. The vector $\mathbf{Z}$ indicates the economic or institutional variables that are hypothesized to determine the content of policy statements and minutes. These include the following: a measure of the output gap, the inflation gap, the size of the accompanying change in the policy rate, a measure of the return on equities, a widely used measure of economic uncertainty, namely the VIX, and a real exchange rate indicator. For the small open economies in our data set, that is, Australia, Canada, and New Zealand, we also consider a commodity price indicator. Finally, some institutional determinants are permitted to separately influence the content variable. Thus, in the BoE's case, we consider the impact of the policy of quantitative easing (QE). In the case of the FED, we consider the role played by unscheduled meetings of the FOMC. Finally, in the BoC's case, we consider the period of the conditional commitment (April 2009-April 2010). All of these institutional variables are introduced as dummy variables, set to 1 when an event takes place (e.g., an increase in QE, or an unscheduled policy meeting) and zero otherwise.

A number of assumptions have to be made to justify a specification such as Equation (1). First, since the specification is estimated separately

Table 1. Some summary statistics: Central bank press releases, minutes, and structural breaks

A. Simple correlations: Press Releases and minutes					
Central Bank		**Content**			
		Stance	**Financial Stability**	**Uncertainty**	**Strong**
FED		.51 (.00)	.89 (.00)	.65 (.00)	.84 (.00)
RBA		.44 (.01)	.78 (.00)	.36 (.03)	.23 (.17)
BoE		-.06 (.72)	.68 (.00)	.08 (.61)	.34 (.04)
Content	**Central Bank**	**Stance**	**Financial Stability**	**Uncertainty**	
Financial Stability	FED	-.15(.34) -.02 (.94)			
	BoC	.31 (.05) .17 (.47)			
	RBA	.48 (.00) .10 (.67)			
	RBNZ	.18 (.25) .10 (.67)			
	BoE	.46 (.00) .50 (.02)			
Uncertainty	FED	-.29 (.07) -.36 (.11)	.52 (.00) .42 (.07)		
	BoC	-.00 (.98) -.30 (.20)	.49 (.00) .37 (.11)		
	RBA	.21 (.19) -.02 (.95)	.34 (.03) -.07 (.77)		
	RBNZ	.27 (.09) .04 (.86)	.12 (.48) -.03 (.89)		
	BoE	.50 (.00) .43 (.06)	.78 (.00) .91 (.00)		
Strong	FED	-.20 (.21) -.11 (.66)	.69 (.000 .32 (.17)	.79 (.00) .87 (.00)	
	BoC	.09 (.59) -.19 (.43)	.69 (00) .62 (.00)	.71 (.00) .74 (.00)	
	RBA	.16 (.33) -.10 (.42)	.25 (.12) -.26 (.27)	.88 (.00) .89 (.00)	
	RBNZ	-.14 (.38) .17 (.47)	.21 (.19) .06 (.80)	.54 (.00) .80 (.00)	
	BoE	.28 (.09) .20 (.45)	.38 (.02) .40 (.08)	.59 (.00) .54 (.00)	
Note: p-values are given parenthesis. The dating for the crisis period is from Dominquez, Hashimoto, and Ito (2012). Data are quarterly.					

continued on following page

Table 1. Continued

B. Structural breaks in an AR(1) model of content terms			
Content	**Central Bank**	**Date of Break (if any)**	**# Breaks Considered**
Stance	FED	none	28
	RBA	none	11
	BoC	none	11
	RBNZ	none	20
	BoE	2009Q3	26
Financial Stability	FED	2009Q1	28
	RBA	none	28
	BoC	none	28
	RBNZ	none	28
	BoE	2006Q1	26
Uncertainty	FED	none	28
	RBA	none	20
	BoC	none	28
	RBNZ	none	20
	BoE	2008Q1	26
Strong	FED	none	15
	FED	none	7
	FED	none	28
	FED	none	17
	FED	2009Q3	26

Note: The individual cells show the simple correlation between the content term in the column and the term in the first row. In the bottom part of the table the first correlations for the full sample (i.e., 2003-2012) while the second correlation applies to the period of the financial crisis. The dating of the financial crisis is from Dominguez, Hashimoto, and Ito (2012). The AR(1) model in part B regresses each of the 4 content terms (stance, financial stability, uncertainty, and strong) on a constant and one lag. The break test is the Goldfeld-Quandt test and the date shown indicates a structural break in that quarter. The total number of breaks considered in the test is given the last column. Data are quarterly.

for each content indicator these are effectively assumed to be independent of each other. There is no reason why this has to be the case, although the evidence presented in Table 1A, at least for the press releases, suggests few difficulties stem from this assumption. Nevertheless, owing to the relatively short samples considered, we eschew these complications one leaves them to future research.

A second assumption of the proposed specification is that the right-hand=side determinants of content are exogenous. While it is reasonable for the content of central bank policy statements and the minutes of the policy making body to respond to the state of the economy and the other determinants described above, it is also worth considering the possibility that content is fashioned in such a way as to minimize the economic impact of any central bank announcement. After all, central bankers have repeatedly underscored their determination to inform and not 'surprise' markets. Therefore, there is an element of endogeneity in some of the right-hand side variables in (1). Extension to the case where the extent of the endogeneity is tested and corrected, where necessary, is also left for future research.

Finally, since the length of policy statements and minutes is finite, and the content indicators previously defined are also limited to between 0 and 1, the latter indicating that 100% of the content of the particular document being analyzed is associated with the particular indicator considered, it is natural, when estimating (1), to view the dependent variable as being censored on the left (i.e., to zero or 0%) and on the right (to 1 or 100%). Therefore, Equation (1) is estimated via Tobit.[10]

Taken together then the results presented in the following section should be viewed as illustrative rather than definitive.

3. EMPIRICAL RESULTS

Table 2, provides the main results of interest. Only the results when C_t^i is proxied by the policy statements are displayed. The same right=hand-side variables are used for each content indicator considered. If a particular variable is not included, it was found to be highly statistically insignificant in a previous round of estimation.

First, all content indicators respond to key macroeconomic variables of interest. This suggests that, during the period investigated, policy statements convey the concern the various monetary authorities expressed over financial stability, uncertainty, the stance of monetary policy and the aggressiveness of central bank language used in press releases. Clearly, since the period being investigated is dominated by the twin crises that originated in the U.S. and the euro zone, this is not be surprising.[11] Nevertheless, the results do point to the usefulness of content analysis as a way of highlighting the role of words, and not only actions, in the conduct of monetary policy.

Next, it is interesting to see that changes in the policy rate have relatively little effect on most of the content indicators. Nevertheless, when central banks take action, such as reducing the policy rate – the usual outcome during the sample considered – this is always an indicator of rising uncertainty about the future outlook, or heightened concern over financial stability questions. Only in the case of the RBA and the RBNZ does a rise in the policy rate signal a less accommodative stance, or vice-versa. Notwithstanding the peculiarities of the era under investigation, the results do tend to point in the direction of policy rate changes complementing the content of policy statements where these were found to be statistically significant. In other words, actions may speak louder than words but, for the most part, the central banks in our sample also use the opportunity of the press release to underscore the reasons for a change in the policy rate.

Table 2. The determinants of indicators of central bank communication, 2003-2012

	Indicators of Central Bank Communication				
Central Bank	**Independent Variables**	**Stance**	**Financial Stability**	**Uncertainty**	**Strong**
RBA N=25	Output Gap	.07 (.06)	.54 (.15)*		
	Inflation Gap	.25 (.06)*	.48 (.08)*	-.26 (.09)*	-.61 (.27)**
	Policy Rate Change	-.63 (.53)	.32 (.56)	-.76 (.30)*	
	VIX (or FCI)	-.02 (.01)***	-.003 (.01)		-.01 (.01)
	Real Exchange Rate	-.01 (.02)	.002 (.02)		
	Equity Returns	-.01 (.01)	-.003 (.004)	.01 (.004)*	.01 (.003)**
	Commodity Prices	.01 (.01)	.01 (.01)	-.01 (.01)*	
	QE or Cond. Comm.	.13 (.13)	.39 (.13)*		.10 (.04)**

continued on following page

Table 2. Continued

	Indicators of Central Bank Communication				
Central Bank	**Independent Variables**	**Stance**	**Financial Stability**	**Uncertainty**	**Strong**
BoC N=34	Output Gap	-.45 (.23)***	.26 (.09)*		
	Inflation Gap			-.16 (.07)**	-.44 (.16)*
	Policy Rate Change	.66 (.34)**			.52 (.30)***
	VIX (or FCI)		-.13 (.06)**	.18 (.07)*	.10 (.07)
	Real Exchange Rate	.03 (.01)**		.02 (.01)*	-.01 (.01)
	Equity Returns	-.05 (.02)*	-.01 (.005)	-.01 (.01)**	-.03 (.01)*
	Commodity Prices	.03 (.01)**	-.005 (.004)	.01 (.003)**	.01 (.005)**
	QE or Cond. Comm. SPREAD (S)	-.38 (.19)** -S	.64 (.19)* .09 (.07)	-.07 (.03)*	.30 (.17)*** .11 (.08)
RBNZ N=35	Output Gap	2.42 (1.48)***	0.2 (.01)*	.02 (.01)	
	Inflation Gap	-33.94 (36.75)	-.15 (.06)*	.42 (.26)	.002 (.001)**
	Policy Rate Change	-2.68 (.93)*			
	VIX (or FCI)	-1.43 (.62)**		-.01 (.004)**	-.0002 (.00009)***
	Real Exchange Rate		.01 (.01)**	-.004 (.003)	
	Equity Returns		-.02 (.003)*		-.0003 (.0001)*
	Commodity Prices				
	QE or Cond. Comm.				.0005 (.0002)**
BoE N=34	Output Gap	-.08 (.02)*	.09 (.05)**	-.30 (.11)*	-.20 (.08)*
	Inflation Gap	-.15 (.05)*	-.18 (.13)		
	Policy Rate Change	-.20 (.10)*	-.01 (.002)*		-.15 (.12)
	VIX (or FCI)		.01 (.01)		
	Real Exchange Rate	.002 (.003)	.01 (.01)	-.03 (.01)*	.002 (.01)
	Equity Returns		-.006 (.004)		
	Commodity Prices				
	QE or Cond. Comm.		-.67 (.29)**	-1..40 (.49)* .14 (.04)*	-.69 (.02)** .04 (.11)
FED N=35	Output Gap	.19 (.06)*	-.09 (.13)	-.01 (.06)	.05 (.05)
	Inflation Gap	-.05 (.06)	-.09 (.10)	.05 (.06)	-.01 (.04)
	Policy Rate Change	.40 (.22)***	-.89 (.43)**	-.45 (.13)*	-.0002 (.0001)**
	VIX (or FCI)	-.01 (.01)	.02 (.01)	.001 (.006)	.004 (.004)
	Real Exchange Rate	.0004 (.002)**	.0009 (.004)**	-.004 (.003)***	-.001 (.003)
	Equity Returns	-.01 (.004)**	-.02 (.01)*	.01 (.01)	.001 (.003)
	Commodity Prices				
	QE or Cond. Comm. SPREAD	.01 (.11) .21 (.06)*	-.06 (.17) .14 (.10)	.11 (.10) .06 (.06)	.07 (.06) .14 (.05)*

Notes: NA means not applicable; NS means not statistically significant and excluded from the generated results, and N is the total number of observations. Censoring is on the left and right, as explained in the text. Regressions were estimated via Tobit (logistic BHHH algorithm) and Huber-White robust standard errors. *, **, *** signifies that he coefficient is statistically significant at the 1%, 5%, and 10% levels, respectively. Data are quarterly.

Financial stability can be measured in a number of ways. While the content of policy statements can evoke something about the monetary authority's position on the subject, financial markets have also developed indicators of financial system stability, financial conditions indicators, or indicators of financial stress. In the latter case, the VIX is a widely used indicator of volatility in stock markets. Yet, there are a few indications from Table 2 that changes in the VIX have an impact on the content of central bank press releases. Only for Canada is a higher VIX associated with greater concerns over the state of uncertainty, while a higher VIX translates, somewhat counter-intuitively, to fewer concerns raised about financial stability.

Turning to the variables that define the standard instrument rule used by central banks, at least until the financial crisis drove some of them to reduce policy rates to the zero lower bound, it is found that both the output gap and the inflation gap have the greatest influences on the content of policy statements that reflect the central banks views about the stance of monetary policy.[12] Moreover, on balance, the output gap figures less prominently than the inflation gap as a variable influencing the content of central bank press releases. Notice, however, there is some heterogeneity in the results. For example, while a higher inflation gap is associated with a more accommodative stance in the BoE's case, the opposite is true at the RBA. Recall that the Governor of the BoE issued several letters indicating that the central bank would miss its inflation target while softening the stance of policy because of the financial crisis. The RBA, however, did not experience either a financial crisis or a recession during the period examined, so monetary policy acted as it normally would. Indeed, the RBA is one of the few central banks in the industrial world that raised policy rates.

Turning to the output gap, this variable seems to have the most impact on the stance of monetary policy, as expected. After all, the ubiquitous Taylor rule relates the inflation and output gaps directly to the stance of monetary policy. Nevertheless, here too there are cross-country differences. For example, while a negative output gap (i.e., output below trend) signals a looser stance in policy, at least as conveyed in the words of press releases from the FED and the RBNZ, monetary policy is seen as tightening somewhat at the BoC and the BoE. Since the data used to generate estimates of the output gap in this study were revised, it is conceivable that relying on the actual data that central banks had at their disposal might lead to different results. Alternatively, taken at face value, the behavior of the BoC and the BoE goes against the principles of the Taylor rule view of how policy rates should be set.

Finally, it is clear that the episodes of quantitative easing by the BoE and the period of the conditional commitment at the BoC impact content about financial stability. Indeed, in both cases, the events in question point to these two central banks expressing greater concerns over financial system stability. At the same time, however, QE and the BoC's conditional commitment policy are associated with less content dealing with economic uncertainty. Hence, it is possible that these policies were able to focus attention on certain challenges facing central banks as reflected in the contents of some of their public statements. Clearly, a policy meant to convey less uncertainty might naturally raise concerns about the state of financial system stability. In addition, in the case of the BoC, the period of the conditional commitment signals stronger language about the direction of monetary policy while, at the BoE, QE results in the content of its press releases relying on less aggressive language. In the BoC's case, the strong language could be viewed as reflecting the BoC's desire to return inflation to target during a spell or low to negative inflation. In the BoE's case, QE was intended to convey a signal of more aggressive monetary easing, an example of actions being stronger than words. This seems to corroborate the view that actions, combined with strong language conveying the central bank's views about policy actions being taken, complement each other.

4. CONCLUSION

This paper has examined whether the language used by five central banks has changed since 2003, to reflect, among other questions being considered, more concern about financial stability and uncertainty about the economic outlook. The paper also considers the extent to which central banks signal the stance of monetary policy as well as the strength of the language used in communicating with markets and the public. The sample considered is from 2003 to 2012, and policy statements and minutes, where available, of central bank policy committees are considered. The five central banks examined are: the Reserve Bank of Australia, the Bank of Canada, the Reserve Bank of New Zealand, the Bank of England and the U.S. Federal Reserve.

I find that central banks in all the countries considered began to display much greater concern about the need to convey a message about the state of financial system stability and also about the level of uncertainty of the economic outlook in their respective economies. Relatively less effort is devoted, however, to communicating the stance of monetary policy or in the aggressiveness in the wording about economic conditions in policy statements. A simple specification is then used to determine whether there exists a statistical connection between the content of central bank statements and a series of macroeconomic, financial and institutional determinants. It is found that all of these types of variables significantly explain central bank communication about financial stability and uncertainty. Moreover, central banks in most of the countries considered appear responsive to some developments in asset markets and financial conditions more generally, to commodity prices, and to the standard determinants of central bank interest rate rules, namely output and inflation developments. Finally, central bank statements tend to reflect the view that these serve, in part, to complement changes in policy rates as well as the introduction of 'unorthodox' policies such as quantitative easing or conditional commitments on policy rates.

In spite of these results, there are several ways in which the specifics of this paper can be improved. For example, the content indicators are examined separately whereas, in reality, the content of central bank releases likely reflects a balance among several competing indicators. Second, some of the determinants of content may not be exogenous. Third, it is likely that the content of meetings of minutes differs from that of policy statements. Hence, a deeper investigation of the relative information content of the two types of releases is likely to be a fruitful area of investigation. All of these extensions are left for future research. Furthermore, the relatively small number of observations for some of the central banks suggests that a more meaningful empirical approach would be to estimate the hypothesized relationship in a panel setting. Finally, whether the particular dictionary used might have influenced the results has not been considered. Although DICTION relies on a dictionary of financial terms, this study has employed a separate dictionary that focuses on how the language of central bank press releases might have changed since the global financial crisis, there is the possibility that neither dictionary adequately conveys the content of central bank press releases or the minutes of policy board meetings. Loughran and McDonald (2012), for example, demonstrate that a great deal of care is needed when quantifying language in the manner done here.

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KEY TERMS AND DEFINITIONS

Central Bank Communication: Either verbal or written forms of expression by the central bank to convey its policies and strategy for the conduct of monetary policy.

Financial Stability: This describes what policy makers consider as normal conditions in financial markets (equities, bonds, foreign exchange).

Language Analysis: The quantification of verbal or written documents either via software programs that count or interpret text or using humans to interpret the content of such material based on a set of rules defined by the researcher.

Normal: This typically means non-crisis conditions.

ENDNOTES

1 Morris and Shin (2002) outline a theoretical model where a transparent and credible central bank prompts the public to ignore any adverse economic signals that might lead it to disagree with, say, a central bank forecast. As a result, the central bank and the public coordinate their outlook for the economy with the implication that the latter become complacent about using and interpreting potentially valuable information.

2 In a similar vein Demers and Yu (2013, in this volume) consider whether there is a link between confidence or ambiguity of the language used to convey earnings forecasts and forecasting performance. Forecasting performance appears to be reflected, for example, in the level of uncertainty expressed in the precision of earnings forecasts. Ongoing research explores the parallel phenomenon concerning the record of central bank forecasts, notably of inflation, the confidence with which such performance is expressed by the central bank and the impact on private sector and other types of forecasts.

3 Wherever possible the data were originally collected at the monthly frequency. In part because not all central banks meet on a monthly basis (e.g., the Bank of Canada and the Federal Reserve) it was more convenient to convert all monthly data to quarterly data via simple averaging of monthly values when conducting the econometric analysis.

4 The regular release of a press release to accompany a monetary policy decision is a relatively recent occurrence and explains the choice of 2003 as the start of the sample.

5 All of the central banks considered in this study, save the Fed (at least until 2012), have a numeric inflation target they are committed to. For a variety of reasons, including the difficulty in distinguishing inflation from non-inflation targeting central banks, at least in how monetary policy is actually conducted, no explicit distinction along this dimension is made across the central banks considered.

6 The words in italics are key words used to create subsequent scores.

7 The author is grateful to Bob Hetzel of the Richmond Fed for clarifying some of the issues around the content of FOMC meetings and the preparation of the minutes.

8 For readers wanting to see versions of Figures 5 and 6 for each of the central banks considered in this study these are available in an unpublished appendix.

9 Essentially, the test procedure involves applying a conventional Chow breakpoint test at every observation between two dates.

10 Alternatively, we could set the content indicator to zero or 1 depending upon whether the relevant terms are contained in the policy statement or minutes. In this case we effec-

tively ask: what is the probability that any of these documents have the content we are interested in? A logit specification would be suitable under the circumstances. Some estimates along these lines were generated but they generally support the conclusions summarized below and are not shown to conserve space.

[11] Roughly 60% of the sample can be said to be dominated by crisis related actions.

[12] Recall, the output or inflation gap is the difference between observed and trend values of the logarithm of real GDP or the price level.

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Chapter 32
Mutual Fund Performance and Investor's Perception: An Indian Perspective

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ABSTRACT

The Indian mutual fund industry is playing a significant role in the development of capital market and in the growth of the Indian economy. It is considered to be a better opportunity where savings are collected from investors and diverted to the capital market to generate better returns for them with lower risk and volatility. Hence, it is of utmost significance to understand the mutual fund industry in India. As such, this chapter makes an attempt to review the various literatures available in regard to mutual funds to evaluate the performance of various mutual fund schemes and to study the investor's perception in selection of a mutual fund. The study shows that mutual funds have failed to offer advantages of diversification and professionalism to the investors and hence could not fulfil their scheme's objectives. It is also found that retail investors are still confused about the mutual funds as an investment avenue. In order to attain sustained profitable growth, the industry should focus on developing distribution networks, increasing retail participation and expanding the reach of mutual funds by conducting awareness programs and extending financial literacy.

1. INTRODUCTION

A mutual fund is a mechanism of pooling together the savings of a large number of investors for collective investments with the objectives of attractive yields and appreciation in their value. It mobilises the savings, particularly of the small and household sectors, for investment in financial market instruments such as shares, debentures and other government securities. The income

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earned through these investments and the capital appreciation realized are shared by its unit holders in proposition to the number of units owned by them. The Securities and Exchange Board of India (Mutual Funds) Regulation Act, 1993 defines a mutual fund as "a fund established in the form of a trust by a sponsor, to raise money by the trustees through the sales of units to the public, under one or more schemes, for investigating in securities in accordance with these regulations" (Gurusamy, 2007). Retail investors are steadily banishing from the stock market and diverting savings into mutual fund sector. They acquire stocks or bonds through mutual funds at lower trading costs and get the benefit of diversification and risk minimization (Khare, 2007).

The mutual fund industry in India made its debut in 1964 with the establishment of Unit Trust of India (UTI), the largest public sector mutual fund in the world. The first unit scheme offered by UTI was the US-64. The main purpose behind introduction of UTI was effective mobilizing as well as channeling of small savings into productive sectors for economic acceleration of the country. Non-UTI mutual funds debuted in India in 1987 with the establishment of SBI Mutual Fund, bringing an end to UTI's monopoly in this sector. It was followed by many other public sector mutual fund set up by public sector banks, LIC and GIC. A tremendous growth has been witnessed in India in the financial market since 1991 with liberalization in India economy. Consistent with this evolution, Indian mutual funds industry has also witnessed a rapid growth. Foreign companies were also permitted to start mutual funds in India. The revolution was the outcome of policy proposal taken by the Government of India where by public sector banks, insurance sectors and foreign companies were permitted to enter the fund market (Gupta, 2000). In a short span of less than one decade, India has observed a changed in the investment pattern of small and medium investors. India's market for mutual fund has witnessed a CAGR of about 29% in a five year period from 2004-2008 as against global average of 4% which accounts as the most rapidly growing market in the world (Gupta, 2011). India has secured the best position among the top ten globally reputed mutual funds as far as growth of the funds are concerned. It has even moved India from 27th place to 26th place in the recent past. Mutual funds transactions on the stock exchanges have also witnessed an inspiring growth over the years. They indeed have been playing a stabilising role in the ever volatile stock markets (Chary & Masood, 2010-2011).

Retail investors face many hardships in stock market investment decision making. They are not familiar with market performance and lack knowledge about maximising returns by proper selection of securities and timing of investment. As such, mutual funds are the secured way for those investors to enter the capital market (Viramgami, 2009). Large market potential, rising income, high saving rate, growing risk appetite, comprehensive regulatory framework by SEBI, favourable tax policies, introduction of new products, increasing awareness etc have made mutual funds a preferred investment option (Rekha, 2012). The reason behind such a considerable attraction towards mutual funds was essentially due to assured returns along with security to investors' investment (Sanyasi, 2013). The regulating authorities namely Securities and Exchange Board of India (SEBI) and Association of Mutual Funds in India (AMFI) are trying to protect the investors in India by supervising and regulating mutual fund industry (Santhi & Gurunathan, 2011). Penetration of mutual fund market has been only 13.7% unit holders from rural area and 38% from urban area. It portrays a very lethargic escalation in the industry. However, with a booming economy and 32.4% saving rate in India, there are lot of scope for favourable growth of mutual fund industry in India (Pandey, Rathore, & Khare, 2007).

2. THEORETICAL BACKGROUND OF MUTUAL FUND

A small investor saves a part of his earnings to meet future expenses as well as some unforeseen expenses. These diverse requirements are expressed in terms of investment purposes as safety and security, liquidity and elevated return. In fact, mutual funds have designed an extensive range of mutual fund schemes to meet the diverse needs of a multitude of investors. Investors have the option of choosing from the wide range of schemes depending upon their requirements. Schemes are generally classified in many forms. At the most initial phase, mutual funds may be close-ended or open-ended. The subsequent classifications of mutual fund are based on their characteristics with respect to the risk level of the asset invested, nature of asset invested, the fund's objectives, industry to which the invested assets belong, trading and investment strategies adopted, structure, frequency of dividend payment and so forth. Schemes based on an asset category of investment may be equity funds, debt funds, money market funds, gilt funds, real estate funds and so forth. Growth funds, balanced funds and income funds represent the extent of the combination of different asset categories in the investments. Industry specific funds focus upon specific industries or sector. Funds' investment portfolios are persistently evaluated and revised by a group of professional managers to closely match the fund's stated investment objective. In recent years, some innovative mutual funds have been launched in India to provide investors with greater access to markets like the gold market and art market. Thus, mutual funds adopt different strategies to achieve investors' objectives and accordingly offer different schemes of investments.

A mutual is a set up in the form of trust, which has sponsor, trustee, Asset Management Company (AMC) and custodian. Sponsor is the person who acts alone or in combination with another body corporate and establishes a mutual fund. Sponsor must contribute at least 40% of the net worth of the investment managed and meet the eligibility criteria prescribed under the Securities and Exchange Board of India (Mutual Funds) regulations, 1996. The sponsor is not responsible or liable for any loss or shortfall resulting from the operation of the schemes beyond the initial contribution made by it towards setting up of mutual fund. The mutual fund is constituted as a trust in accordance with the provisions of the Indian Trusts Act, 1882 by the Sponsor. Trustee is usually a company (corporate body) or a board of trustees (body of individuals). The main responsibility of the trustee is to safeguard the interest of the unit holders and also ensure that AMC functions in the interest of investors' and in accordance with the SEBI regulations, the provisions of the trust deed and the offer document of the respective schemes. The AMC is appointed by the Trustees as the investment manager of the mutual fund. The AMC is required to be approved by SEBI to act as an AMC of the mutual fund. The AMC if so authorized by the Trust Deed appoints the Registrar and Transfer Agent to manage the mutual fund. The registrar processes the application form, redemption requests and dispatches account statements to the unit holders. The Registrar and Transfer agent also handles communications with investors' and updates investor records.

An AMC is required to calculate the Net Asset Value (NAV) of a fund and publish it in a minimum of two national newspapers. The NAV at any point of time is the sum total of the market value of the assets that comprise its portfolio minus the liabilities at that time. In other words, the NAV of a fund is the amount that all the unit holders will receive if the fund is dissolved or liquidated after paying all its liabilities. For most funds, the NAV is determined daily, after the close of trading but some funds update their NAV multiple times during the trading day. Open-end funds sell and redeem their shares at the NAV and so process orders only after the NAV are determined.

Closed-end funds may be traded at a higher or lower price than their NAV i.e. they are traded at a premium or discount, respectively. If a fund is divided into multiple classes of shares, each class will typically have its own NAV.

3. OBJECTIVES AND METHODOLOGY

Indian mutual fund industry is playing an important role to provide an alternative avenue to the entire gamut of investors in a scientific and professional manner. It has played a significant role in the development of capital markets and in the growth of the Indian economy. Though it is relatively new, it has grown at a dynamic speed, influencing various sectors of the financial market and the national economy. Thus, in this context, it has become significant to study the mutual fund market in India. The objectives of the study are to evaluate the performance of various mutual fund schemes by considering return and risk and to study the investor's perception pertaining to mutual fund investment. To fulfill the objectives of the present study, the researcher emphasized on various past literatures.

4. DISCUSSION

Mutual funds have attracted the attention of global practitioners and academicians in India and abroad to evaluate the performance of various schemes from time to time by considering return and risk of the investment. Attempt has also been made by researchers to draw sound conclusions on the factors responsible for the selection of mutual funds as an investment option. As there is a vast universe of companies in the field of mutual funds providing unlimited number of schemes, it becomes really hard to evaluate the performance of all companies as well as investors' perception towards mutual funds in a single study. A few of the studies conducted in this field were pioneered by Treynor (1965), Sharpe (1966), and Jensen (1968). It was followed by numerous other studies that have focused on mutual fund industry.

4.1. Fund Performance

Several researchers have undertaken studies from time to time on mutual funds and their performance evaluation in India. Most of the studies are related to benchmark comparison which is a significant fund performance measure. Benchmark comparison facilitates in signifying the efficiency level of the fund managers in generating better returns of managed portfolios compared to the market or index portfolios. An attempt has been made by the present researchers to provide a few reviews of those studies.

Sarkar and Majumdar (1995) assessed the performance of five close-ended growth funds for the period from February 1991 to August 1993. The performance of the funds has been proved to be statistically insignificant with high risk factor. Hence they concluded that the performance of the funds was below average when compared with the index fund.

Jayadev (1996) attempted to evaluate the performance of two growth oriented mutual funds namely Mastergain and Magnum Express on the basis of monthly returns and compared to benchmark returns. The study was carried out during the period from June 1992 to March 1994 using Jenson, Treynor and Sharpe ratio. The study concluded that the two funds disappointed in earning better returns. Mastergain performance was superior as per Jensen and Treynor measures and on the basis of Sharpe ratio, its performance was unsatisfactory when compared with benchmark. The performance of Magnum Express was unsatisfactory on the basis of all these three measures. Both the growth oriented funds also failed to offer advantages of diversification and professionalism to the investors. Grubber (1996) studied the performance of mutual funds and put forward evidence

of persistence of underperformance. He concluded that there has been a negative performance when compared to the market. He further concluded that in spite of inferior performance of actively managed portfolios there had been a fast growth of mutual funds industry in India.

Gupta and Sehgal (1998) evaluated performance of 80 mutual fund schemes over four years period (1992-96). The study has tested the proposition relating to fund diversification, consistency of performance, parameter of performance and risk-return relationship. The study has noticed the existence of inadequate portfolio diversification and inconsistency in performance among the sample schemes.

Gupta (2001) assessed the outcome of 73 selected schemes with different investment objectives, both from the public and private sector using Market Index and Fundex. NAV of both close-ended and open-ended schemes from April 1994 to March 1999 were also tested. The result depicted that the selected schemes has not been properly diversified and risk and return of schemes could not fulfil their scheme's objectives.

Ravinderan and Rao (2003) in his study made an attempt to evaluate the performance of Indian mutual funds in a bear market. The study was conducted for the period September 1998 - April 2002 on a sample of 269 open ended schemes by using performance index, risk-return analysis, Treynor's ratio, Sharp's ratio, Jensen's measure and FAMA's measure. The study observed that most of the sample mutual fund schemes couldn't generate excess returns over expected returns and further concluded that the funds were not adequately diversified and were not managed optimally.

Elango (2004) undertook empirical study for private sector and public sector schemes. His study indicated that private sector schemes have outperformed public sector schemes in terms of NAV, innovative products and in deployment of funds. However, public sector funds showed low volatility as against greater inconsistency for private sector.

Sondhi and Jain (2004) examined 26 equity schemes drawn from 26 AMCs belonging to public and private sector. They emphasized that equity mutual funds performance were inferior in comparison to risk and return. Sondhi and Jain (2005), in their another paper, made an attempt to study 19 private and 17 public sector mutual fund equity schemes during the period 1993-2002. There existed inconsistency in the performance of the funds. The returns were higher than the BSE 100 index. However, it was lower than the returns on 364 days treasury bills. Private equity schemes had outperformed due to its reputation, professional management, well-researched stock selection and timing skills. The study further underlined that more than three-fourth of public sector schemes couldn't attain better returns in spite of higher investor confidence and high safety.

Bodla and Garg (2005) reviewed 24 growth oriented schemes of mutual funds. They assessed the funds by applying risk adjusted performance measures as recommended by Sharpe, Treynor and Jensen. The conclusion drawn from the assessment showed that there were insignificant difference between market return and fund return.

Muthappan and Damodharan (2006) analysed 40 schemes for a period of 5 years from April 1995 to March 2000. The study observed that majority of the schemes have achieved superior returns compared to the market but have not performed better than 91 days Treasury bill. They further observed that 23 schemes have outperformed both in terms of total risk and systematic risk. 19 schemes performance were superior while growth schemes earned average monthly return. The average unique risk of 7.45% with an average diversification of 35.01% portrayed that the sample schemes were not adequately diversified.

Guha (2008) determined the return-based style analysis of equity mutual funds in India using quadratic optimization of an asset class factor model proposed by William Sharpe. The study identified the "Style Benchmarks" of each of its sample of equity funds as optimum exposure to 11 passive

asset class indexes. A comparative study of the performance of the funds with that of their style benchmarks revealed that the funds' performance were inferior to their style benchmarks. Bhatt and Patel (2008) observed the performance of 10 mutual fund scheme using Sharpe index method. The study portrayed that fund with high index value has performed better than fund with low index value. Phaniswara and Rao (2008) analysed performance of 60 mutual fund schemes of 29 mutual fund companies operating during 2008. The fund were evaluated using risk adjusted performance measures and observed that there were mismatch of the risk return relationship in some schemes and most of the selected schemes failed to outperform the market.

Mehta (2010) evaluated the performance of 10 funds of the both UTI and SBI mutual fund schemes. The study was accomplished on the basis of portfolio evaluation techniques using Sharpe, Treynor and Jensen Index and FAMA during 2006-07 and 2007-08. The study depicted that SBI mutual fund schemes has outperformed UTI schemes in both the years and UTI and SBI mutual funds have superior returns in 2007-08 as compared to 2006-07.

Dharmraja and Santhosh (2010) conducted a study for a period of two years - Bull Run period from January 2007 to December 2007 and Bear Run period from January 2008 to February 2009 to examine 5 balance mutual fund and 5 Income mutual funds. The findings revealed that there was generation of maximum return accompanied by high rate of risk during Bull Run period. However, the performance of the balance mutual fund was inferior to the market during the same period. During the Bear Run period, income mutual fund has lesser risk compared to stock market. On comparing balance mutual funds and income fund, it was concluded that income funds have performed better than the balance mutual fund during Bear Run period and mutual fund investment were relatively risk free than stock market as the investment being managed by the professionals. Devi and Kumar (2010) focused on the performance of Indian and foreign equity mutual funds and has observed that among Indian equity funds, the returns are highest for equity tax savings funds (55.87%) followed by diversified funds (54.73%) whereas it is just the reverse in case of foreign mutual fund as equity diversified funds are the toppers in return (57.57%) followed by equity tax savings funds (55.82%). They have further identified that there was not much difference in the returns between Indian and foreign equity index funds and equity tax savings funds.

Dhume and Ramesh (2011) made an attempt to analyse the performance of the few sector specific mutual funds using different approaches of performance measures. The sectors considered for the study were banking, FMCG, infrastructure, pharma and technology. The study highlighted that all the sector funds have better performance than the market except infrastructure funds. Bawa and Brar (2011) identified a few selected growth mutual funds schemes of both public sector and private sector schemes during the period 1st April 2000 to 31st March 2010 to evaluate their performance. The study concluded that the returns of private sector growth schemes have been better than public sector growth schemes.

Sukhwinder, Batra, and Bimal (2012) examined 10 equity schemes for the period of two years and observed that out of all sample schemes only 4 schemes were able to give more reward to volatility than benchmark. Mannar (2012) conducted a study to evaluate the performance of the four equity funds during the period from 2002-03 to 2011-12. Two funds houses namely HDFC and ICICI Prudential were selected for the study. The funds selected were HDFC Top 200 (G), HDFC Capital Builder (G), ICICI Prudential Top 200 (G) and ICICI Prudential Top 200 (G). The study identified that the average performance of the HDFC top 200 scheme has been inferior by a large factor when compared to the other schemes under study. The Performance of all the funds was to an extent better than the market with only a few rare

exceptions. Inder (2012) attempted to examine the performance of index funds in comparison to market index. The study showed that index funds have been replica of the market index as they always try to capture the market sentiment.

4.2. Investment Perception of Mutual Fund Investors

The researcher further made an attempt to review a few of the studies that have been focused on the investment perceptions of mutual fund investors. Singh and Chander (2003) pointed out that occupational status and age have immaterial influence on the choice of scheme. However, the important factors in the selection of schemes for retail investors were attributed to the past track record, safety and future growth prospects. Investors also expected prompt service, reliable information and also repurchase facility from the companies.

Devasenathipathi, Saleendran, and Shanmugasundaram (2007) in their study disclosed that 30% of the respondents in the sample group of 200 has awareness of mutual funds through consultant's advisory services, 46% respondents in the age group of 25-35 years has interest in mutual funds with substantial investments in the same and 31% of the respondents has invested in mutual funds for meeting future requirements. The study further unfolded that 49% of the respondents has given high preference for investment in equity fund when compared to debt and balanced fund. The study also disclosed that dividend has been the most preferred investment option for the respondents.

Parihar, Sharma, and Parihar (2009) focused their study on investment decisions of retail investors and revealed that majority of retail investors were still reluctant towards mutual fund investments

Rao and Parashar (2010) in his study made an attempt to identify the factors affecting the perception of investors regarding mutual funds investment. The study was conducted in three states namely Rajasthan, Gujarat and Madhya Pradesh. They concluded that tax incentive was one of the important factors affecting the retail investors while investing in mutual fund.

Rehman, Shaikh, and Kalkundrika (2011) assessed the investment decisions of retail investors with respect to mutual funds. Their study highlighted that the behaviour of retail investors were based on various demographic factors like age, gender, marital status, level of market knowledge, educational qualification of retails investors and the number of dependents. Shanmugsundaram and Balakrishnan (2011) determined the investors' behaviour on result announcement. It was observed that when there was announcement of favourable consequence by the company, 38% of the respondents inclined to invest substantially, 40% of the respondents desired to hold the securities and remaining 22% of investor inclined to book the profit. Kandavel (2011) investigated the factors which influenced the retail investors regarding preference for investment in the mutual funds. He identified that investment behaviour of retail investors do not have a high level of consistency due to the influence of different purchase factors. He further opined that negative perceptions about mutual funds can be overcome through proper induction of investor awareness programme. It was also recommended that proper segmentation and positioning of products by mutual fund companies are of utmost importance.

Rekha (2012) observed that even though there were encouraging factors contributing to the expansion of the industry, there were a few factors inhibiting its growth. The factors have been endorsed to low levels of customer awareness and lack of knowledge about mutual funds, limited innovation in product offerings, unwillingness to undertake even minimum risk, inaccessibility in smaller towns and cities due to lack of efficient distribution network and abysmal financial literacy. Singh (2012) argued that the majority of the respondents lack knowledge of the functioning of mutual funds. He further argued that demographic factors, gender, income and qualification have

significantly influenced the investors' attitude towards mutual funds. However, two demographic factors namely age and occupation have not been found influencing the attitude of investors' towards mutual funds. As far as the benefits provided by mutual funds are concerned, return potential and liquidity have been perceived to be most attractive by the invertors' followed by flexibility, transparency and affordability.

5. CONCLUSION

Mutual fund industry in India is gradually marching towards upward phase. It is found that most of the studies have focused on estimation of the risk exposure and return of portfolios, estimation of NAV and comparison of fund with a benchmark. It is found that high competitions among the private and public players in the industry have affected its performance. Mutual fund has failed to offer advantages of diversification and professionalism to the investors and hence could not fulfil their scheme's objectives.Despite of the fact, there have been positive returns generated by mutual funds investments where private sector has outperformed public sector. Most of the funds in the market provided the returns equal to risk free rate. Moreover, over the last few years level of awareness and interest of investors on mutual funds has increased. But level of awareness has not yet reached to mass investors. The past studies have shown that retail investors are still confused about the mutual funds and have refrained themselves from considering mutual funds as an investment avenue. The important factors in the selection of schemes for retail investors were attributed to the past track record, safety and future growth prospects, tax incentive and also various demographic factors like age, gender, marital status, level of market knowledge, educational qualification of retails investors and the number of dependents. Chary and Masood (2010-2011) suggested that SEBI has to inspire the culture of mutual fund investment in the minds of the investors and even focused that asset managers should develop the forecasting skills in order to manage the portfolio of the fund effectively. There is an urgent need to streamline the regulation of mutual fund industry. Capital market itself is a complex activity regulated by SEBI. So, a separate regulatory body to regulate the operation and management of mutual funds should be set up (Pandey, Rathore, & Khare, 2007). In order to attain sustained profitable growth, the focus should be on developing distribution networks, increasing retail participation and expanding the reach of mutual funds to every nook and corner by conducting awareness programs and extending financial literacy (Rekha, 2012). Investment decision of retail investors in mutual funds can be encouraged by introducing special investment schemes and providing many offers or attractive prices (Mathivannan & Selvakumar, 2011).

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KEY TERMS AND DEFINITIONS

Mutual Fund: A type of professionally managed collective investment scheme that pools money from many investors to purchase securities. While there is no legal definition of the term "mutual fund," it is most commonly applied only to those collective investment vehicles that are regulated and sold to the general public. They are sometimes referred to as "investment companies" or "registered investment companies." Most mutual funds are "open-ended," meaning investors can buy or sell shares of the fund at any time. Hedge funds are not considered a type of mutual fund.

Retail Investor: An individual investor who buys and sells securities for their personal account and not for another company or organization.

Risk and Return: The principle that potential return rises with an increase in risk. Low levels of uncertainty (low-risk) are associated with low potential returns, whereas high levels of uncertainty (high-risk) are associated with high potential returns. According to the risk-return tradeoff, invested money can render higher profits only if it is subject to the possibility of being lost.

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Chapter 33
Agricultural Investment Risk Relationship to National Domestic Production

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ABSTRACT

This empirical case study investigated the uncertainty of agricultural investment schemes in Nigeria and their relationship to national domestic production. Government administrations have invested a substantial amount of money into the agricultural sector, yet thus far, there have been very few visible results to show for it. The private sector does not seem to be interested in developing agriculture even with government incentives. The purpose of this study is to identify investment risk factors for national agriculture development as perceived by business stakeholders. Ordinary Least Square (OLS) was then used to examine the strength of the cause-effect relationship for the agricultural investment factors in terms of expected domestic production. The findings were that there was no significant relationship between commercial bank credit granting to businesses for agricultural development and therefore no impact on national domestic production. On the other hand, the regression analysis did support the hypotheses that there was a significant relationship between government funding towards the agricultural sector and national domestic production as well as a significant relationship between the public agriculture credit guarantee scheme and national domestic production, respectively. Based on this positive finding, the study closes with several unique recommendations for policy makers in order to stimulate the investment into the agricultural sector to increase national production.

INTRODUCTION

Nigeria has a developing economy with fertile agricultural conditions and a tropical climate (Johnston, 1970; Kibly, 1969) but its oil reserves propelled the country into becoming the most industrialized nation in the African continent (Ojo & Akanji, 1996). However, the oil reserves have an uncertain future since they are already becoming depleted.

In addition to investing in the oil reserve extraction, the Nigerian government have tried to accelerate the rate of agricultural development in a bid to transform the nation into a more stable

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developed economy. The economy held so much hope for attainment of such goals within a short period and this was even before the advent of oil as the main export commodity (Ukpong, 1993).

Agriculture is the principal source of food and livelihood in Nigeria. This industry employs 70% of the nation's work force and is a major source of livelihood for the majority of the population in Nigeria (Abayomi, 1997). Over the past two decades, agricultural yields have stayed the same or declined. Although there has been a recent rise in agricultural productivity, it is derived more from expanded planting areas for staple crops rather than from yield increases. Increasing and sustaining agricultural productivity should be a critical component of programs that seek to reduce poverty and attain food security in Nigeria (Ukpong, 1993).

Notwithstanding the oil reserves, agriculture is still the most dominant sector, which contributes to national domestic production. In spite of this Abayomi (1997) pointed out that private businesses are predominately unwilling to invest more into agricultural development, which is contrary to the government objectives, and puzzling considering the publicly funded incentives which have been available.

The World Bank (2011) studied agricultural investment in developing nations and identified three actions, which countries like Nigeria should do to improve the economy:

1. Increase food production which would increase business income;
2. Make household food, water and energy production secure;
3. Restore and maintain the natural resources.

The World Bank (2011) claimed that nations such as Nigeria often fail to effectively develop their agricultural section to its full potential because they purchase rather than develop their imports, they do not use mechanization to facilitate agricultural production, and most significantly there is a lack of credit to stimulate development.

In Nigeria, the lack of credit to finance agricultural investment is a major problem. However, since the availability of adequate credit is central to the improvement for agricultural production in the economy, the Federal Government of Nigeria recently prioritized the agricultural sector, and directed commercial banks to through the Central Bank of Nigeria (CBN) to allocate a certain percentage of their loan funds to the agricultural sector (Ukpong, 1993).

In fact, to encourage the commercial banks to meet this target, the CBN introduced the Agricultural Credit Guarantee Scheme (ACGS) in 1977 to guarantee credit disbursed by commercial banks to the sector. The loan amount was raised and the guarantee rate was raised to 75% against default payment of loans (CBN 1981).

Statement of Problem

Before the 1970s, Nigeria's biggest source of revenue was from agriculture. Nigeria was the world's largest producer of palm products, producing 64% of the world's palm kernel and 30% of the palm oil. Nigeria was also the second largest producer of peanuts, producing 40% of the world's peanuts and 27% of the world's peanut oil. In addition, Nigeria was among the top cocoa and cotton producers (Johnston, 1970).

This situation began to change drastically in the 1970s with the discovery of crude oil in Nigeria. Oil extraction led to the government's neglect of Nigeria's agricultural sector. Without government support of the sector, agricultural production suffered a serious decline, and Nigeria's self-sufficiency level in food production dropped to 20% and unemployment to around 30%.

Due to a host of factors including low productivity, poor market access, falling terms of trade, and restrictive trade regimes, Nigeria's relative market share in the world market has been declining for decades. According to the World Bank (2011),

Nigeria has suffered a loss in its world market for agricultural exports – 55% points for groundnuts, 27 points for cocoa, and 14 points for coffee.

Presently, agricultural production is mostly at the family and subsistence levels yet even this does not meet the food demand of Nigeria's ever-growing population. Furthermore, farmers who have tried to organize and form cooperatives to boost production and purchasing power have not had the requisite skills and training to run these initiatives. As a result, most have failed. Farmers also often lack the proper education that would enable them to maximize profits. As a result, most goods are not processed but sold in their raw state, thus yielding low returns and high levels of post harvest losses (Abayomi, 1997).

The impact of this situation includes low quality and quantity of food, with limited production, resulting in high food prices and malnutrition. There have also been wasteful agricultural methods, negative attitudes toward agriculture, and urban migration. Since the 1970s, every effort the government has made to improve agricultural production has failed.

Today, ways to improve agricultural yields are hardly ever discussed. The purpose of this study is to examine and document the factors, which could reduce uncertainty and risk for investment into the agricultural sector, by showing a positive relationship between investment risk and national domestic production.

Study Objective

The main objective of the study is to empirically investigate the uncertainty surrounding agricultural investment in Nigeria. The specific objectives are as follows:

1. To analyse the risk factors for agricultural investment in Nigeria;
2. To highlight constraints for agricultural productivity in Nigeria;
3. To measure the cause-effect relationship of investment risk explanatory variables on national agricultural production, which include,
   a. Commercial bank credit to the agricultural sector,
   b. Government budget to the agricultural sector,
   c. Government budget for agricultural credits guaranteed scheme fund.

This paper is a single case study of a developing country, Nigeria. The choice was made out of the researcher's interest given the country's economic circumstances. The researcher's philosophy is post-positivist. The period covered by the research is twenty-four years period, 1986 – 2009. The availability of uniform data on the relevant variables informed the researcher's choice of the period for this analysis, to make the findings credible.

LITERATURE REVIEW

There is no doubt; agriculture is often the driving force behind many sustainable and successful economies. It plays a myriad of roles in hunger and poverty alleviation, provision of raw material for industrialization, creation of employment and job opportunities, facilitates foreign trade and entrepreneurial growth, reduces the nation's dependency on foreign goods, ensures a sustainable economy with well nourished and healthy people, and serves as a clean alternative to energy provision (Johnston, 1970).

However, different policy drivers in different political administrations have invested enormous efforts and budgets on agricultural development programmes without clear goals and visible strategies. Thus, their plans have seldom worked over the years in Nigeria.

As noted previously, agriculture is the principal source of food and livelihood in Nigeria, and employs nearly three-quarters of the nation's work

force. Over the past decades, agricultural yields have not significantly improved. Although there has been a recent rise in agricultural investment and productivity, it is derived more from expanded planting areas for staple crops than from yield increases. Increasing and sustaining agricultural investment and hence, productivity should be a critical component of programs that seek to trigger sustainable economic growth through the contribution of agriculture to real gross domestic product (Real GDP).

Despite the importance of agriculture such as production of food for population, provision of raw materials for industries and a source of employment, agriculture has not contributed significantly to the development of the economy. It is believed that more than 70% of the Nigerian population is engaged in agriculture, and if agriculture is developed, the country will experience reasonable economic growth and development.

The greatest concern of many people in Nigeria, including the national leaders, is the food insecurity problem that presents itself in the face of declined agricultural productivity and increased population pressure. This explains why New Partnership for Africa's Development (NEPAD) in July 2003 resolved that agriculture should be made a top priority and budget allocations for this sector was raised to a minimum of 10% of total public expenditure within five years (World Bank, 2011). Hence, issues that relate to agricultural development are not treated without seriousness.

Role of Agriculture in Nigerian Economy

According to Anyanwu (1997), agriculture involves the cultivation of land, raising and rearing of animals for the purpose of production of food for man, feed for animals and raw materials for industries. It involves cropping, livestock, forestry, and fishing, processing and marketing of these agricultural products.

Abayomi (1997), like many other economists asserted that in most developing countries, agriculture is both the main traditional pursuit and the key to sustained growth of the modern economy. She noted that economic growth has gone hand in hand with agricultural progress; stagnation in agriculture is the principal explanation for poor economic performance, while rising agricultural productivity has been the most important concomitant of successful industrialization.

Among the roles conventionally ascribed to the agricultural sector in a growing economy are those of providing adequate food for an increasing population; supplying raw materials to a growing industrial sector; constituting the major source of employment; earning foreign exchange through commodity exports, and providing market for the products of the industrial sector.

Ogunfiditimi (1996) contended that until the late 1950's that agriculture contributed over 60% of GDPP. Its percentage contribution however has fallen drastically in recent years due in part to the boom in petroleum industry. However, the oil boom notwithstanding, the agricultural sector still provides employment for over 70% of the Nigerian population.

Apart from provision of the means of livelihood to farmers, it creates job opportunities for people who serve the farming and agro – allied industries within the country. Ukpong (1993) reiterated that in view of the importance mentioned above most public policy makers, especially since independence in 1960, have expected the sector to ratify the bulk, if not all, of the food requirements of the country and to supply most of the agricultural raw materials needed by the manufacturing sector.

Furthermore, Reynolds (1975) stated that agricultural development could promote economic development of the underdeveloped countries in four distinct ways:

- By increasing the supply of food available for domestic consumption and releasing the labour needed for industrial employment;

- By enlarging the size of the domestic market for the manufacturing sector;
- By increasing the supply of domestic savings; and
- By providing the foreign exchange earned by agricultural exports.

Agriculture has been seen as a means of reducing dependence on certain importation, containing food price increases, earning foreign exchange, absorbing many new entrants to the labour market and increasing farm incomes at times of severe unemployment and rural poverty. Agreeing with the above views, Johnston (1970) writes that the appraisal of agriculture contribution or role in the national economy can be made by using four primary criteria, namely:

- The proportion of the population engaged in agriculture.
- The share of agriculture in the Gross Domestic Product.
- The proportion of the nation's resources (other than labour) devoted to or employed in agricultural production.
- The contribution of the agricultural sector to foreign trade.

Following these studies, Anyanwu (1997), determined that Nigerian agriculture has not been able to meet the food needs of the country. Rather, food production per capita has been declining. To complement the low domestically produced food supply; there has been a substantial rise in food imports. These have taken substantial portions of the much-needed foreign exchange for importing capital for development purposes. Available data revealed that average food imports have accounted for about 9.15% of total imports over the period between 1960 and 1993. Nigerian's quick turn from a low food importing to a high food importing country with food bill accounting for 14.71% of 1991's total import bill compared with 6.87% in 1970 was a sign of collapse of the agricultural sector.

Anyanwu (1997) noted that this situation does not bode well for the Nigerian economy especially when we realized that there were available agricultural resources that could be exploited to increase the local production of foodstuffs. With respect to employment, he noted that more than 80% of the rural population of Nigeria is engaged in one type of agricultural activity or the other. This roughly indicates the extent to which the agricultural sector absorbs the labour force in the country.

However, World Bank Report (2011) puts it that the agricultural sector employed 71% of the total labour force in Nigeria in 1960 and by 1977; this had dropped to 56%. It rose to 68% in 1980, fell to 55% in 1985 and further fell to 53% in 1986 and 57% annually from 1989 to 1992. Nonetheless, the fall in the proportion of labour force engaged in agriculture was also due to the structural changes in the economy where other sectors are assuming different dimensions and engaging more labour than they previously did (Ukpong, 1993).

During the course of economic development, a decreasing proportion of the nation labour force which will be employed in agricultural over time; this is inevitable so it is important that agricultural labour productivity increases in order to compensate for the out flow of labour, at a rate not less than that of labour migration less natural increases (World Bank 2011). In addition, it is important to expand non–agricultural employment to absorb the migration of labour from the agricultural sector. It is necessary to point out that given the importance of labour in agriculture of most African nations including Nigeria, because without this labour absorptive capacity in the industrial sector, the rapid outflow of labour from the agricultural sector would generate social and economic problems (World Bank, 2011).

In fact, a partial consequence of a high labour out flow from agriculture has been a decline of agricultural production in Nigeria in recent years. While assessing the contribution of agriculture to GDP, Ogunfiditimi (1996) observed that until the

Nigerian civil war of 1967–70, agriculture dominated Nigerian's economy, contributing some 53% to GDP in 1965. By 1984, this percentage share had decreased by almost 50% to 30%.

The pattern of Nigerian's economic structure changed dramatically during the era of independence. However, while agriculture's percentage share of GDP between 1965 and 1984 diminished, the absolute value of agriculture's contribution to GDP increased from $2.2 billion to $19.8 billion. This suggests that although there was a relative decline in agriculture, it may not necessarily have been absolute.

Nonetheless, it is difficult to say whether the rise was due to a real increase in the value of agricultural products or whether inflation in the agricultural sector was so high that it masked the stagnation that many believed was occurring. Studies conducted in rural Nigeria reveal an average annual inflation rate of 30% in the agricultural sector for 1970–80. This is far higher than the average annual rate of inflation for the nation as a whole, which was 18.2% for 1970–78.

In his analysis, Ihimodu (1993, pp. 33) stated that "agriculture had often been described as the mainstay of the Nigerian economy, especially so before the oil boom of the 1970s." Consequently, agriculture was expected to play a significant role in improving the development of the national economy. He maintains that these roles are typical of the contribution normally made by the agricultural sector to the economics of developing countries. The agricultural policy for Nigeria, (Federal Ministry of Agriculture, 1987) outlined the traditional contribution expected of Nigerian agriculture. They include the provision of adequate food, a source of employment, foreign exchange, raw materials for domestic industries and the provision of a market for the product of the industrial sector. Therefore, it was logical to anticipate such an improvement in Nigeria.

The contribution of agriculture to the national food supply production could be measured indirectly via the volume as well as the value of food imports (Ihimodu, 1993). He also noted that a direct measure of food production is difficult because of lack of adequate statistical data. It has always been claimed that the agricultural sector supplied most of the food needs of the economy especially before and during the 1950s and 1960s.

In recent times however, there has been some concern that there exists a widening gap between domestic food supply and total food requirements. Some studies have shown that while the demand for food has been growing at about 3.5% per annum, food production has been growing only at about 2.5% per annum (Federal Ministry of Agriculture, 1987). This has led to a significant increase in food imports both in absolute terms as well as in relative to the total import bill. To a large extent, the absolute value of import had risen overtime, as had the proportion of food in the total import bill. Generally, before 1974 the food bill constituted less than 10% of total import.

Despite this, after 1974 food import increased above 10%, rising to about 18% on the average between 1984 and 1985. In 1984 specifically, food import constituted 21% of total national import bill. There appeared to be some decline in the share from about 1986 onwards. Thus, it is obvious that the agricultural sector has successfully played its role of food supplier in the economy until the 1980s when food import became intensified.

On the other hand, the raw material contribution by the agricultural sector appeared to be the least satisfactory. This situation may have been caused partly as a result of historical development, as well as the technologies adopted in the industrial sector of the economy. The colonial pattern of development regarded the Nigerian economy basically as a source of raw materials for the British industries and therefore, all efforts were geared towards satisfying that requirement. This pattern, no doubt must have accounted for the initial slow pace of industrialization in Nigeria.

Moreover, the industries that were established depended mainly on imported inputs. One of the consequences of the dismal performance of the

agricultural sector in this regard is the retardation of industrialization in the country. It should be clear, though, that the pattern of development, the orientation, adverse agricultural pricing policies, and bias of industrialization, rather than the capability of the agricultural sector were responsible for this poor performance of the sector.

The potential of the agricultural sector to make a substantial market contribution depends on two major considerations. One is the purchasing power of the agricultural sector, which depends on the rate of modernization of both the economy and agriculture in particular. A high rate of agricultural modernization implies a fast rate of substitution of modern inputs such as tractors, improved seeds, fertilizer etc. for traditional implements like hoes, cutlasses and traditional seeds. On this count, the Nigerian agricultural sector has not performed satisfactorily.

There are two major factors contributing to the agricultural sector. These are capital and labour transfers from agriculture to the other sectors of the economy. Capital transfer is one of the major roles played by the agricultural sector in the Nigerian economy.

An objective on which the government was always silent has been the revenue transfer from the agricultural sector to other sectors. This has been occurring more frequently, without monitoring, since the agricultural marketing boards were abolished in 1986. Most of the accumulated profits of the marketing boards were converted by state governments to grants and loans.

The Nigerian agricultural sector was virtually the sole earner of the country's foreign exchange before the oil boom, while only a very small proportion of the earnings were attributed to other sectors such as mining (the next largest). Agricultural products accounted for an over whelming proportion of the total export earnings in the 1950s and early 1970s, again prior the oil boom. In the second half of the 1950s, agricultural export accounted for 86% of the total export earnings. By the first half of the 1970s, the proportion fell drastically to 26% between 1970 and 1974 and to an insignificant 3% in the last half of the 1980s.

It is obvious that the sector did play a very dominant role in mobilizing foreign exchange resources required for the development of the economy up to the early 1970s, when Nigeria hit the jackpot, so to say, in petroleum oil.

Agricultural Growth Factors

Under this heading, trends in input utilization, capital requirements, and the national agricultural production gap are researched as parameters to represent the growth of agriculture in Nigeria.

Input Utilization Trends

Three approaches are adopted to achieve self-sufficiency in food production. First, the intensive use of improved inputs such as fertilizers, seeds, and agrochemicals to control pests, diseases and weed. In Nigeria and elsewhere, improved farm cultural practices have been adopted in the past to complement the use of such improved inputs. Second is the expansion of total land area under cultivation and thirdly there is the combination of the two.

The expansion of land under cultivation involves enhancing the productive capacity of marginal lands through the use of irrigation facilities and deforestation. However, this method is expensive. Consequently, the intensification of inputs is normally preferable as a means for boosting agricultural output. In Nigeria, massive resources have been channelled into the procurement and distribution of farm inputs. Following a report by Federal Ministry of Agriculture and Natural Resources, fertilizer consumption increased in the early 1980's into the 1990's and peaked in 1993, with a total consumption reaching 1,590 thousand metric tones. However, declined in 1994 to the lowest level of 357.8 thousand tonnes in 2001 (Ogunfiditimi 1996).

In conclusion, agriculture is arguably the most important sector in Nigeria in terms of employment engaging about 70% of the labour force (Igbedion & Aderiye, 1994). Agricultural holdings are generally small and scattered, farming is subsistence characterized by simple tools and shifting cultivation. These small farms provide about 80% of the total food. The Nigerian climate from the tropical area of the coast to the arid area of the north makes it possible to produce virtually all agricultural products that can be grown in the tropical and semi-tropical areas of the world.

Financing Uncertainty

In general, total credit to the agricultural sector depicted a rising trend from 1990 to 2001. Total credit, which stood at N722.9 million in 1980, increased to N6, 932.4 by 1990 andN50, 493.59 by 2001. (CBN, 1993)

Even so, the annual growth rate of credit to the sector was declining. In 1990, the public sector contributed 24.0% of the total credit while the private sector accounted for the balance of 76.0%. This trend continued until 1993 where the public sector accounted for about 28% of the total credit. Thereafter, the composition of total credit was reversed, with the share of the public sector falling to 18.0, 14.0 and 3.0% in 1994, 1996, 1999 and 2000 respectively.

The diminishing trend was due to non-mobilization of savings by the specialized credit institution, coupled with the reduction in government grants. Likewise, capital budgetary allocations to the sector, which stood at 11.5% of total capital expenditure in 1989, had declined to 6.7% by 1990. The downward trend continued to 2001 (CBN2001).

Agriculture Investment Uncertainty

Nto (1981) and CBN (1981) agreed that these problems include among others, natural hazards, like unfavourable climate – winds, which are unpredictable and some of which have no immediate solution and thus increased the risks of agricultural ventures. They agreed that the inelastic nature of land, relative scarcity and mobility of farm labour also contribute to the risky nature of agricultural project.

More so, they identified the high rate of perishing of agricultural products, poor and inadequate infrastructural facilities in rural areas where farming is mainly carried out as factors which further scare away the would be labour from the farming communities and this has brought about the erroneous belief that farming is a traditional rather than a form of business. Furthermore, to explain that the highly vulnerable nature of food stuff to fluctuations in prices often deter prospective creditors from extending credit to farmers because of the high risk involved.

Government Funding Uncertainty

The success of agricultural loan scheme hangs greatly on government policy and implementation. Garba (1991) argued that in Nigeria, government policies are inconsistent, often self-contradictory and hardly allowed to mature. For instance, while the importation of wheat, maize, rice etc were banned by government in the country, sugar, fish, fish product, salt, etc, importation were generously encouraged despite abundant resources to produce them here in the country.

The CBN summarizes the problems caused by the government to include, the inadequate provision and untimely release of funds in the national budget, lack of adequate pre – project studies, problems of infrastructure and marketing, the inability to solve the problem of land tenure – despite the promulgation of the land use act in 1978.

Farmer Uncertainty Perspectives

Nto and CBN (1981) identified problems encountered here to include, the deliberate miscon-

struction of the objectives of government credit initiated programmes. Most farmers according to them regard agricultural loans as a national cake, which is to be shared by all.

The issue of loan diversification by farmers and the problems of high level of illiteracy among farmers were also identified. So also are management problems leading to inefficient application of funds, which is due in part, to wrong selection of enterprise. Exaggerated assessment of the farmers' credit needs and their reluctance to accept time assessment also poses a problem.

Financial Institution Uncertainty

The CBN summarizes obstacles associated with credit policy and credit delivery to include; the general inefficiency of the present mode of credit delivery. Specifically, the problems among others are delays in processing application for loans forms, granting of inadequate loan, inadequacy of relevant skilled staff, and drawing up amortization schedule.

Additional problems include the unjustifiable insistence on particular type of collateral, inability of existing financial institutions to reach the small farmers, inadequate interest shown towards agricultural lending, the question of interest rate chargeable on agricultural loans and the mutual distrust between the bankers and the borrowers.

Infrastructure Uncertainty

Basic infrastructure such as transportation, electricity, all season motor able roads, water, marketing and irrigation facilities; are needed to support agriculture. The provision of most of them is, however, capital-intensive.

It has been observed that capital expenditure ratio, which was consistently below 6.0% for most of the 1990's was grossly below the Food and Agriculture Organisation recommended level of 25% of the annual budget for developing countries. Consequently, the resources regularly allocated to the agricultural sector have neither been inadequate not to meet the developmental requirements of the sector nor make adequate provisions for its infrastructure support facilities. These and other daunting challenges have continued to ensure low agricultural output, fluctuations in prices of commodities, and enormous wastage, especially during the harvest months.

Environmental Uncertainty

The Basic natural resources of soil, climate, and vegetation provide the needed environment for sustainable agricultural development. The soils are relatively poor and fragile in some parts of the country. In addition, poor husbandry practices, excessive and intensive rainfall, and other unfavourable climatic conditions combine to reduce the quality of otherwise productive soils.

Owing to poor vegetation cover, parts of the savannah region of Nigeria is susceptible to desertification, while humid and warm tropical rain forest conditions encourage the prevalence of crop pests and diseases. The cultural practice of bush burning and over-grazing may contribute to soil degradation, if not properly managed. The frequently reported cases of oil spillage in the Niger Delta area also affect the aquatic environment. Furthermore, gas flaring has had a negative impact on soil temperature, thereby reducing the vital bioactives necessary for enhancing soil fertility (Ojo, 1993).

Business Uncertainty

The agricultural sector, like other sectors of the national economy, has had its fair share of poor resource management. Insufficient and\or inefficient human resources have continued to frustrate the attainment of sustainable agricultural development and demands urgent attention.

The challenge manifests itself in various forms, such as ineffective budgeting and control mechanism, and inefficient execution of agricul-

tural projects. The opportunities for a high rate of capital formation and technological advancement in the sector will continue to be a mirage until the management constraints are resolved head on.

Land Use Policy Uncertainty

The value of output must exceed the value of inputs in a sustainable land use system in which there is a symbiotic relationship between the socio-economic and biophysical environment. Despite Nigeria's large expanse of land and a long-standing *Land Use Decree*, Nigeria's farming system cannot sustain the growing population because of its concentration in smallholdings, which are not economically viable.

Institutional Reform Factors

Agriculture Universities

In the continuing attempt to build capacity to boost agricultural output, the Federal government established three Universities of Agriculture in Abeokuta, Umudike and Markurdi respectively to offer degree programmes in all disciplines of agriculture.

This initiative is the government holistic approach to solving the perennial problem of inadequate human resources at all levels of the agricultural sector.

Research Institutions

In order to improve the funding of Nigerian Agricultural research institutes, government obtained a World Bank loan for specified research activities involving agricultural research institutes in the country.

However, the level of funding of research in the institutes and the universities of agriculture could not be sustained, largely on account of their ever-increasing number and personnel. Besides duplicating their functions, the institutes have continued to be dependent on the subventions from the Federal Government for virtually all their operations.

All in all, the impact of the reforms on the sector are yet to be felt as most of the institutes remain grossly under-funded, while the perennial problem of inadequate human resources in the sector still persists (Ojo & Akanji, 1996).

Launch of Nigeria Import-Export Bank

The Nigerian Government established the Nigerian Export Promotion Council (NEPC) in 1986 and the Nigerian Export-Import Bank (NEXIM) in 1991. They were established essentially to provide incentives for exports, provide funds for trade and project finance; and render export advisory services.

However, the sustainability of the institutions has been jeopardized due to a combination of factors, including: low level of loans recovery, resulting from severe devaluations of the domestic currency and the non-implementation of institutionalized exports incentives, all of which have combined to discourage potential exporters.

Rural Development Programme

It has been estimated that over 60.0% of Nigeria's population live in rural areas, with the majority of them being involved in agricultural activities. In an attempt to improve the quality of life of the rural people and thereby stem the tide of rapid rural-urban population drift as well as facilitate the promotion of sustained and orderly development of rural Nigeria, the Federal Government excised the responsibilities of rural development from the Ministry of Agriculture and transferred them to the Federal Ministry of Water Resources.

The government also established the National Agricultural Land Development Authority (NALDA) in 1991 to ensure the availability of closest land as well as reduce the burden of land preparation for agricultural activity. NALDA has the

mandate to execute a national agricultural land development programme designed to moderate the chronic problem of low utilization of abundant farmland. However, the performance of NALDA has been constrained by high cost of agricultural equipment maintenance and their incessant breakdowns, as well as the lack of spare parts, all of which have affected negatively on farm operations and agricultural productivity.

PUBLIC POLICY FACTORS

Agriculture Credit Allocation

A potent policy guideline to stimulate agricultural production is the prescription of a minimum allocation of commercial and merchant banks total loans and advances to agriculture, which consistently remained a priority sector.

The policy was expected to ensure adequate provision of credit to output growth.

From a figure of 4% in 1972, the sector allocation of commercial banks' loans and advances to the agricultural sector increased by 11 points to 15% in 1986. This figure was sustained until 1993 when it was increased to 18% between 1994 and 1996 (Babalola & Odoko, 1996).

However, in 1996, the CBN authorities embarked on the process of phasing out mandatory bank credit allocation to the preferred sector, while an incentive package was to be introduced to encourage banks voluntary lending to the priority sector. The system was abolished in October 1996 (CBN, 2001). This perhaps was in line with the deregulation of the financial sector, which has been embarked upon since 1987.

Shortfall revenues were deposited with the CBN as a penalty for non-compliance. Such deposit did not count as part of the banks required reserved assets and they are ultimately lent to the agricultural sector through the Nigerian Agricultural Rural and Cooperative development Bank (NARCDB).

Agricultural Credit Guarantee Scheme Fund

In order to complement the sectors prescriptions, the Federal Government in March 1997 established the Agricultural Credit Guarantee Scheme Fund (ACGSF) to induce commercial and merchant banks to increase lending to agriculture.

The scheme is under the management of the CBN with a Board of Directors responsible for policymaking. Under the scheme, banks loans to farmers are guaranteed 75% against default in payment. When a default occurs, the Fund pays lending bank from the security pledged by the farmer. The payment is made from a Fund set up by the Federal government (60%) and the CBN (40%) with an authorized capital of N100m.

As at December 1990, a total of 122,246 projects with loan amounts totalling N765.44m had been guaranteed. From the outcome of the operation of the scheme, the enabling Decree No. 20 of 1977 had been amended by Decree No. 18 of 1988 thereby making it responsive to the changing characteristics of the operating environment. In particular, the amended decree formally provided a waiver of pledging of tangible security for loans of N5,000 and above (Federal Ministry of Agriculture, 1987).

Agricultural Marketing Promotions

Before the abolition of the Commodity Boards System in 1986, the CBN provided funds to the six Commodity Boards (cocoa, rubber, palm produce, cotton, groundnut and grains) for the purchase of produce for export.

The transitional periods that followed the Boards dissolution also saw the CBN extending financing facilities to the state governments for the purchase of grains which were reported to be in excess of immediate requirements – in order to trigger price stabilization effects.

A total of about N84.2 million was provided to all the states for this purpose in 1985/86 season. It should be mentioned that presently, commodity marketing/export is now liberalized, mainly a private sector affair, with financing from the commercial and merchant banks as well as other financial institutions (Ojo, 1993).

National Agriculture Production Constraints

Studies in the literature have identified a number of sector-wide constraints, which impede agricultural productivity in Nigeria.

These include: poor agricultural pricing policies, low fertilizer use, low access to agricultural credit, land tenure insecurity, land degradation, poverty and gender issues, low and unstable investment in agricultural research, and poor market access and marketing efficiency (Ojo, 1993; Babalola & Odoko, 1996). These are discussed below.

Low Pricing and Low Fertilizer Use

Fertilizer use is promoted mainly by the fertilizer subsidy policy in Nigeria. Input subsidies have been a part of Nigeria's agricultural price policy since independence, and in spite of economic reforms in Nigeria, fertilizer subsidies have remained. In addition, under these sustained and high input subsidy programs, investments in core public goods such as research and extension, which also aim to boost productivity, are limited.

Although improved crop varieties exist, low fertilizer use is a serious constraint to agricultural productivity growth, averaging 10 to15 kilograms per hectare. An important factor is low and unstable domestic production. There has been no domestic production of fertilizer since the early 2000s, because NAFCON, the dominant fertilizer producer in Nigeria, has been shut down.

Other issues, which affect domestic supply of fertilizers, include high transport costs from port to inland destinations, poor distribution infrastructure, the absence of capital for private sector participation in distribution, significant business risks facing fertilizer importers, and inconsistencies in government policies.

Low Access to Agricultural Credit

Access to agricultural credit has been positively linked to agricultural productivity in several studies. Yet this vital input has eluded smallholder farmers in Nigeria. Banks with large loan funds are generally difficult for smallholder farmers to access.

Problems with collateral and high interest rates appear to frequently screen out most potential rural smallholder beneficiaries. In addition, agricultural loans are often short-term with fixed repayment periods, a loan structure that is not suitable for annual cropping or livestock production.

Land Tenure Insecurity and Land Degradation

An important institutional constraint is the absence of a clear title to land. Group ownership of land in Nigeria has been associated with such problems as limited tenure security, restrictions on farmers' mobility, and the inevitable fragmentation of holdings among future heirs. It may also limit access to formal credit, since the farmer cannot use land as collateral.

This reduces incentives to invest in land quality maintenance or improvement. Because poor farmers cannot afford alternative farmlands, and do not have customary access to lands not inherited, they remain on depleted lands and further degrade these resources. Thus, poverty and custom may constrain farmers' ability and willingness to mitigate land degradation, leading to declining productivity.

Poverty and Gender Factors

Poverty is a constraint to agricultural productivity. When farmers cannot afford yield-enhancing inputs, low productivity and food insecurity can follow.

Gender imbalances also constrain productivity. In spite of their significant role in agricultural production in many parts of Nigeria, women have varying and relatively limited rights to farmland, and lower access to extension services and credit. These constraints limit their agricultural productivity.

Low Unstable Agriculture Research Investment

When research is poorly funded, agricultural technologies cannot be improved, and there will be no downstream farm income increase, rural employment generation, reduction in food prices, establishment of agro-based industries, and economic growth. In short, the absence of new technologies in agriculture will slow the growth of agricultural productivity and the reduction of rural poverty.

Public research and development (R&D) spending in Nigeria has been low and unstable since independence, and the government budget process for funding agricultural research is complex. Private sector involvement in agricultural research has remained negligible to date.

Poor Market Access and Low Marketing Efficiency

Agricultural marketing efficiency in Nigeria is dismally low. Transport costs are high due to poor road conditions, limiting access to inputs, credit, and output markets, and reducing the transmission of key market information.

METHODS

This paper is a single explanatory case study following the principles of Yin (2009). The researcher held a post-positivist philosophy since quantitative data type evidence (descriptive statistics) were collected from archives to implement an explanatory analysis strategy using the hypothesis testing and general analytics research methods (Strang, 2013).

The unit of analysis was the cause-effect of national factors on the agriculture national production, therefore the level of analysis was the country as a whole. The primary level of analysis focus was on the agriculture sector stakeholders. The data was available in the archives, which are publicly accessible, so there were no participants.

The formal research method was general econometric analytics with hypothesis testing, which included ANOVA and Ordinary Least Squares regression techniques. The econometric method was the best approach since the analysis strategy was cause-effect and the factors were economic and numerical. ANOVA and regression techniques are commonly used to test hypotheses (Strang, 2009).

Research Hypotheses

The research work was guided by the following hypotheses:

H1: There is no significant relationship between commercial banks' credits to agriculture and agricultural contribution to real gross domestic product (Real GDP).

H2: There is no significant relationship between government's budget to agriculture and agricultural contribution to real gross domestic product (Real GDP).

H3: There is no significant relationship between agricultural credits guaranteed scheme fund and agricultural contribution to real gross domestic product (Real GDP).

In this study, two types of test are conducted: a test of the hypothesized cause-effect model significance (F-test) and a test for the statistical significance of each predictor (t-test). The tests were conducted at the 5% significance level.

In a given regression equation with k regressors for estimator's test of significance, the null hypotheses is:

H_0: $\alpha_i = 0$, and the alternative hypothesis is H_1: $\alpha_i \neq 0$.

For a decision the observed F-ratio, Fs, is compared with the theoretical F-ratio, $F_{0.05}$, which has V_1 = k- 1, $V_{2\,=}$ N-K degrees of freedom; N is the sample size and K is the total number of parameters estimated. The decision rules are:

1. If $Fs > F_{0.05}$, Reject H_0 - the regressors have a significant influence on the dependent variable;
2. If $Fs < F_{0.05}$, Accept H_0 - the regressors have an insignificant influence on the dependent variable.

Furthermore, two-tailed tests are conducted by comparing the observed t-ratio, t_s, with the theoretical t-ratio, $t_{(0.025)}$ that has degrees of freedom N-K. The null and alternative hypotheses are respectively, H_0: $\alpha_i = 0$ and H_1: $\alpha_i \neq 0$.

The decision rules are:

1. If $/t_s/ > /t_{(0.25)}/$, Reject H_0 - α_i is not equal to zero and with regressor influence, the dependent variables vary significantly;
2. If $/t_s/ < /t_{(0.025)}/$, Accept H_0, α_i is not statistically different from zero and with explanatory variable does not influence the regression significantly.

Empirically, the standardized 'F' distribution table indicates the critical cut-off F-ratio at 5% significance level is 3.0984. From the student's 't' distribution table, the critical t-ratio for two-tailed test at 5% significance level 2.080. These critical ratios will be compared accordingly with the calculated F statistic of the various estimators and observed t-ratio (t_s) for each parameter.

Data Collection Procedures

The data was accessed from the Nigerian government data archives in the various issues of the Central Bank of Nigeria Statistical Bulletin.

Annual time-series data was collected for the variables under study (which included Agricultural sector contribution to real Gross Domestic Product, commercial banks' credit to the agricultural sector, Government capital budget to the agricultural sector and Government recurrent budget to the agricultural sector) covering a 24 year period during 1986-2009.

The Agricultural sector contribution to real Gross Domestic Product (AG GDP) was the dependent variable and is explicitly considered because it measures the performance of the country's agricultural sector.

The relevant explanatory variables include the commercial banks' credit to the agricultural sector (BC AG), Government budget to the agricultural sector (AG BUD) and Agricultural Credit Guaranteed Scheme Fund (ACGSF).

Cause-Effect Model Specification

The ordinary least squares single equation technique was the estimation procedure chosen for this study. It was used for estimating the specified equation.

In this model, the researcher intended to investigate the impacts of the selected indicators of agriculture investment risk on the nation's Real Gross Domestic Product (Real GDP). The explanatory variables include the commercial banks' credit to the agricultural sector (BC AG), Government budget to the agricultural sector (AG BUD) and Agricultural Credit Guaranteed Scheme Fund (ACGSF). Explicitly, the model of the study is specified in Equation 1:

$$AG\ GDP = \alpha_0 + \alpha_1 BC\ AG + \alpha_2 AG\ BUD + \alpha_3 ACGSF + ei \quad (1)$$

where:

AG GDP = Agricultural Sector contribution to Real Gross Domestic Product
BC AG = Commercial Banks' Credit to Agricultural sector
AG BUD = Government budget to Agricultural sector
ACGSF = Agricultural Credit Guaranteed Scheme Fund
ei = Stochastic variable or error term
α_0 = Intercept
α_1, α_2, α_3 = Parameter estimates.

Techniques to Evaluate Hypotheses

The technique for evaluation of results implies the use of the following standard criteria: R^2 (adjusted R^2 for degrees of freedom) for testing goodness of fit of the estimated regression equation; F (ratio) for testing the significance of the regression coefficient; t (ratio) for testing the significance of each regression coefficient; and 'd' statistic (Durbin-Watson) for testing the randomness of the residuals.

Finally, the *a priori* sign and magnitude of the coefficients will be used to evaluate the results and tests conducted to ensure that the assumptions of the ordinary least square method are fulfilled.

Results and Discussion

Preliminary Data Analysis

First, the data were summarized from the CBN archives by independent uncertainty factor and by year to provide a practical meaning for agriculture investment risks (BCAG, AGBUD, and ACGF). The dependent variable data Real GDP (AGGDP) were summarized by year, as shown in Table 1.

Table 1. Summary of independent investment risk factors and dependent GDP variable by year

Year	BCAG	AGBUD	ACGSF	AGGDP
1986	1,830.30	925.4	68,417.4	72,135.2
1987	2,427.10	394.3	102,152.5	69,608.1
1988	3,066.70	650	118,611.0	76,753.7
1989	3,470.50	1,062.60	129,300.3	80,878.0
1990	4,221.40	1,966.60	98,494.4	84,344.6
1991	5,012.70	672.3	82,107.4	87,503.5
1992	6,978.90	924.5	88,031.8	89,345.4
1993	10,753.00	2,835.30	80,845.8	90,596.5
1994	17,757.7	3,719.10	103,186.0	92,833.0
1995	25,278.70	6,927.70	164,162.1	96,220.7
1996	33,264.10	5,574	225,502.5	100,216.2
1997	27,939.30	7,929.60	242,038.2	104,514.0
1998	27,180.70	11,840.40	215,697.2	108,814.1
1999	31,045.7	38,259.80	246,082.5	114,570.7
2000	41,028.9	10,596.40	361,450.4	117,945.1
2001	55,846.1	64,961.90	728,545.4	122,522.3
2002	59,849.7	44,803.80	1,051,589.8	190,133.4
2003	62,102.8	16,045.20	1,164,460.4	203,409.9

continued on following page

Table 1. Continued

Year	BCAG	AGBUD	ACGSF	AGGDP
2004	67,738.6	59,773.40	2,083,744.7	216,208.5
2005	48,561.5	90,798.20	3,046,738.5	231,463.6
2006	49,393.4	33,916.60	4,263,060.3	248,599.0
2007	149,578.9	39,004.09	4,425,861.8	266,477.2
2008	517,205.2	40,954.30	6,721,074.6	283,175.4
2009	449,475.0	43,002.01	8,349,509.3	299,996.9

Sources: CBN Statistical Bulletin, various issues

Cause-Effect Model Analysis

The results of the ANOVA and Ordinary Least Squares regression are shown in Table 2. Based on the regression estimates in Table 2, the R-squared (R^2) value of 0.905277 shows that at 90.53% the explanatory variables explain changes in the dependent variable. This means that at 90.53% the independent variables explain changes in the contribution of agriculture to Real Gross Domestic Product (Real GDP).

Table 2. Estimates from ANOVA and ordinary least squares regression

Variable Coefficient Std.Error t-value t-prob Part R^2
Constant 90044.00 6916.6 13.019 0.0000 0.8944
BC_AG -0.11599 0.092175 -1.258 0.2228 0.0734
AG_BUD 0.78769 0.25763 3.057 0.0062 0.3185
ACGSF 0.031292 0.0058548 5.345 0.0000 0.5882
$R^2 = 0.905277$ $F(3, 20) = 63.714$ [0.0000] s = 24963.9 DW = 1.36
RSS = 1.246388416e+010 for 4 variables and 24 observations
AG GDP = $\alpha_0 + \alpha_1$BC AG + α_2AG BUD + α_3ACGSF + ei
AG GDP = 90044. -0.11599BC AG + 0.78769AG BUD + 0.031292ACGSF
S.E. = (6916.6) (0.092175) (0.25763) (0.0058548)
t 13.019 -1.258 3.057 5.345
R^2 = 0.905277 F-Statistic = 63.714 D.W. = 1.36

This simply means that the explanatory variables explain the behaviour of the dependent variable at 90.53%. The calculated F-statistics of 63.714, which is greater than the F-table value (3.0984), implies that all the variables' coefficients in the regression result are statistically significant to the contribution of agriculture to Real Gross Domestic Product (Real GDP). The Durbin-Watson (DW) as shown in the regression analysis is 1.36.

The above model tested the effect of three different variables namely – commercial banks credits to the agricultural sector, government budget to the agricultural sector and the agricultural credit guaranteed scheme fund on the contribution of agricultural sector to real Gross Domestic Product. In order to obtain the regression result, the OLS technique with the help of the PC Give software was used.

The result obtained from the regression shows that there is negative relationship between the contribution of agriculture to real Gross Domestic Product and commercial banks credits to the agricultural sector with a coefficient of -0.11599. The corresponding standard error and t-values show that this coefficient is not statistically significant.

Hence, commercial banks credits to the agricultural sector are inelastic to the contribution of agriculture to real Gross Domestic Product in Nigeria. This negativity of the coefficient of commercial banks credits to the agricultural sector is not in conformity to the economic a priori

expectation of a positive impact of commercial banks credits to the agricultural sector on the contribution of agriculture to real Gross Domestic Product.

In addition, the regression result shows that government budget has a positive impact on the contribution of agriculture to real Gross Domestic Product with a coefficient of 0.78769. The coefficient of government budget Rate is statistically significant as shown by both the corresponding standard error and t-values.

Thus, government budget is elastic to the contribution of agriculture to real Gross Domestic Product. This 'positivity' of the coefficient of government budget conforms to the economic a priori expectation of a positive impact of government budget on the contribution of agriculture to real Gross Domestic Product.

Furthermore, the result obtained from the regression shows that agricultural credits guaranteed scheme funds has a positive and significant impact on the contribution of agriculture to real Gross Domestic Product. This is indicated by its positive coefficient of 0.031292. Thus, agricultural credits guaranteed scheme funds is elastic to the contribution of agriculture to real GDP since the standard error and t-values revealed that the coefficient is statistically significant. The positivity of agricultural credits guaranteed scheme funds coefficient conforms to the economic a priori expectation of a negative impact of agricultural credits guaranteed scheme funds on the contribution of agriculture to real Gross Domestic product.

From the regression result, both tests revealed that commercial banks' credits to the agricultural sector were not significant in explaining the contribution of the agricultural sector contribution to real GDP during the period of analysis, 1986-2009. However, the tests showed that government budget to agricultural sector and agricultural credit guaranteed scheme fund were significant to the contribution of agriculture to real GDP in Nigeria during the period of analysis, 1986-2009.

Hypotheses Test Results

The next step was to determine how much the agricultural uncertainty explanatory factors affected the Gross Domestic Product (GDP) dependent variable. This step is warranted since any reliable estimated regression equation is expected to conform to the *a priori* restrictions imposed or determined by the theoretical underpinning of the study in question. These issues are examined below.

In the regression equation, the coefficients of commercial banks' credits to the agricultural sector did not conform to the expected positive sign (this can be seen in Table 2 as '-0.11599BC AG'). However, the coefficient of government budget to agricultural sector and agricultural credit guaranteed scheme fund factors conformed to the expected positive signs respectively.

The empirical evidence from the results presented in Table 2 do not support the first hypothesis (H1) that there is a significant relationship between commercial banks' credits to the agricultural sector and the contribution of agriculture to real GDPP. This lack of significance for commercial banks' credits to the agricultural sector can be seen in its standard error value and t-test in Table 2.

However, the results of the regression do support the second (H2) and third (H3) hypotheses, namely that there is a significant relationship between government agriculture budget contribution towards to real GDP, and that there is a significant relationship between the agricultural credit guaranteed scheme fund and real GDP, respectively. The significance of the government budget to the agricultural sector and agricultural credit guaranteed scheme fund can be seen in their standard error values and t-tests respectively (see Table 2).

CONCLUSION AND RECOMMENDATIONS

The main thrust of this research was been to investigate the cause-effect uncertainty of agricultural investment in Nigeria. The investigation was an attempt to evaluate the impact of the selected measures through which investments are made in Nigerian agricultural sector and find out how they have helped in the contribution of agriculture towards the nation's overall economic performance during the period under analysis, 1986-2009.

The results are favourable in that the Ordinary Least Squares model indicated that two the of the three explanatory factors improved agricultural national production, namely: government budget towards the agricultural sector and agricultural credits guaranteed scheme fund. The results indicated that there was no significant relationship between commercial banks' credits for the agricultural sector and the contribution of agriculture to real GDPP.

Implications and Recommendations

The implications are that Nigerian policy makers should give higher priority to encouraging greater investments in the agricultural sector to achieve national economic growth through real GDPP. From the various tests concluded and hypotheses evaluated, it might well imply that commercial banks' credits to the agricultural sector over time have not proven to be significant to the performance of the sector.

These findings do not specifically generalize to other countries unless their socio-political, economic and agricultural factors are similar to Nigeria. Nonetheless, the trends may be worth examining for another country. Additionally, the research methods and techniques would be useful for analyzing the same hypotheses in another country, or later on in Nigeria (using updated data).

In view of the findings of the study, the following recommendations can be made:

- It is suggested that Nigerian policy makers should give greater priority to encouraging greater investments in the agricultural sector to achieve the desirable level of contribution of agriculture towards the national economic growth through real GDP;
- Policy makers should always avail themselves of quantitative research such as the present study to objectively and empirically measure the factors and variables to inform policies;
- The practice of changing macroeconomic policies by successive federal governments does not promote stable long-term investments in agriculture;
- The government and relevant agencies must look for ways of strengthening the operations of the agricultural credits guaranteed scheme fund (ACGSF);
- The federal government's agricultural credit guarantee scheme could be expanded and offered through commercial banks, to reduce uncertainty;
- Finally, the government's budgetary allocation to agriculture must be significantly increased to boost further investments in agriculture.

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Chapter 34
Liquidity Saving Mechanisms and Bank Behavior in Payment Systems

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ABSTRACT

Interbank payment systems form the backbone of the financial architecture. Banks need to hold costly funds at the central bank to process interbank payments. Each bank would individually like to hold a low amount of funds and finance its outgoing payments from payments received by other banks during the day. Collectively, however, all banks cannot "free ride" on other banks' liquidity, which makes bank behavior in interbank payment systems a complex and interesting topic. This chapter investigates the effect of Liquidity Saving Mechanisms (LSM) in interbank payment systems. LSM mechanisms have recently been implemented and proposed in many major interbank payment systems. The chapter applies a novel methodology combining Agent Based Modeling (ABM) and game theory. The authors model a stylized two-stream payment system where banks choose a) how much liquidity to post and b) which payments to route into the each of two "streams": an RTGS stream and an LSM stream. The authors simulate the systems using realistic settlement processes and solve equilibrium choices for the amount of liquidity to post and the fraction of payments to settle in each stream. The authors find that, when liquidity is expensive, the two-stream system is more efficient than the vanilla RTGS system without LSM. This is because the LSM achieves better co-ordination of payments. When liquidity is inexpensive, the second stream does not add value, as banks find it convenient to ignore it and use the plain RTGS stream. For an intermediate range of cost of liquidity, several equilibria may emerge. Besides a corner equilibrium where all payments are settled via the LSM stream, there are equilibria where both streams are used. Interestingly, some of these may be inefficient, as they involve a (somewhat paradoxical) mix of intensive use of the LSM and high liquidity usage in the RTGS stream. The appeal of the LSM resides in its ability to ease (but not completely solve) strategic inefficiencies stemming from externalities and free-riding.

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INTRODUCTION

Interbank payment systems form the backbone of the financial architecture. They are the ultimate method of settlement of obligations between banks, and provide final settlement for a number of ancillary systems: retail payment systems, securities settlement systems, fixed income and foreign exchange systems. Given the value of payments transacted there - typically around 10% of a country's annual GDP each day (Bech, et al., 2008). Due to the fact that interbank payment systems provide the ultimate means of settlement, their safety and efficiency are is of great importance to the whole economy and a pre-requisite for the effective implementation of monetary policy.

Up until a few decades ago, the interbank payment systems predominantly operated on the basis of net settlement. The payment to and from each bank would be processed over the course of the day and the net amounts due would be transferred from net debtors to net creditors on the books of the central bank. Due to the credit risks that this could cause if the payments were credited to customers before final interbank settlement, central banks began introducing Real-Time Gross Settlement (RTGS) systems. In such systems, the funds are credited in gross value together with the payment instructions so that intraday credit positions between banks do not arise.

The main cost faced by the banks operating in these systems is related to the provision of liquidity, which is needed to settle the payments. Indeed, most interbank payment systems use a Real-Time Gross Settlement (RTGS) modality, whereby a payment obligation is discharged only upon transferring the corresponding amount in central bank money. While this eliminates settlement risk, it also increases the amount of liquidity required: if two banks have to make payments to each other, these obligations cannot be 'offset' against each other. Instead, each bank must send the full payment to its counterparty.

RTGS systems, however, require much more liquid funds than net settlement systems. These settlement funds are normally provided free but against eligible collateral by the central banks. Even so, the collateral pledged may have alternative uses creating an opportunity cost.

As the amounts are very high, the costs are real and banks have an incentive to economize on liquidity usage. Each bank would individually like to hold a low amount of funds and finance its outgoing payments from payments received by other banks during the day. The RTGS structure may therefore incentivize free-riding. A bank may find it convenient to delay its outgoing payments (placing it in an internal queue) and wait for incoming funds which it can 'recycle.' By so doing, a bank can avoid acquiring expensive liquidity in the first place. Collectively, however, all banks cannot 'free ride' on other banks liquidity, which makes bank behavior in interbank payment systems a complex and interesting topic.

There are three main reasons why such 'waiting strategies' are in practice limited to a level that allows payment systems to function smoothly. First, system controllers may detect and penalize free-riding behavior. Second, system participants typically agree on common market practices and may punish non-cooperative behavior[1]. Third, banks themselves have an interest in making payments in a timely fashion. The cost of withholding a payment too long may eventually exceed the cost of acquiring the liquidity required for its execution.

However, it is a well-known fact that a certain volume of payments is internally queued for a while. These payments do not contribute to any liquidity recycling as they are kept out of the settlement process. A tempting idea is therefore to coordinate these pending payments according to some algorithm which may allow saving on liquidity.

These algorithms are called 'Liquidity Saving Mechanisms' (LSMs), and systems employing them are generally termed hybrid systems. There

are many kinds of hybrid systems; the simplest type combines two channels for settlement: one, which works by offsetting queued payments, and one, which works in RTGS mode. Banks may then use the first for less urgent payment, and the second for transactions that need to be settled instantly.

Given the amounts of liquidity circulating in payment systems (the average daily turnover in the UK system CHAPS exceeds £300 billion), and given that banks do delay payments internally, hybrid features may substantially reduce the amount of liquidity needed to process payments. Put differently, given a certain amount of available collateral and a certain volume of payments to settle, adoption of an LSM may increase settlement speed. For these reasons, liquidity saving mechanisms are becoming increasingly popular in interbank payment systems: while in 1999 hybrid systems accounted for 3% of the value of payments settled in industrialized countries, in 2005 their share had grown to 32% (Bech, et al., 2008).

In this chapter, we argue that introduction of a LSM in an RTGS system amounts to changing the 'game' between participants, thereby changing the tradeoff liquidity cost/delay costs. To study this change, we first model a plain RTGS system, where banks decide 1) the amounts of liquidity to devote to settlement and 2) how many (and which) payments to hold in internal schedulers. This plain RTGS system is then augmented by an LSM. Here banks decide the amount of liquidity to devote for settlement and how many (and which) payments to submit to the LSM stream. Hence, instead of internal schedulers, the banks use the LSM, where payments are settled at zero liquidity cost, as soon as perfectly offsetting cycles form.

BACKGROUND

There are three branches in the literature on liquidity saving mechanisms in interbank payment systems. The first one considers the problem of managing a central queue in isolation. The problem is interesting from an operational research perspective. For example, in the 'Bank Clearing Problem' the objective is to settle as many payments as possible with a given amount of funds. As each payment reduces the sender's funds and increases the recipient's funds, the choice of which payments (from a potentially large set) to include is not trivial. In fact, it is a variant of the 'knapsack problem'[2] and belongs to a class of computationally hard problems. Hence, there is a need to find approximate algorithms for solving these problems (see Guenzter, et al., 1998; Shafransky & Doudkin, 2006). An exact solution is given by Bech and Soramäki (2002) for the special case where payments need to be settled in a specific order.

The second branch of the literature is aimed at testing the effectiveness of specific LSMs by carrying out 'counterfactual' simulations. This approach has been used by system operations before implementation of LSMs into operational systems. Leinonen (2005, 2007, 2009) provide a summary of such investigations and Johnson et al. (2004) simulate the application of an innovative 'receipt reactive' gross settlement mechanism[3] using US Fedwire data. These works have the advantage of being based on real data, but generally take banks' behavior as exogenous (even if sometimes historical data are modified to enhance realism). However, it could be objected that if the system is changed in a significant way, as with the introduction of an LSM, behavior could change substantially, thus invalidating the data used in the simulations.

Third and last, some theoretical papers model liquidity saving mechanisms as games, where bank behavior is endogenously determined. McAndrews and Martin (2008) develop a 2-period model where each bank in a continuum has to make and receive exactly 2 payments of unit size. Banks have to choose when to make payments, and how (they can choose to pay either via the RTGS stream, or via the LSM). Delayed payments generate costs, as does the use of liquidity. Banks may be hit by

liquidity shocks–i.e. the urgency of certain payments is ex-ante unknown. The model is solved analytically under assumptions on the pattern of payments that may emerge. As the authors show, an LSM enlarges the strategies available to the banks, as it allows them to make payments conditional on receiving payments. While a priory beneficial, this is shown to produce perverse strategic incentives, which may counteract the mechanical benefits of an LSM.

The computational engine for the LSM offsetting algorithm employed in the present chapter is borrowed from the operational research literature (Bech & Soramäki, 2002). But as this chapter concentrates on the banks' strategic behavior, it is closely related to the third, game-theoretic branch of the literature. However, in contrast to McAndrews and Martin (2008), we solve payoffs numerically by means of simulations. Our conclusions are broadly in line with theirs: liquidity saving mechanisms may generate efficiency gains. However, undesirable outcomes may also result. In McAndrews and Martin (2008), the overall balance depends on a number of parameters: the size of the system, the cost of delay, the proportion of time-critical payments (in their model, payments are either time-critical or not). Our model instead offers sharper predictions, as the only crucial parameter is the cost of liquidity. This is a consequence of the different (more parsimonious) construction of our model, which also means that any comparison between the two can only be in rather general terms.

Using simulations allows us substantial freedom in designing our model. For example, we need not restrict our attention to the case of exactly 2 payments sent by (and to) each bank. Nor do we have to look only at a scenario with only two time-periods. Instead, we can allow for arbitrarily many payments to be made, in all possible patterns and sequences, over an arbitrarily long day.

SIMULATION MODEL

Our framework is a simple model of a payment system, adjusted in two different ways to describe the two systems that we compare. Banks make choices–to be illustrated later–that jointly determine system performance and hence their costs or payoffs. The game-theoretic structure of the model is straightforward: a one-shot simultaneous-move game, of which we find the Nash equilibria.

As described later, the model has an implicit time dimension. However, this only pertains to the settlement process, i.e. to the model used to derive the banks' payoffs. Once the choices are simultaneously made, the expected-value payoffs are determined so there is no dynamic interaction between banks. A main innovation of the chapter is the way payoffs are determined: They are numerically generated by a simulation model, which mimics a payment system in a fairly realistic way.

We allow banks to exchange many payments over many time-intervals, generating complex liquidity flows with 'queues,' 'gridlocks,' and 'cascades' (See Beyeler, et al., 2007, for details on the dynamics of this process). We argue that this enhances realism by incorporating the complex system's internal liquidity dynamics into the payoff function. The parameters used in the simulations are summarized in Appendix 2.

Payment Instruction Arrival

Our model features N banks, who receive payment instructions (orders) from exogenous clients throughout a 'day.' Each instruction is the order to pay 1 unit of liquidity to another bank with certain 'urgency.' An instructions is thus a triplet (i, j, u), where i and j indicate the payer and payee, and u the payment's urgency (discussed below). Payment instructions are randomly generated from time 0 (start of day) to time T (end of day) according to a Poisson process with given intensity.

For each arriving instruction, payer (i) and payee (j) are randomly chosen from the N banks with equal probability. As a consequence, the system forms a complete and symmetric network in a statistical sense. Each bank sends the same number of payments to any other bank on average. However, this may vary from day to day. On one day a bank may be a net sender vis-à-vis another bank, on others a net payer.

The urgency parameter u is drawn from a uniform distribution U~[0,1], and reflects the relative importance of settling a payment early. If payment r with urgency u_r, is delayed by t time-intervals, it generates a delay cost equal to $u_r t$ to the payer.

Completeness of the payment network is a simplifying assumption. However, it is not at all unrealistic for systems with a low number of participants such as the UK CHAPS where banks send and receive payments to and from each other. Symmetry also simplifies our work, and is also useful for technical reasons explained later on. As for the assumption of a uniformly distributed u, the simulations show that this is not essential: qualitatively similar results would be obtained using a two-modal beta distribution (in which most payments are either very urgent, or not urgent at all), or a bell-shaped beta distribution (with most payments being 'quite' urgent, and only few payments of low or high urgency).

Payment Settlement

We look at two alternative payment settlement scenarios. One where the bank has a choice of submitting the payment in either an RTGS stream or to hold its submission, and one where it has the choice of the RTGS stream and the LSM stream. Payments submitted into the RTGS stream settle immediately upon submission, but only if the sender bank has enough liquidity. If the sender lacks sufficient liquidity, the payment is held in a central queue in RTGS system and is released for settlement when the sender's liquidity balance is replenished by an incoming RTGS payment. Upon settlement, liquidity is transferred from payer to payee.

The holding of payments in a bank's internal queue functions in the simplest way: a payment is withheld for the whole day, and submitted to the RTGS stream at final time T. While always available to banks (barring specific throughput requirements), this second stream represents a rather extreme behavior. In reality banks may delay payments only for a certain time, and release them following sophisticated rules[4]. We use this very stylized benchmark for the sake of simplicity.

In contrast, the LSM is managed by a controller, who continuously offsets payments on a multilateral basis. To find offsetting cycles, we use the Bech and Soramäki (2002) algorithm. The algorithm finds cycles of maximum size under the constraint that each bank's payments are settled according to a strict order–in our case first-in-first-out. Because payments in the LSM stream settle only by offset, this stream requires no liquidity. At the end of the day, any payments that could not be offset in the LSM stream are moved to the RTGS stream and settled according to its rules. This ensures that all payments scheduled for the day are settled on it.

Our aim is to compare the two systems. The first system is a natural benchmark for a plain RTGS system. The second one is a specific example of a dual-stream system, as we adopt a specific offsetting algorithm. For the LSM in particular, we adopt that specific algorithm because presented in Bech and Soramäki (2002).Our choice is motivated by the following characteristics of the algorithm. First, the algorithm has a fast calculation time which makes it suitable for a real-time settlement environment (settlement does not need to suspended for the time the algorithm is run). This makes it also very suitable for our simulations. Second, it retains the order (i.e. prioritization) in which payments were submitted to settlement by the banks. Third, it can be shown that the algorithm

is optimal (given the order constraint) and fair. Variant of the algorithm are also used in some real RTGS systems such as the Danish interbank payment system.

The Game: Choices and Costs

At the start of the day, each bank makes two choices:

1. Its opening intraday liquidity in the RTGS system $\lambda_i \in [0,\Lambda]$ and
2. An urgency threshold $\tau_i \in [0,1]$.

Payment instructions with urgency greater than τ_i are settled in the RTGS system. Payment with urgency smaller or equal to the threshold are either queued internally or routed to LSM, depending on the model. As the urgency parameter of the payments is drawn from U~[0,1], τ_i is also the (expected) percentage of payments that bank *i* queues internally or routes to LSM. Once banks have chosen their opening intraday liquidity and urgency threshold, settlement of payments takes place mechanically: banks receive payment instructions and process them according to urgency.

Costs are defined as in Galbiati and Soramäki (2011). At the end of the day, each bank pays a total cost, defined as the sum of a) the liquidity costs incurred in acquiring the opening intraday liquidity and b) the delay costs, which depend on the delays experienced during the day. Given a profile of choices $\sigma=\{\sigma_1,\sigma_2,...\sigma_N\}$ where $\sigma_i=(\lambda_i,\tau_i)$ is bank *i*'s strategy, the costs borne by *i* are:

$$C_i(\sigma) = \alpha\lambda_i + D_i(\sigma) = \alpha\lambda_i + \sum_r u_r(t_r - t_r') \quad (1)$$

where α is the price of liquidity and $(t_r\text{-}t_r')$ is the lag between reception and execution of payment *r* with urgency u_r. For a given outcome, liquidity costs (first element in Equation 1) depend linearly on liquidity cost α and delay costs (second element in Equation 1) depend linearly on payment urgency u_r. The dependence of total costs C_i on τ_i and on 'others' choices σ_j comes via the delays $(t_r\text{-}t_r')$, which depend on the τ's and λ's of all banks in the system.

Equilibrium

The model has *N* players, actions λ_i and τ_i for each player and costs (payoffs) determined as described in the above section. We concentrate on the symmetric equilibria of this game, i.e. on choice profiles $\{(\lambda_1,\tau_1),\ldots(\lambda_i,\tau_i),\ldots(\lambda_N,\tau_N)\}$ such that: 1) all banks choose the same actions (i.e. $(\lambda_i,\tau_i)=(\lambda_j,\tau_j)\,\forall i,j$) and 2) each (λ_i,τ_i) is a best reply to others' choices. As usual, an 'equilibrium' is a strategy profile such that any unilateral deviation is not beneficial to the deviator–even if it would lead to a non-symmetric outcome.

By restricting attention to symmetric equilibria, we may miss equilibria where banks adopt different, albeit mutually optimal, choices. Our focus on symmetric equilibria is mainly dictated by simplicity reasons. However, extra-model considerations suggest that such asymmetric equilibria (should they exist) would be unlikely to survive in reality. First, if a bank posted less liquidity than others, it might be seen to 'free-ride' and could be somehow sanctioned in the long run. Second, in reality banks do not know the choices of their counterparties. What they typically do know is some average indicator of the whole system, and this is what they play against. If *N* is large, all banks will face the same 'average opponent,' and, being identical, they will all choose the same best reply to that. This confirms that symmetric equilibria are the ones to concentrate on here.

Model Parameters and Payoff Simulations

We use simulations to determine the payoff function. We model a system of 15 banks. The Poisson process for instruction arrival (and thus

length of the day) is calibrated as to produce an average of Z=30 daily payments per bank. This number is essentially arbitrary and chosen from practical considerations of computational speed a sufficiently large scale for the system.

We know that, under normal circumstances, banks e.g. in UK CHAPS system hold liquidity in the range of 5 to 25 percent of their gross daily payments. This suggests that, if we fix Z=30, we should choose Λ (upper bound for liquidity choices by banks) such that Λ/Z exceeds the 25% upper bound (so that equilibrium choices are not artificially constrained by our parameters choice), but is somewhat comparable to it. This is why we set Λ=10, so Λ/Z=33%.

The price of liquidity α is also arbitrary. However, when we vary it for our comparative statics exercises, its range needs to be calibrated in a somewhat meaningful way. As mentioned above, a realistic value for the ratio (equilibrium liquidity)/Z is in the region [0.05, 0.25] for CHAPS banks. Thus, we let α vary in a range which produces equilibrium choices falling in a comparable range. Indeed, in our experiments a bank's equilibrium liquidity range from 0 to 10, i.e. from 0 to 33% of daily gross payments (Z=30).

To compute the payoff function of bank *i* (Equation 1), we need to find the delays experienced by *i* for each strategy profile $\sigma = \{\sigma_1,\sigma_2,... \sigma_N\}=\{(\lambda_1,\tau_1),\ldots(\lambda_i,\tau_i),\ldots(\lambda_N,\tau_N)\}$.With 15 banks and, say, 5 choices for each λ_i and τ_i, exploration of the full strategy space would require looking at $(5\times5)^{15}/15!$ unique combinations. To simplify, we restrict ourselves to computing payoffs for strategy profiles $\sigma = \{\sigma_1,\sigma_2,...\sigma_N\}$ of the type $\{\sigma_1, \sigma_2 = \sigma_3 =...=\sigma_N\}$. This is justified because, like said above, we restrict attention to symmetric Nash equilibria. Hence, we only need to consider deviations from strategy profiles of the type $\{\sigma_1= \sigma_2 = \sigma_3 =...= \sigma_N\}$, i.e. we only need to know the delays experienced by *i* for each of the profiles of the type $\{\sigma_1, \sigma_2 = \sigma_3 =...=\sigma_N\}$. This greatly reduces the action profiles to explore, because now the delays are a function of four variables only: a bank's own actions $(\lambda_i\tau_i)$, and the (common) action by all 'others' $(\lambda_{-i}\tau_{-i})$[5]. We simulate the settlement process for λ taking on all integers in [0,10], and τ any number in [0,0.2,0.4,..1]. That is, we compute $11^2\times6^2 = 4'356$ values of the delay function, for just as many action profiles. Because payment orders arrive in a random order, we need to simulate a good number of 'days' for each action profile, to obtain a reliable estimate of the 'average day.' We deemed that n = 200 days for each action profile are a large enough sample–because at that point the observed average across days is no longer sensitive to further increases in n. Hence, we simulate $200\times11^2\times6^2 = 871'200$ days in total.

Yet, 11×6 choices for each bank are not enough to obtain 'smooth' results: when computing the equilibria, undesired artifacts emerge. Hence, we numerically smooth out and interpolate the delay function $D_i((\lambda_i\tau_i),(\lambda_{-i}\tau_{-i}))$ on a refined grid, a 4-dimensional cube with $41^4=2'825'761$ points, which correspond to banks choosing λ in [0,10] in steps of 0.25 (41 liquidity levels) and τ in [0,1] in steps of 0.025 (41 threshold levels). Adding liquidity costs as in Equation 1), we get to the payoff function.

RESULTS

We start by analyzing the costs for payment delays and then add liquidity costs to arrive at total costs–i.e. the payoff function of the game. Once these are established, we describe the properties of equilibria that arise in a game with such payoffs.

Delay Costs

We start by looking at the delay costs in a plain RTGS system. Figures 1 and 2 show the two components of delay costs: delays stemming from the RTGS stream, and delays stemming from either delaying payments internally, or delaying them in the LSM stream. The urgency threshold τ is shown

Figure 1. Total delay costs: RTGS with internal queues as a function of threshold. Each chart in the panel represents a given level of liquidity in the system.

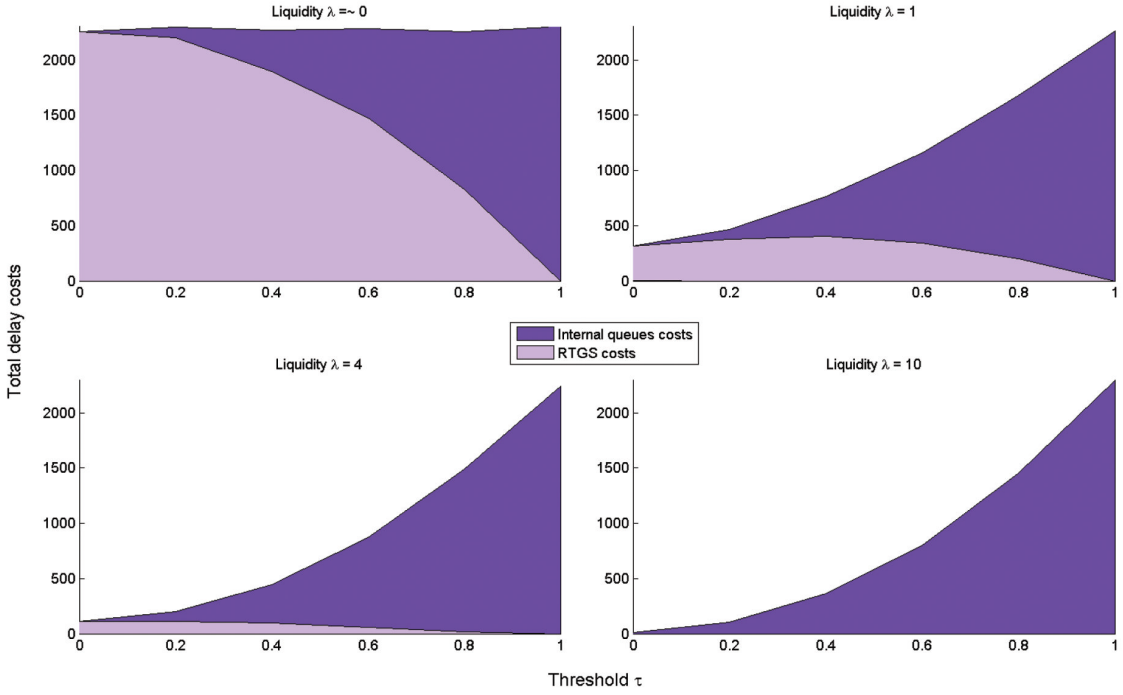
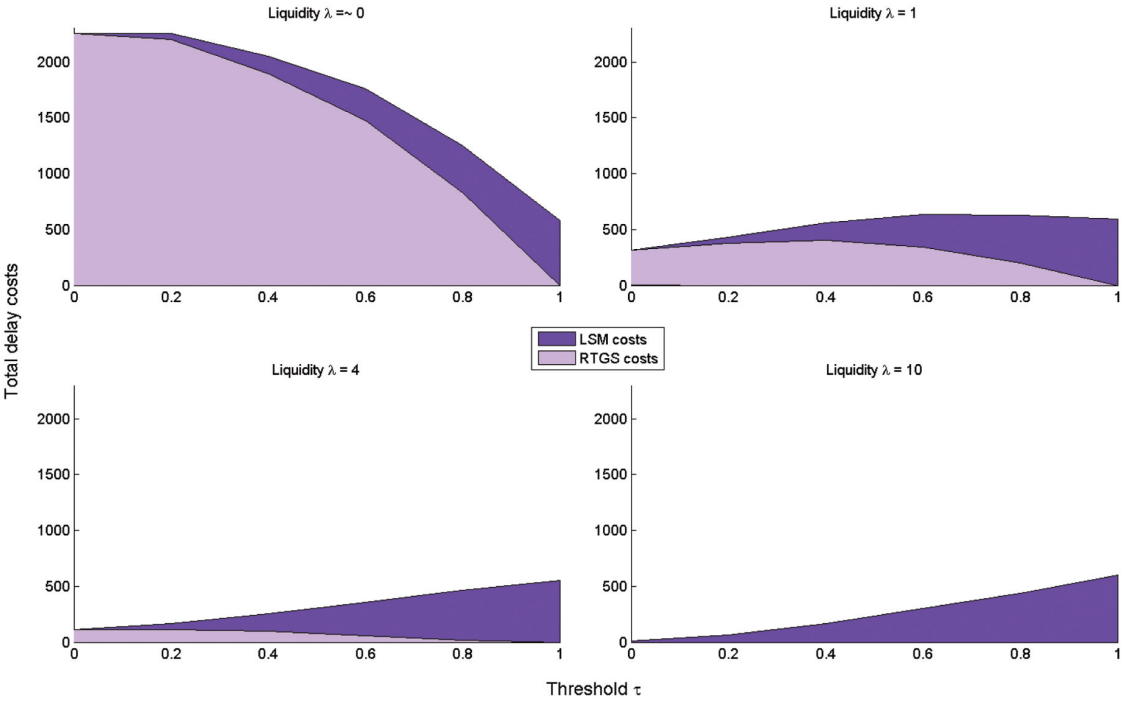


Figure 2. Total delay costs: RTGS with LSM as a function of threshold. Each chart in the panel represents a given level of liquidity in the system.



in each panel on the horizontal axis; the vertical axis shows the delay costs. The four panels are for increasing levels of liquidity chosen by the banks.

When banks have almost no liquidity (Figure 1, top left), no settlement takes place and payments are delayed either in RTGS queue or held internally at the banks. When liquidity is increased (top right), settlement can take place in the RTGS stream. As more payments are held internally (i.e. as the threshold τ grows), the costs stemming from delays in the RTGS stream rise, reason being that the liquidity efficiency of the RTGS system is reduced, so more delays accumulate there. The same of course holds for internal queues' delays (as more payments are indeed queued internally). From a certain point on though (when τ~0.4), RTSG delays (and the associated costs) start to fall. This is because RTGS payments become so few, that even if they settle rather slowly, their number is limited, so the effect on the product (delays)×(number of delayed payments) actually falls. In the limit, as $\tau = 1$, no payments are sent to the RTGS stream, so no delays accumulate there. With higher level of liquidity, the mechanisms at work are exactly identical, except that RTGS delays are smaller.

A LSM stream can reduce delays substantially. When all payments are settled using the LSM stream ($\tau = 1$), the amount of liquidity λ present in the system is irrelevant (indeed, liquidity is only used in the RTGS stream). In this case, delays are around one fifth of those suffered when the LSM is not available.. By the same token, the delays in the LSM stream are not affected by the amount of liquidity, but only by τ, i.e. by the share of payments submitted to the LSM. So when liquidity is increased, delays in the RTGS stream are reduced, while delays in the LSM stream are unaffected. However, just like the RTGS stream, the LSM stream is more efficient when more payments are submitted to it[6].

Total Costs

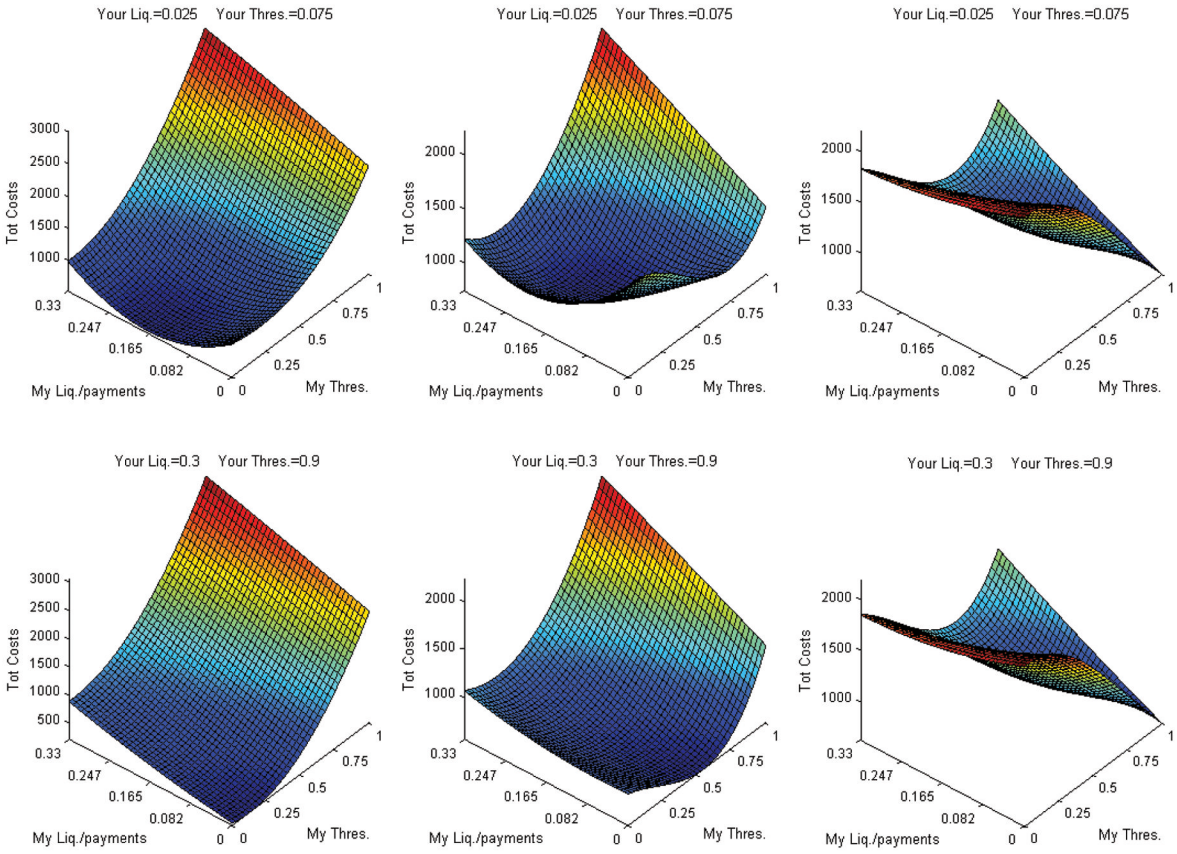
Total costs are obtained by adding liquidity costs to delay costs, as discussed before (Equation 1). In turn, delay costs depend on the liquidity and threshold choices by all banks. Figure 3 refers to a system with an LSM. Taking the point of view of a single bank, it shows how 'my' total costs depend on 'my' choices, for various 'others' choices–which of course may be different from 'my' choices.

The pictures in the first row show the impact of 'my' choices when 'others' liquidity is low. The second row shows the consequences of 'my' choices when 'others' liquidity is high. Moving left to right along a row, the 'others' threshold is increased. These figures show that the dependence of 'my' payoffs on 'my' choices varies dramatically. For example, when others provide little liquidity and route most payments to RTGS (Figure 2, top-left), my total costs are minimized by routing all my payments to RTGS, providing somewhat more liquidity than the others. So, in a sense, I would be forced to give in and provide liquidity, if others do not. On the other hand, if other banks provide large amounts of liquidity and route half of payments to RTGS (bottom-middle), I should provide no liquidity at all (others already do so sufficiently) and I should route most payments to RTGS, according to the well-known 'free-riding' strategy.

This shows that the basic structure of a 'plain' RTGS liquidity game (whereby there are incentives to free-ride, but if others do so, I should accommodate) is preserved in this more complex setting. However, as we will see in what follows, the presence of the LSM softens these incentives, making it possible to achieve better equilibrium outcomes.

The efficiency of each stream (RTGS or LSM) depends on the share of payments routed to it by the 'others' (i.e. by their threshold). In addition,

Figure 3. 'My' costs for different choices by 'others'–with LSM



the efficiency RTGS stream also depends on the amount of liquidity committed by 'others': the more liquidity 'others' post, the more attractive the RTGS becomes, as 'my' liquidity and 'others' liquidity are complements.

Equilibria

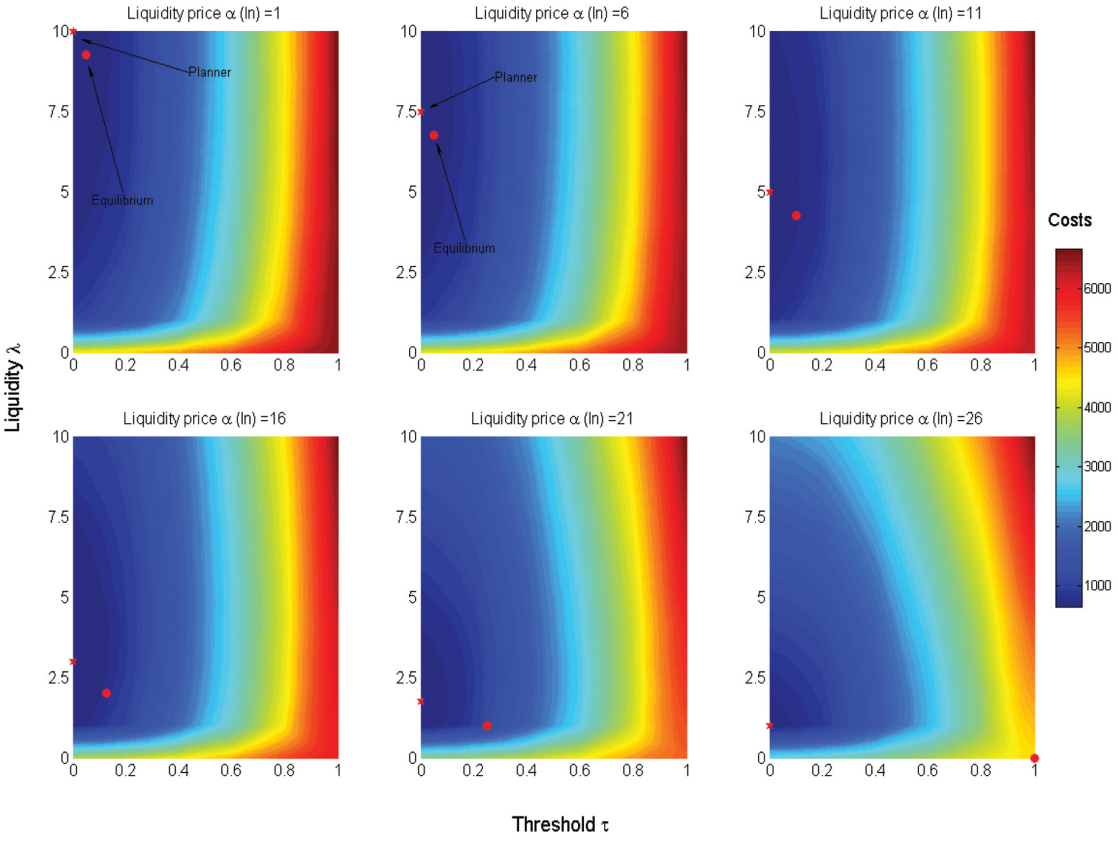
As mentioned earlier, we concentrate on symmetric equilibria, i.e. action profiles where all banks make the same choices. To find these, we look for fixed points of the best reply correspondence. That is, for each choice by the 'others,' we compute 'my' optimal choice of τ and λ, and then look for choices, which are best replies to themselves.

A key parameter in the model is the price of liquidity α in Equation 1. This is arguably the variable over which central banks and policy makers have the greatest influence. Thus we look at how the equilibrium varies when the price of liquidity α changes. An accurate calibration of the model is beyond the scope of this chapter. Thus, we let the parameter α vary in a range wide enough for the equilibria to span the whole strategy space–keeping the price of delays fixed.

RTGS with Withholding Payments

Figure 4 shows equilibria and the planner's choices for different prices of liquidity. Equilibrium choices are represented by dots, while the planner's choices are represented by stars. The background gradient shows system-wide costs, which are, by definition, lowest at the planner's choice.

Figure 4. Equilibria and planner's choices without LSM. Each chart refers to a given price of liquidity (lowest price on top-left; highest price on bottom-right).



The planner's choice of τ is dichotomous. Either all payments are sent to RTGS, or they are all internally queued until the end of the day. Equilibrium choices are less stark, and banks typically use both queues and RTGS. When the (relative) price of liquidity rises, banks post less liquidity and resort to delaying payments internally. Importantly, the equilibrium is inefficient: a cost-minimizing planner would provide more liquidity to the system and would never delay payments internally. Equilibrium costs are always more than 15% higher than the social optimum, reaching multiples thereof at high liquidity prices. Only when the price of liquidity is extremely high, the equilibrium coincide with the planner's optimal choice, both being $\{\lambda=0, \tau=1\}$.

The reason for this inefficiency is explained by two externalities. On the one hand, there is a positive externality in liquidity provision: incoming payments to a bank can be recycled for making other payments, so liquidity is in a sense a common good, as in Angelini (1998). As a result, equilibrium liquidity provision (λ) falls short of the social optimum. On the other hand, internal queues generate a negative externality: banks have an incentive to delay less urgent payments, and use liquidity for more urgent ones. However, by doing so, they slow down the beneficial liquidity recycling in RTGS, which in turn affects other banks. Hence, banks queue more than they should from a social perspective–i.e. τ exceeds the level that would be chosen by the planner.

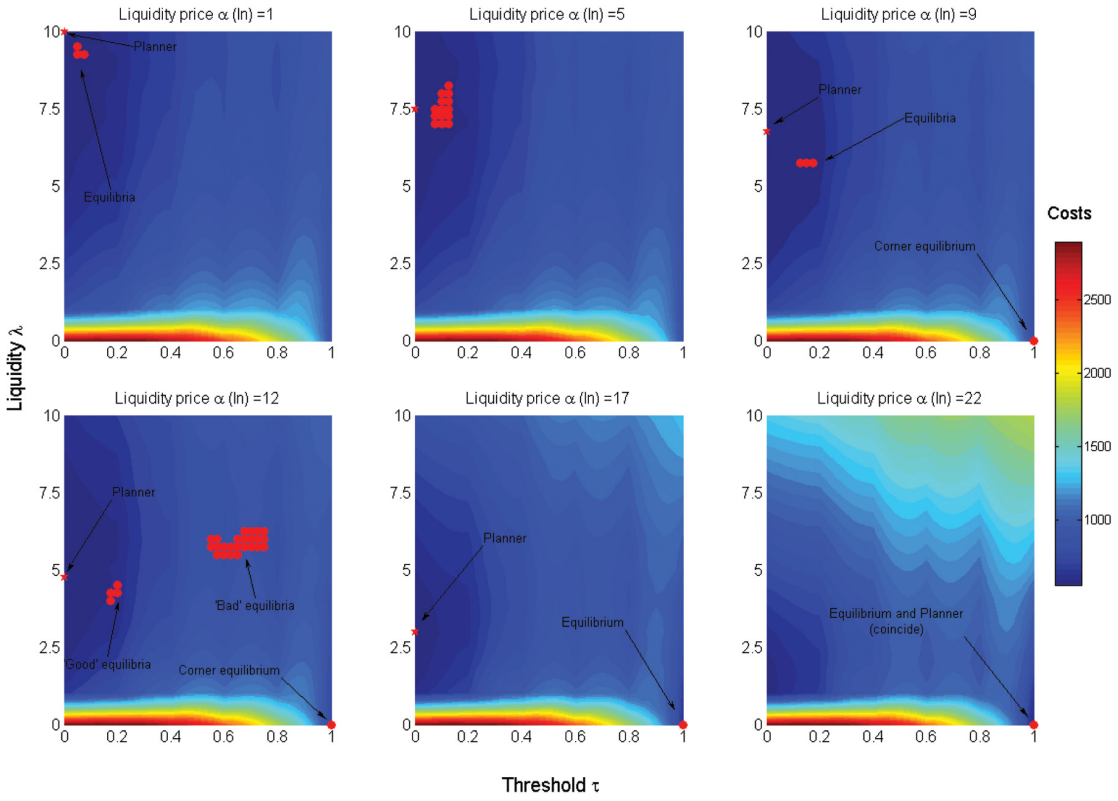
RTGS with LSM

As with internal delays of payments, the routing of payments to a LSM allows banks to reserve liquidity for urgent payments in RTGS. However, while internal queues merely postpone settlement until the end of the day, the LSM allows for settlement as soon as offsetting cycles are found, without making use of liquidity. Thus from the outset, the LSM offers a more efficient way of queuing payments.

However, increased efficiency of the second stream induces banks to use it more intensely. In addition, an increase in τ causes a reduction in RTGS volumes, which in turn causes this stream to lose in efficiency. Hence, there is a trade-off between the efficiency levels of the two streams. When 'played with' by individual banks, these effects may produce unexpected outcomes, as we show next.

Figure 5 shows that, when liquidity costs change, the equilibria change essentially as in the RTGS with internal queues model. In particular, as the price of liquidity (α) rises, liquidity provision (λ) decreases and usage of the LSM (τ) increases. Compared to the social optimum, liquidity provision is too low and payments are delayed too much. For very high prices of liquidity, both banks and the planner rely exclusively on the LSM. Only then is the equilibrium efficient. The planner never uses both streams at the same time–as was already discussed.

Figure 5. Equilibria and planner's choices for a system with LSM. Each chart refers to a given liquidity price α (lowest α on top-left; highest α on bottom-right).



The main novelty with an LSM compared to internal queues is that, for an intermediate range of liquidity costs, multiple equilibria emerge (shown in the picture as separate clusters of ε-equilibria[7]). In a typical case, there are up to three equilibrium types:

1. A corner equilibrium $\lambda=0, \tau=1$ (all payments via LSM);
2. Equilibria with moderate use of both liquidity and LSM ('good equilibria').
3. Equilibria with high usage of both liquidity and LSM ('bad equilibria').

Equilibria under (a) are socially optimal (i.e. coincide with the planner's choice) only in the extreme circumstances of very high liquidity costs. However, they are typically better than the equilibria under (c). These latter are called 'bad' as they feature the highest costs among all equilibria. Equilibria under (b) are typically those with lowest costs, so we call them 'good.'

Although 'bad,' the equilibria under (c) are interesting for their paradoxical features: high liquidity usage (λ) and high reliance on the LSM (τ). Their existence is probably explained as follows. LSM features economies of scale, so its high usage may be self-sustaining. However, as mentioned at the start of this section, over-use of the LSM is detrimental to the RTGS stream, which may in turn require inefficiently high amounts of liquidity.

CONCLUSION

We presented in this chapter a model of two stylized payment systems. In both of them, banks can queue non-urgent payments to reserve liquidity for urgent ones. In the first system, queued payments are held internally by the banks and are submitted for settlement at the end of the day. In the second system, queued payments are routed to an LSM and are settled throughout the day by an offsetting algorithm.

As expected, the LSM is more efficient than decentralized queuing: it pools otherwise segregated queues, allowing continuous settlement throughout the day (Figure 1 and Figure 3). However, more importantly, an LSM changes the strategic interaction between banks, modifying their incentives.

To assess the effects of an LSM from a welfare point of view, we first look at the choices of a social planner, whose objective is to minimizing total costs for the system. When only internal queues are available, the planner willingly delays payments (sets $\tau < 0$) only when liquidity is very expensive (Figure 5). In all other circumstances, the planner submits all payments to the RTGS stream. The planner makes a similar dichotomous choice if it can use an LSM: its sends payments in the LSM only if liquidity exceeds a certain level; otherwise, is settles all payments via the RTGS stream. Thus, from the planner's perspective, a LSM is only valuable in extreme circumstances.

When looking at banks acting strategically, more complex behavior emerges in equilibrium: for a range of liquidity prices, banks use both direct RTGS settlement and queues (be these internal queues or the LSM). As to be expected, they also queue more at higher liquidity costs. In equilibrium, banks under-provide liquidity and suffer both higher delays and overall costs than socially optimal: the 'central planner' would only use the RTGS stream and provide it with more liquidity than the banks do. This inefficiency is due to the fact that banks tend to free-ride on each others' liquidity.

However, a system with an LSM is capable of delivering better outcomes than those resulting in the absence of a LSM. Indeed, for a range of liquidity prices, we find 'good' LSM equilibria, which feature lower total costs than their non-LSM counterparts. Cost savings here derive from faster settlement and often, although not always, to lower liquidity usage.

Our results point out a caveat, though: for a range of liquidity prices, a system with a LSM may also generate 'bad' equilibria with 1) high liquidity usage, 2) intense use of the LSM, and 3) high costs, exceeding those obtained without LSM. The existence of these (somewhat paradoxical) equilibria is explained as follows. The LSM stream features economies of scale: the more payments are sent in it, the more efficient the stream becomes. Hence, its high usage may be self-sustaining. However, the RTGS stream also features economies of scale, which is to say: if many payments are sent to the LSM stream, the RTGS stream may become *less* efficient. Because of this, it may require high amounts of liquidity, which lead to an overall cost-inefficiency. This suggests that liquidity saving mechanisms can be useful, but they may need some coordination device, to ensure that banks arrive at a 'good' equilibrium.

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KEY TERMS AND DEFINITIONS

Circles Processing: An algorithm that searches for subsets of payments that could be settled simultaneously with the funds available to each bank which consist of external liquidity and funds received from payments in the algorithm's solution.

Gridlock: A situation where several payments await the settlement of each other but none can be settled with existing allocation of funds among the sending banks. See circles processing.

Interbank Payment System: A system operated by the central bank that allows financial institutions to transfer claims on central bank money, or ancillary systems that settle in central bank operated payment systems.

Intraday Liquidity: Funds available for settling payments. These consist normally of reserve balances and intraday credit extended from the central bank.

Liquidity Risk in Payment Systems: The risk that lack of funds prevents the settlement of payments longer than preferred by the bank.

Liquidity Saving Mechanisms (LSM): Allow payment settlement with less liquidity by enhancing participating bank's coordination on the timing of payment submission or by synchronizing timing of settlement so that payments can offset each other.

Real Time Gross Settlement (RTGS) Systems: Are funds transfer systems where the transfer of funds takes place from one bank to another on continuous (real time) basis and where each payment is processed individually (gross) only if sufficient cover is available on the sending bank's account.

Settlement Risk in Payment Systems: The risk that arises when a payment has been credited to the account of the recipient before full cover has been transferred by sending bank. RTGS settlement eliminates settlement risk.

ENDNOTES

1 e.g. 'The European Interbank Guidelines on Liquidity Management' by the European Banking Federation (EBF) or 'Throughput Guidelines' in the CHAPS system rules.

2 A problem in combinatorial optimization, which derives its name from the problem faced when packing a rucksack of limited size with valuable objects–so as to maximize the total value of objects fitting in it.

3 RRGS bases the settlement of queued payments on the value of incoming payments rather than on a participant's account balance–providing enhanced incentives to submit payments for settlement earlier.

[4] Larger banks usually employ software algorithms to release payments based on estimates on the bank's liquidity position on the given day and on future days. The schedulers may contain limits for bilateral positions, buffers for unexpected events, and are tied with the bank's end of day liquidity management in the interbank lending market. Smaller banks release payments individually and manually.

[5] Galbiati and Soramäki (2011) show that, in a simpler game where banks choose *only* the amount of liquidity to settle payments, all that matters for a bank are its own liquidity and the average (sum) of others' liquidity (in technical terms, they show that the liquidity game is a potential game). This suggests that concentrating on strategy profiles of the kind $\{\sigma_1, \sigma_2 = \sigma_3 = ... = \sigma_N\}$ may be not so restrictive as it could seem at first.

[6] Total delays can be calculated as $x \bullet (\tau/2) \bullet \tau$, where x is the average time delayed, $(\tau/2)$ the average urgency and τ the volume routed to RTGS. Simulations show that total delays scale as $\alpha \bullet \tau$, so one deduces that $x \sim \alpha \bullet 1/\tau$. In a sense, LSM displays increasing returns to scale with respect to processed volumes. The larger the pool of payments on which an LSM searches for cycles, the more likely (and longer) will be the cycles themselves.

[7] An ε-equilibrium is a strategy profile from which deviation yields at most a small (ε) gain to the deviator. Here it is simpler to compute and visualize ε-equilibria (instead of plain equilibria) because our numerical results are obtained on finite 'grids' in the $(\lambda, \tau)^2$ space.

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Chapter 35
Banks and People in the Development Process:
A District-Level Analysis of the Banking Habits in India

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ABSTRACT

Economic development is crucially an end product of mobilizing dormant savings into the fragrance of a new life - what is commonly called as investment. Banks play a crucial role in this channelization. In an underdeveloped economy like India, there are many traditional avenues of savings (such as gold, land, livestock, real estate, and so on). There may be many motives why people opt for traditional avenues rather than formal banking. The traditional avenues are believed to be more trustworthy and down to earth. The strict rules and stereotyped functioning of the formal banks can make them uncomfortable to the people in the underdeveloped areas. Thus, a huge fund in India is caught in the web of informal banking streams. This chapter seeks to understand how far and to what extent these changes have occurred in India. First, the authors consider a case study from rural India that depicts disparate banking behavior of rural populace. Next, they use district level data on banking habits across all the states of India. The authors first note the pattern and distribution of banking habits of people across the subcontinent. They then try to assess the reasons behind such discrepancy.

INTRODUCTION

Traditional macro economic theory asserts that the key to economic development is the availability of savings. An improvement in savings would release funds that can be invested. In all our standard theories, the synchronization between saving and investment is automatic. In the neo-classical approach, the problem of investible fund is not put forth. In the Keynesian model, the matching between saving and investment is essential. But, this is only in the aggregative sense. Keynesian

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equilibrium is determined when demand for investible funds matches the supply, i.e. saving. What these models safely assume is the working of a well-structured banking system, wherein the supply of investible funds is automatically directed towards its demand.

In the modern economy households save while companies invest. It is certainly important that the aggregate saving equates aggregate investment as argued by the Keynesians. But this is half the story. Successful investment requires the collection of disparate savings of the families and its channelization to the investors. In modern parlance, we can designate it as a co-ordination problem. Text book macroeconomics does away with this co-ordination problem by assuming the functioning of a well-established banking system.

The problem became serious when the economists began to study the underdeveloped world. There, more often than not, savings are scattered and often in various static or 'unusable' forms (such as gold, properties of the religious institutions, land etc). This view of co-ordination failure is not new to the thinkers outside the hallowed boundary of economics. Francois Bernier was a French traveler who visited India during the reign of the Mughal emperor Aurangazeb. He was of the view that average Indians were very rich. Even a peasant woman used to wear earrings. But, there were little investing activities. People used to bury their valuable treasures under the earth. Thus they lost any chance of being invested and creating income and wealth.

This problem is still prevalent in the current Indian milieu. Lack of or absence of formal saving practices is still there in the country. Huge amount of money are still being saved informally. This huge informal saving is actually belittling the opportunity of capital and wealth creation. It is in turn hampering economic development in the country. In order to spread the banking services to the hitherto uncharted territories as well as to channelize the informal and unused savings in the country to the formal routes, the RBI is now vociferously preaching for 'financial inclusion'.

In our paper we will try to decipher the reasons behind the lack of co-ordination in the country between savings and investment. In other words, we will try to find out the reasons behind lack of or absence of formal saving or institutional savings habits in the country. We will attempt to unravel the micro level indicators that have any bearing on the formal saving habits or the banking habits of the people in the country.

The paper is divided into 4 sections. Section 2 discusses a case study of disparate banking behavior. Next we consider the basic data that is used in the study as well as the methodology in section 3. The next section takes account of the analytics of disparate savings behavior. In section 5 we conclude.

2. CASE STUDY

In line with our scheme of things, here we incorporate a case study. The case study is based on a socio-economic study conducted by the Post Graduate students of the University of Burdwan in a cultivable area in Bolpur in Birbhum district during February 2013. The study is based on the data collected from 306 households coming from different villages within the Sian Muluk of Bolpur, Srineketan block.

The villagers in this are engaged in various types of semi-skilled and unskilled jobs. This includes working in agriculture, unskilled non-farm labor service, various types of petty businesses, services and others. Among the women there are many who remain as housewives. These people are not all of homogeneous categories. Out of the families surveyed, about 39% are above the official poverty line while 61% are below the poverty line (Table 1).

However, once we come to their source of loans, 16.81% depend on banks. This means about 83% of the total sampled households depend on

Table 1. Economic profile of the households surveyed

	No of Households	Percentage of Households
APL	119	38.89
BPL	187	61.11
Total	306	100

Source: A socio-economic survey conducted by the Department of Economics, Burdwan University

various sources of non-bank credit. Among these sources, 0.88% comes from post office and 4.42% from panchayat. This roughly amounts to 5.3% from official sources. Among the remaining 78%, roughly 30% depends on moneylenders, 30% on chit funds and micro-finance and 7% from other sources (Table 2).

Chit funds are unofficial loaning and depositing agencies in rural and semi-urban West Bengal. Originally, the word chit comes from 'sheet of paper'. These are formed by an agreement between individuals who form Rotating Savings and Credit Institutions (ROSCAs).[1] Each individual saves a fixed amount in the common pool during each month or at some common interval of time. A lottery is made at each meeting to decide who will receive the entire pooled amount as loan for a certain specified period. The person is liable to pay the money back and the pot is again distributed.

However, the chit funds have expanded its role beyond the legal limits of ROSCAs, as specified by the SEBI. In rural Bengal, these unauthorized chit funds play a substantial role in the informal market. They attract huge deposits by alluring a high rate of interest. They also charge a high rate on interest on the loan given by them.

The question arises as to why the residents in rural and semi-urban areas depend so heavily on non-bank institutions. In our case study we found at least three main reasons for this.

The first reason is the easy accessibility of these loans. Most of the loans are so small that commercial bankers would not feel profitable to release them. Our data shows that about 97% of the loans are of less than or equal to Rs 50,000 only. Again, 52% of the loans amounts to less than or equal to Rs 10,000. There are loans even below Rs 1000 (about 8%). It is clear that no commercial bank would offer this small amount of loan (Tables 3 and 4). Added with this, is the fact that a huge amount of loan is disbursed without any collateral (63.16%).

Personal acquaintance, informal bonding etc. are more important to obtain a loan than collateral. In the rural and semi-urban areas, even the middle and rich families might not be able to procure collateral in the appropriate form as required by the formal loaning agency.

The third important aspect of informal loan is its flexibility. In many cases, the purpose for which the loan is taken and its actual use are in complete contrast with one another. For example, though only 4.23% of the borrowers state agriculture as the purpose of taking out the loan, the actual utilization of the loan for agricultural purpose is roughly 39%. Similarly, the amorphous other categories (that mostly includes expenditures on societal duties such as marriage of sisters, daughters etc.) accounts to only 7.62% as the declared purpose for loans, which actualizes to 24%. Faced with uncertainties, the rural and semi-urban families often have to re-orient their expenditure plans. Such re-orientation requires flexibility in

Table 2. Source of loans

Money Lenders	Chit Funds	Panchayat	Self-Help Group	Post Office	Bank	Relatives	Land Lords
30.08%	30.08%	4.42%	10.61%	0.88%	16.81%	6.19%	0.88%

Source: A socio-economic survey conducted by the Department of Economics, Burdwan University

Table 3. Amount of loans

Amount of Loans	Percentage of Households
Rs 0 – Rs 1000	7.64
Rs 1001- Rs 5000	19.50
Rs 5001 – Rs 10,000	32.20
Rs 10001-Rs 50,000	37.28
Rs 50,001-Rs 4.50 lakh	3.38

Source: A socio-economic survey conducted by the Department of Economics, Burdwan University

Table 4. Loan with Collateral/no Collateral

Loan with Collateral	Loan with no Collateral
36.84%	63.16%

Source: A socio-economic survey conducted by the Department of Economics, Burdwan University

loan use that is not possible in the formal sector (Tables 5 and 6).

Thus our case study reveals that it is not merely income that determines the use of formal banking. There are many advantages in the use of informal sources. These sources are flexible, easily accessible and somewhat non-structured. In many cases, when there is an urgent need of loans, the households have to depend on the informal sources for their only avenue. Many of these informal sources are a part and parcel of their lives. They meet these agents in their day to day activities of life. They believe them and depend upon them. Sometimes, they form social ties with the informal lenders. Formal loans, on the other hand, are a world apart. Unless the formal sector finds some innovative ways to attract the borrowers and the savers, the hope of financial inclusion will remain a distant dream.

3. SOME SALIENT FEATURES OF THE DATA USED AND METHODOLOGY

The empirical analysis requires data on various aspects of the saving behavior of people. Some of these can be gathered from the amenities data of the Indian census 2001. Another and more important source is the District Level Household and Facility Survey data of 2007-08 (DLHS 3). Both these data give the district level features. These two sets of data are combined together for our purpose.

From census 2001, we gather data on the total number of households availing banking services for 581 districts in India, coming from 34 states and union territories. We find out the proportion of households availing banking services in each of the 581 districts that we selected. In our study, we refer the proportion of households availing banking services as the dependent variable and

Table 5. Purpose of loan

Agriculture	Livestock Purchase	Durable Asset Creation	Education	Medical Purposes	Trade	Other Activities
4.23%	16.94%	24.57%	12.75%	25.42%	8.47%	7.62%

Source: A socio-economic survey conducted by the Department of Economics, Burdwan University

Table 6. Actual utilization of the loans

Agriculture	Livestock Purchase	Durable Asset Creation	Education	Medical Purposes	Trade	Other Activities
39.08%	6.89%	1.15%	3.45%	16.09%	9.19%	24.15%

Source: A socio-economic survey conducted by the Department of Economics, Burdwan University

we refer it as 'bank' in our study. We try to find out how 'bank' depends upon various other factors. From the census data, we get number of households according to the usage of various durable goods such as radio, transistor; television; telephone; bicycle; scooter, motor cycle, moped; car, jeep, van; and none of the specified assets. Finding the proportion of households who hold none of the specified assets and subtracting the proportion from one for each district, we derive an estimate of 'assets'. It is anticipated that 'assets' and 'bank' are positively correlated. In other words, increased asset holding should require higher banking practices by the people.

We have also used the District Level Household and Facility data of 2007-08 (DLHS 3) for our study. DLHS is a wonderful effort by the Ministry of Health and Family Welfare and the survey was conducted by the International Institute of Population Sciences. For this survey data was collected from over 0.72 million households cutting across 28 states and 6 union territories. The survey was conducted on the basis of 17 parameters that include education, living standard and health. In our study, we have used data on 9 parameters. The parameters that are used in our study are presented in Table 7.

A careful look at the table brings out some important features of the data. For two variables – 'pov' and 'marr', the variability is more than 70%. Higher CV in the variable 'pov' implies widespread disparity in income of the people in the country. Higher variation in 'marr' implies a wide asymmetry in the development of social consciousness among the women.

In all other variables – 'lit', 'bo2', 'mod', 'antl', 'inst', 'immun', 'breast' – the variability is below 50%. Lowest variability is observed in the variable 'lit'. It means that there have not been any significant fluctuations in the literacy level across different areas in the country. In 'bo2' also, there has not been any significant variation. A moderately higher degree of variation has been

Table 7. Survey parameters in DLHS 3

Sl. No	Variables/ Components	Classification	Notation in our study	Mean	Coefficient of variation	Max. Value	Min Value
1	Percent total literate population (Lit)	Education	lit	71.02	15.6	97.5	31.5
2	Lowest wealth quantile (%)	Standard of living	pov	18.90	94.5	85.0	0.0
3	Percentage of girl's marrying before completing 18 years	Social	marr	22.48	71.4	82.5	0.0
4	Percentage of births of order 2 and above	Health	bo2	62.57	16.8	83.3	12.1
5	Any modern method (%)	Health	mod	48.02	33.6	79.1	6.5
6	Mothers who had at least 3 ante-natal care visits during the last pregnancy (%)	Health	antl	53.52	47.8	99.7	7.7
7	Institutional births (%)	Health	inst	49.55	48.7	100.0	5.9
8	Children (12-23 months) fully immunized (BCG, 3 doses each of DPT, polio and measles (%)	Health	immun	56.75	38.4	98.0	3.8
9	Children breastfed within one hour of birth (%)	Health	breast	44.65	46.6	91.7	4.1

observed in the variables – 'mod', 'antl', 'inst', 'immun' and 'breast'.

Since the variable 'bank' is truncated at zero, the ordinary least squares will yield inconsistent results. For this we have to resort to the Tobit analysis. The variable 'bank' is a censored variable. This is not observable for families with no banking habits. The Tobit methodology is useful here.

However, before the Tobit regression, we used step regression technique to identify factors that are most relevant for the analysis. The step regression technique is a useful tool to combat the problem of multi-collinearity so common in the cross-sectional analysis. The variables are selected according to the improvement in the F- value. The set of independent variables may change from one regression to another depending upon the criteria of rejection by the step technique.

4. EMPIRICAL ANALYTICS OF THE DISPARATE SAVINGS BEHAVIOR

The variable that we identify as constituting the formal saving propensity is the 'bank'. It is noted that there are a number of factors on which 'bank' depends. Firstly, 'bank' has correlation with the earning and wealth profile of families. Wealthier the family, higher should be the formal saving propensity. However, this text-bookish relationship between the earning capacity and the dependent variable 'bank' needs to be taken with a pinch of salt. Improvement of the family earning propensity increases the capacity to use formal banking system. However, there is no guarantee that the formal system will be used.

In a traditional society, there are numerous avenues of savings, most of them are informal in character. A potential saver has the option to choose between these various available avenues. In many cases, the potential savers may have an inherent distrust for the formal bankers. This distrust may be due to part-fear or due to part-bad experience in the past. The inflexibility of the formal banking system and its various requirements makes it less lucrative. For example, in order to save in the formal system, a potential saver has to devote both time and money. Informal options are available at his doorstep. Normally, formal banking system operates within a stipulated time. Most of its activities are limited within that time. On the contrary, informal sectors are more flexible. If I want to deposit money at the stroke of midnight, it is almost impossible to avail a formal bank. However, it is far easier if I approach an informal bank. Loan disbursement policies of the formal banks are more structured and generalized. On the other hand, informal loans are tailor-made to the recipient's demand. Added to this, is the personal ties with the informal bankers that makes it seem more reliable[2]

Thus the relationship between the saving propensity in the formal sector has to be mediated through a number of variables. Many of them reflect the quality of life and awareness towards the modern system. We have considered 8 such variables ('lit', 'marr', 'bo2', 'mod', 'antl', 'inst', 'immun', 'breast'). Two other important variables are 'assets' and 'pov'. In order to find out the relationship, we have considered 3 types of regression. These regressions are based on the distinction between the variables 'pov' and 'assets'. 'Pov' measures the percentage of families who are below the destitute levels. 'Assets' on the other hand refers to the measure of durable goods purchased by the households (such as bi-cycle, scooter, TV etc). These two variables should have different levels of influence. The variable 'assets' is directly related to 'bank' because of loan requirement for building up assets. 'Pov' on the other hand, relates to 'bank' through an improvement in the saving capacity of the families. We have considered 3 types of regression. In the first regression, both 'pov' and 'assets' are used allowing the step to choose among them. In the second regression, we used only 'pov'. In the third regression, we used only 'assets'.

The first regression retains both 'pov' and 'assets' within the regression. Both of them have the required signs (positive for 'assets' and negative for 'pov') and are significantly related to 'bank'. This implies that both these variables are important in explaining the formal saving propensity of the families. Among the lifestyle variables, all are significant and have the required signs. 'Lit' is positively related to 'bank', implying a beneficial effect of awareness. More aware a family is of the formal saving avenues, the greater will be the willingness to save in formal avenues. 'Mod' has a positive relation with 'bank', implying a general improvement in awareness and the intensity to formal savings. However, 'bo2' has a positive sign. Here, the third factor of wealth may be very vital. Given the literacy level, richer families have larger number of children and higher propensity to save in the formal sector. Relationship between 'breast' and formal saving propensity is similarly explained. In the so-called rich families, there is a negative tendency towards breast feeding the child.

In all, our first Tobit regression has satisfied more or less all the anticipated relationships that we have hoped it to confer to us. Now we look to our next regression. Here the regression has been done by omitting the variable 'assets'. Here the additional variables that have entered in our Tobit regression are 'marr', 'inst' and 'immun'. The variable that has not come into the analysis is 'pov'. Other variables ('lit', 'bo2', 'mod', 'breast') that came in explaining the relationship remained same with same signs. The variable 'marr' reflects the percentage of girl's marrying before entering the adulthood. Higher value of this variable 'marr', symbolizes social stigma and prevalence of male dominance. This actually stems from lack of literacy, mainly lack of female literacy and lack of social awareness. So, it is quite likely that higher the value of 'marr', lower will be the inclination towards formal banking activities. The variable 'inst' is positively related to 'bank'. Higher percentage of institutional birth implies more awareness towards health as well as faith towards institutional set up. Availability of institutional health facilities in nearby area is also very important in determining the percentage of institutional birth. It is needless to say, an area with higher institutional birth, should also show same kind of institutional affinity in regard to savings behavior also. This unquestionably explains the positive relationship between 'inst' and formal saving behavior. 'Immun' has also quite evidently positive relationship with formal banking habits. Higher percentage of children having immunization indicates higher health and social awareness among the parents. They are also likely to be more conscious and aware of the formal banking system. So, in the second Tobit regression analysis also, all the anticipated relationships have been supported. Now we enter into the third Tobit regression where we omitted the variable 'pov'.

If we omit the variable 'pov', then the variables that come in explaining the relationship with formal saving behavior with various factors are 'marr', 'bo2', 'inst', 'immun' and 'breast'. The direction of relationship with bank and these variables does not show any peculiarity. The same kind of relationships (negative for 'marr' & 'breast' and positive for 'bo2', 'inst' and 'immun') appear in this Tobit regression also. The same explanations that we gave earlier for these variables hold here too.

5. CONCLUSION

The paper considers the banking behavior of people in an under developed economy like India. In the age of financial inclusion, a huge section of the populace is still outside the formal banking system. Unlike the common concept, poverty is not always the main reason behind this disparate saving behavior. Various types of informal outlets provide easy and cheap access to loan and savings. They are flexible and provide on the door services. It is often difficult for the formal sector to compete with this. Unless intelligent uses of

Table 8. OLS Results of Determinants of 'bank' when both 'pov' and 'assets' are included

Variable Name	Estimated Co-Efficient	T-Ratio
ST	-0.14716E-02	-2.526
LIT	0.16627	3.226
POV	-0.92075E-01	-2.584
BO2	0.15096	2.852
MOD	0.27003	7.707
BREAST	-0.98238E-01	-3.563
ASSETS	0.47740	14.28
CONSTANT	-0.21607	-3.492

Table 9. Tobit Result of Determinants of 'bank' when both 'pov' and 'assets' are included

Variable Name	Normalized Co-Efficient	T-Ratio
ST	-0.12942E-01	-2.3563
LIT	1.4423	2.9555
POV	-0.85170	-2.5363
BO2	1.3573	2.7210
MOD	2.6073	7.7114
BREAST	-0.94660	-3.6331
ASSETS	4.5548	13.325
CONSTANT	-2.0253	-3.4682
BANK	9.3230	33.670

Table 10. OLS Results of Determinants of 'bank' when the variable 'assets' is omitted

Variable Name	Estimated Co-Efficient	T-Ratio
ST	-0.55108E-02	-7.452
DT	0.11654E-02	2.882
LIT	0.23048	3.965
MARR	-0.13547	-3.065
BO2	0.16747	2.786
MOD	0.20028	4.889
INST	0.16360	4.418
IMMUN	0.10579	3.373
BREAST	-0.21486	-6.925
CONSTANT	0.36704E-01	0.6126

Table 11. Tobit Results of Determinants of 'bank' when the variable 'assets' is omitted

Variable Name	Normalized Co-Efficient	T-Ratio
ST	-0.46654E-01	-7.3117
LIT	1.8766	3.7866
MARR	-1.0632	-2.8229
BO2	1.7671	3.4757
MOD	1.6967	4.8523
INST	1.4921	4.7649
IMMUN	0.80005	3.0380
BREAST	-1.9117	-7.2195
CONSTANT	0.30659	0.58749
BANK	8.4304	34.082

Table 12. OLS Results of Determinants of 'bank' when the variable 'pov' is omitted

Variable Name	Estimated Co-Efficient	T-Ratio
ST	-0.63073E-02	-5.698
MARR	-0.19985	-3.274
BO2	0.23925	2.535
INST	0.27551	5.390
IMMUN	0.12754	2.816
BREAST	-0.18645	-3.944
CONSTANT	0.22075	2.781

Table 13. Tobit Results of Determinants of 'bank' when the variable 'pov' is omitted

Variable Name	Normalized Co-Efficient	T-Ratio
ST	-0.33104	-1.3619
LIT	2.6003	-0.29403
BO2	-0.20116	-0.29403
MOD	2.3425	5.2435
BREAST	-1.6029	-4.3349
ASSETS	0.30461	1.2534
CONSTANT	0.85285	1.2346
BANK	7.3620	23.694

banking instruments are facilitated, it might become impossible for the formal sector to tap these sources and a huge wastage of internal savings can't be prevented. Instead of being locked in the informal cup-boards, informal savings should be diverted to the investible activities of the land. Only then the tall talks of financial inclusion can be fruitful (Tables 8 through 13).

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ENDNOTES

1. Besley & Loury, (1993) have given a detailed analysis regarding the economics of ROSCAs.
2. A similar analysis has been made by Banerjee & Duflo, (2001), Poor Economics: A Radical Rethinking of the Way to Fight Global Poverty with regard to the informal health sector in Rajasthan. In spite of the competence, people opt for informal health services even when the formal health services facilities are cheap and standardized. Patients feel easy with the informal doctors with whom they can communicate more easily. To them, formal doctors are a world apart, who does not understand their language, tend to undermine them and live in a superior complex.

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Chapter 36
Customers' Perspectives of Internet Banking Adoption in Developing Economies

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ABSTRACT

The competition in the banking sector has increased dramatically from the past decade. This increased competition environment in the financial service sector has resulted in the development and utilization of alternative delivery channels. The advancements and revolutions in the communication and information technology have changed the functional scenario of the banking sector significantly. Internet banking is a novel delivery channel of banking and has been found to be an optional channel for the traditional banking because of the savings in time, money and effort. Banks have become more and more competitive to meet the customers demand for ease of use, functionality, relative advantage, greater accessibility and the best of the services at a lower price. The objective of this study is to investigate the factors which influence the adoption of Internet banking adoption in private sector banks of India. Factors such as perceived usefulness, perceived ease of use, perceived risk, relative advantage and trialability have been found to be the determinants of Internet banking in the previous studies. A new variable called conspicuousness has been introduced in the present study. Such a study has not been reported in the literature in the Indian context. A model has been proposed and tested using various statistical techniques. The findings are of great use primarily for the banks which are planning to offer Internet banking services, and for already existing banks to focus on the gaps. This research article provides valuable insights into the underlying contextual factors of Internet banking behavior for researchers and practitioners. The outcome of the study can be used to formulate new marketing strategies to increase the customer base of Internet banking market.

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INTRODUCTION

Businesses in the developing economies are highly reliant on information technology and communications to compete in the global market. Banks started relying on information technology and communications to penetrate the existing markets and to enter new segments. Globalization has resulted in foreign banks expanding their businesses across the world. The arrival of foreign banks into the Indian market with the latest information technology based services has pressed the Indian banks to follow the latest technologies in banking to counter the threat of competition. The arrival of foreign banks followed by an increase in the number of private banks has resulted in a stiff competition among the banks, to provide the best of the services to the esteemed customers. The Indian banking sector is going through a series of innovations in its operational aspects. With the growing demand for convenience products and services, banks are striving hard to maintain the equilibrium. The economic fluctuations in the markets may result in positive and negative shocks to the banks Nathan et al. (2010). These external shocks for the banks may be inevitable if the business and funding models are faulty Aidan et al. (2008). Fadzlan (2010) empirically finds that foreign banks have higher technical efficiency compared to their domestic bank counterparts. According to Jagdish et al. (2011) organizations have been investing heavily in building information links with their suppliers and buyers to reduce costs and lead times to improve the timely customized delivery of products and services. Banks are trying to differentiate their products and services to gain an advantage over their competitors, by trying to offer services at customer's home. Even mobiles service providers have a large spectrum of financial service offerings to attract new customers and to also to retain the existing.

Today, bank consumers round the globe are looking for the ease and convenience of online banking to take care of their financial needs. People are being comforted by the newer methods and technologies of accessing the Internet to check the status of their finances by the click of a mouse. Internet has egressed as a convenient delivery channel for these service providers Arpan et al. (2012). The recent and rapid developments in communications and information technology have brought unprecedented change in the lives of the people as well for banks. Internet has touched almost all aspects of human lives including the way we live, shop, entertain and interact. With this rapid development in communication and information technology, various activities are handled electronically from the home or workplace. In fact, Internet is a global phenomenon, making both time and distance irrelevant. Gordian et al. (2011) states that service industries started investing in information technology to bring cost savings in their operations. It has emerged as a convenient channel for many service providers. Therefore, Internet definitely tries to influence the way people save and invest. The financial service providers, from the developed countries have been using Internet as a channel to deliver their services more effectively and efficiently. Internet banking is defined as the delivery of banking services to customers through the Internet Chi et al. (2007). Majority of the service providers from the developing countries started reaping the benefits by using Internet as a service channel. The adoption of agile technologies and methodologies by the managers made the information system, qualitative and foolproof Kenneth et al. (2010). The financial institutions use information technology as a tool to grant loans and maintain records of individuals and enterprises that have been evaluated as credible Tarik et al (2009). Tero et al. (2004) define Internet banking as the Internet protocol through which customers can use different banking services ranging from bill payment to making investments. The costs of information technology appear to have a stronger positive impact on bank performance when there are greater environmental changes Abbas et al., (2012). Ruiliang et al. (2012) examines

that, it is very much essential for banks to share the information between the online and traditional retailers for a profitable e-business. Internet banking is the tool which allows consumers to do the banking transactions from the comfort of a home with the help of an Internet connection. Internet banking uses more traditional technologies such as personal computers and Internet in order to pay bills, transfer funds and obtain account information Mavri (2006). The amazing characteristic of Internet banking is allowing the customers to manage their own accounts. The customer can monitor and control his finance such as money transfers, utility bill payments, fixed deposits etc from home with the help of Internet (Mukherjee and Nath, 2003). The benefits of Internet banking are vivid which add value to customers' satisfaction in terms of quality of services as well to gain competitive edge over the competitors. Managing and integrating the financial data of the consumers globally is a major concern for banks as the data is spread worldwide. The diffusion of latest technology, computers and growth of Internet make customers crave for varieties of services and more of convenience.

The diffusion of innovations model proposed by Rogers (1962) includes five characteristics such as relative advantage, compatibility, complexity, observability, trialability which influences the consumer acceptance of new products or services. The rate of adoption of innovation depends on the complexity of the innovation, the more complex is the innovation, the lower is its rate of adoption (Tornatzky and Klein, 1982). According to Black et al. (2001), it would take more time for the diffusion of innovations if the service is complicated and difficult to understand. These have given rise to the need for such a study on Internet banking in the Indian context. Though numerous studies have been conducted on this topic before, still this research is not superfluous because Internet banking is a very vivacious in today's scenario and hence it needs to be constantly updated and studied. This paper seeks further to understand the development of Internet banking in the Indian context through an investigation of the factors that influence customers' acceptance of Internet banking services. Only the private sector banks of India have been considered in the present study. Intention to use Internet banking services has been taken as the dependent variable in the present study. This research reports the findings in the consumer adoption of Internet baking in India and also finds out the factors which influence the adoption of these services.

The rest of the paper is organized as follows. Section 2 deals with the review of the relevant literature. Section 3 outlines the proposed research model and the hypotheses. Section 4 describes the salient aspects of data collection. Section 5 provides data analysis and results. Section 6 presents conclusions.

LITERATURE REVIEW

A significant number of studies do exist in the literature about Internet banking, but not many exist in the Indian context. Internet banking has gained a significant popularity in the recent past and hence there is a need of contributing to the literature on Internet banking. The literature about Internet banking is reviewed and summarized in this section. Internet banking channel has been found out to be the cheapest delivery channel for delivering the banking products and services once established (Sathye, 1999). The lack of awareness about the benefits offered by Internet banking services and security concerns have been found out to be the impediments for the adoption of Internet banking services by consumers. The objective of Internet banking is to provide financial services to consumers round the clock from any remote location across the globe. Hence, in order to be successful in providing these services, banks are keen to understand the reasons for adoption of Internet banking services. This has led to the enormous research in the field of banking. Recent

literature on banking industry reveals that several researchers have investigated the adoption of Internet banking. It has been proved that Internet banking channel is the cheapest delivery channel for banking products once established. Cost savings, time and freedom from place have been found to be the main reasons for the acceptance of Internet banking (Black et al., 2002). Several studies indicate that perceived usefulness and perceived ease of use are the crucial factors for any innovation or technology acceptance which was adopted from the technology acceptance model proposed by Davis (1989). Perceived usefulness has been defined as the degree to which a person believes that using a particular system would enhance his/her job performance (Davis, 1989). Whereas perceived ease of use is the degree to which a person believes that using a system would be free of effort Davis (1989).

Kolodinsky et al. (2004) investigated the effect of the factors such as relative advantage, complexity, compatibility, observability, risk tolerance, and product involvement on adoption. Customers comprehend Internet banking transactions to be risky and more prone to fraud as there is a monetary value involved. Therefore, perceived risk has been found to be one of the major factors which hinder the acceptance of Internet banking (Sathye, 1999; Tan and Teo, 2000). Perceived risk may include financial, physical, or social risks which are associated with trying an innovation (Polatoglu et. al. 2001). Bauer (1960) defines perceived risk as the risk involved in any action of a consumer that will produce consequences, which cannot be anticipated with certainty, and some of them are likely to be unpleasant. Walker et al. (2002) state that customers are worried that technology based service delivery systems will not work as expected. If the level of willingness to take risk exceeds the level of perceived risk only then consumers adopt Internet banking services. The opportunity to try an innovation is an effective way of reducing perceived risk and hence may lead to adoption of the innovation. According to Rogers (1983), consumers might adopt an innovation if they are given the opportunity to try the innovation. Gerrard et. al. (2003) defines trialability as the degree to which an innovation may be experimented with on a limited basis. Tan and Teo (2000) suggest that by trying a technology users feel more comfortable with the innovation and are more likely to adopt it.

Ndubisi and Sinti (2006) linked compatibility, complexity, trialability and risk to Internet banking adoption. The above factors supported the Internet banking adoption along with the moderating variables such as education, exposure to IT and usage frequency. Relative advantage has been found to be an important element in the adoption of Internet banking. It is often referred to as convenience, cost, time and effort savings with a decrease of discomfort in the adoption of an innovation (Rogers, 1983). Internet banking has been found to be hassle free and more advantageous compared to other banking options. (Black et al., 2001). Derrick (2012), consumers consider not only the relative advantage afforded by currently available products, but also the relative advantage expected from future generation products. It is presumed that a consumer who perceived Internet banking to advantageous over other banking options would adopt the services. Guriting and Ndubisi (2006) found perceived usefulness and perceived ease of use as the strong determinants of behavioural intention to adopt online banking. A high visibilty of the Internet banking services in the media is termed as conspicuousness which has been derived from the model of diffusion of innovation (Rogers, 1983). Rogers (1983) considers visibility as observability and later Moore and Benbasat (1991) redefine it as two constructs namely visibility and result demonstrability. But, Black et al., (2001) find that a simple visibilty has no effect on the adoption of any innovation. In the present research, a new construct called conspicuousness which means a high level of visibility has been introduced. The utilization of the traditional theoretical models with minor

modifications and variety of analyses in the Indian context makes this study unique. This study focuses on individual perspective and proposes to identify factors that influence adoption and use of Internet banking services by customers of private sector banks in India.

AN OVERVIEW OF BEHAVIOURAL THEORIES OF ADOPTION

The behavioural theories that have achieved popularity in the study of technology adoption behaviour are discussed below.

1. **Theory of Reasoned Action (TRA):** Proposed by Ajzen and Fishbein (1975) explains and predicts the determinants of intended behaviour of individuals.
2. **Technology Acceptance Model (TAM):** Proposed by Davis (1989) to address, why users adopt or decline information technology.
3. **Theory of Planned Behaviour (TBP):** Developed by Ajzen (1991) by adding a new construct - perceived behavioural control to TRA.

1. Theory of Reasoned Action

In this theory, a person's attitude towards behaviour consists of a belief that particular behaviour leads to a certain outcome and an evaluation of the outcome of that behaviour. If the outcome seems beneficial to the individual, he or she may then intend to or actually participate in a particular behaviour. Subjective norm is a person's perception of what others around them believe that the individual should do. That is, whether or not a person participates or intends to participate in any behaviour is influenced strongly by the people around them. The behavioural intention is affected by the attitude towards behaviour and subjective norm as shown in Figure 1.

2. Technology Acceptance Model

The technology acceptance model (TAM) developed by Davis (1989) was adapted from TRA (Fishbein & Ajzen, 1975). The objective of TAM is to provide an explanation of user's acceptance and usage behaviour across a variety of end-user computing technologies (Davis, 1989; Davis et al., 1989). Among other technology acceptance and diffusion models, TAM is arguably the approach most widely accepted and used by information system researchers. TAM postulated that user acceptance of a new technology is determined by their behavioural intention to use the system, which can be explained jointly by user's perception about the technology's usefulness and attitude towards the technology use. Attitude is jointly influenced by two behavioural beliefs, perceived usefulness and perceived ease of use as shown in Figure 2.

Davis (1989) defines perceived usefulness as the degree to which a person believes that using a particular system will enhance his or her perfor-

Figure 1. Theory of reasoned action (Source: Fishbein and Ajzen, 1975; Ajzen, 1980)

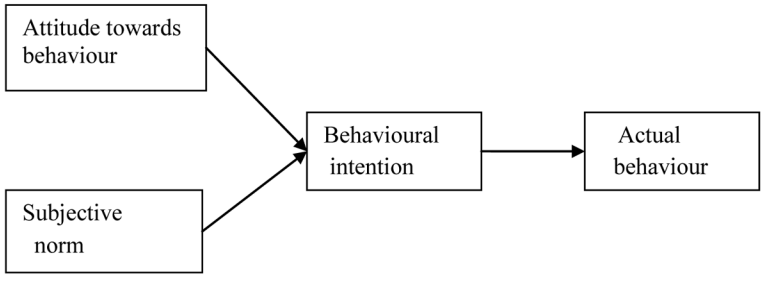
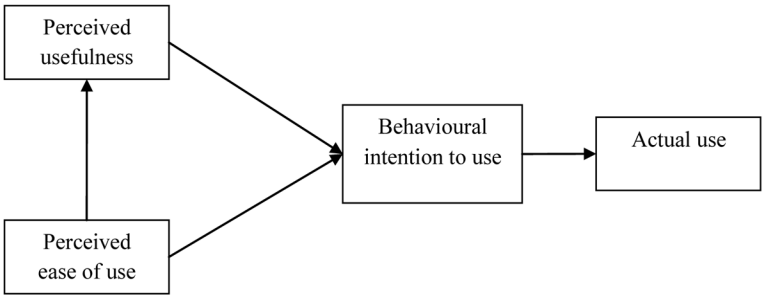


Figure 2. Technology acceptance model (Source: Davis, 1989)



mance, while the perceived ease of use is defined as the extent to which a person believes that using a particular system is free of effort.

3. Theory of Planned Behaviour

Theory of planned behaviour is the successor of theory of reasoned action proposed by Ajzen and Fishbein (1975, 1980). This succession was the result of the discovery that behaviour appeared to be not 100% voluntary and under control. This resulted in the addition of perceived behavioural control and this theory was called the theory of planned behaviour. TRA has been successfully applied to predict behaviour and intention in a variety of domains. Despite strong predictability of TRA, it became problematic as most of the researchers found subjective norms on behavioural intention to be insignificant, while some other authors found the opposite. Hence, a new construct has been added to the theory of reasoned action. In combination, the attitude towards the behaviour, subjective norm, and perception of behavioural control, leads to the formation of a behavioural intention as shown in Figure 3.

PROPOSED RESEARCH MODEL

From the literature review and the various behavioural theories of adoption, the crucial factors for the adoption of Internet banking services have been identified as perceived usefulness, perceived ease of use, perceived risk, relative advantage, trialability, and conspicuousness. The following hypotheses have been formulated and tested. Figure 4 illustrates the proposed research model.

Figure 3. Theory of planned behaviour (Source: Ajzen, 1991)

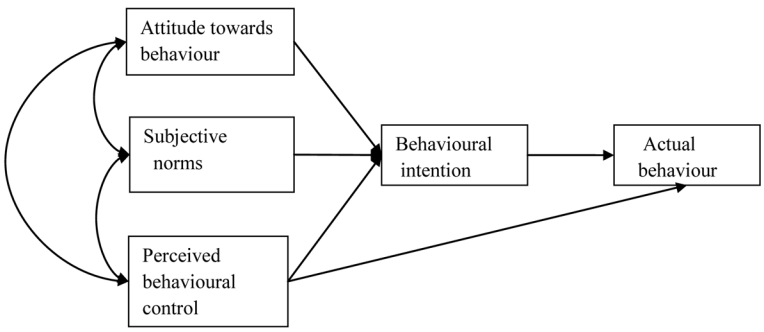
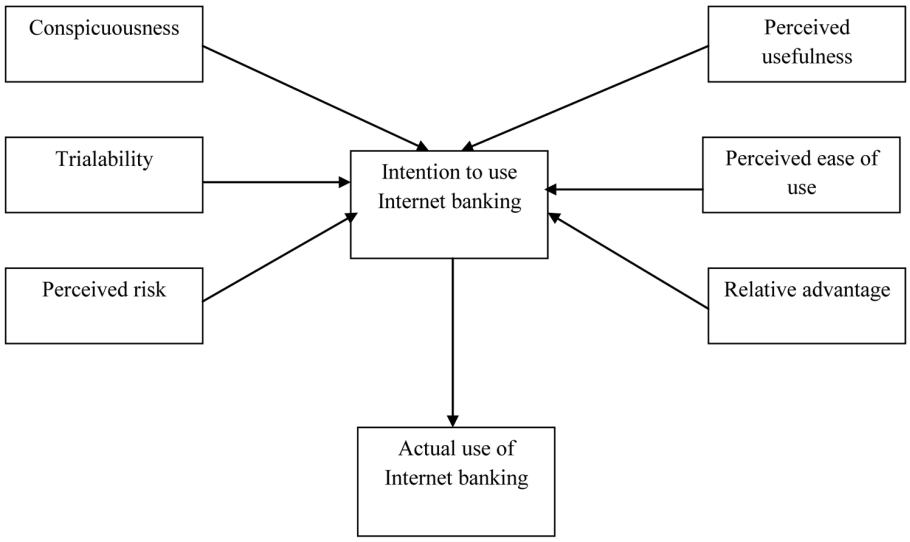


Figure 4. Proposed research model



Dependent Variable: Intention to Adopt or use Internet Banking

The dependent variable is the intention to use or adopt Internet banking services. Ajzen (1991) predicted behavioural intentions by using attitudes, subjective norms and perceived behavioural control. The more favourable the attitude and subjective norm with respect to behaviour, and the greater the perceived behavioural control, the stronger should be an individual's intention to perform the behaviour under consideration (Ajzen, 1991).

- **Independent Variables:** The independent variables in the study are perceived usefulness, perceived ease of use, perceived risk, relative advantage, trialability and conspicuousness.
- **Research Work in Brief:** The sequential process involved in this research work is enumerated as given:
  - Formulation of Hypotheses
  - Data collection and Validation
  - Hypothesis Testing using Statistical Analyses

Formulation of Hypotheses

Perceived Usefulness (PU)

Davis (1989) defines PU as the degree to which a person believes that using a particular system would enhance his or her job performance. From the technology acceptance model proposed by Davis (1989), it is evident that PU is a significant factor affecting acceptance of an information system. Further, from the prior studies on Internet and Internet banking, perceived usefulness has been found to be an important determinant in the adoption of Internet banking services. So, in the context of Internet banking, perceived usefulness may be explained as performing the banking tasks anytime and from any location. Therefore, the following hypothesis has been tested:

H1: Perceived usefulness will have a positive effect on the intention to use Internet banking.

Perceived Ease of Use (PEOU)

Davis (1989) defines PEOU as the degree to which a person believes that using a system would be

free of effort. From the technology acceptance model, PEOU is a major factor which affects the acceptance of information system (Davis et. al., 1989). In the context of Internet banking, perceived ease of use may be explained as using a system which is perceived to be easier to use than the conventional one. A significant number of studies suggested that perceived ease of use influences intention (Agarwal and Prasad, 1997). Thus, the following hypothesis has been proposed:

H2: Perceived ease of use will have a positive effect on the behavioral intention to use Internet banking.

Perceived Risk

Perceived risk, in the context of Internet banking may be associated with the financial loss as a result of using the services or with the electronic delivery channel. Black et. al. (2001) analyzed perceived risk in terms of risk of error and the level of security. A large number of studies have found that perceived risk is one of the major factors affecting user adoption of Internet banking. Thus, the following hypothesis has been formulated:

H3: Perceived risk will have a negative effect on the behavioral intention to use Internet banking.

Relative Advantage

Rogers (1962) defines relative advantage as the degree to which an innovation is perceived as being better than the idea it supersedes. Relative advantage in the context of Internet banking may be explained as allowing customers to access their bank accounts from any location and at any time of the day in contrary to the traditional banking. Tornatzky et. al. (1982) finds relative advantage to be an important factor in determining the adoption of new innovations. Also, a large number of studies have found relative advantage as a crucial factor in the adoption of Internet banking. This leads to the following hypothesis:

H4: Relative advantage will have a positive effect on the behavioural intention to use Internet banking.

Trialability

According to Rogers (1983), consumers might adopt an innovation if they are given the opportunity to try the innovation. Gerrard et al. (2003) define trialability as the degree to which an innovation may be experimented with on a limited basis. In the context of Internet banking, trialability can be viewed as the ability to access one's own account and carrying out the banking transactions on a trial basis preferably at bank premises with the help of bank personnel who will be able to demonstrate how it works and the benefits it offers. This reduces the fear of adopting Internet banking services and encourages the potential customers to adopt it. Thus, the following hypothesis has been tested:

H5: Trialability will have a positive effect on behavioral intention to adopt Internet banking.

Conspicuousness

Conspicuousness can be defined as high visibility. It can be viewed as the coverage of Internet banking in the media i.e. attracting the attention of the society. With such an exposure of Internet banking, potential customers could gain knowledge about the services and its benefits. If such information about the services and benefits can be shared with friends and colleagues, then there is a chance of adoption. Thus, the following hypothesis has been tested:

H6: Conspicuousness will have a positive effect on behavioral intention to adopt Internet banking.

Data Collection

In this research, questionnaire has been used as a data collection tool to meet the objectives framed. The data for this study has been collected by means of a survey conducted in a metropolitan city in India, with the help of a questionnaire. The design of the questionnaire is to be taken care in all aspects such as instructions, appearance, order and an expression of appreciation for the help rendered by the respondent in filling up the questionnaire. A five point Likert scale ranging from strongly agree to strongly disagree are used as a basis to know the respondent's views in the present research.

Filled in questionnaires were obtained from three different locations i.e., colleges, corporate offices and banks. This results in a sample that is well distributed in terms of demographics. Convenience sampling has been used in this present study on Internet banking.

A total of 450 questionnaire forms were delivered to the customers of private sector banks, out of which 347 filled in forms were received giving a response rate of 77 percent. After careful screening and scrutiny, questionnaire with incomplete and vague responses were discarded and were not included in the analysis. The questionnaire consists of questions that are related to demographic information, the possible factors affecting the acceptance of Internet banking and the use of Internet banking services.

The questionnaire has been developed and tested with a focus group consisting of banking professionals. The focus group verified that the hypotheses developed might be the affective factors in explaining the adoption of Internet banking. Based on the feedback from the focus group, the questionnaire was modified. Before proceeding with the main study, a pilot study is conducted. A pilot study is a survey on a small scale as a trial prior to the main survey that tests the questionnaire. To refine the questionnaire, it is required to conduct a pilot survey. Poorly designed questionnaire leads to the collection of inappropriate or inaccurate data. Hence, it is not proper to assume that questions in the questionnaire are perfectly and accurately framed at the first attempt itself. Based on the feedback from the pilot study, the inappropriate and unclear items are dropped; the wordings of some of the questions have been changed to improve clarity and new items added. After making amendments, the new version is re-tested. After the completion of pilot study and focus group interviews, the questionnaire is assumed to be free from all sorts of errors and ambiguities.

The sample size is calculated using the following general formula.

$$N = P\,(1 - P)\,Z^2_{\alpha/2}/e^2$$

where,

N= number of observations required
P= 0.085 = percentage of Internet proportion in India
(Internet penetration in India) =8.5%
$Z_{\alpha/2}$ = 1.96, standard normal variate at 95% confidence interval
e = error = 0.05

Thus, the sample required has been obtained as 119. In the actual study, the sample size is chosen as almost thrice the required sample size so that the resultant sample represents the entire population.

RESULTS AND ANALYSES

The data was edited, coded and analysed using Statistical Package for the Social Sciences-SPSS 16.0 for windows. All the statistical analyses have been performed using SPSS. The demographic profile of the respondents is shown in Table 1.

From Table 1, it is found that 41.9% of the respondents are in the age group 26-35 years,

Table 1. Characteristics of the sample

Variable		Frequency	Percentage
Gender	Male	247	71.2
	Female	100	28.8
Age	18 - 25	145	41.9
	26 - 35	138	39.8
	36 - 45	46	13.3
	46 - 55	9	2.3
	56-65	9	2.6
Education	Pre-degree	2	0.6
	Degree	137	39.5
	Post Graduation	140	40.3
	Research	25	7.2
	Diploma	43	12.4
Occupation	Student	20	5.8
	Faculty	39	11.2
	Professional	226	65.1
	Supervisor	8	2.3
	Technician	6	1.7
	Business	22	6.3
	Retired	26	7.5
Income (Rs./-)	< 1.6 Lakhs	38	11
	1.6 - 3 Lakhs	85	24.5
	3 - 5 Lakhs	130	37.5
	5 - 8 Lakhs	62	17.9
	8 - 10 Lakhs	15	4.3
	> 10 Lakhs	17	4.9
Internet usage	1 - 2 Years	16	4.6
	2 - 3 Years	27	7.8
	3 - 5 Years	87	25.1
	5 - 7 Years	92	26.5
	> 7 Years	125	36

71.2% of the respondents are male, 40.3% of the respondents are post graduates, 65.1% of the respondents are professionals/officers, 37.5% of the respondents are in the income range Rs.3 Lakhs - 5 Lakhs and 36% of the respondents have been using Internet for more than 7 years.

Reliability Analysis has been carried out to check the internal consistency of items. In order to use the measurement scales it is important that the reliability as well as the validity needs to be demonstrated. Hence, the construct reliability has been tested using the index of Cronbach's alpha. Nunnally (1978) recommends the value of Cronbach's alpha to be at least 0.7 to show high internal consistency. Cronbach's alpha values of the factors are shown in Table 2.

In the present study, the Cronbach's alpha values of all the factors have been found to be higher than the recommended value which shows a high internal consistency of the measures.

Validity is arguably the most important criteria for the quality of a test. It refers to whether or the test measures what it claims to measure. In this study, factor analysis is employed to establish the construct validity. Before proceeding with the factor analysis, Kaiser-Meyer-Olkin (KMO) and Bartlett's sphericity tests have been performed to find the appropriateness of data for factor analysis. The Kaiser-Meyer-Olkin (KMO) measure more than 0.7 indicates that it is appropriate to use factor analysis. A confirmatory factor analysis has been conducted on the items comprising perceived usefulness, perceived ease of use, perceived risk, relative advantage, trialability, conspicuousness and intention to use. The Kaiser criteria of eigen values greater than 1 has been used to determine the initial number of factors to retain. The Kaiser-

Table 2. Cronbach alpha values

Factor	Cronbach Alpha Value
Perceived usefulness	0.854
Perceived ease of use	0.883
Perceived risk	0.810
Relative advantage	0.931
Trialability	0.778
Conspicuousness	0.833
Intention to adopt/use (dependent variable)	0.837

Meyer-Olkin (KMO) measure was 0.833. From the Bartlett's sphericity test, the value of chi-square is found to be 7251 with a significance of 0.000. Hence, the constructs have been found to be valid.

Multi-regression analyses are performed to test the hypotheses and to examine the associations among the constructs. The results have been reported in Tables 3, 4 and 5.

A linear multiple regression analysis has been carried out on the proposed model, where intention to use is the dependent variable and perceived usefulness, perceived ease of use, perceived risk, relative advantage, trialability and conspicuousness are the independent variables. From the ANOVA result shown in Table 4, it is evident that the model applied is significantly good enough in predicting the outcome variable. It can be observed that the *p*-value is statistically significant and the value of *F* computed is well above the *F* critical value at 95 percent level of confidence. Hence, the null hypothesis that there is no relationship between the dependent and independent variables is rejected. Therefore, it is concluded that there is a relationship between the dependent and independent variables.

From the results of regression analysis shown in Table 3 it is found that the coefficient of determination R^2 is 0.645. This means that 64.5% of the variability in the dependent variable (i.e., intention to use Internet banking) can be explained by the independent variables such as perceived usefulness, perceived ease of use, perceived risk, relative advantage, trialability and conspicuousness. The R^2 value and the adjusted R^2 value are very close which implies that the model includes only the factors that are significant, i.e., the model is not over specified.

Table 3. Regression model

Model	R^2	Adjusted R^2	Standard Error of the Estimate
1	0.645	0.639	0.66406

Table 4. ANOVA results

Model	Sum of Squares	df	Mean Square	F	Sig.
Regression	272.766	6	45.461	103.092	0.000
Residual	149.932	340	0.441		
Total	422.698	346			

Table 5. Regression results

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	0.070	0.268		0.263	0.793
Perceived usefulness	0.504	0.059	0.423	8.490	0.000
Perceived ease of use	-0.084	0.040	-0.069	-2.126	0.034
Perceived risk	-0.044	0.042	-0.034	-1.030	0.304
Relative advantage	0.261	0.061	0.229	4.248	0.000
Trialability	-0.031	0.048	-0.021	-0.638	0.524
Conspicuousness	0.277	0.057	0.248	4.887	0.000

Hence, the multiple regression equation is obtained as follows:

Intention to use Internet banking services = 0.070 + 0.504*Perceived usefulness - 0.084 * Perceived ease of use - 0.044*Perceived risk + 0.261*Relative advantage -0.031*Trialability + 0.277*Conspicuousness

According to the hypothesis H1, perceived usefulness will have a positive effect on the intention to use Internet banking. From Table 5, perceived usefulness is found to be statistically significant at 0.05 level ($\beta = 0.423$, $p = 0.000$). Thus, the hypothesis H1 has been supported. This suggests that the bank customers perceive Internet banking to be useful.

The hypothesis H2 states that perceived ease of use will have a positive effect on the behavioral intention to use Internet banking. Table 5 reveals that perceived ease of use is found to be statistically significant at 0.05 level ($\beta = -0.069$, $p = 0.034$). Thus, the hypothesis H2 is supported. This suggests that the bank customers perceive Internet banking as easy to use.

According to the hypothesis H3, perceived risk will have a negative effect on the behavioral intention to use Internet banking. It is found from Table 5 that perceived risk is statistically insignificant at 0.05 level ($\beta = -0.034$, $p = 0.304$). Thus, the Hypothesis H3 is negated. This means that the bank customers are not finding Internet banking transactions to be risky. This may be because of the efforts taken by banks in making the Internet transaction more secure.

The hypothesis H4 states that relative advantage will have a positive effect on the behavioural intention to use Internet banking. The findings from Table 5 show that relative advantage is statistically significant at 0.05 level ($\beta = 0.229$, $p = 0.000$). Thus, the hypothesis H4 is supported. This means that bank customers are perceiving Internet transactions to be relatively advantageous than the traditional banking.

Hypothesis H5 states that trialability will have a positive effect on behavioral intention to adopt Internet banking. It is observed from Table 5 that trialability is statistically insignificant at 0.05 level ($\beta = -0.021$, $p = 0.524$). H5 is therefore negated. The possible reason for the failure of the hypothesis is lack of support from the banks to offer the services on a trial basis.

The hypothesis H6 states that conspicuousness will have a positive effect on behavioral intention to adopt Internet banking. Table 5 reveals that conspicuousness is found to be statistically significant at 0.05 level ($\beta = 0.248$, $p = 0.000$). Thus, the hypothesis H6 is supported. This means that the higher the visibility of the banks services in the public media, the higher would be the rate of adoption.

In summary, out of the six hypotheses, four were found to be statistically significant in this empirical study. Rejection of hypothesis H3 reveals that perceived risk has a positive effect on Internet banking. Hence, only one hypothesis H5 is rejected. The factors perceived usefulness, relative advantage and conspicuousness have been found to have a very strong relationship with intention to adopt Internet banking services.

CONCLUSION AND FUTURE RESEARCH DIRECTIONS

Information technology services are considered as the key drivers for the rapid changes globally. Internet banking is the most recent and innovative service which is the new trend among the consumers. In India, Internet banking is an uprising banking service and has not been widely accepted by customers because of various reasons. Many banks are striving hard to provide the best Internet banking services to their customers. It is important for bank managers to frame their problems appropriately and address them in a proper manner. Otherwise, the problems poorly addressed may create more problems and take longer time to fix in

the long run (John, 2010). Hence, it is of prime importance for bank managers to identify the factors that influence the adoption of these services. The aim of this paper is to investigate the significant factors which influence the consumer's adoption of Internet banking services. The results of this study show that perceived usefulness, perceived ease of use, perceived risk, relative advantage, and conspicuousness are the important determinants of Internet banking adoption. The findings clearly state that the factors which were discarded in the prior studies have shown a significant influence in the Indian context in this present study. This might be a result of the cultural and perceptual differences. As such, there is still room for further investigation into the adoption of Internet banking in India. We could investigate our research model in different time periods and make comparisons, thus providing more insight into the phenomenon of Internet banking adoption. Only private sector banks have been covered in the present study. An investigation of the consumer adoption of Internet banking services offered by public sector banks can be carried out. Further, a comparison of both public sector and private sector banks is an extensive area for future research. Also, a study on the perspectives of corporate banking customers can be an ideal work for future. Banks cannot presume that consumers are homogenous in terms of the attitudes and behaviors. Hence, research into the demographic and socio-economic factors is extremely important in enabling financial service providers to target specific segments of the customer base. The findings of this study are particularly important for banks to concentrate on the problem areas to attract more customers and to help decide how to allocate resources to retain and expand their customer base. Banks also need to concentrate on those factors which are really influencing the bank users in adopting Internet banking. With an increase in the penetration rate of Internet banking, the work force required in the banks and transaction costs can be reduced significantly. This research article provides valuable insights into the underlying contextual factors of Internet banking behavior for researchers and practitioners. The outcome of the study can be used to formulate new marketing strategies to increase the customer base of Internet banking market. Hence, banks should consider the importance of these factors for designing, implementing, maintaining and promoting their products and services.

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Chapter 37
Understanding Security in Consumer Adoption of Internet Banking:
Biometrics Technology Implementation in the Malaysian Banking Context

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ABSTRACT

As a continually growing financial service of electronic commerce, Internet banking requires the development and implementation of a sound security procedure. The existing literature highlights security as the primary factor which determines the adoption of Internet banking technology. The secondary information on Internet banking development in Malaysia shows a very slow growth rate. Much literature states that Malaysian consumers strongly agree that they are slow to adopt Internet banking because of a lack of security and reliability of transactions over the internet. The major factors affecting the adoption of Internet banking in Malaysia involve security, risk, and trust. Since biometrics technology has also been implemented in certain government departments, the issues such as new and impossible to implement in other areas should not occur and technology is growing to enhance the security level of the authentication system. Clearly, in order to grow consumer Internet banking demands, banks must make key improvements that address these consumer concerns.

INTRODUCTION

Global Internet users exceeded 2,267 million people in December 2011 (IWS, 2012), offering a huge new market for Internet-based services such as Internet banking. Since the new millennium, Internet banking has experienced explosive growth in many countries and has transformed traditional banking practices. By offering Internet banking services, traditional financial institutions seek

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to lower operational costs, improve consumer banking services, retain consumers and expand their share of customers. Internet based banks can operate at an expense ratio of 15-20% compared to 50-60& for the average bank (Booz, Allen, & Hamilton, 1997). Thus, by encouraging customers to use the Internet for banking transactions, banks would save considerable operating costs.

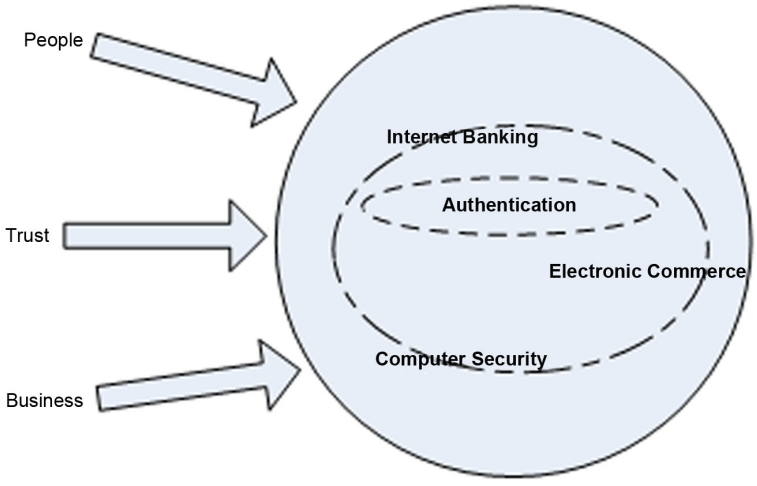
In the new banking environment, Internet banking is increasingly managed as an operational activity and an important component of a multi-channelled strategy. However, the Internet is an open environment. Online applications or technologies are typically exposed to security threats such as worms, crackers, viruses, spoofing, and password-sniffing. According to Sathye (1999), in Australia the main obstacle of Internet banking adoption is the security concern and the lack of awareness and benefit of the system.

Security concerns in Internet banking include threats made through network and data transactions or authentication unauthorized account access due to authentication failure. Perceived security, then is the "customers' perception of the degree of protection against these threats" (Yousafzai, Pallister, & Foxall, 2003). Internet banking and the issues surrounding authentication, which is the mechanism at the heart of e-commerce security, is shown in Figure 1. The diagram presents the implementation of appropriate authentication mechanisms to ensure an adequate level of trust between the parties conducting the transaction.

Customers are apprehensive about the security of their personal financial information that could be accessed via the Internet. The need for security has already been recognized within the electronic banking community and a number of technologies have been developed to secure electronic transactions. The most common approaches used to secure current online transactions are the incorporation of the 128-bit RSA encryption key technology to Web browsers the use of digital certificates and firewalls.

This study will examine the key factors influencing consumer adoption of Internet banking. To identify the slow growth trend of Internet banking adoption in Malaysia, a number of studies have been conducted in Malaysia and other countries. Suganthi, Balachandher, and Balachandran (2001) explored the adoption of Internet banking in Malaysia and determined that it was slow due to factors such as security, consumer awareness, ease of use, accessibility, reluctance to change, preference for personalized services and cost of adopting

Figure 1. Implementation of appropriate authentication mechanisms



the innovation. Sathye (1999) identified security concerns and lack of awareness about Internet banking as the main obstacles to the adoption of Internet Banking in Australia. Furthermore, the study found that Australian consumers were not adopting Internet banking because they were concerned about the safety and security of transactions over the Internet.

There are a few security issues occuring in Malaysian Internet banking such as Online Identity Fraud or Phishing. "Phishing" is a type of identity theft where criminals blast emails to a mass audience in their malicious attempt to bait you into fake websites. Online identity fraud also known as "Phishing" occurs when fraudsters pose as trusted organizations and send out thousands of fraudulent emails to random email addresses. These e-mails usually contain a link to a look-alike website that will trick bank customers into revealing sensitive information such as their user ID, password and TAC. The sensitive information enables the fraudsters to access the customer's bank account.

While numerous studies have been undertaken to examine issues in the wider context of e-banking and customer loyalty, comprehensive research in the area of e-banking issues and customer preferences in the specific context of Malaysia has been rather limited. A study conducted examined the evolution of e-banking in Malaysia and analyzed the various electronic delivery channels such as automated teller machines (ATM), telebanking and PC banking (Balachandher, Santha, Norhazlin, & Rajendra, 2000). Another study investigated the factors that affect the adoption of e-banking in Malaysia (Suganthi et al., 2001).

Ramayah, Ismail, and Koay (2002) identified the following six external variables that influence Internet banking adoption among Malaysian consumers namely, prior experience, training, perceived risk, awareness, cost and external pressure. This study highlighted the fact that the majority of respondents have no experience in using Internet banking. Another study by Rouibah, Ramayah, and Oh (2009) found that five factors (perceived ease of use, perceived usefulness, attitude, subjective norms and perceived behavioral control) have a direct positive effect on behavioral intention to use.

This study also revealed that the Theory of Planned Behavior (TPB) model has the best explanatory power, followed by the Theory of Reasoned Action (TRA) and the Technology Acceptance Model (TAM) models. This research represents a unique study in the e-banking field that compare three models (TRA, TPB, and TAM) adoption in Malaysia. However, results testing the explanatory power of the different models revealed that TAM model has the best explanatory power, followed by TPB and TRA models (Rouibah, Ramayah, & Oh, 2011).

Raju, Thiagarajan, and Seetharaman (2007) studied the extent of decision to adopt and the growth of the Internet banking services by Malaysian consumers. A study conducted by Marhana, Fadzli, and Zakaria (2012) revealed that a majority of Muslim consumers have not used Internet banking due to the fact that some people still have no opportunity to use the service and unsure of the security of such a service. Hanudin and Ramayah (2010) found that Perceived security and privacy (PSP) was one of the key factors to determine a bank customer's intention to use SMS banking.

Thomas, Kellermann, and McNevin (2002) highlighted the fact that electronic security adds value to a naked network. Electronic security is composed of soft and hard infrastructure. Soft infrastructure components consist of policies, processes, protocols, and guidelines that protect the system and data from compromise. Hard infrastructure consists of hardware and software needed to protect the system and data from security threats from inside or outside the organization. Thomas et al. (2002) states that although technology opens up new dimensions of scope and timing, it also creates the possibility for crimes to be committed very quickly. In the past, to steal 50,000 credit card numbers would have taken months, even years, for highly organized criminals. However, nowa-

days one criminal using a few tools available on the Web can hack into a database and steal those numbers of identities in seconds. According to Thomas et al. (2002), these are among the reasons why e-security must be taken very seriously now.

Perceived trustworthiness is defined as the customers' perception of confidence in the bank's competence, integrity and benevolence to provide the banking and financial services over the Internet (Yousafzai et al., 2003). Previous research has shown that trusting perceptions directly or indirectly influence the e-consumer's intentions to purchase (Grazioli & Jarvenpaa, 2000). Electronic banking decisions involve trust not simply on the transaction medium but also between the customer and the bank or the financial service provider.

The banking and financial industries report the highest incidence of misuse, a total of 57%, which is directly related to these industries having one of the highest dependencies on computers in the workplace (Hutchinson, 2000). A security breach at Citibank six years ago is still extensively cited in banking and security circles, being one of the few successful electronic bank frauds on record (Barlotta, 1999). The incident involved hackers who penetrated Citibank's security system and progressively wired money to banks around the world. When the heist was discovered in September 1994, US$10 million was gone. All but $400,000 was eventually recovered. One of the latest security threats is a computer program known as "Nmap" a network exploration tool and security scanner. On execution, it causes a bank's intrusion-detection system to falsely believe it is being attacked by hundreds of hackers across the globe, when the bank is actually being hacked by just one person (Barlotta, 1999).

Since further information to better understand Internet banking in Malaysia is needed, this research investigates the security effect and trust on consumer's intention to continue use Internet banking. Secondly, this study looks at the relationship between each of the security requirement factors on intention to continue using Internet banking and investigate whether perceived trustworthiness and perceived effectiveness of biometrics technologies usage moderates the relationship between security and trust towards intention to continue using the Internet banking system.

BACKGROUND

The Malaysian banking sector comprises licensed institutions; namely commercial banks, finance companies, merchant banks, discount houses and money brokers which are licensed under the Banking and Financial Institutions Act 1989 (BAFIA) and supervised by Bank Negara Malaysia (BNM, 2009). The banking sector plays an important role as financial intermediary and is a primary source of financing for the domestic economy, accounting for about 70% of the total assets of the financial system as at the end of 1999. At the year of 2000, there were 31 commercial banks (of which 14 were fully foreign-owned), 19 finance companies, 12 merchant banks and 7 discount houses. Upon completion of a merger program among domestic banking institutions, the number of domestic banking institutions was significantly reduced to 10 domestic banking groups consisting of 10 commercial banks, 10 finance companies and 9 merchant banks. Currently, the domestic banking institutions (excluding the discount houses) control about 75% of the banking sector's market share in terms of total assets and total deposits (BNM, 2009).

Technological development particularly in the area of telecommunications and information technology is revolutionizing the banking industry. With the proliferation of Internet expansion and computer usage, the electronic delivery of banking services has become ideal for banks to meet customer expectations. Competiveness in the industry has resulted in the Malaysian Government to structure a legal framework for banks to provide Internet Banking services.

On June 1, 2000, the Malaysian Central Bank gave the green light for locally owned commercial banks to offer Internet banking services. On June 15, 2000, Maybank, the largest domestic bank became the first bank to offer Internet banking services in Malaysia. On August 7, 2002, 8 Malaysian Commercial Banks started offering Internet banking services. They were the Alliance Bank Malaysia Berhad, Ambank Berhad, Bumiputra-Commerce Bank Berhad, Hong Leong Bank Berhad, Malayan Banking Berhad, Public Bank Berhad RHB Bank Berhad and Southern Bank Berhad (Suganthi et al., 2001). Presently, only banks licensed under the Banking and Financial Institution Act 1989 (BAFIA) and the Islamic Banking Act 1983 are allowed to offer Internet Banking services in Malaysia. To date, there are 22 commercial banks registered with Bank Negara Malaysia which includes 9 local banks and 13 foreign banks.

In 2002, 25,000 Maybank customers and 10,000 HSBC customers had subscribed to Internet banking (Yu, 2002). The fact is that these two financial institutions are the leading banks in Malaysia providing Internet banking services.

Internet banking adoption in Malaysia is relatively low and very little research has been done to understand the key adoption determinants. Even though the electronic revolution has commenced in Malaysia, Internet banking is still in the infancy stage. So, it has become very hard for the banking industry to design interventions that would enhance the diffusion of Internet banking (Ndubisi & Sinti, 2006).

According to Sohail and Shanmugham's (2003), research on customer preferences for e-banking in Malaysia and the factors which influenced the adoption of electronic banking reveals that accessibility of Internet, awareness of e-banking, and customers' reluctance to change are the factors that significantly affected the usage of e-banking in Malaysia. These studies conclude that although e-banking offers new frontiers of opportunities, there are several critical psychological and behavioral issues that need to be addressed in trust, security, reluctance to change and a preference for human interface.

There are a few security issues occuring in Malaysian Internet banking such as Online Identity Fraud or Phishing. "Phishing" is a type of identity theft where criminals blast emails to a mass audience in their malicious attempt to bait you into fake websites. Online identity fraud also known as "Phishing" occurs when fraudsters pose as trusted organizations and send out thousands of fraudulent emails to random email addresses. These e-mails usually contain a link to a look-alike website that will trick bank customers into revealing sensitive information such as their user ID, password and TAC. The sensitive information enables the fraudsters to access the customer's bank account.

Past literature shows the acceptance and implementation of biometric technologies in certain government departments, the issues like new and impossible to implement in other areas should not occur and repeat. These technologies are growing to enhance the security level of authentication system.

The Malaysian Computer Emergency Response Team (MyCERT) consists of specialists such as Intrusion Analysts, Malware Analysts, Application Security Analysts, and Emergency Response Professionals. MyCERT operates the Cyber999 Help Centre, a public service that provides emergency response to computer security related emergencies as well as assistance in handling incidents such as computer abuses, hack attempts and other information security breaches. This MyCert Security Breaches (2005-2010) summary report provides an overview of activities carried out by MyCERT (2010) relating to computer security incident handling and trends observed from the research network. The summary below highlights statistics of categories of incidents handled by MyCERT from 2005 to 2010 (Refer to Table 1). In general cyber security incidents include but are not limited to:

Table 1. MyCERT Security Breaches (2005-2010)

	2005	2006	2007	2008	2009	2010
Harassment	43	63	68	72	174	419
Fraud	149	287	364	907	1022	2212
Malicious Code	82	68	182	277	283	1199
Denial of Service	7	6	8	12	28	66
Intrusion	467	897	385	766	1766	2160
TOTAL	748	1321	1007	2034	3273	6056

1. Attempts to gain unauthorized access to a computer system or its data,
2. Unwanted disruption or denial of service,
3. Unauthorized use of a system for processing or storing data,
4. Changes to system hardware, firmware or software without the knowledge or consent of the system owner.

Generally, all categories show increasing trends in the number of reports every year. Fraud and intrusion recorded a high number of incidents representing 37% and 36% of incidents handled respectively for the year 2010 and this is followed by malicious code 20%, harassment 7% and denial of service 1%. System intrusion incidents are generally attributed to web defacement. MyCERT observed that the main cause of defacements were vulnerable web applications. Fraud incidents are mostly phishing sites of local and foreign institutions (MyCERT, 2010).

According to Stuart, Li and Choucri (2009), Figure 2 shows a screenshot of the total CERT reported incidents of three countries including China, Malaysia, and Brazil from 2003 to 2008. The number of CERT incidents reported in the case of Brazil is much greater than that of China and Malaysia in most years. If only the linear Y-axis scale could be used, the data strands of China and Malaysia would be pushed to the bottom of the chart because of the huge differences.

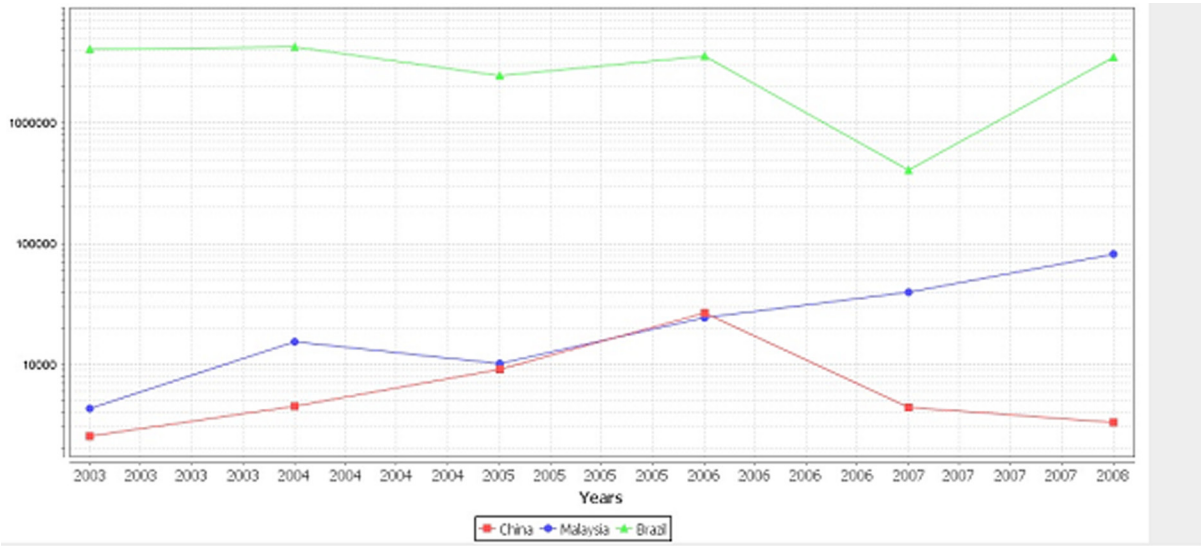
PROBLEMS

According to the Association for Payment Clearing Services (APACS) (2008), in 2007, over 20 million adults used online banking and 93% of online banking users access their main current account. However, only 55% of Internet users bank online. Internet banking users are worried about the Internet banking security issues that are happening today. There were 1,462 money mule recruitment incidents in 2007, compared with 1,087 in 2006. There were 25,797 phishing websites targeted against UK banks and building societies in 2007, up from 14,156 in 2006 (APACS, 2008).

Despite the considerable diffusion of consumer Internet banking in many countries to date, banks seek further market expansion. Currently, market growth trends are uncertain. It is possibly due to increased security concerns linked to rising identity fraud and online scams. Customer confidence on e-banking would also largely depend on how the banks would deal with any erroneous transactional and security concerns that may occur during online banking (Sohail & Shanmugham, 2003).

In 2002, it was estimated that there were approximately 800,000 Internet banking users in Malaysia with many new users signing up with their respective banks (Phang & Fernandez, 2002). Out of all the banks operating in Malaysia, Maybank had 600,000 registered users and the largest

Figure 2. Screenshot of the total CERT reported incidents from 2003 to 2008



Country/Region	Data	2003	2004	2005	2006	2007	2008
China	Total CERT Reported Incidents	2557.0	4485.0	9112.0	26476.0	4390.0	3291.0
Malaysia	Total CERT Reported Incidents	4295.0	15286.0	10147.0	24252.0	39639.0	82649.0
Brazil	Total CERT Reported Incidents	4126941.0	4232104.0	2482200.0	3601322.0	404695.0	3520501.0

number of Internet banking customers (Phang & Fernandez, 2002). According to the 2008 survey on household use of the Internet by Malaysian Communications and Multimedia Commission, it was shown that Internet banking usage in Malaysia was only at 31.8 percent in 2008.

According to recent studies by Raju et al. (2007) and Lu, Hsu, and Hsu (2005), it was stated that Malaysian consumers strongly agree that they are slow to adopt Internet banking because of the lack of security and reliability of transactions over the Internet. Clearly, in order to grow consumer Internet banking demand, banks must make key improvements that address consumer concerns. This is in line with the findings of management consultants McKinsey & Co in 2000 that revealed that only 31% of Malaysians indicated an interest in adopting Internet banking, whilst an overwhelming 66% cited security and risk as their major concern (Ng, 2002).

The findings of Suganthi, et al. (2001) found that one of the important factors affecting Internet banking in Malaysia was security concerns. This finding is also supported by the findings of (Ramayah et al., 2002) which found that most individuals are reluctant to use Internet banking as they have concerns over security and privacy issues.

The main issues in Malaysia regarding Internet banking are the weak security and trustworthiness in the adoption of using Internet banking applications. Therefore, this study will investigate security requirement factors which influence the adoption of Internet banking applications.

BIOMETRIC TECHNOLOGY IMPLEMENTATION

Biometric technology provides a range of automated methods which can be used to measure and analyze a person's physiological and behavioral characteristics (Alhussain & Drew, 2009). It usually involves a scanning device and related software which can be used to gather information that has been recorded in digital form. According to Alhussain and Drew (2009), by using biometric technology, e-government aims to give its citizens

improved services with efficient and secure access to information by providing reliable identification of individuals as well as the ability for controlling and protecting the integrity of sensitive data stored in information systems.

In fact, in the law enforcement community, matching fingerprint images or parts of palm print images is the most common method to identify suspects and bring guilty criminals to justice. In some movies, we may also see a criminal telephone the victim and the police record the voice of the criminal and search for the criminal according to voice identification. These scenes are examples of identifying people using their unique physical features (e.g., fingerprints, palmprint, and face) or behavioral trait (e.g., voice) and automatic biometrics can help in this scenario. When automatic biometrics technology became more and more mature in the law enforcement area, it was introduced into civilian applications by the biometrics product vendors.

Biometrics technology applications are not limited to the areas mentioned earlier. The technology has been expanded to time, attendance and monitoring. At present, some factories and companies are using punch cards to monitor the movement of their employees. When they come to work, they need to punch a hole in their cards and punch another hole when they leave. This kind of thing can be assisted by biometrics. With a biometrics system, employees may press their fingers onto a small platform when they arrive or leave. The literature discussed thus far shows the acceptance of biometrics technology implementation and it has been implemented in certain government department.

DISCUSSION

The research conducted in Sweden by Brobeck and Folkman (2005) shows that companies believe that biometrics is for organizations with a very high security need. Furthermore the result shows that individuals are positive towards biometrics. Finger-scan is the most known, trusted and preferred technology. Most likely because it is a mature identification technique that has been around for a long time.

Fahad, Rami, and Mumtaz (2008), stated that the majority of Saudis would have a preference to use fingerprint identification methods. The study by Fahad, Rami, and Mumtaz (2010b) has confirmed the acceptance of biometrics authentication system using fingerprint are practically and culturally accepted by the Saudis. Another research has been conducted by Fahad, Rami, and Mumtaz (2010a), which shows the acceptance to use the biometric authentication system in the online banking environment can be predicted by using Technology acceptance model.

Security in online transactions is an issue that hinders widespread adoption of e-business in solutions that involve money/securities and stock. Currently, electronic transaction theft is far above armed robberies and fraudulent accounting in some countries. Likewise biometrics is increasingly being adopted in security related solutions such as in immigrations and restricted access. As with any technology, adoption approaches determine success. Research needs to be carried out to establish methods that will ensure success finally.

SOLUTIONS AND RECOMMENDATIONS

The bank must first attract the banking consumer's attention to Internet banking services before the consumer will consider Internet banking. As a continually growing financial service of electronic commerce, Internet banking requires the development and implementation of a sound security procedure. This involves designing effective methods where users can be authenticated in a remote environment. Specifically for Internet banking, there is a real need for a unique way to identify

and authenticate users without the possibility of their authenticity being cloned.

By reading the signals, following the trends and issues on security will not be the end for Internet banking. Internet banking crimes keep increasing every day. Thus the findings from this research will provide important suggestion to enhance the level of security in Internet banking. The cyber crime such as phishing activities keep increasing every quarter. To enhance this issue by investigating biometric authentication systems in online banking will secure the log in process to the system and removes password vulnerabilities; enhanced convenience such as employees quickly log in using their finger; reduced help desk costs by eliminating calls for password resets.

Biometrics is not a new thing in the market. Finger print is one of the biometric authentications which has been used since a 100 years ago for detering criminal purposes. In Malaysia, biometrics has been using in e-government environment and the largest department that used the biometrics technologies was National registration department. HSBC Bank in Malaysia has introduced second level of security via using Internet banking which is login, password and USB device. But there is some problems which occur when customers forget to bring the USB device or the device goes missing. Therefore, implementation of biometric technologies to enhance the security level other than the normal authentication (login and password) will be the best solution and unique security solution. Although this is a new technology in Internet banking but this system has been used in other services authentication such as in immigration, airport gate, e-government, e-commerce and etc. The possibilities of biometrics technologies can be implemented in the Internet banking environment such as fingerprinting, iris, keystroke, speech and etc. The combination of the previously mention factor will be the best solution such as fingerprint with the speech or iris with the fingerprint. Fingerprint scanner via USB has been introduced in the market; iris and voice can be capture via camera and microphone. The technology has been growing very fast and most of the new computers are already packaged with all the prior peripherals.

Biometrics industry has been growing tremendously in developed countries like US and Japan. There are many gadgets being introduced in those countries in order to facilitate the current lifestyle. The card-less payment system should be replaced and they must be more easier, reliable, secure, cash free and tension free payment system such as biometric payment system in which no body have to take dozens of cards for shopping, traveling, pass in office, university or bank as door lock, Internet online shopping and many kinds where card system is installed (Kumar & Ryu, 2009).

FUTURE RESEARCH DIRECTIONS

Many financial institutions and government organizations have introduced their latest secure systems through the web, such as biometric authentication systems to enhance efficiency, to lessen threats and costs, and also to improve security. As a result, phishing would be reduced due to the lack of data input by users. Some banks in Malaysia have used authentication to Internet banking system by login, password and USB devices. With increasing security requirements, improving system performance, and decreasing costs, more and more biometric applications and systems are used across broad sectors of society, such as the military, government, education, and business, for both physical and logical security. Seeing that more and more financial institutions and government organizations apply the biometric technology, it is significant for them to identify factors that influence their client behavioral intention to use such systems. This chapter identifies a number of main factors influencing Internet banking users intention to continue e-banking services by proposing a viable solution such as biometrics technologies to enhance the security level.

There is a vast amount of research on the adoption of latest technologies along with users. However, biometric technologies implementation in Internet banking is still a new idea. The significant aim of many organizations is to evaluate factors that develop the adoption and acceptance rate of new technology and come to a decision which technologies are worthy of implementation. Nevertheless, there is a lack of literature on biometric technology adoption and acceptance, mainly in the ASEAN countries. First, its shows biometrics implementation provided a good understanding of the likelihood of user acceptance in biometrics technologies by highly educated people and those who are familiar with the Internet banking, they may not provide insight into consumers who are not regular Internet banking users. Furthermore, the research findings concern perceptions and do not address how well a biometrics technologies system solution would actually meet consumers' needs.

Biometrics technology implementation in Internet banking application is still a new idea. Biometrics technology has successfully being implemented in other area such as in e-government. Results obtained from the implementation in e-government showed that the reliablity of the intial system should be developed in order to authorized user's authentication based upon his/her biometric data. The system developed should also protect against access from non-authorized users. By looking at the implementation of biometrics technology in e-government, a larger experiment can be conducted to get an idea of the possibility of implementing such a system more widely.

CONCLUSION

The literature generally agrees that Malaysian consumers are slow to adopt Internet banking because of the lack of security and reliability of transactions over the Internet (Raju et al., 2007). Nevertheless, consumers seem wary of using the Internet for using online applications such as credit card and e-payment systems (Lu et al., 2005). Other researchers in Malaysia (Amin, 2007; Haque & Ismail, 2008; Haque, Tarofder, Rahman, & Raquib, 2009; Suganthi et al., 2001) have stated that security, risk and trust are the major factors affecting the adoption of Internet banking in Malaysia.

Thus the findings from this research will provide important suggestion as to the extent of enhance the level of security in Internet banking. There are many important solutions to enhance the security; Fahad et al. (2010a) has suggested that to increase security and decrease risk of viruses, as the browser is built in such a way that there is no need to type Uniform Resource Locator (URL).

There are a few solutions for existing login to Internet banking such as login, password and USB devices. The effectiveness is still an issue because users may forget to bring devices along with them and may forget the login password. By looking at the next level of authentication security steps the benefits of investigating biometric authentication systems in online banking will secure the login process to the system and remove password vulnerabilities; enhance convenience such as employees quickly log in using their finger; reduced help desk costs by eliminates calls for password resets. Therefore, biometric technologies implementation in Internet banking environment can enhance the security level.

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KEY TERMS AND DEFINITIONS

Biometrics Technologies: Enables automatic personal recognition based on physiological or behavioral characteristics. It is relies on who you are or what you do as opposed to conventional methods, which rely on what you know (knowledge of passwords or other secrets such as cryptographic keys) and what you possess (such as a token or an ID card) (Alhussain & Drew, 2009).

Identification and Authentication: The ability to uniquely identify a person or entity and to prove such identity (Hutchinson & Warren, 2003).

Internet: Internet is a method of communication that utilizes networked computers as a medium. Internet enables direct transformation of information from providers to customers.

Internet Banking: Internet banking can mean the setting up of a Web page by a bank to give information about its product and services. It involves provision of facilities such as accessing accounts, funds transfer, and buying financial products or services online (Sathye, 1999).

Perceived Security: Perceived security is defined as the 'customer's perception of the degree of protection against these threats" (Yousafzai et al., 2003)

Perceived Trustworthiness: Perceived trustworthiness is defined as the customers' perception of confidence in the bank's competence, integrity and benevolence to provide banking and financial services over the Internet (Yousafzai et al., 2003). According to Mayer, Davis, and Schoorman (1995), three main elements of trustworthiness can be identified and validated: integrity (trustee honesty and promise keeping), benevolence (trustee caring and motivated to act in the trustor's interest) and competence (ability of the trustee to do what the trustor needs).

Phishing: Is a type of identity theft where criminals blast emails to a mass audience in their malicious attempt to bait you into fake websites or also known as 'online identity fraud'(source: ("Website,") www.cimbclicks.com.my/keepsave.htm).

Privacy: The ability to prevent the unlawful or unethical use of information or data (Hutchinson & Warren, 2003).

Security: In the context of electronic banking, threats can be made either through network and data transaction attacks or through unauthorized access to the account by means of false or defective authentication (Yousafzai et al., 2003).

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Chapter 38
Use and Management of Conventional ICT and Mobile Technology in Microfinance: A Bangladesh Perspective

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ABSTRACT

Microfinance has been a significant means of reducing poverty since the mid-1970s. With the economic, social, and demographic characteristics, Bangladesh has been one of the countries where microfinance interventions are notable. In Bangladesh, hundreds of microfinance organisations have been implementing microfinance programs covering almost one-third of the rural population of the country. Studies show that the proper use of Information and Communication Technology (ICT) may help microfinance intervention in different ways. It may help increase operational performance, organisational upsizing, and poverty outreach, and decrease interest rate with many other organisational and social implications. This chapter looks into the Information Systems (IS) of microfinance of Bangladesh, the extent and intensity of the use of ICT, the factors that hinder the use of ICT in microfinance, the approaches to ICT management, and the emerging mobile technology-based operational model of microfinance and perceived implications of the changing landscape of ICT on this development program.

INTRODUCTION

Since time immemorial, a significant proportion of the world's population has been in a vicious cycle of poverty. Considering the extent and intensity of poverty in the world, the United Nations (UN) has fore-grounded its poverty reduction agenda through its Millennium Development Goals (UN, 2000). Microfinance has been a significant means of reducing poverty since the mid-1970s. Realising the important role of microfinance in liberating the poor from this cycle of poverty, the UN pro-

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claimed the year 2005 as the International Year of Microcredit, and the Nobel Peace Prize for 2006 was dedicated to the pioneer of the microfinance movement, Professor Muhammad Yunus and the Grameen Bank that he built for the intervention of microfinance.

Nowadays, thousands of microfinance organizations have been established, especially in the LDCs (Least Developed Countries), and they are engaging millions of economically and socially marginalised women and men within their microfinance program operations. With the economic, social and demographic characteristics, microfinance has been an important sector of Bangladesh for long time. Besides Grameen Bank, hundreds of microfinance organizations have been implementing microfinance program covering almost one-third rural households of the country with an aim to address the economic and social problems of poor community of the society (CDF and InM, 2011).

The implementation of microfinance program is information intensive. A successful implementation of this highly distributed nature of program intervention is largely dependent on the information systems of it (Iyengar et al., 2010; World Bank, 2010). The use of ICT (Information and Communication Technology) in the information systems of microfinance can be helpful for operational performance, supervisory performance, increasing transparency, accountability and poverty outreach with many other positive organisational and social implications if the ICT is properly managed (Mia, 2013). This chapter looks into the currently-used Information Systems (IS) in microfinance of Bangladesh, the extent and intensity of the use of ICT, the factors hinder the use of ICT in microfinance, the approaches to ICT management, and the emerging mobile technology-based operational model of microfinance. The chapter concludes with some recommendations regarding the use and implications of the changing landscape of ICT in the microfinance sector of this developing country.

MICROFINANCE SECTOR AND USE OF ICT

Although helping poor people through providing financial services used to be in the long past in different parts of the world (Seibel, 2003; Nath, 2004), the present movement of microfinance began after the liberation war of 1971 in Bangladesh, within the context of on-going poverty and undeveloped social circumstances, exacerbated by the war and post-war destruction (Choudury et el., 2009; Yunus and Joils, 1998). Since then the movement of alleviating poverty through providing financial services for the poor and involving them into a process of social development has been going on in the country. Presently, about 700 registered microfinance organizations are providing microfinance services covering 33 million active borrowers from 17, 400 outposts throughout the country (CDF and InM, 2011). Grameen Bank, BRAC and ASA are the major providers of microfinance of Bangladesh. PKSF is the apex funding body that provides wholesale funds to the microfinance organizations especially the medium and small sized organizations. Except for Grameen Bank, all other microfinance organizations of the country are regulated by newly formed Microcredit Regulatory Authority (MRA).

Use of ICT: Organisational IS

The use of ICT in the information systems of microfinance in Bangladesh started in the mid-1980s. During this period, BRAC, Proshika and then Grameen Bank started using customised software for the information management of microfinance. Until the late-1990s no organisation used customised software for microfinance of this country other than these three large organizations. However, the use of spreadsheet software has been popular besides using manual information systems since early 1990s in microfinance organizations. A recent survey (Mia, 2013) on 58 microfinance organisation of the country reveals

that presently about 30% microfinance organizations use customised software system, of which only 7% organizations use the system both at the head offices and field level offices, and 23% organizations use it only at head offices. The use of web-based online system is still rare in the microfinance organizations of the country. About 60% organizations use spreadsheet software besides the using manual system. Organizations that use customised software also use spreadsheet for preparing casual summary reports besides using the customised software for regular data processing and reporting purposes. About 10% microfinance organizations still use fully manual information systems for microfinance intervention. Four major types of information systems are briefly discussed in the following paragraphs.

Fully Manual Information Systems: The survey reveals that a small proportion (about 10%) of microfinance organizations in Bangladesh still use fully paper-based manual information systems for their microfinance operations. The information systems within all layers of these organizations are fully paper-based. All the functions related to information systems, such as data recording, processing, communicating, calculating, reporting and conducting feedback are accomplished manually, using paper. These organizations are usually very small in size and located in remote areas of the country. However, it has been observed while staying in the field, and corroborated by the survey results, that alongside the formal information systems, mobile phones have been widely used within microfinance operations as an information device for activities such as information gathering, consulting, decision making, decision and information passing, getting approval, providing suggestions and more. Even the organizations using paper-based fully manual information systems as their formal information systems also use the mobile phone as a casual information device for their microfinance operations.

Combination of Manual and Spreadsheet Software: The majority of the microfinance organizations (about 60%) use spreadsheet software along with their paper-based information systems. Spreadsheet software is mostly used for the compiling, summarising and reporting of the raw data recorded by paper-based systems. In addition, some organizations also perform financial analysis of microfinance data using spreadsheet software. Typically, organizations begin by using spreadsheets at the head office and then extend their use to their midlevel and branch offices. However, the use of spreadsheet software at the midlevel and branch office level has not been observed in many organizations. About 20% of organizations use spreadsheet software at midlevel offices in addition to using it at head office, and only 2 of the 58 organizations use spreadsheets at all levels - head office, midlevel offices and branch offices of the organizations. It is noteworthy that PKSF provided spreadsheet reporting formats including calculation formulas to its partner organizations. Partner organizations provide the reports produced using this spreadsheet format to PKSF every month as observed while studying at head offices in all the cases that receive funds from PKSF.

Off-Line Customised Software: Although the use of off-line customised software for microfinance began several years ago in some of the larger organizations in Bangladesh, at the time of writing its use is not widespread among the microfinance organizations of the country. The survey reveals that about 30% of the organizations use customised software for microfinance implementation. About 20% of organizations use it only at head office level, and under 10% (4 organizations) use off-line customised software at branch office level, in addition to using it at head offices. It has been observed in the field that organizations that use the off-line customised systems only at head office level collect data from branch offices in the form of a monthly report at end of each month,

and use this paper-based data as the input of the customised systems running at head offices. Then the system at head office processes the data and produces customised reports as the output of the system. Organizations using the systems both at head office and branch office levels like BRAC and ASA collect raw data at the end of each month from the branch level systems using portable storage devices, and upload this data to the head office systems for further processing and reporting.

On-Line Customised Web-Based Software: On-line web-based customised software for microfinance is still hard to find within the microfinance sector of Bangladesh. From the survey responses it was found that only 1 of the 58 organizations uses web-based on-line systems for microfinance. In this systems all the microfinance data is entered at the branch level and immediately stored into the central server located either at the office of the software developers, or at the head office of the microfinance organisation. All the information and reports about the microfinance program implementation can then be accessed from anywhere using this password-protected on-line system. It is noteworthy that organizations using off-line or on-line customised software also use spreadsheet for casual calculation and reporting.

The usefulness of spreadsheet software for internal and external reporting, and the maintenance-free usability of spreadsheet software even by the general staff having no technological background, also promote the use of spreadsheet software, especially in the socio-economic and technology contexts of this developing country. The freely available spreadsheet software and the usefulness of it may even discourage migration to customised software, especially in the cases of small and medium sized microfinance organizations. The survey also reveals that besides the formal and information systems discussed above, 100% of microfinance organizations use mobile phones in their microfinance programs.

Use of ICT: Sectoral IS

Although the microfinance sector of Bangladesh is an important sector of the country that has passed more than three decades with a large number of microfinance organizations covering about one-third of total rural households of the country (Ahmed and Hakim, 2004), yet there is no sectoral ICT-based information systems in place. However, the case study observes that the microfinance organizations provide periodic reports on microfinance operations to PKSF and MRA, CDF (Credit and Development Forum) and MIX (a Washington based international information exchange centre for microfinance) on a regular basis.

Microfinance organizations that get funding from PKSF must send monthly reports to PKSF formally using predefined paper formats. Besides, the paper-based reports most of the microfinance organizations also send operational data using PKSF-provided spreadsheet files through email to PKSF. After receiving the data PKSF processes and analyses it, and uses it for monitoring, supervision and other administrative purposes. All the microfinance organizations working with the licence from MRA send six-monthly reports manually to MRA. MRA uses these reports for regulation-related activities. Most of the microfinance organizations also send yearly summery reports to CDF that the CDF uses for preparing 'Bangladesh Microfinance Statistics' as an annual publication of CDF. Some microfinance organizations also send microfinance operational data electronically to MIX and this is used for preparing global microfinance statistics and for exchanging information among the microfinance organizations all over the world.

In 2004 PKSF initiated the development of a credit bureau database with financial support from the World Bank. Application software was developed and hardware was procured for the systems.

The systems were not finally successful because of the problem of backward linking with the client databases of microfinance organizations that were manual in most cases (World Bank, 2010).

Factors Hindering the Use of ICT in Microfinance

It can be seen from the discussion of above section that although the microfinance program of Bangladesh is one of the largest covering microfinance of the country but the use of ICT in information systems of microfinance is still remarkably low. This section looks into the major factors that hinder the use of ICT in microfinance of this developing country.

Financial Issues: In a recent survey a considerable number of microfinance organizations mentioned that they did not computerise their information systems because of the financial problem as a primary reason (Mia, 2013). The findings of this study show that most of the small and medium sized microfinance organizations are not financially strong. These organizations are highly dependent on loan money for their microfinance operations. Due to financial constraints, these organizations tend to be less interested in spending significant amounts of money on ICT from their microfinance capital. Poor performing small and medium sized microfinance organizations of the country are especially constrained financially. The management staff of small microfinance organizations perceived that those organizations that have a small number of branches can manage their data with manual information systems. They stated that small organizations cannot afford the costs of ICT-based information systems. Some organizations speculate that they will get more return in a shorter time if they invest their money in microfinance instead of investing it in ICT. Some are more interested in capturing new geographic areas for microfinance operations rather than investing in ICT.

Scarcity of IT Firms and Experts: A considerable number of organizations mentioned the scarcity of IT firms and experts in the country as one of the strong barriers to computerisation (Mia, 2013). The scarcity of IT firms and experts who are grounded in both technology and microfinance is one of the factors that hinder the use of ICT-based information systems for microfinance. The working processes and procedures of microfinance differ from organisation to organisation. Due to the lack of standardised processes and procedures of microfinance, developing an information system that could be used in all organizations is difficult. IT firms or professionals with the knowledge and skills for working on the information systems with heterogeneous work processes and procedures tend not to develop in the country. IT professionals possessing experience in the working processes and procedures of microfinance are also rarely found within the general IT industry of the country.

Electricity and ICT Infrastructure Problem: As a developing country the problem of electricity, both in terms of area coverage and the quality of supply, is a common phenomenon in Bangladesh. At present, a considerable portion (about 40%) of the country is not covered by the electricity network (Bangladesh Government, 2010). Even in the areas where there is network coverage, there is a significant amount of interruption in the supply of electricity throughout the year. It was also observed that the Internet bandwidth tends to be weak in most parts of the country. More recently, some mobile phone operators have been providing Internet services through Internet modems, but the available bandwidth is not yet adequate for running on-line web-based information systems smoothly as it was observed during field visits in different parts of the country. These fraught issues with the lack of power supply and the inadequate ICT infrastructure within the country discourage microfinance organizations from migrating from manual to ICT-based information systems.

Fear that they are Incapable of Replacing Manual Systems with ICT-Based Systems: Information systems for microfinance are distributed, complex, sensitive and non-standardised, that are used by the semi-literate staff members, and in many cases for the non-literate borrowers in underdeveloped rural and slum settings (Iyengar et al., 2010). Organizations are doubtful of their ability to replace their manual information systems with ICT-based systems within this organisational context. It has been observed that organizations take years to computerise the running transaction data and the reconciliations needed for this. For example, organizations like BRAC had to go through a rigorous reconciliation process taking a number of years when they started branch office computerisation.

Fear of the Inability to Maintain ICT-Based Systems: Microfinance is by nature a volatile program. There are frequent changes in program polices and operational procedures with which information systems need to comply (Iyengar et al., 2010). Microfinance program operations take place in a distributed manner, mostly in rural areas far from head offices. The maintenance of computer hardware and software with frequently changing requirements is difficult in remote operational areas. The microfinance operations cannot be stopped even for one day if the system is down. From the discussion with the IT staff, it appeared that the organizations, especially the mid-sized ones, fear that it would be very difficult for them to manage this maintenance-intensive remotely-located hardware and software, and so they stay with their manual systems.

Fear that Existing Staff will be Unable to Use ICT-Based Systems: Majority of microfinance staff members have very low educational backgrounds. In most cases they are recruited from the local area. These staff members are not familiar with ICT-based information systems. Management staff fear that most of their existing staff would not be able to work with ICT-based information systems. They also fear that if they try to replace the existing staff members with more educated personnel familiar with ICT, or capable of using ICT-based information systems, then it would have a negative impact upon their profitability, at least in the short term, as higher salaries would be needed for them.

Fears of Transparency: Microfinance organizations are monitored and regulated by the funding agencies and the government regulatory authority on a regular basis. As it was also mentioned in World Bank (2010), a significant number of microfinance organizations do not want the external funding and regulatory bodies seeing all their financial and operational conditions. The higher management thinks that if their information systems become digital then they would not be able to hide information from the monitoring and regulatory bodies. For example, PKSF does not provide finance if the organisation's OTR (On-Time Realisation) is below a certain percent. MRA can call for disciplinary action and even cancel the operational licence of microfinance organizations if they find irregular operations. Many organizations prefer to sacrifice the benefits of computerised systems and remain non-transparent to the external funding and regulatory bodies by using manual information systems.

APPROACHES TO MANAGING ICT

In the microfinance sector of Bangladesh, four broad approaches of ICT management can be observed. The approaches are discussed in the following paragraphs.

Managing ICT by the Organization: The microfinance organization itself manages its ICT without taking direct help from outsiders. In this approach the organization develops software in-house usually through opening a new department. People in this department also take care of the activities of system testing, implementation, hardware and

network installation and maintenance. For example Grameen Bank, Proshika and ASA follow this approach. In the case of Grameen Bank, rather than opening an internal new department it has given all the ICT management responsibility to a sister concern named Grameen Communications, for cost control and to keep ICT management entity separate from the microfinance operational entity for confidentiality and security reasons. ASA, another large microfinance organization has recently launched its own ICT project for the total computerization of its large information systems solely by its own internal ICT management department. This approach enables faster development and support, and more easily matches the IT-based systems with business processes, but prevents learning and adaptation of good practices of others.

Managing ICT by the Organisation and External Firms: There are microfinance organizations who manage their ICT in a combined management approach involving external IT firms with their own IT team. Instances of this approach in the microfinance of Bangladesh are rare, but BRAC is a good example of this approach. BRAC operates the largest microfinance program in the world, giving most of the IT project management responsibilities to an external IT company. This company developed information systems for BRAC and implemented them in all branch offices of BRAC throughout the country. A team within the microfinance program works with the external IT company, to link between BRAC and the company. However, BRAC is currently taking the management of IT back from the external company in a gradual manner. Interestingly, BRAC started managing IT projects by itself at the beginning of IT use in the mid-80s, went for outsourcing in the late 90s, and now again is in the process of taking back to its own management.

Managing ICT by External Firms: A recent trend of total ICT management by external IT firms has been emerging in the microfinance sector. Seeing the benefits of using IT for microfinance, an increasing number of microfinance organizations are showing interest of using IT for their operations. At the same time, given the large market in the microfinance sector and after a long process of capacity building, a few Bangladeshi IT firms have gained the capacity to develop information systems for microfinance. Some smaller-sized microfinance organizations have started using IT with this approach of IT project management. This is a very new trend of ICT management in this sector and its positive and negative aspects are not yet clear. With this approach a rapid growth of IT use in the sector is likely that did not occur with the other approaches. However, some instances of mishaps have been observed like non-matches of the system with the business process and inability to provide instant support by the external firms.

Managing ICT by Apex Funding Body: There was an initiative to manage IT projects by PKSF, the apex funding body of the microfinance sector in Bangladesh. This project started in 2002 with the aim of developing and implementing an IT-based information system for its partner organizations. PKSF started this project observing the lack of capability of its partners to develop their own systems. However, the apex funding body was likewise unsuccessful and abandoned in 2007, but for different reasons, including the inability to streamline the dissimilar business process of different partners, lack of adequate project planning, and the appointment of members within the project for political reasons rather than their abilities.

USE OF MOBILE PHONES AND EMARGING MICROFINANE MODEL

Previous sections discuss the use and the approaches of managing conventional ICT in microfinance of Bangladesh. This section concentrates the use of mobile phones and the emerging mobile phones enabled microfinance operational model with its presumed implications on the fundamentals of conventional microfinance.

As an information and communication device the mobile phone in microfinance is seen to be an enabler of a new business model of future microfinance of the world (Reed, 2013). Because of the growing coverage of the unbanked households by the cellular networks in the developing world, an increased outreach with a new model of low-cost microfinance through the use of mobile phones has been a growing expectation of the bodies concerned with global microfinance (Reed, 2013; CGAP, 2012; 2008; 2006). Statistics of the International Telecommunication Union (ITU) shows that the subscriptions rate of mobile-cellular network in Bangladesh was 6.4% of total population in 2005, and after a very sharp growth it stood at 56.86% in 2011 (ITU, 2012). Because of the declining call charges and the wider availability of low-priced phone sets the use of mobile phones among the rural poor community is also remarkable in this developing country. It has been observed while staying in the field that all the microfinance staff members, including the frontline operational staff, have mobile phones and almost all of the borrowers can be reached either through their own or their neighbours' mobile phones, even in rural areas of the country.

Pattern of Present Use

It has been observed in the case studies and survey that the use of mobile phones in microfinance of the country is remarkable. However, the pattern of using this mobile technology in the microfinance sector of the country is not the same as it is in M-PESA of Kenya (Reed, 2013) or similar models used in other developing countries to provide financial services for the unbanked individuals (CGAP, 2012; 2008). In Bangladesh, the use of mobile phones in microfinance is as yet mostly confined within the microfinance organizations for 'operations management' rather than using it in the borrower community for 'transaction management'. Some of the current usage of mobile phones in microfinance organizations of the country is discussed.

The survey data indicates that about 40% of microfinance organizations, mainly the large and mid-sized ones, use mobile phones for microfinance data communication on a regular basis. The lower layer of the organizations send daily or weekly reports on important indicators such as disbursement, OTR (On Time Realisation), OD (Overdue), savings, savings withdrawals, and borrowers in-out status to the upper layer of the organizations either verbally or using texting (SMS) by mobile phones. The upper layer management collects the reports from different stations of lower layer of its jurisdiction, and records the data on a specified report format. Then all the collected reports are compiled and passed on to the upper layer using the same method by mobile phones. In most cases SMS is used as the staff of the middle layer travel a lot by motorcycle for supervisory purposes, and it is difficult for them to receive phone calls to receive the data from lower layers. Many organizations like BRAC do this reporting exercise daily in order to keep the upper layers of the organizations updated about these important indicators, as the formal reports go to the upper layers at one month intervals in most cases. However, the survey indicates that the use of mobile phones for this data flow between two monthly reports mostly happens within the large and mid-sized organizations. Locally based small microfinance organizations rarely practice this type of daily or weekly reporting on a regular basis.

As the survey revealed and it was observed in the case studies, mobile phones are heavily used in all microfinance organizations for operational and decision making purposes such as providing instant decisions and suggestions, following-up assigned tasks, getting and providing approvals, and letting the senior staff know about the work. Upper level managers assign tasks to the lower level staff and follow up the assigned tasks using mobile phones. Managers of different levels provide instant decisions and suggestions about ongoing operations to the lower level managers and operational staff using mobile phones. The

practice of using SMS by mobile phones for these purposes is also seen in some organizations as a way to keep records of the decisions and approvals of the work.

Sometimes the mobile phones are used to supervise the operation of this highly distributed and supervision-dependent economic program, which is known as 'mobile-supervision'. For example, using mobile phones, managers can try to check whether their subordinates are in the scheduled place of work by talking to other people who are supposed to be there, or asking some information which cannot be provided without being present at the work place. He said that this type of remote supervision practice can be seen in many microfinance organizations of the country.

It has been observed in all cases that the communication between frontline operational staff and borrowers using mobile phones is a very common. The participants in the focus groups of all organizations in the case studies described the use of mobile phones for various purposes such as to find out information about loan approvals and instalment payments, to provide suggestions, to inform about emergency issues, to call for meetings, and to communicate the reasons for non-attendance. Some focus group participants also said that they can get information for creditworthiness assessment of the new applicants, use of loans, even the information about members intending to abscond from neighbouring group members using mobile phones in a convenient and safer way.

Evidence of mobile phone use for more sophisticated purposes, such as to contact a call-centre by the borrowers of microfinance, is also observed in the country. BRAC started a call-centre for its microfinance borrowers mainly for two purposes – acknowledgement of loan repayment, and borrowers' complaint management. Firstly, when repayment instalments are paid (especially for the bigger category of loans) and the repayment data is entered into the branch offices' computer, an auto-generated signal is sent to the call-centre system located at the head office in Dhaka, and the call-centre system automatically sends an acknowledgement of the receipt of the repayment to the borrower's mobile phone. Secondly, microfinance borrowers send their comments and complaints about the service to head office management through call-centres, by mobile phone. The call-centre staff record these comments and complaints and submit them to the concerned head office management so that they can proceed with the issues.

It has been observed in the case study that a number of large and mid-sized microfinance organizations provide foreign remittance services to the borrowers and even non-borrowers using mobile phones. These organizations work in collaboration with the international money transferring companies or banks. The international money transferring companies or banks transfer the money from the foreign countries to Dhaka (the capital city of Bangladesh) and the partner microfinance organizations transfer the money from Dhaka to the remittance receiving households located even in the remote areas of the country through the local branches of the microfinance organizations using mobile phones. BRAC performs this PIN (Personal Identification Number) based services through mobile phones in one day as it has own collection points in most of the countries where Bangladeshi people work. However, this mobile phone based money transfer through microfinance organizations is limited to incoming foreign remittance. Outgoing transfer from country to abroad and transferring money from one person to another within the country through microfinance channels are not yet been permitted by the central bank of the country.

Premise for the Future Use

The usage of mobile phones in microfinance in Bangladesh discussed above denote that except for the auto-acknowledgement services of instalment repayment for the borrowers of bigger loans of one organisation, other usage of mobile phones

are mostly related to the operation management of microfinance and the foreign remittance services. The use of mobile phones still remains mainly within the microfinance organizations rather than using it in the borrower community for transaction management. However, the present movement of providing financial services for the poor using mobile phones elsewhere in the developing world like M-PESA (Reed, 2013; CGAP, 2012; 2008; Hayes and Westrup, 2010) is very different from the usage of mobile phones in the microfinance organizations of Bangladesh.

The present movement of mobile phone-enabled financial services for the poor is based on a transaction management system in the client-server technology platform where the central computer 'servers' store and process transaction data which are connected to the mobile phone 'clients'. Authorised users, both individuals and organizations can use mobile phones to perform transactions with other authorised users for different purposes such as deposit, withdrawal, money transfer, bills payment, and even salary and wages payment like a mobile branchless bank. However, when physical cash is required the users need to go to a local 'banking agent' appointed by the systems operators or to an ATM booth. This is a general purpose transaction management system usually run by cellular network operators where microfinance organizations or other financial service providers and their clients can join and perform financial transactions (Reed, 2013; CGAP, 2012). This model is in practise in a number of developing countries including Kenya, Uganda, South Africa, the Philippines, India and Brazil (Reed, 2013; Hayes and Westrup, 2010; Duncombe and Boateng, 2009; Donner, 2008). It has been claimed that if the microfinance transactions are performed using this system then it would help increase outreach, reduce cost of operation, save time, bring transparency and minimise financial misappropriations in microfinance (Reed, 2013; Hayes and Westrup, 2010). These authors also argue that this mobile phone-enabled microfinance would radically change the conventional business model of microfinance.

As this model is not in practice in Bangladeshi microfinance, it was not possible to study the feasibility, usability and implications of the system in the context of the country during the field work of this study. However, with the experience and understanding from the seven months exploration of the microfinance sector of Bangladesh, some reflections about this mobile phone-enabled new model of microfinance in the contexts of the country are discussed below.

According to the mobile phone-enabled new business process of microfinance the branch offices of the conventional microfinance as the basic operational outposts would not be needed. The weekly meeting of microfinance borrowers with the operational staff of microfinance organizations would not take place for loan and savings instalments collection and development discussion. Instead, the microfinance borrowers would deposit their loan and savings instalments using mobile phones to the account of microfinance organisation. In order to get a loan, usually once in a year, the borrower would either go to the local 'agent' appointed by the microfinance organisation or a loan disbursing branch.

It would be a vital transformation of the conventional microfinance operational landscape with deep implications for change in many areas of microfinance. On the one hand, the basic concept of people's organisation (Yunus and Jolis, 1998) in the microfinance borrower community that is the borrowers' group and sub-groups would be lost. The phenomenon of 'individualism' would emerge in place of the core concept of 'collectivism' in microfinance. The operational staff of microfinance organisation would not go to the borrowers community on a regular basis and the development discussion and demonstration would no longer be taking place. Hence, there is the possibility of a drastic fall in social performance of microfinance (Yunus and Jolis, 1998; Anderson et al., 2002; Leatherman, 2011).

On the other hand, it would substantially minimise the operational cost of microfinance. The staff involved in frontline operation and management, which accounts for more than 90% of total staff (CDF and InM. 2010) would be downsized significantly as the weekly instalments collection work and the time consuming manual data processing are not required in the mobile phone-enabled model of microfinance. Microfinance organizations would be able to reduce interest rates significantly which has been a controversial issue in microfinance for long time (Ahmmed, 2004; Matsaert, 2004; Marilou, 2004). It would help save time for the borrowers to perform the repayment transaction in an automated way using mobile phones. It may contribute to reducing financial misappropriations that usually happen in the operational level of conventional microfinance. As the loan disbursement and repayment data would be recorded in the central server, the long-discussed issue of client overlapping (Chaudhury and Matin, 2002; World Bank, 2010) would be identified. This new approach of mobile phone-enabled microfinance may address almost all the information related challenges that the World Bank study (World Bank, 2010, pp. 2-3) identified without developing and implementing the World Bank proposed huge project of centralised ICT platform for the microfinance sector of the country. Even the organisational and sectoral reporting problem that the World Bank (2010) study identified could be done using the transaction data from the computer 'servers' connected with the mobile phone 'clients'.

One of the prime objectives of mobile phone-enabled approach is to increase the outreach of microfinance (Reed, 2013; Hayes and Westrup, 2010). The mobile phone-enabled model might be helpful for 'geographic outreach' in the countries where accessibility in the remote areas has been a challenging aspect for microfinance intervention. In the case of Bangladesh the 'geographic outreach' is not an issue. The existing microfinance organizations cover almost all areas of the country (CDF and InM, 2010). However, there is an issue of 'poverty outreach' in Bangladesh. There is a possibility of more exclusion of the very poor segment of population in this technology depended approach in the context where a tendency of exclusion of this segment is already present in Bangladesh. However, further work is needed to examine how the mobile phone-enabled new approach of microfinance may affect the issue of 'poverty outreach' of microfinance in Bangladesh.

Mobile phones are already in the hands or within the reach of microfinance borrowers of Bangladesh. Coverage by cellular networks is available in almost every corner of the country. Mobiles phones can be used with very low tariffs, and low cost phone sets are available in the country. Given these circumstances, thorough research on the assumptions and propositions discussed above needs to be conducted in Bangladesh. Conducting pilot studies within the frame of action research methodology, involving cellular network operators, microfinance organizations and borrower community, may help develop a suitable model of mobile phone-enabled microfinance in the demographic, organisational, technology and the socio-cultural context of Bangladesh. Alternative ways to address the presumed negative implications as mentioned above might also be found for this promising new way of microfinance intervention.

CONCLUSION

It is observed that although the use of ICT in microfinance started long ago in Bangladesh but the extent and intensity of the use have not been significant in the socio-economic, infrastructure and technology context of this developing country. The nature of human resources in microfinance, and the unstandardized and distributed nature of the operational model of this development program have also been hindering the use and effective management of ICT in this sector. Given the growing coverage of mobile phones

even in the borrower-base of microfinance, it is likely to transform the conventional microfinance operational model into a mobile phone-based transaction management model of microfinance in near future. The lower operational cost, less time involvement for the borrowers and lenders and grater outreach of this mobile phone-enable microfinance transaction model would also be the motivational factors to promote this model in Bangladesh. Consequently, the conventional ICT in the field level would mostly be replaced by the mobile technology for the program. However, besides different financial and operational advantages of this emerging model, the risk of ignoring the fundamental social side of this development program is there in this model. Thorough studies on the mobile technology based operational model of microfinance and implications of it on the social side of the program should be carried out involving microfinance organizations, cellular network operators and borrowers. Then the approach of managing ICT would also take different shape accordingly with the vital changes of the use of ICT for this development program.

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KEY TERMS AND DEFINITIONS

Conventional ICT: Information and Communication Technologies that have been in use for a considerable period of time are sometimes termed as conventional ICT. For example, personal computers and associated software, printers, internet, traditional communication devices etc.

Microfinance: Microfinance is a development programme that aims to improve the economic and social life of people in poverty. It mainly provides small amount of money to poor households as loans without collaterals for income generating activities. Microfinance programme also involves the households in a process of social development besides the economic activates. In terms of coverage, microfinance is one of the largest poverty interventions that reach about 200 million individuals and their families around the world.

Mobile Technology: Information and Communication Technologies that are used with mobile devices for input and output purposes. In this chapter the term 'mobile technology' is used for the mobile phones and similar type of devices which can be used for the purpose of financial transactions in microfinance operations rather than using stationary ICT solutions for microfinance.

Outreach: The term outreach is used to mean the number of people covered into the microfinance programme operations. Household members of the individuals who are covered by the microfinance programme operations are also treated as outreach of the programme.

Poverty Alleviation: It is the prime objective of microfinance programme intervention. Especially in the developing countries a considerable proportion of the population live in poverty. Microfinance intervention is carried to help them come out of poverty through creating self-employments which is termed as poverty alleviation.

Poverty Outreach: Coverage of very poor households by microfinance intervention is referred to be the poverty outreach of the programme. For example, Microfinance Summit Campaign reports that about 200 million individuals and their families are covered my microfinance programme but the poverty outreach is about 175 million in the world.

Social Performance: It is believed that trying only for economic development of the poor households does not work. Besides the economic development social development is essential. Otherwise, economic development may not persist. For this, activities for the social development of the poor household and their society are embedded in microfinance programme design. The social performance of microfinance programme is measured considering the intensity and the effectiveness of the social development activities of the programme. Sometimes this term is also used to denote the overall mission and achievements of a microfinance programme intervention or a microfinance organisation.

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Chapter 39
Self-Service Technology Banking Preferences:
Comparing Libyans' Behaviour in Developing and Developed Countries

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ABSTRACT

Technology-enabled banking services are currently being implemented in developing countries. This research examines how citizens of developing countries adapt to these changes in their banking services. Technological expansion has been occurring in the Arabic region since the 1980s; however, the focus has been on trade and services offered by industries. The banking sector is an information intensive industry and should be at the forefront of advanced use of Information and Communication Technologies (ICTs). The banking sector has started to utilize technology-enabled services through the Internet and mobile devices, with the goal of improving customer relationships by empowering customers. One common trend is increasing the use of self-service technologies, which are facilitated by ICTs. This study discusses how Libyan banks should focus their technology strategies to relate to customers, reduce costs and improve services, achieved through the use of a survey completed by customers who have become accustomed to technology-enabled banking services in the developed world. The current availability of technology-enabled banking services in Libya is limited. This paper presents a comparative review of the use of technology-enabled banking services by Libyans when they are in Libya and whilst they are in Australia (a foreign developed country where Libyans are furthering their education).

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1. INTRODUCTION

There have been rapid changes in the ways that customers deal with their banking institutions, with technical innovations leading to the adoption of technology-enabled banking (electronic banking (e-banking) and mobile banking (m-banking)). These have become a common channel of choice for interactions between customers and their banking institution, compared with traditional face-to-face interactions. Self-Service Technologies (SSTs) have made it easier for customers to complete banking transactions and other related banking services as they provide increased availability of services, with customers being less dependent upon the opening hours and location of their bank (Storbacka, Strandvik, & Grönroos, 1994). The incentives for customers to use these new banking channels are expectations of increased productivity, decreased costs and increased added value. The ubiquitous nature of e-banking has created a shift in the relationship between customers and their banking institution.

Throughout the developed world, the implementation and usage of Information and Communication Technology (ICT) in the service sector has been dramatic. The banking sectors' operations have altered as they have adopted ICT applications into the banking process (Cracknell, 2004; Jalal-Karim & Hamdan, 2010). Customers have highlighted the need for services to be provided through the Internet and mobile phones (Akel & Phillips, 2001; Jalal-Karim & Hamdan, 2010). As a result, ICT services have replaced normal straightforward face-to-face interactions with online banking services (Amin, 2007), a SST. As a result, the ICT revolution has set the stage for increases in financial activity across strategies in the banking sector and it is altering a rapidly moving market place (Jalal-Karim & Hamdan, 2010). This technological development has influenced the range of services and led to improved availability for increasingly larger client groups. Self-service has become one of the key concepts of technologies (Banerjee, 2009; Freeman, 2009). Despite these advances in the developed world, the situation has been remarkably different in developing nations, as the core technologies have not previously been available to customers and face-to-face service has been the norm.

This paper presents the recent advancements in the banking sector generally, with the adoption of comprehensive SSTs used to create improved customer relationships (Jalal-Karim & Hamdan, 2010). Initially, an explanation of the case study of Libya is presented. A review of the potential benefits of SSTs to the customer, through m- and e- banking, is then provided. Finally a preliminary investigation of the SSTs that are used by Libyans in Libya compared to Australia is presented, highlighting the differences in use between the two countries. This study provides the starting point for identifying the types of services that future Libyan professionals could use on their return to Libya. To achieve the goal of determining the technologies with potential for improving customer relationships in the Libyan context, the following questions need to be addressed:

1. What types of ICT technologies are used by Libyans:
   a. In Libya (i.e. a developing country) and
   b. In Australia (i.e. a developed country)?
2. Which ICT-enabled banking services (i.e ATMs, phone banking, Internet banking and mobile banking) are used by Libyans:
   a. In Libya (i.e. a developing country) and
   b. In Australia (i.e. a developed country)?

This study is unique as, rather than focusing on technology adoption within a specific developed or developing country, this study considers the adoption choices of users from a developing country, comparing their usage of banking services in both their home (developing) country and in a developed country. Prior research has identified

that developing counties can take advantage of both developed and other developing counties to model their growth of e-business adoption (Raven, Huang, & Kim, 2007).

2. THE LIBYAN CASE

In most developed countries, technology is a central element in dealing with the challenges of modern banking, including lowering costs and enabling efficiency improvements. Certainly, most banks worldwide are highly successful at utilising ICT to provide efficient banking services to their customers. Libya is in a unique position to realign its priorities for the use of technology throughout its banking system, with an interim Government being formed on December 4, 2011, and most of the UN sanctions that had previously frozen Libya's foreign assets being lifted on December 16, 2011. These events have provided the Central Bank of Libya with the ability to support the exchange rate, increase economic stability and manage public expectations (The World Bank, 2012). This section highlights the policies under the previous regime. It should be noted that the modernisation of the Libyan banking system is clearly identified in the Strategic Plan for the Central Bank of Libya (Central Bank of Libya, 2012).

In 1993, Libya created a new law allowing the establishment of private-sector banks. Rules allowing Libyan banks to seek foreign partnerships provided opportunities for greater foreign investment in the local banking sector. However, as with other sectors of the economy, the business environment created a disincentive for foreign banks due to regulations and the unpredictable nature of government policy. In 2006, the government of Libya introduced laws enabling greater financial liberalisation and introduced a flexible banking system, albeit, in a cautious fashion (Central Bank of Libya, 2006), with general recognition that development of the banking sector was essential for Libya's economic reform (Twati, 2008). It has been identified that the adoption and ongoing use of e-commerce by Libyan citizens has been constrained by three main challenges, one of which was Libya's banking system (Hunaiti & Masa'deh, 2009). In 2008, most Libyan banks were still using manual systems of banking, and technology-enabled systems had not yet found their way to most banks (Twati, 2008). Although banks in Libya have been able to differentiate themselves using a low cost model, many banks have focused on achieving excellence through customer service. In contrast, the Commerce and Development Bank has benefited by serving their customers through adoption of ICT technologies since their inception. With 83% of the funding of Libyan banks coming from customer deposits, the current and substantial modernisation program underway across the Libyan banking system to upgrade available services, and deal with the use of non-cash payment instruments (credit and debit cards) used in most parts of the world is essential

According to the Central Bank of Libya Annual Reports (2005; 2006), most banks in Libya have adopted new ICTs. These ICTs include core banking systems with automated cheque processing, Visa, Mastercard and Automatic Teller Machines (ATMs). These ICT programs were designed to introduce SSTs to customers. To allow Libya to keep pace with the rest of the world, the SWIFT system (used for transferring money worldwide through ICTs) has been introduced in the last few years (Twati, 2008; Twati & Gammack, 2006).

With an understanding of the change in banking polices within Libya, it is important to also consider the access that citizens have to technologies to utilize these SSTs. The number of Internet users in Libya was approximately 353,900 in 2009, with a population of approximately 6,735,620 in July 2012 (The World Bank, 2012). In 2009, approximately 5.5% of the Libyan population had direct access to the Internet, which is a very low percentage even for a developing country. However, Kridan and Goulding (2006) noted the popularity of Internet cafes within Libya which

increases this level of Internet use significantly beyond those with direct access. In 2010, there were 72,800 fixed broadband lines in the country, with overall Internet use increasing to 14% of the Libyan population by 2011 (The World Bank, 2012). As a result, some banks have considered this low level of adoption as a reason not to provide technology-enabled banking services via the Internet. However, telephone and mobile banking is a service that is starting to be used by banks, with estimates that approximately 10.9 million mobile phones are in service (The World Bank, 2012). Historically, Libyan banking has relied heavily on traditional face-to-face channels to provide banking services to customers; this is one of the many reasons why banks suffer from an inefficient manual process of banking.

From a customer relationship perspective, Libyan banks have understood that improving this relationship is an important factor for success, and that the cost to acquire a new customer is always higher than to maintain a loyal customer (Afsar et al., 2010). The move to increased use of ICTs creates additional challenges for enhancing customer relationships and also maintaining current customer loyalty. It requires customers to accept and adapt to new technologies, and limits the interaction between customers and service providers (Thao & Swierczek, 2008). Libyan banks must consider how to retain customers through good service and attracting a new customer in this environment is likely to be very difficult and costly (Al-Hajri & Tatnall, 2008). There is still limited research about Libyan banks in particular benefiting from ICTs; therefore Libyan banks require information to inform the development of a realistic strategy to embed ICT programs and applications into their business process, which in turn will lead to supporting customer relationships. As previously noted, most Libyan banks were still using manual systems of banking and technology-enabled systems had not yet found their way to most banks as recently as 2008 (Twati, 2008). In a review of Libyan banks in 2011, only one bank had implemented both online and mobile banking for customer use (Commerce and Development Bank), and one bank was using SMS banking (Wahada Bank). Two other banks had banners on their websites advertising that online and mobile banking were 'coming soon'. This status is notably different to banking in developed counties (e.g. Australia), where all banks have forms of online and mobile banking. In summary, the Libyan banking industry is in the process of undergoing dramatic changes to adopt modern SSTs, however questions over adoption by customers need to be considered. The following section outlines the potential SSTs that Libyan banks could adopt as part of their SST portfolio for customers.

3. SELF-SERVICE TECHNOLOGIES

Information and Communication Technologies (ICTs) facilitate connections and the ability for communication between banks and their customers (Wamalwa, 2006). ICT is an essential element for increasing customer relationships because it can be used to improve customer service strategies in several ways. Individual services can be enhanced, with services and products transformed to meet new customer demands and ICT tools being used to increase interaction with customers (Wells, Fuerst, & Choobineh, 1999). Interactions with ICTs will reflect directly on customers' decisions about banks. Kardaras and Papathanassiou (2000) suggested that the Internet can provide businesses with a cheaper way to perform activities and to access customers' views and positions about products and services.

Studies by Leek, Turnbull and Naudé (2003), Ayed Mouelhi (2009), and Costello and Tuchen (1998) have determined that up to 56% of firms in the banking sector commonly use Internet-based SSTs for online transactions. Leek et al. (2003) noted that only 38% of banks used the Internet for purchase processes and only 10% of financial firms used the Internet for customer support ser-

vices. It can be clearly seen that ICT tools have the potential to provide beneficial applications for both customers and the Libyan banking sector in the future. From a developed country perspective, a study by Costello and Tuchen (1998) identified that ICTs were used to facilitate communications in the Australian insurance sector as early as 1998; these ICTs included SSTs such as email, electronic mediums and the Internet. These tools have created the potential for change in firms' delivery of products for clients, and as a result ICT creates market wide accessibility to service face-to-face customers. A number of the tools used in ICT (such as mobile phones, e-mail, Internet, audio and video conferencing) will together likely change the future of Libyan financial firms and clients. SSTs seek to move processes towards individual customers (Leek et al., 2003) and facilitate the provision of better products and services at lower prices (Chesher & Kaura, 2003). Thus, SSTs are significant at reducing costs and increasing flexibility.

Although largely ignored by developed countries, due to their ubiquity computers can create business value by restructuring the banking sector to enhance its effectiveness. Most firms in the Libyan banking sector now have a network of computers and related devices because the core functions of storage, processing and communication are facilitated through these devices. The following section provides details of the two main examples of SSTs that are currently being adopted by Libyan banks: mobile banking and Internet banking.

3.1. Mobile Banking

M-banking is defined as 'a channel whereby the customer interacts with a bank via a mobile device, such as a mobile phone or personal digital assistant' (Laukkanen & Pasanen, 2007). The term m-banking refers to performing banking activities (such as viewing an account balance or performing an account transactions) via a mobile device. This is most often presented via SMS, mobile voice and mobile banking applications. M-banking provides an additional channel to reach customers. Services that can be provided through m-banking include (Scornavacca, 2006; Laukkanen & Pasanen, 2007): view account balance; view account transaction history; view credit card information; view loan statements; monitoring of term deposits; process one to one payments; bill payment processing; domestic and international fund transfers; status of requests for credit, including mortgage approval, and insurance coverage; loyalty-related offer based services; and exchange of data messages and email, including complaint submission and tracking.

Previous studies have identified that m-banking has had a positive influence on relationship processes between banks and customers. M-banking has significantly changed the way many customers access their bank account (Pousttchi, 2004). It has been strongly established as the most important distribution and communication channel for retail banking, its broad reach across the developing world has shown it to be one of the most significant technologies for customers (Donner & Tellez, 2008), and it provides an opportunity for banking institutions to introduce new services to customers (Amin, 2008).

However, in developing nations such as Libya, there has been little demand for mobile banking (m-banking) services in the banking sector (Dewan et al., 2009). Libyan banks have traditionally delivered services through face-to-face interactions with customers at branch offices. Recent modernization of telecommunications has enabled new access methods for banking services. As stated previously, only two Libyan banks currently utilize mobile banking as part of their services, however, with the penetration of mobile phones in the country this is one potential channel that could be used to increase customer loyalty. Notably, m-banking is the first communications technology

to have more users in developing countries than in developed ones; e.g. more than 800 million mobile phones were sold in developing countries in 2003 (Ivatury & Pickens, 2006).

3.2. Internet Banking

The changes facilitated by the Internet are evolutionary and have influenced the financial sector internationally (Davison et al., 2000). The adoption of Internet technology is occurring in developed and developing countries, and it changes banking from traditional delivery channels to electronic delivery channels (Ahmed et al., 2009). In developed countries like the USA, UK and Australia, Internet technologies have been used by the banking industry for several years, and banks have followed strategies to encourage their clients to employ e-banking. For example, a study (Evans & Sawyer, 2009) in Australia reported that 37% of business services were delivered to the customer via the Internet in 2009, compared to 21% of business services during 2005.

Libyan banks have utilized (limited) Internet-based interactions with customers since 1998, which has required these banks to regularly upgrade their technology (Twati, 2008). The Internet has emerged as an important new business tool with the interaction of communication with customers, as it provides many types of communication among clients and banks such as single-to-single and either many-to-many or limited-to-overall reaches. The slow adoption of technology to support banking in Libya is resulting in Libyan banks and their customers missing out on the usefulness and convenience of Internet technologies (Al-Hajri & Tatnall, 2008). Internet banking is one of most important forms of dealing online and building relationships with individual customers because it allows banks to provide services through the use of the Internet without traditional temporal and spatial borders (Xu et al., 2009). Therefore, the Internet can serve as an interactive channel for direct communication and information exchange between clients and bankers. It helps customers to access accounts, transfer funds and buy products online (Mastoori, 2009; Al-Sukkar, 2005). Elalag (2003) found, that of the 4370 clients who visited web sites, 82% of them preferred to interact with banks via the Internet because of the logic and predictability of the interactions, and 22% of customers believed they were likely to get the best service for the best price because of the Internet.

The Internet has led to an explosion in the development of activities in the banking sector and the economic development of most nations (Al-Hajri & Tatnall, 2008). Characteristics that have impacted on the rate of e-banking adoption include reputation, protection, social desirability, compatibility, convenience and proficiency (Mastoori, 2009). These factors can be considered as drivers of e-banking adoption by customers. Internet trust and security have also been found to play a serious role in Internet banking adoption, with negative perceptions of these issues creating challenges for customers' e-banking adoption (Xu et al., 2009). Therefore, these characteristics of the Internet can lead to increased efficiency and improved competition of banks to service clients when managed well.

Jordanian banks have reported two main benefits of using the Internet (Al-Sukker, 2005). Firstly, bankers can deliver a great level of information about the bank's services showing full costs via the Internet in a short amount of time. Customers and potential customers can use it to identify deals and then for self-service after they have made a decision about which product is suitable for their needs. Secondly, e-banking allows interaction between the bank's systems and clients, with a high degree of flexibility of communications and interaction. In fact, the Internet is an important element for banks to create relationships and attract non-customers when it has sent voice or e-mail. E-mail is one of the most effective technologies for providing good opportunities for fast business

and very high value for customers. Employees can use e-mail for personalised communication, or to communicate with all customers simultaneously (Al-Sukker, 2005).

Brown (2009) has shown that customer satisfaction with banking services has several dimensions, including support satisfaction for clients, ease of use, security, transaction, payments, information content, customer trust and innovation. Thus, these factors help clients to make positive decisions towards adopting online services with banks over a long period. Moreover, the Internet has removed many barriers of interaction among customers and bankers by eliminating the obstacles created by geography, time, location and creating smooth business (Alyabis, 2000). Banks are able to use the Internet to establish advantages and minimise the issues when they interact with customers.

Indeed, e-banking has presented competitive advantages via cost reduction, positive word-of-mouth communication, better satisfaction, trust and customer loyalty. Evans and Sawyer (2009) identified that the Internet has given banks the ability to communicate with customers in a personalised way without the need for face-to-face interaction, saving communication costs with generation of revenues when communications occur through e-mails and live chats (Ahmed et al., 2009). In reality, it has led to an increase in service efficiency of banks, with lower costs of operations towards customers and avoiding losing customers who probably would have switched to another bank (Mastoori, 2009; Xu et al., 2009; Ahmed et al., 2009). The Internet has offered wonderful potential for expanding the marketplace, creating new clients, reducing costs and improving profit margins for banks (Alyabis, 2000). E-banking can improve banking management for most processes of relationships with customers and it provides opportunities to expand a bank's marketplace compared to other banks (Xu et al., 2009).

3.3. Diffusion of Innovations

There have been a number of factors that the literature has identified as affecting an individual's adoption of a technology. Rogers (2003) identified five perceived attributes of innovation: relative advantage; compatibility; complexity; trialability; and observability. Each of these perceived attributes plays a role in an individual's choice to adopt, or not adopt, a product/service. Customers' relative advantage of using e-banking is that they can interact with the service anytime from anywhere. The Internet has been used by banks to offer services to a wide range of customers over a broad geographic area (Akel & Phillips, 2001). For example, e-banking can provide services with a high degree of convenience, speed, low price and high value for customers, and it does not rely on the opening hours of banks or the location of customers (Mastoori, 2009; Ahmed et al., 2009). E-banking is highly compatible with the existing arrangements of most customers; it can be used with a customer's own ICT equipment and their current bank accounts. Complexity has the potential to be an issue as it is determined by the system(s) used by the bank and a customer's proficiency with the Internet. Trialability of e-banking could be conducted through the use of in-branch kiosks. This would allow a customer to observe e-banking and ask any questions that they have about using the service, thus reducing the complexity of adoption. In a previous study by Sathye (1999) on the adoption of e-banking in Australia during the late 1990s, the major inhibiting factors of customer adoption of e-banking were identified as the lack of awareness of e-banking and security concerns. The low awareness was attributed to customers' being unable to observe other users interacting with e-banking systems. In Australia, the nature of engagement with e-banking has changed since Sathye's (1999) research was published. Evans and Sawyer (2009) noted this increase in adoption in their more recent studies.

The diffusion of a product/service does not occur immediately. There is a normal frequency of adoption for products and services, which Rogers (2003) refers to as the "adopter categorization on the basis of innovativeness" (p. 281). During this normal adoption process, the product/service is adopted initially by the innovators in a society. Following this, the early adopters adopt, and then the early majority. Adopting later in the process are the late majority and the laggards of an adoption. When considering the introduction of e-banking in a country, this adoption process is important to consider.

Diffusion of an innovation in a developing country is impacted by four areas: the regulatory environment; infrastructure; policies; and culture (Raven et al., 2007). Each of these areas need to be taken into consideration for technology transfer to occur and for the country to 'leapfrog' the traditional technology developmental processes. This idea of leapfrogging has also been identified by Davison et al. (2000). The developments that have occurred in these areas for Libya have been discussed in Section 2 of this paper.

4. METHODOLOGY

As this paper focused on Libyans who are in a foreign country (Australia) and use banking systems in both Libya and Australia, it is important to consider the population of this sample. The present population of Libyans who are studying in Australia is 2,601 (753 higher education & ELICOS 1.848) (Australian Education International, 2011). Students are the ideal sample group for this study as typically they intend to return to Libya at the completion of their studies (a requirement of the scholarship on which they are studying) and they would have a bank account in Libya and in Australia.

A stratified sample of eligible participants was taken. This process refers to a technique of sampling in which each possible sample has the same probability of being selected from population with the population of the study known. The sample was chosen from the Libyan community (students) who live in different cities in Australia. A cover letter in Arabic (Official Language of Libya) was sent explaining the importance of the study and requesting a response from the respondent. Although this sample is not normal of the typical Libyan population, previous studies in other countries have shown that professionals are more likely to engage in online activities (Ahmed et al., 2009; Donner & Tellez, 2008; Jalal-Karim & Hamdan, 2010). These participants were also chosen by the Government to come to Australia and study advanced degrees (typically masters degrees and above) as they are opinion leaders in Libya and on their return they would have greater influence over the country's population.

This paper presents the results from the questions asked to participants about the technologies that they used when they were in Libya before coming to Australia to further their education and the technologies that they currently use while they are in Australia. Questions were asked about their interactions with their bank in both Libya and Australia. Participants were asked to state whether the particular technology was available at their bank and, if it was, whether they used or did not use the technology. Participants were asked if they used the traditional method of going to a teller to complete their transactions and then were asked about a number of technologies. The technologies that were focused on were: Automatic Teller Machines (ATMs); telephone banking; Internet banking; and mobile banking. Descriptive analysis of the data was conducted using SPSS 18 and there were 141 responses that were suitable for analysis from the 384 surveys sent (approximately 36.7% valid response rate).

5. RESULTS

The following section of the paper presents the results from the study. Initially the descriptive

statistics of the participant demographics are presented. This is followed by an analysis of the responses to technology use and banking technology use by participants in both Libya and Australia.

The descriptive analysis of data is important to understand the sample of participants and how this relates to the overall population.

From the frequency distribution of the respondents (Table 1) it can be seen that there was a total of 141 respondents. 74% of the respondents were male and 26% of respondents were female. Although this does not reflect the Libyan population (CIA World Factbook, 2012) the figures may reflect the population that is being educated in Australia. In terms of age, 1.4% of the respondents were 24 years or less. The age group analysis shows that the majority of the respondents (52.8%) were in the age range of 25-34 years, and 37.7% were in the 35-44 years range. Only 5.6% of the respondents exceed 45 years. In Libya, 62.7% of the population are 15-64 years old, and the median age of a Libyan is 24.5 years (CIA World Factbook, 2012) so the sample is slightly above the national average. However, the sample age range reflects those people most likely to engage in e-banking and m-banking on their return to Libya. With respect to the level of education, respondents were primarily people with high education. In 2003, Libya had a 'school life expectancy' of 17 years of education (CIA World Factbook, 2012). Although, this sample size is above the national average, as stated above studies in other countries have shown that professionals are more likely to engage in online activities (Ahmed et al., 2009; Donner & Tellez, 2008; Jalal-Karim & Hamdan, 2010).

Table 2 shows a comparison of the use of technologies by participants in both Libya and Australia. The results indicate that there is greater use of most technologies when participants were in Australia. All participants stated that they used the Internet while in Australia. The only exception to higher technology usage in Australia was the traditional telephone, with a large number of participants stating that they did not use that technology in Australia. The Computer and Internet usage differs greatly from the national average of Libya, where only 14% of the population currently using the Internet (The World Bank, 2012). This may be a reflection of the sample population; the fact that the participants are in Australia furthering their education indicates that this is not a normal cross-section of the overall Libyan population. This sample population that uses the Internet in both Libya and Australia have a greater chance for adopting e-banking as they are already using the complex technology and have observed its benefits. This is in alignment with some of Rogers (2003) perceived attributes of innovation.

Table 3 shows the results of the usage of banking technologies in both Libya and Australia by participants. There is increased usage of technology-enabled banking services while participants are in Australia compared with how they conducted their banking in Libya. This identifies areas that Libyan banks should focus their attention on when reviewing the technologies that

Table 1. Demographics for participants

Measure	Item	Frequency	Percentage %
Gender	Male	104	73.8
	Female	37	26.2
	Total	**141**	**100**
Age	18 – 24	2	1.4
	25 – 34	74	52.5
	35 – 44	53	37.6
	45 – 54	8	5.7
	Total	**137**	**97.2**
	Missing	*4*	*2.8*
Education Level	High school	3	2.1
	High diploma	34	24.1
	Undergraduate	46	32.6
	Postgraduate	53	37.6
	Total	**136**	**96.5**
	Missing	*5*	*3.5*

Table 2. ICT device use in Libya and Australia

	Telephone		Mobile Phone		Computer		Internet	
	Libya	**Australia**	**Libya**	**Australia**	**Libya**	**Australia**	**Libya**	**Australia**
Not Available	32	26	13	0	14	0	14	0
Don't Use	16	34	8	5	11	2	5	0
Use	89	55	119	133	113	136	119	139
Total	**137**	**115**	**140**	**138**	**138**	**138**	**138**	**139**
Missing	*4*	*26*	*1*	*3*	*3*	*3*	*3*	*2*

Table 3. Banking technologies used in Libya and Australia

	At a Teller		ATM		Phone Banking		Internet Banking		Mobile Banking	
	Libya	**Australia**	**Libya**	**Australia**	**Libya**	**Australia**	**Libya**	**Australia**	**Libya**	**Australia**
Not Available	28	11	78	0	79	3	93	2	82	6
Don't Use	4	36	37	4	42	76	35	14	37	75
Use	106	75	19	136	12	48	6	118	13	46
Total	**138**	**122**	**134**	**140**	**133**	**127**	**134**	**134**	**132**	**127**
Missing	*3*	*19*	*7*	1	*8*	*14*	*7*	*7*	*9*	*14*

they are implementing; previous research (Twati, 2008) focused only on the low level of ICT adoption in Libya. These results are of interest as they show that a technology that is taken for granted in Australia, such as the ATM, is not available to a large majority of Libyans when they bank in Libya. The results also show that traditional face-to-face interactions with a bank teller (used by 106 participants in Libya compared with 75 participants in Australia) are used less by Libyans when other technology-enabled services are available.

Table 4 shows how customers have changed their use of the five different means of conducting banking. A review of the relevant survey responses identified that, for surveys where data was missing, the participant either did not use that banking service or perceived that the banking service was not available to them. Therefore, 'Missing' responses are recorded as 'Don't' in Table 4. The Don't:Don't row indicates the participants who did not use the service when they were in Libya or when they were in Australia. The Don't:Do row shows participants who did not use the service in Libya but have adopted the service in Australia. The Do:Don't row indicates the participants who used the service while they were in Libya but do not use it in Australia. The Do:Do row indicates the participants that use the service both in Libya and Australia. From Table 4, an increase in the adoption of SSTs while the participants were in Australia can be seen. To analyse whether these results showed any significant changes in participant use of SSTs between Libya and Australia, a McNemar Chi-squared test was conducted.

Table 5 shows the results of the McNemar Chi-squared tests conducted on the data from Table 4. The tests all show significant changes in participant use of the services. For the 'at the teller' service (a traditional face-to-face service), a significant decrease in the use of this service was shown by the result. This could be due to a number of factors, from language issues (English is not the participants' native language) to geographic boundaries. For the SSTs (ATM, phone

Table 4. Banking changes between Libya and Australia

	At a teller	ATM	Phone Banking	Internet Banking	Mobile Banking
Don't:Don't	31	4	85	21	88
Don't:Do	4	118	44	114	40
Do:Don't	35	1	8	2	7
Do:Do	71	18	4	4	6

Table 5. McNemar Chi-squared test on banking changes

	Chi-Squared	df	P
At the teller	23.077	1	0.000*
ATM	113.076	1	0.000*
Phone Banking	23.558	1	0.000*
Internet Banking	106.216	1	0.000*
Mobile Banking	21.787	1	0.000*

* statistically significant as P<0.05

banking, Internet banking and mobile banking), the significant difference occurred in the direction of increased adoption of the services. The increased level of adoption could be attributed to the increased availability of the banking SSTs to the participants, an increased level of general Internet access (as all the participants were in Australia under Student Visas, it would be expected by their educational institutions that they could use this technology), and/or that it was easier for participants to interact with SSTs compared to 'at the teller' due to language and geographic issues. Future research through participant interviews would inform an increased understanding of the reasons for these changes in service usage between the developed and developing country.

6. DISCUSSION AND CONCLUSION

As shown in the section above, ICT provides the potential for Libyan banks to attract new customers and create positive relationships through utilization of technology-enabled services, as these services are used by Libyans when they are in other countries. This issue has previously been highlighted in the literature, where technology-enabled services were used to offer customers an enhanced range of services at very low cost, resulting in banks having the potential to provide advantages to their customers (Cracknell, 2004). However, the low level of ICT infrastructure in developing countries like Libya is a barrier to develop these technology-enabled services and to allow customers to adopt them. One specific significant challenge is the lack of uniform e-payment systems; credit cards are not common in Libya because of ICT infrastructure limitations, trust and security issues. As a result, many customers have not been able to fully profit from technologies and banks cannot develop better relationships with their customers (Twati, 2008; Thao & Swierczek, 2008).

This study's findings have important implications for Libyan banks' use of ICT applications. They can be used to support Libyan banking staff to better understand the key ICT applications and channels on which they must focus in order to improve customer satisfaction and their services. Effective ICT has become an absolute necessity to engage with customers. It can also improve banks' efficiency, usefulness, flexibility, cost saving, competitive advantage, data collection and management, and service quality of interactions with customers. ICT has changed banks' business processes and method of operation internationally. These changes must be understood and responded to by Libyan banks if they are to compete in the rapidly progressing international financial sector.

The results from this paper present preliminary findings into the technology usage of Libyans before they left Libya (i.e. a developing country) to further their studies compared to during their studies in Australia (i.e. a developed country). The data from this paper can contribute new knowledge to fill the gap in literature addressing technology adoption while a person is in a foreign county for an extended period of time. Further research is needed to understand this relationship between what a person does when living in a developing nation compared to how they interact when they are in a developed nation for an extended period of time, as well as their expectations upon returning to the developing nation.

Additional challenges faced by Libya, as a developing country, include: the level of customers' experience with ICT which impacts on m-banking uptake and the need for provision of support services during the introduction of new banking channels (Khatri & Kurnia, 2011); the management of perceptions about the acceptability of new banking channels; the implementation of the technologies and related systems within banks to support the implementation of SSTs for customers; and the development of awareness and knowledge about how to derive maximum benefits from new banking channels. Each of these challenges presents areas requiring further research.

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Chapter 40
Leveraging Technology Options for Financial Inclusion in India

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ABSTRACT

Financial services have a ubiquitous need however the urban rich have easy and universal access with wider options, compared to the low-income group who are forced to accept informal, expensive and riskier means to fulfill their financial needs. The demand and supply of financial services for the poor is imbalanced, with supply being acutely constrained by lack of viability and sustainability of current business models. Technology and IT has a pivotal role in making financial inclusion a viable reality. Technology, including information technology can enable lowering costs by increasing automation, enhancing efficiency, enabling scaling up through uniformity, consistency and security. Multiple technology choices are available to financial service providers but few have been proven yet. This paper examines technology options at the front end and back-end in detail with a critique of alternatives available for financial inclusion in Indian context.

INTRODUCTION

Access to financial services (in the form of savings, credit, insurance, remittance or welfare payments) is a fundamental tool for managing a family's well being and productive capacity, to smooth expenditure when inflows are erratic, to build surplus when the demand for expenditures is heavy (school fees, marriages, buying farm equipment) or to protect against emergencies. However only one-quarter of financial households have any form of savings with formal banking institutions (Adams, et al., 2008). The following Figure 1 depicts how finances help a person at every stage of his life. It not only improves person's social, educational and financial status, also provides capacity to manage shocks and vulnerabilities at any point of time in life (Singha & Gayithri, 2012; Borghoff, 2011; Ravi, et. al., 2011; Zhang, 2011). According to the World Bank (2009), getting financial services to

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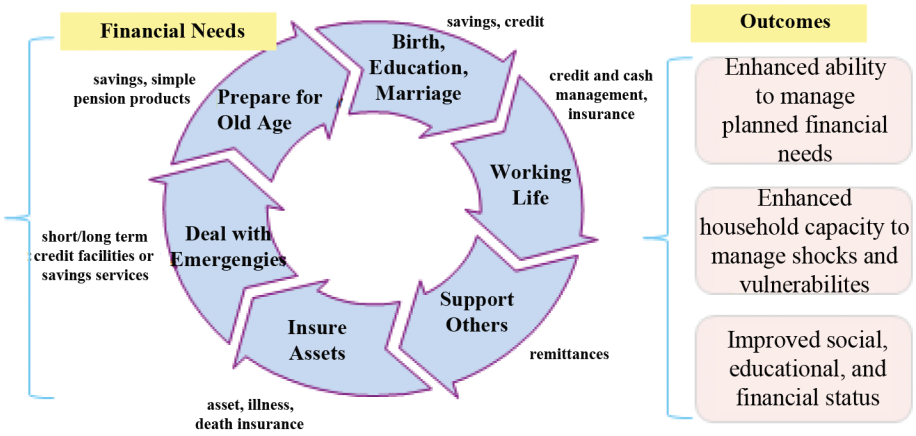
Figure 1. Financial needs (Microsave)

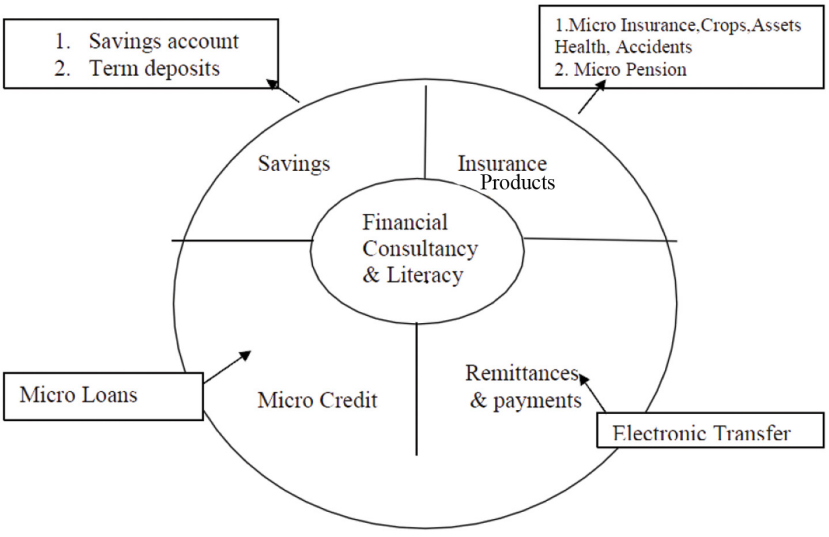


rural people is the biggest challenge in the quest for broad –based financial inclusion.

According to the "Transact" the national forum for financial inclusion "Financial Inclusion is a state in which all people have access to appropriate, desired financial products and services in order to manage their money effectively." It is achieved by financial literacy and financial capability on the part of the consumer and financial access on the part of product, services and active suppliers." The following Figure 2 depicts the Components (Savings, Micro credit, Insurance and Remittance) of Financial inclusion.

Several studies have demonstrated that there is considerable demand for financial inclusion by the under-banked and unbanked provided these services address specific consumer needs such as ease and proximity of access, security, low-value high-volume transactions, and financial services that offer value better than existing informal alternatives and integrate into the livelihoods, such as entrapping income during harvesting and enabling

Figure 2. Components of financial inclusion (Karmakar, 2010)



access during festive seasons or emergency needs (World Bank, 2008; Balmer, et al., 2005). They also have a willingness to pay reasonable charges to avail these services (Cheney, 2008). Given the few and expensive alternatives for financial services that poor have, they are willing to pay a price based on perceived value and cost of existing alternatives likes loan sharks, money lenders or informal savings with high risk.

Key influencers of demand and willingness to pay are demographics, literacy levels, social-dynamics, local enablers and inhibitors, availability of informal and alternate channels (together with their cost and convenience), adaptability to change, comfort with technology, and other exogenous and endogenous factors (Affleck & Mellor, 2006).

Out of the 428 million deposit accounts in India only 30% are in rural areas. With a rural population of 741.6 million, the rural penetration of bank is as low as 18%. Even where access to banking is available the transaction cost of savings in India is as high as 10% for the rural people (Group Savings and Loans Associations: Impact Study, 2010).

Banks usually target customers with regular and stable incomes, like salaried employees and well established businesses. This is efficient and profitable as most of these clients conduct high value and less frequent transactions, resulting in lower operating costs (Chakrabarty, 2006). Banks service most customers from branches, while facilitating few transactions outside the branch premises, through ATMs (cash withdrawal and deposit), internet and mobile banking (cheque book request, bill payments, funds transfers, and balance enquiries).Banking is currently costly and labour intensive for all concerned.

Due to high cost of delivery and small average size of the transactions, it is not profitable business for banks to set up shop to cater for the poor people (Chakrabarty, 2006). As a consequence a large segment has remained financially excluded.

But, the situation is gradually changing and increasingly several organisations including Banks, Mobile Network Operators (MNOs), Technology Service Providers, Business Correspondents (BC's) and large agent networks are recognizing that there is considerable potential at the bottom of the pyramid (Wilcox, 2011; 2015). They understand that getting low income segments into the regular financial sector is beneficial both for the people belonging to this segment and the financial institutions.

Widespread penetration of mobile technologies and their integration with banking infrastructure has enabled banking services outreach in a low cost and more efficient manner through mobiles phones (Suoranta & Mattila, 2004). Advances in biometrics and its integration with Point of Transaction (POT) terminals has enabled substitution of bank personnel by technology, supported by less qualified agents and business correspondents, enhancing security and lowering costs (Davis, & Owens, 2009; World Bank, 2008).

The policy environment too has evolved considerably. Using a mix of loose and tight regulations and taking a controlling, direction setting or mentoring approach, it has provided suitable incentives and disincentives to promote financial inclusion. Policy enablers such as extending outreach through third party agents and agent network managers or business correspondents have been promoted by the Reserve Bank of India (RBI, 2009; 2010).

Today a wide range of technologies are available that can address requirements for financial inclusion in parts.

LITERATURE REVIEW

Financial Inclusion has been on the agenda of several institutions around the world. Across the developed countries, access to financial services is largely ubiquitous; there is an abundance of cash

and credit on demand, from multiple channels, and 24 hours a day. But in developing countries the situation is very different; approximately 88 percent population is excluded from access to the formal financial system (Richard, et al, 2009).

A mix of gratuitous and market-led approaches has been tried in various geographies. Migration of poor to urban environment for better and steady wages is quite common in developing countries. This leads to the first and second generation migrants usually remitting money back to their split families.

In Kenya, M-PESA from Safaricom (a leading telecom operator) has leveraged this need to achieve significant take-up using mobile technology. It launched the Sambaza product that allows subscribers to send small amounts of airtime value across the network to others and pay utility bills.

In Brazil, Utility and other payments including welfare payments have been tapped by large banks using branchless banking methods. Initially started and incentivised by the state for social and welfare payouts (Saeed, et. al., 2012), the services gradually scaled and became mainstream financial services.

Philippines is pioneer in enabling financial services through mobile phones. Products like Smart Money and GCASH have enabled large amount of money transfers between urban, rural areas and overseas, leveraging the distribution advantages of Mobile Network Operators (MNOs). Countries like Sudan, Ghana and South Africa have adopted mobile technology for inclusive finance. Latin American countries like Uruguay, Paraguay, Argentina, Venezuela and Colombia started with a huge success. As a result several mobile financial products have emerged for e.g. Tigo cash in Ghana, Pago Movi in Peru, Nipper n Mexico and Oi in Brazil.

Tigo Cash in Ghana is a mobile financial services product that allows people to use mobile phone as a mobile account. It provides an affordable, fast, convenient and safe way to send and receive money, buy airtime credit, pay for goods and services using a mobile phone anywhere in Ghana (Okyere, Gloria, & Kwamena, 2011). Customers can deposit and withdraw money from their mobile phone with any one of authorized Tigo Cash Agents. They are not required to hold a bank account to use the service. There are a few easy steps to begin sending money with Tigo Cash:

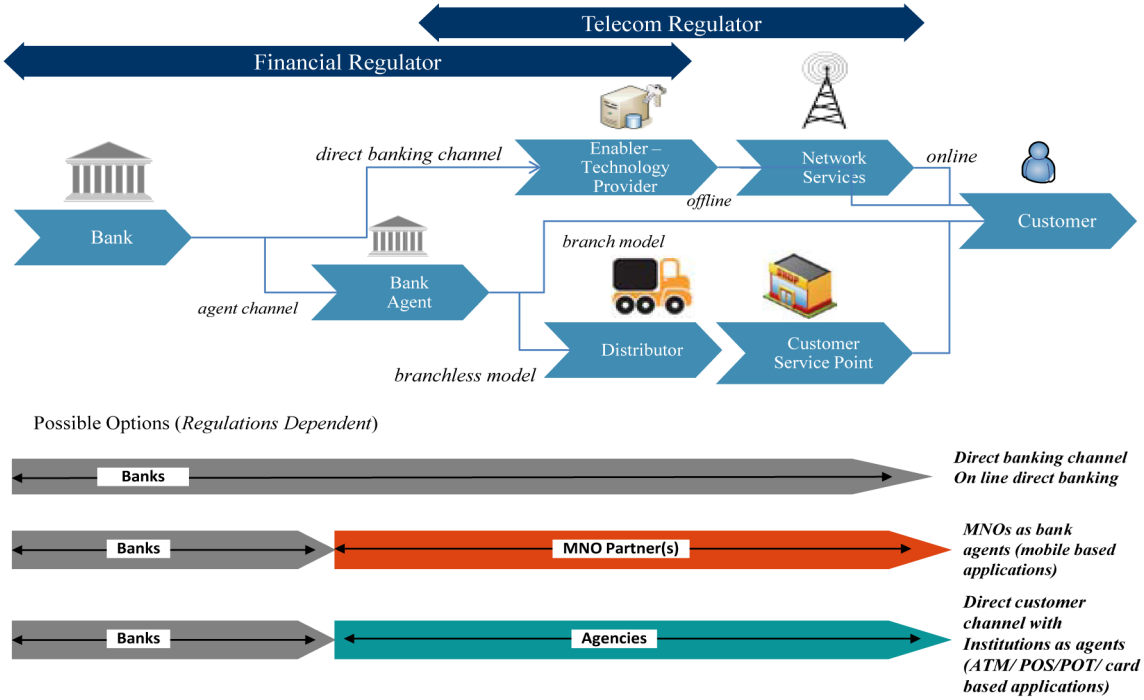
- Customers have to first sign up for the service at a Tigo Cash Agent or a Tigo Service Center by providing their picture ID for proof.
- After the account is activated, customers can deposit cash into the account – for free!
- With money in their account, the customer can use their Tigo mobile phone to send money, buy airtime credit or pay bills at anytime, from anywhere and to anyone in Ghana.
- To withdraw money from their account, the customer can visit a Tigo Cash Agent or a Tigo Service Center.
- Transaction cost involved in mobile banking is very low as compared to traditional banking. (It is US $ 0.50 as compared to US$ 2.5).

TECHNOLOGY OPTIONS AT THE FRONT END

People can access financial services either through a brick and mortar model (which is branch based) or through an ICT model (which is branchless). Figure 3 depicts the technology options for the branchless model. There are three possible ways of doing this:

1. Online Direct Banking (PC/Internet Banking)
2. ATM/Mobile ATM/Point of Terminal (POS/POT) and Smart Card Based
3. Mobile Banking (USSD, SMS, STK, IVR Technology based Financial Services)

Figure 3. Branchless banking model (Microsave)



Anybody (urban/rural) can access financial services using online Direct Banking provided the person has Personal Computer and Internet facility. This is very popular among urbanized.

ATM/Mobile ATM/Point of Terminal (POS/POT) and Card Based technology revolutionized banking sector around 30 years ago. Initially, ATMs were bulky, expensive and difficult to maintain and replenish. Their deployment was delayed for over 20 years in many countries like Africa, India due to the cost, inadequate telecommunications and electricity supply. Now the scenario has changed due to improvement in technology, Financial institutions have started deploying POS/POT devices, Mobile ATMs in rural locations that often provide the same functionality as ATM at a fraction of the cost (Ketley, 2009). Banks have also started interoperability (using Bank A's card on Bank B's ATM) and this has reduced the operational cost dramatically. In some countries commercial banks have migrated all of their customers to electronic channels, using debit cards at ATM and POS devices. The cost of implementing plastic cards has reduced dramatically in recent times so this seems to be much cheaper option, but processing takes little bit more time as daily transaction has to be uploaded offline at the banking server site (Davis & Owens, 2009).

Mobile Technology based Financial Services can also be accessed using mobile phones with STK (SIM Tool Kit), SMS (Short Message Service), USSD (Unstructured Supplemental Service Data), Mobile App and through IVR (Interactive Voice Response) mechanism.

Mobile Phones with SIM Tool Kit (STK) is a very popular option being used in developing countries (Kumar & Mino, 2011). Mobile Phones with USSD (Unstructured Supplementary Service Data) are based on communication technology that is used to send text between a mobile phone and an application program in the network. It is very much similar to Short Messaging Service (SMS). Each type requires customers to remember codes to initiate transactions e.g. USSD requires

the format typically in a set of * numbers and a # (like * 140* 12345678#) to initiate a query. USSD transactions are session based as compared to SMS and because of this property it is very popular in banking applications as the customer can immediately see his/her transaction happening (Soni, 2010).

For Mobile Banking user should be fairly literate and techno savvy so in order to provide appropriate training mobile financial service providers are developing simple step by step guide with mobile screen shots to ensure that the customer and agents can easily process transactions.

Voice IVR is at a very trial stage. Using this technology there is no need to remember PIN or hold smart cards. Authentication is based on user's voice.

Table 1 shows the various technology options available today in Indian context and their comparison (in terms of ubiquity, complexity, security/trust, cost, scalability) in enabling financial inclusion at scale.

Mobile USSD and SMS based applications are most ubiquitous as most of the mobile handsets (low end to high end) support this. But they are not easy to use as the customer has to remember the specific codes for each and every transaction. But, now a days to deal with m-banking, m-commerce providers are providing users with quick reference guides to assist them in remembering the codes for various transactions. Security/ reliability in USSD applications is quiet high as MNOs offer most reliable communication format whereas Voice (IVR) and SMS are at second and third level. Mobile STK is very user friendly

Table 1. Comparison of mobile technology options and their potential in enabling financial inclusion at scale

Technology / Features	Mobile (USSD)	Mobile (SMS)	Mobile Apps	Mobile (STK)	POS (Card)	Mobile ATM	Voice IVR
Ubiquity	● Suggested by mean basic to smart phones	● Suggested by mean basic to smart phones	◔ Needs data capabilities and high memory on phone	◑ Contained by SIM card memory and distribution	◔ Low for banking usage	○ Very low penetration	○ At trial stage
Complexity/ Usability	◔◑ High volume transactions are of few types only. Needs ability to read/write numeral and characters	◕ Needs ability to read/write numerals, words, and characters.	◔ Users should be fairly literate and technology savvy	◑ Some degree of literacy required. At times suggested by school going children	◕● Complexity is usually around biometric recognition	◑ Users literacy required	◕ No need to remember PINs or hold smart cards
Security and Trust	◑ More prone to human error	◔ More prone to human error	◕ Security can be embedded	◕ Security can be embedded	● Biometric authentication	● Can print receipts.	◔ Voice authentication not yet proven
Cost	● $20 onwards	●	◑	◕	◔ $400+ (device)	○	○
Ability to Scale	● Alone high priority format	◕	◔	◑	◔	○	○
Overall	●	◕	◔	◑	◔	○	○

●◑○High, Medium, Low scores

option for customers but uploading STK menu becomes sometimes unreliable (especially on low end phones). POS based mobile machines and Mobile ATMs are less complex from usage point of view as an agent can be deployed at the village centre/Kiosk which can help novice users to perform transactions.

Voice IVR is comparatively easy to use but their cost is high as compared to mobile USSD and Mobile SMS based applications and security, ability to scale is also major concern as it is at a very trial stage. Overall, Mobile SMS and USSD based applications take high score.

Many other innovations are in early stages and few of them might evolve and achieve scale to benefit the cause of financial inclusion. UIDAI's *Aadhar* project (Aadhar, UIDAI) is using fingerprint and iris recognition technologies to rollout unique identification for 700 million people in India. This has the potential of addressing the severe challenges associated with identification of individuals for financial services. Interbank mobile payment system (IMPS), a service developed by NPCI offers instant interbank electronic fund transfer through mobile on 24x7 basis. Mobile ATMs are being adopted by several institutions and undergoing constant innovation. RFID and NFC based technologies integrated with mobile technologies are evolving.

TECHNOLOGY OPTIONS AT THE BACK END

As law mandates, any transaction on an account involving cash has to be made within the physical premises of the bank. The Reserve Bank of India has permitted the appointment of Business correspondents to accept deposits or make cash payments on behalf of banks provided it is updated at the banking site within 24 hours time frame. So with the help of modern information technology and managerial capabilities of business correspondents, banking functionalities can be easily extended to remote regions and transaction data can be uploaded at the banking site either online or offline.

In case of online BC's system is directly connected to the Banking site and in case of offline the data is stored temporarily at the BC's Back-end Server and later on (may be at the end of the day) it is transported to the Core Banking System (CBS). Based on these it can be Tier 2 (Figure 4) (when no storage server is needed, financial data directly being transferred to CBS) or Tier 3 (Figure 5) Architecture (in case of offline, when storage server is needed to store transactions temporarily).

No-one technology has emerged that can be best suited for the purpose. Few technology options at the front end and back end hold the promise of

Figure 4. Tier 2 architecture for back-end processing (on-line with direct integration through service providers)

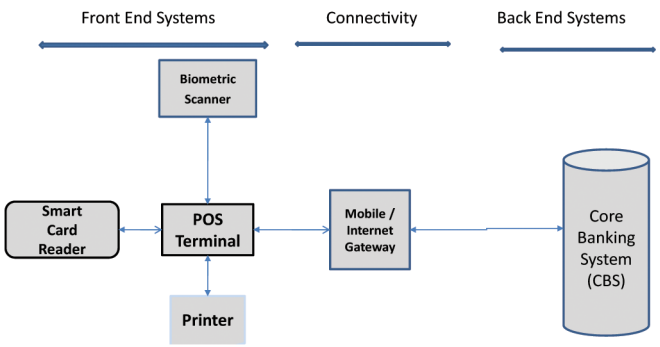
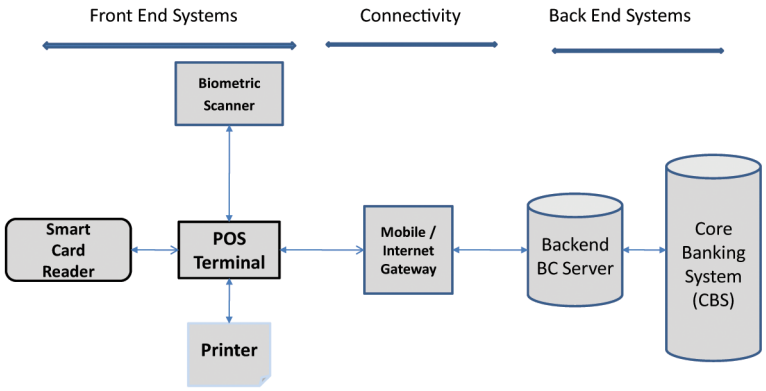


Figure 5. Tier 3 architecture for back-end processing (off-line with indirect integration though service providers)



enabling. Technologies will also need continuous improvement and innovation to meet the demand of more complex products and to keep pace with growing business.

CASE STUDY

As a result of strong will of Government and after realizing the great potential of mobile technology to provide efficient low cost services at the bottom of pyramid, several public sector banks like State Bank of India, Union Bank of India, Axis Bank, Andhra Bank, Punjab National Bank (list is too long..) have set up or are in the process of setting up mobile phone based micro banks. Even telecom providers such as Bharti, Airtel, Vodafone and reliance Communications have tied up with banks to extend their mobile remittance services to rural areas (Davis & Owens, 2009). Several technology firms such as Ekgaon Technologies and Spanco systems have also stepped up to offer mobile banking tools.

Eko India Financial Services Pvt. Ltd. is another business correspondent (BC) financial service, for State Bank of India (SBI) and ICICI Bank, India's top two largest banks, and provides no-frills bank accounts and deposit, withdrawal and remittance services to customers (nearly 80% of whom are migrants or the unbanked section of the population) through mobile banking. They have seen a rapid growth in mobile transaction volumes in select corridors (New Delhi – Bihar) after launching domestic remittance product "Tatkal" from SBI. Eko enables customers to conduct financial transaction at a neighbourhood retailer by leveraging USSD technology while providing the security of a commercial bank

Technology companies FINO and A Little World (ALW) are also using the Business Correspondent (BC) model to deliver NREGA wages and pensions in several districts of Andhra Pradesh. Before processing payments, FINO/ALW collect fingerprint and other KYC data from each beneficiary. Payments are delivered on behalf of banks by local agents using a biometric enabled transaction processing (POS) device. FINO/ALW provide smartcards to each beneficiary. They have witnessed huge volumes of pro-active client enrolments and EBT transaction by rural beneficiaries receiving social payments - employment wages (NREGA) or old age pension funds.

FINO uses Tatkaal smart-card based product for remittance purposes. They provide end to end technology solutions like flexible saving schemes, loans, insurance, remittances using Biometric identification enabled hand held devices and mobile handsets, facilitating transactions at the

customers' doorstep through agents.They have also enabled cashless and paperless insurance processing to effectively reach at the bottom of pyramid customers.

ALW is India's first domestic payment system with specific focus on reaching out to masses with lowest available communication infrastructure. The main technology focus of ALW is on biometrics based ID, RFID smart cards, and NFC (Near Field Communication) mobile phones.

MAJOR LEARNINGS

Today a wide range of technologies are available that can address requirements for financial inclusion in parts. But no –one technology has emerged that can be best suited for the purpose. These options co-exist in various forms with limited standardization, challenges in terms of achieving interoperability, critical mass and higher costs. Recognising client needs, their context, drivers and influencer's and building financial services strategy on these is critical for succeeding in the long run. Technology can be a major enabler or handicap. The major attributes that an appropriate technology needs to have are (Hoffmann, 2006):

- **Suitable:** A key driver for choice of technology is suitability to the business model – clients, agents, products offered, policy compliance. No one size fits all and a technology working well in one context or environment might be a misfit for a similar purpose in another environment. Philippines's GCASH and SMART find menu driven formats to have proven very user friendly, whereas due to illiteracy reasons, but these had limited uptake in India. Eko (Bharathan & Bhargava, 2010) has instead found USSD to be more promising. A combination of mobile and POS/ card based with bio-metric authentication solutions might work better in fulfilling the unique needs for certain demographics.
- **Cost Effective:** Technology constitutes a large component of cost of delivery of financial services and hence extremely important to be managed well. USSD & SMS formats exhibit the promise of being more cost-effective, provided other considerations like usability, security, reliability are met. MNOs prefer SIM based solutions, which apart from being more cost-effective; allow market differentiation and client "stickiness/retention" also through walled-garden approach (Mobee Bank, 2008).
- **Secure:** Security needs to be viewed from two perspectives (a) technology security and (b) human ignorance or negligence. Technology has evolved considerably and offers reasonable secure and idiot-proof solutions, provided the right processes in place. POS with biometrics has worked out better where authentication becomes vital, as with government payments. In South Africa a bank using USSD2 has not faced a single case of fraud vis-à-vis ATM and POT which can be hacked more easily (Stone & Grossman, 2009). Economies with lower literacy levels face the challenge of client ignorance or negligence. Needing assistance to fulfill financial transactions they end up disclosing PINs and passwords.
- **Proven and Scalable:** Scalability is a key consideration as market demands can be unpredictable and institutions struggle to respond (GSM Association, 2010). Technology and processes often limit the much-needed and rapid scale-up or down. Telenor witnessed a demand of 2.0 million clients within weeks of launch of service. Adopting proven technologies can mitigate these risks with the added advantage of lower costs driven by the benefits of volumes and scale. Several institutions and technol-

ogy providers are experimenting with completely new technologies which are nascent and yet to be proven at any scale.

- **Longevity:** Every technology has a shelf-life and eventually becomes obsolescent or is succeeded by the next generation. With 3G and 4G networks growing rapidly and a strong emphasis on http with Java and Android handsets, there is a great scope for USSD, SMS and STK based applications. MNOs have greater flexibility and deeper pockets to drive the technology decisions.

Investing in skill and capacity building to enable financial and technology illiteracy, overcoming language barriers, developing selling and servicing skills, managing risks, establishing controls and ensuring compliance are the other major challenges.

CONCLUSION

Technology has a major role to play in not only financial inclusion but inclusive growth of the excluded. Over the years technology evolution has enabled overcoming several handicaps and challenges which previously prevented financial services to be extended far and wide. Enabling low-value high-volume transactions to be made possible, lowering capital expenditure and operating costs, automation of processes, enhancing security and reliability, safeguarding consumers and enhancing trust, enhancing service levels are some of the factors that technology interventions have helped improve. However there is no technology silver bullet that can be a panacea for all challenges. Front and back-end technologies have provided solutions to many issues nevertheless these have been island solutions addressing issues in silos but not comprehensively. Innovations around a more comprehensive framework are still underway and might lead to a more holistic solution in times to come.

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Chapter 41
Investment Attractiveness of Visegrad Group Countries: Comparative Analysis

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ABSTRACT

The aims of this chapter are to evaluate the main determinants of the inflow of FDI into selected countries of CEE and to examine the volume, dynamics, and structure of FDI inflow into these countries. Due to certain similarities, the authors focus the analysis on four countries: Poland, the Czech Republic, Hungary, and Slovakia. The reasons are geographic proximity, political, economic, and cultural similarities, as well as shared experiences of economic transformation. This chapter focuses on matters pertaining to foreign direct investment, mostly on the reasons motivating FDI inflow in light of selected studies and theories. The authors also provide characteristics of the dynamics and structure of FDI inflow into the V4 countries. The final part of the chapter compares investment attractiveness, the system of incentives, and identifies barriers facing investors in the analyzed countries.

INTRODUCTION

One of the main features of the modern economy is the internationalization of economic operations, which is connected with globalization and regionalization, This consists mainly of establishing and developing transnational links among companies. These links may take various forms, starting from simple ones (e.g. exports) up to the much more advanced channels of international capital flows. One of the ways to expand into a foreign market is foreign direct investment (Stawicka, 2007, p. 7).

As mentioned, foreign direct investment (FDI) is linked to regionalization and globalization, particularly when it comes to the selection of investment localization. Regionalization may be considered at two levels. Firstly, there is international economic integration, i.e. the establishing of regional integration groupings (regionalization of the world economy). Secondly, there is also

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the currently observed phenomenon of increased importance of regions and their emergence as separate structures (regionalization of national economies). Globalization, in the context of economic development, may lead, on the one hand, to differentiated effects and marginalization of some areas and, on the other hand, to the increased importance of a territory and location as a source of competitive advantage. Thus, we are dealing with two apparently contradictory phenomena, whereby globalization increases the importance of a territory at the regional and local level. In the literature this is referred to as *glocalization* (Robertson, 1994; Svensson, 2001; Swyngedouw, 2004; Pietrzyk, 2004).

International capital flows, also in the form of FDI, are among the main factors conducive to globalization. At the same time, investors are seeking locations that would meet their specific expectations and boost business development. The countries of Central and Eastern Europe (CEE), when implementing systemic transformation at the beginning of the 1990s and opening up their markets for foreign investors, also had to face these new trends in the global economy. Since 1991 these countries are also members of the Visegrad Group (V4), established with the initial objective to support the aspirations of Poland, Czechoslovakia (later the Czech Republic and Slovakia) and Hungary on their path to EU accession. After 2004, in accordance with its Declaration, the V4 has aimed at optimum cooperation with all countries, in particular with its neighbouring countries, and its ultimate goal is the development of democracy in all parts of Europe. Moreover, its members support the building of European security based on cooperation and coordination within existing European and Transatlantic institutions and structures. These countries are also connected by their cooperation within the structures of the European Union (EU), NATO, OECD, and WTO.

The countries of Central and Eastern Europe by offering relatively good location and human resources at relatively low operational cost, and by investing in infrastructure, they became attractive investment locations. For over 20 years Central and Eastern Europe in particular the Visegrad Group countries, has become an ever more attractive destination for long-term capital investment. According to the assessment of Ernst & Young, Central and Eastern Europe is the third the most interesting investment region globally (Ernst & Young's, 2012). The reasons behind this are not only systemic transformation and the opening up of their economies to foreign investors, but also general security, related to membership in international organizations and being a part of the European single market. The countries' EU accession in 2004 particularly boosted investors' interest in the region, providing the guarantee of stability and relatively high economic and legal predictability.

As a corollary of the V4 countries' EU membership, entrepreneurs achieved access to numerous State aid programs. They may expect better economic operational conditions with the support of the EU structural funds, the Cohesion Fund, as well as other external sources of funding, such as, e.g. the Norwegian Financial Mechanism, EEA Financial Mechanism, and bilateral cooperation programs with Switzerland. Thus, the Visegrad Group countries offer investors benefits connected with economic and political security and the access to a large and affluent market at relatively low business operational costs, plus all sorts of allowances and preferences (Ministry of Economy, 2012).

Contrary to common opinion, however, the assessment of FDI inflow to countries and regions is not without ambiguity. For this reason, in this Chapter we try to illustrate the overall effect of FDI inflow to the countries of Central and Eastern Europe, using the example of Visegrad Group members, i.e. Poland, the Czech Republic, Hungary, and Slovakia. Besides the overview of selected theoretical aspects and empirical studies, the Chapter focuses on the dynamics and structure of FDI inflow to a region and on the assessment of the investment attractiveness of the analyzed area.

BACKGROUND: FDI IN THEORY AND EMPIRICAL STUDIES

Definition and Types of FDI

Capital migration in the form of FDI is one of the most important consequences of globalization and, at the same time, it is a catalyst for the internationalization of manufacturing, services, and trade, and a leading source of technology and know-how. Besides, among the various sources of foreign capital, FDI is regarded as the most beneficial and the safest type of international capital flows and a way of financing restructuring and development in the host countries. FDI inflow results not only in the transfer of financial resources but it also brings concrete investment goods. Under a favourable combination of systemic and structural factors, it is the most efficient way of receiving foreign capital and a vital factor for accelerating growth. Its role is most clearly visible in those countries which underwent systemic transformations, including the countries of Central and Eastern Europe, which for over two decades have been trying to generate a good business climate for foreign investors. Thus, investors may help a country (region) improve its image in international business circles, which, in turn, impacts its ability to compete for more investors and to generate growth. This is why FDI is so valuable for areas competing within Regional Trade Agreements (RTAs). So the first question naturally is: What is FDI?

According to the OECD definition, *foreign direct investment* "reflects the objective of establishing a lasting interest by a resident enterprise in one economy (*direct investor*) in an enterprise (*direct investment enterprise*) that is resident in an economy other than that of the direct investor" (OECD, 2008, p. 48). The process may take the form of (Świerkocki, 2004, p. 93):

1. Acquisition of shares giving the right to manage a business,
2. Acquisition of all of the business,
3. Starting a business from scratch, including the purchase of real estate (known as a *greenfield* investment).

When starting a business from scratch a common business entity employed is a *joint venture*. This may involve the establishment of a new company in cooperation with a domestic operator. This solution is beneficial to both sides. The foreign partner profits from the domestic operator's better knowledge of the target market and its institutional and legal environment. The domestic operator, in turn, may count on subsidies and the transfer of knowledge, technology and management methodology from the foreign partner.

Acquisitions include *brownfield* investments. They mostly consist of modernization of existing companies. The changes usually relate to production organization, assortment, machinery, and staff. Moreover, e.g. in Poland, foreign investors may open their branches based on the principle of reciprocity. In such instances, an entrepreneur may pursue economic activity only within the scope specified for its parent company (Official Journal of The Republic of Poland, 2013, art. 85.1-86).

Foreign entrepreneurs may also establish their representations abroad. However, the scope of their activities may cover only advertising and promotion of a foreign business (Official Journal of the Republic of Poland, 2013, art. 93-94).

A transaction in a host country is considered a FDI when it entails investment in a company's equity. FDI also covers subsequent capital flows between a parent company and the direct investment enterprise, such as reinvesting profits, net purchases of shares in the company and/or debt instruments by the direct investor, and internal borrowings from the direct investor. In addition, the involvement of a foreign investor in the domestic company may consist of membership in the Supervisory Board, involvement in management, in-kind transactions between companies, replacement of management staff, making knowledge

and technology available, and granting long-term loans on terms more favourable terms than those offered on the market. The usual threshold that allows a particular investment to be classified as FDI is ownership by the foreign investor of at least 10% of stock or shares of the direct investment enterprise (Kłysik-Uryszek, 2011, pp. 16-17; OECD, 2008).

Hence FDI is a much more complex phenomenon that just capital flow itself. Establishing a multinational business entails, e.g., opening branches abroad, technology transfer, production organization, and ensuring appropriate labour resources, including management staff. FDI should be distinguished from Foreign portfolio investments, which are capital flows that consist of the acquisition of foreign financial instruments, e.g. stock, bonds, deposits by residents of another country etc.

As already indicated, the assessment of the significance of FDI to the global economy has been the subject of many studies and analyses. Their conclusions, depending on internal and external circumstances, are not without ambiguity. There is one point, however, where all the authors agree: FDI plays an important role (positive or negative) in the global economy. The importance of an investment may be measured by the size of flows, i.e. with the value of an investment in subsequent years, and by their overall value, i.e. the sum of amounts cumulated in a specific period (Świerkocki, 2004, p. 93).

Motives and Determinants of FDI Inflow to a Country (Region)

In recent decades, the development of economic activity of multinational companies has prompted a great deal of research concerning the motivation behind the inflow of foreign direct investment. FDI is considered one of the most important stimulants of growth, which also provides support to an economy in times of stagnation. Thus studying foreign investors´ motivations may be especially useful for public administration officials. A rich review of the theory and empirical studies devoted to reasons behind FDI inflow can be found in, e.g., Assuncao, Forte, Teixeira (2011).

Numerous theories of the 1960s sought to explain the determinants of FDI inflow. Some of them were based on microeconomic factors, such as organizational aspects, cost reduction, and economies of scale. Others related to macroeconomics, e.g., availability and allocation of resources, barriers to entry, political stability, market size, etc. (Dunning, Lundan 2008; Faeth, 2009).

The first studies of the premises for FDI, based on models by Heckscher-Ohlin (1933), MacDougall (1960) and Kemp (1964), referred to the benefits from operation on a foreign market resulting from e.g., lower cost of labour and reduced transaction risk. The theory of internalization was initiated by Buckley and Casson, who pointed out that companies decide to invest abroad when transaction costs are higher than the costs of internalization in the host country (Faeth, 2009; Assuncao, Forte, Teixeira, 2011).

However, the most comprehensive approach was proposed by Dunning (eclectic theory/OLI paradigm), who linked internalization with traditional trade theory and classified the benefits attained by companies as a result of the internationalization of economic operations. Undoubtedly, Dunning's main contribution to the theory of economics is the listing of various theories and concepts as well as variables relating to ownership, location and internalization which determine the international activities of companies (Dunning, Lundan, 2008). Factors which belong to the OLI model are most often analyzed as FDI location determinants: infrastructure, human capital, economic stability, and production costs. Also institutional factors are taken into account (corruption, political stability, quality of public institutions, and tax and financial incentives) and factors resulting from the new trade theory (market size, market growth, openness of the economy and factor endowments) (Assuncao, Forte, Teixeira, 2011).

In fact, entrepreneurs, when making decisions on foreign investment, are guided by an array of factors. Obviously, above all, they wish to improve the economic performance of their companies and to strengthen their position on the international market. This means economic factors are the main reasons for FDI. Specific location is selected based mostly on the domestic market potential (possibly including the potential of neighbouring markets or of the market of an integration group as well) and on demand-specific factors. Investors analyze e.g. the size and structure of a particular market, per capita income, consumer preferences, and soft and hard infrastructure. The growth rate of the host economy is also relevant - Mottaleb (2007) and Busse and Hefeker (2007) list it as an important determinant of FDI inflow. Market size is especially important for the so-called *market-seeking* FDI undertaken with a view to gain access to the local market and to circumvent barriers protecting the market.

Not all of FDI, however, is motivated by the wish to enter a particular market. Direct investors also want to find a location which will ensure access to specific resources unavailable in their countries (regions) of origin. These resources may also be cheaper or better in the host country. Here we have in mind mainly raw materials, labour, and production capacity. Often investors want to improve the international competitiveness of their companies, and sales on the domestic market are less of a motivation.

Human resources and social capital, R&D potential, innovation, institutional framework, territorial forms of production organization (clusters), and other intangible assets are also important determinants of FDI inflow. These are typical of better developed areas and may be attractive for more advanced types of economic operations. Some of them may be generated or supported by national, regional and local authorities, which can influence the investment attractiveness of an area in question.

The wish to rationalize costs by consolidating production, benefiting from more favourable regulations (e.g. tax and labour laws) and gaining access to a bigger market of a regional integration group are also among the reasons for a foreign investment in a particular location (Kłysik-Uryszek, 2011, pp. 18-19). Bevan and Estrin (2004) demonstrated that the mere prospect of EU accession of the countries of Central and Eastern Europe was an important determinant of FDI inflow. Similar conclusions were reached by Egger and Pfaffermayr (2002), who showed that the prospects for changes in an integration group, be it in qualitative terms (e.g., intensification of integration) or resulting from the accession of new countries, impacts FDI inflow.

Foreign investors are also motivated by legal and institutional premises, such as (Kłysik-Uryszek, 2011, pp. 20-21):

1. Economic, political and social stability, security, and predictability of legal and administrative regulations;
2. Tax policy, State aid, including investment incentives and allowances;
3. Regulations concerning market entry, operations, and protection of competition;
4. Efficiency of state administration and institutions involved in the business environment (the so-called 'business climate').

Depending on the type of activity pursued, infrastructure in the region may also be a determinant for a location decision. Investors may consider various types of infrastructure: telecommunication, transport, but also social infrastructure including health, education, sports and leisure, or culture. All of these are elements of the overall assessment of the investment climate of a country (region), which serves as the basis for the location decision for an FDI and its future continuation.

The motives most often listed in the literature are confirmed in empirical studies conducted, *inter alia*, in the countries of the Visegrad Group. One

example may be the 2010 direct study of a sample of companies with foreign capital conducted in Poland at the regional level (Dorożyński, Urbaniak, 2011). The sample studied was representative - it included companies of different sizes, with differentiated involvement of foreign capital, types of operations and geographical structure of sales. The results to a large extent confirmed theoretical considerations, but also have a practical dimension as they identify issues to be taken care of by the public administration responsible for the policy vis-à-vis foreign investors.

According to the foreign investors surveyed, the most important motives for FDI location in Poland were connected with the availability of labour with appropriate skills. Other important reasons for FDI location included low costs and wages and the availability of the required qualifications. Favourable geographical location also strongly motivated investors, who expected income from sales on the internal market, interpreted here as also encompassing the EU market. The most discouraging factors were poor transport and social infrastructure and red tape, i.e. the protracted administrative procedures and incompetence of administration officials. However, the problems were not so big as to cause foreign investors to resign from their location decisions.

A review of the literature on the motives for FDI location shows it depends on many factors connected with the particular circumstances of the investing enterprises and the development level of the host country. In most cases, however, resource- and market-related determinants prevail. The former are connected with the wish to find better and cheaper production factors; the latter are focused on increasing or maintaining sales.

Benefits and Costs of FDI in the Host Country

As stated earlier, the impact of FDI on the host country is ambiguous. The economic changes implicated by the entry of foreign economic operators are of interest to many market actors and economists dealing with developmental subjects. FDI consequences for the economy can be observed at various levels. It is often the case that positive changes in one or more areas are accompanied by unfavourable changes in other areas. Generally, however, it is assumed that FDI-related benefits offset the undesirable effects and provide a positive impulse to the economy of the country and region in which they are located. However, there are some of studies which question this thesis.

Due to the complexity of FDI's effects on the economy, we usually take into account only some key areas over time - those most sensitive to the impact exerted by investors and the best reflecting the economic situation of regions where FDI is located (Kłysik-Uryszek, 2010, pp. 79-80). In most cases the effects are changes in production, GDP (Fortanier, 2007), the productivity of production factors (Haskel, Pereira & Slaughter, 2007), quantitative and qualitative changes on the labour market, changes in competition, innovation, and dissemination of knowledge and technological progress (Kathuria, 2000).

Many works provide examples confirming that FDI inflow acts as an impulse for regional development. Since Keynes it has been known that business cycles depend on the changes in investment rates and in the capital intensity of investment (Harrod, 1939; Domar, 1946). This thesis is the starting point for models where growth is a variable, dependent on increased capital supply. According to Rostow (1971), author of the idea of economic convergence, countries with insufficient capital resources may make their growth more dynamic by attracting foreign direct investment. These theories remain up-to-date. The key change which occurred since they were put forward is that at present global investors are not only American, Japanese and West European holdings, but also companies from Arab and Asian countries, which were mostly established as a result of redeployment of the production equipment of huge corporations.

Theories of economic development provided the background for concepts linking FDI inflow with economic development. Japanese economists were particularly committed to the subject and made several attempts to explain it, e.g. Ozawa, Fukuchi, Oguchi, Yoon, etc. (Nytko, 2009). These models are similar, yet only Ozawa's model of economic development stages was broadly disseminated throughout the world (Ozawa, 1992). Based on theories of economics and the experiences of Asian countries, in particular Japan, the countries of South-East Asia and Latin America, Ozawa observed that they developed successfully by opening up their economies to the external world. That contributed to the creation of a favourable climate for multinational corporations to transfer their operations to these countries, allowing local companies to absorb modern management, production and marketing solutions, all of which taken together helped modernize their economies. Thus, the general conclusion may be that FDI development changes the structure of the economy, with daughter companies supporting the emergence of comparative advantages in international trade and impacting on ownership advantages of local companies, as a result of which they may operate on foreign markets. The perspective of an improved position on international markets for the less developed countries, created by innovations flowing with and from FDI, is also demonstrated by Akamatsu (1962) in his "flying geese" model.

A large portion of the studies demonstrating the impact of FDI on the host country focus on the analysis of developing countries (Aitken & Harrison, 1999; Nunnenkamp, 2002; Sumner, 2005), mainly the so-called *emerging markets* (Whitman, 1999; Report of the Working Group of the Capital Markets Consultative Group, 2003; Zhang, Li, Li & Zhou, 2010; Globerman, Shapiro&Tang, 2004; Hailu, 2010). There are much fewer studies devoted to the highly developed countries (Lipsey, 2000). As most of them point to positive effects of FDI inflow into economies and regions, many countries offer attractive conditions to foreign investment, treating it as a transfer medium for scientific and technological progress and an economic development factor. This is confirmed by the examples of South Korea, Taiwan, Singapore, and Malaysia. The positive effects of FDI for the economy of India has been described by Marwah & Klein (1998), and similar results were documented for China (Li, Liu & Rebelo, 1998) and Singapore (Lim & McAleer, 2002).

While the results of some studies, e.g., by Aitken & Harrison (1999) and Konings (2009) point out neutral or negative effects of FDI on the host country's economy, according to Görg & Greenway (2004) this is due to the fact that the positive effects of an investment are noticeable in the long-run and may not be captured in short-term analyses (which dominate in literature). Besides, multinational corporations may deliberately hide benefits of their investment from local competitors. It is also worth mentioning that the positive impact of FDI may be visible only in selected industries and "occur not horizontally (intra-industry) but vertically through relationships that are missed in conventional spillover studies" (Görg & Greenway, 2004, p. 180).

The level and dynamics of GDP are often used as measures of FDI's impact upon a given economy. Studies based on econometric models usually highlight the positive effects of FDI inflow when it comes to a host country's GDP, independent of its development stage. In the work by Roy & Van Der Berg (2006) such effects are presented using the example of the U.S. economy. Analyses for countries of East Asia were conducted e.g. by Baharumshah & Thanoon (2006), for Malaysia - Karimi and Yusop (2009), and for India and China by Agrawal & Khan (2011). FDI promotes economic growth, but the scale of benefits additionally depends on other factors, e.g. trade policy regulations, workforce qualifications, and absorptive capabilities. Horizontal studies by Choe (2003) on a sample of 80 countries representing different development levels (e.g.,

Japan, countries of Western Europe, Africa, and Latin America) also demonstrate the influence of economic growth on attracting further FDI.

FDI also impacts the labour market, a phenomenon which has also been widely studied.[1] Usually changes in the size of employment, wages, and "quality" of jobs are analyzed in this context. According to Cieślik (2003), the quantitative effects of FDI inflow depend on the structure and flexibility of the labour market. On one hand, foreign companies create new jobs but, on the other hand, they restrict the employment in the domestic sector by competing for access to capital with local operators. When wages are rigid and foreign companies invest in production which is more capital-intensive than the local one, financing it with domestic capital, employment in the host economy may decline. When FDI is financed completely with foreign capital or brings with it greenfield investments, employment may increase.

In the opinion of Kłysik-Uryszek (2010), the effects of FDI inflow for the labour market in the host economy may be simultaneously positive and negative, and they materialize at three levels: quantitative, qualitative, and location-specific. The first level means e.g. increased net capital, which creates new jobs in local cooperating companies, but may push domestic competitors out of the market. Qualitative effects may mean higher wages and improved productivity resulting from the applied technology and better work organization, but may also bring with it the implementation of undesired employment practices (longer working hours, restrictions vis-à-vis trade union membership, etc.). Location-specific effects (of a regional dimension) may lead to the creation of new and better jobs (generating more value added) in regions of high unemployment, or it may contribute to the further concentration of economic activity in urban areas, which deepens regional imbalances (Kłysik-Uryszek, 2010, p. 85).

There are studies in the literature showing that FDI raises the demand for skills in the host country. This means that local workers, prior to gaining employment in a multinational company, must participate in additional, costly training, unless they can take advantage of special training offered by corporations. These processes increase the resources of highly qualified workforce on the local market. Confirmation can be found in studies by Feenstra & Hanson (1997), who argue that U.S. FDI into Mexico contributed to rising Mexican demand for higher-skilled workers across both regions and industries. However, studies by Blonigen & Slaughter (2001) do not confirm the existence of a relationship between skill upgrading within U.S. industries and either outward or inward FDI. Surely, however, FDI may result in skills upgrading on the local market, with domestic companies having to compete with the foreign companies, both in terms of knowledge and attracting skilled labour. According to Aitken, Harrison & Lipsey (1996) this provides an impulse to local companies to improve management efficiency and human resource quality, while knowledge transferred by workers facilitates reproducing organizational and management solutions, as well as imitating technologies and procedures of market leaders.

Some researchers are trying to prove that the presence of multinational corporations where employees receive higher wages may raise the wage rate in the domestic economy. Aitken, Harrison & Lipsey (1996) analyzed FDI's impact on wages in domestic firms in Mexico, Venezuela and the US. They detected a positive impact of FDI on wages in domestic firms in the US, but in the remaining two countries the impact was negative, i.e. the increasing presence of FDI in Venezuela and Mexico led to a reduction in wages paid by domestic firms. Girma, Greenaway & Wakelin (2001) studied the same effect with respect to the UK manufacturing sector, but they could not confirm that FDI impacts domestic wages in any way.

FDI may also have differing impacts on the productivity of domestic firms. A positive influence is due to the fact that skilled workforce, trained in corporations, may later decide to start their own businesses (Fosfuri, Motta & Ronde,

2001). Besides, foreign corporations may create demand for local inputs, increasing the specialization and efficiency of upstream and downstream activities and generating positive externalities for local industries (Markusen & Venables, 1999). On the other hand, the presence of multinational companies may adversely affect the productivity of local companies, which is especially visible in the short-term, or it may have no influence at all (Görg & Greenaway, 2004).

Corporations may also monopolize local markets and draw demand away from domestic firms, causing them to cut production and reduce their efficiency (Aitken & Harrison 1999). Moreover, they may replace local suppliers with foreign ones, and thus negatively impact the regional economy (Lall 1978). Very interesting conclusions can be found in Siotis (1999). He reveals that FDI may be initiated by a company without any particular skills, in the hope of acquiring valuable skills from local firms. Effects of penetration may thus be absorbed not only by FDI firms, but also by the parent company in the country of origin. From the point of view of local firms, such FDI may be harmful as they capture competitive advantages.

Along with the flow of capital, foreign companies transfer technology by selling licenses, patents or technological solutions, and offering technical assistance, education or knowledge. Modern studies focus not only on the effects of technology transfer but also on its reasons and diffusion channels between economic entities. Technology transfer, its diffusion and promotion of innovation are definitely among the most desired benefits of FDI. Kokko (1992) identifies the following ways of technology transfer to the host country:

1. Demonstration effect – imitation;
2. Competition effect;
3. Effect of international relationships;
4. Effect of learning (subcontractors).

Multinational corporations are usually more often and more willingly invest in R&D than domestic entities. OECD data show that R&D outlays in corporations are substantial, even when compared with aggregate R&D expenditures of countries (OECD 2010, p. 121) and public funding of R&D in the business sector in a number of countries (OECD 2009, p. 120). Thus, we may conclude that R&D expenditures in a joint venture with foreign capital may influence the total R&D operations in the host country. It also happens that the fear of multinational corporations entering the domestic market increases R&D outlays in local companies (Aghion, Blundell, Griffith, Howitt & Prantl, 2009). Another benefit may be the "diffusion of information and knowledge to host country organizations. Potential receivers of this knowledge are domestic firms, universities, or research centres" (European Commission 2012, p. 8).

However, the technology transferred to new locations is not always the *first/best* technology. Older 'mature' technology may be transferred, already withdrawn from highly developed countries but still allowing for competitive advantage in a given location. The literature is dominated by the opinion that *second-best* technology may be more favourable for the host economy, as its assimilation is easier (Blomstrom & Kokko, 2003; Glass & Saggi, 1998).

FDI inflow makes the economy more competitive internally, better integrated with the international system, more open and perceived as more competitive (Kłysik-Uryszek, 2010). FDI inflow may also increase exports (Banga, 2006) and their diversification (Jayaweera, 2009), which will be visible mostly when investors export their products to international markets or when they buy in international markets. Corporations which exploit low costs of production in the host country may generate trade if FDI is designed to service the global market. Such conclusions can be found in

Ekholm, Forslid & Markusen (2007), who see a clear link between FDI and the growth in exports, some of which may be to new markets or in new industries, thus also diversifying exports. Harding & Javorcik (2012) prove that FDI offers the potential for raising the quality of exports in developing countries. The research sample described in the publication included 105 countries in the period between 1984-2000. If local companies improve their productivity and become more competitive as a result of cooperation with other corporations, they may expand to foreign markets.

The review of the literature on FDI's effects for the host country shows they may go in different directions, and are not always positive. They depend on a wide range of factors connected with the features of the investing company, the development stage of the host country, and the local environment. Thus we should be very cautious in assessing FDI effects and always consider circumstances specific to a given region and to the host country.

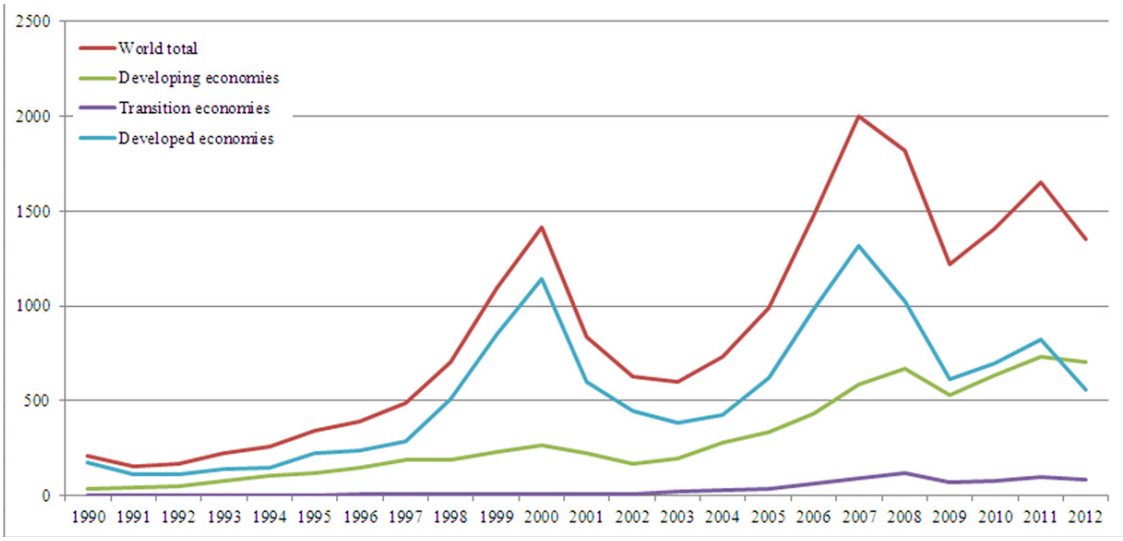
STRUCTURE OF FDI INFLOW IN THE VISEGRAD GROUP COUNTRIES

Direction of FDI in the World Economy

The dynamic increase in global FDI started in the mid-1980s. To date we have witnessed three breakdowns in its upward trend, connected with general slowdowns in global growth dynamics (Figure 1).

In 1985 less than USD 60 bn were invested all over the world, while in 2000 the figure reached as much as USD 1.4 trln. At the beginning of the 21st century, global FDI was significantly reduced as a result of the global economic downturn, which was accompanied by lower investment activity of multinational corporations, but this trend reversed in 2004. FDI flows from developed countries[2] grew by roughly 40% on average from 2003 until the end of 2007, supported by high economic growth in key host economies and strong corporate performance (Sauvant, Maschek & McAllister, 2009, p. 2).

Figure 1. Inward foreign direct investment flows from 1990 to 2012 (bn USD)
Source: UNCTADStat



The year 2007 was the record-breaking year for FDI inflow, which reached USD 2 trln. The financial crisis, which began in 2008, visibly influenced international capital flows. FDI inflow dropped by 20% compared to the previous year, reaching even 33% declines in developed economies. In 2009 FDI was further reduced by 40%. The drop was caused mainly by the drastic decrease in mergers and acquisitions (by 2/3) and, to a lesser extent, by the reduced number of *greenfield* projects. In addition, terms of loans became more rigid and firms' profits dropped, which significantly reduced their investment potential (Poulsen & Hufbauer, 2011, p. 2). For these reasons, many companies, mostly large multinational corporations, gave up or suspended their FDI projects. In many countries privatization was also stopped, e.g., Sweden, Kuwait, France, Mexico. Massive capital withdrawals were observed, and profits were repatriated instead of being reinvested. This trend was common and visible in many industries, starting from the extracting industry up to manufacturing and services.

The actual financial crisis emphasized the flexibility of the developing and transition economies to the current global economic situation (Carp, 2012, p. 39). The increased volume of FDI at the beginning of the crisis was reduced in 2008 by 16%, and in 2009 by about 21%. Clear changes could be noted in the hierarchy of beneficiaries and investors, mainly by raising the relative weight held by investors in developing and transition countries.

In 2012 FDI volume decreased by almost 1/5. The deepest drops were reported for developed economies, mainly in the EU. Declines were recorded in 22 out of 38 developed economies, including 16 European economies. FDI in this group dropped by 32%, to the lowest level in ten years. Almost all industries suffered from the crisis. The smallest declines were recorded in the manufacturing sector (food processing, tobacco, pharmaceuticals) and services for business, communication, transport, and logistics.

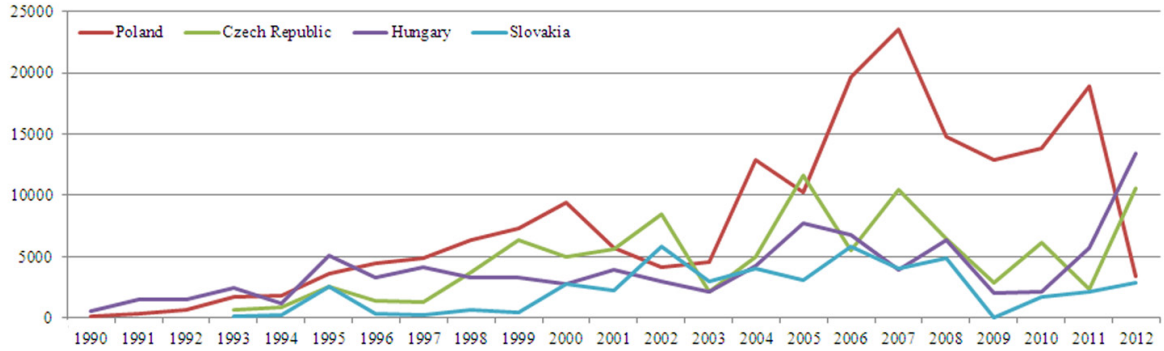
In 2012, for the first time ever the developing economies absorbed more FDI than developed countries. Nine developing economies and two transition economies ranked among the 20 largest recipients of FDI in the world (WIR, 2013). Among developing regions, FDI inflows to developing Asian countries fell by 6.7% as a result of decreases across major economies, including China, Hong Kong, India, the Republic of Korea, Saudi Arabia and Turkey. However, 2012 inflows to Asia are still high, accounting for 58% of FDI flows to developing countries. FDI to Latin America and the Caribbean decreased only slightly, by 2.2 per cent in 2012, and amounted to over 240 bn USD. Africa was a region that saw FDI inflows rise in 2012 to about USD 50 bn. Slightly smaller FDI inflows were experienced by the transition economies of South-East Europe and the Commonwealth of Independent States.

The global ranking of the largest FDI investors shows that investors from developing and transition economies have become very active in recent years and are willingly seeking new investment locations in the world. In 2012 two developing countries now rank among the five largest foreign investors in the world, with China was the world's third largest investor, after the United States and Japan.

FDI Inflow Dynamics in the Visegrad Group Countries

Since the beginning of the 1990s, when the Visegrad Group countries opened up their economies, investors have been showing increasing interest in locating FDI in their territories. The Czech Republic, Poland, Slovakia, and Hungary are economically much further advanced than the majority of Central and East European countries.[3] They were the first to launch systemic transformations and one of their top priorities in modernizing their economies was to attract as many operators with foreign capital as possible, and the highest possible volume of FDI (Figure 2).

Figure 2. Inward FDI flows to Visegrad Group countries, annually 1990-2012 (mln USD)
Source: UNCTADStat



In the first years of transformation, Hungary received the most FDI, due to its more attractive legal framework compared to the other countries in the Group. Hungary was also the first to involve foreign investors to a great extent in the privatization process (Sass & Kalotay, 2012, p. 1). On top of that, labour was inexpensive in Hungary and the government was able to offer extremely attractive investment incentives. FDI inflow to other V4 countries, mainly to Poland, started when foreign operators were allowed to participate in privatization. Moreover, radical reforms and the size of the Polish market rapidly increased Poland's attractiveness. Since 1996 Poland has systematically attracted more foreign capital than the remaining three countries and, with the exception of two years, regularly received the largest share of FDI inflows.

On the other hand, the Czech Republic and Hungary recorded declines in FDI inflows in mid-1990s. In the Czech Republic this was caused by foreign exchange crisis in 1996. Little FDI inflow was yet noticeable in the Slovak territory until 1998 (with the exception of 1995). This was because the government had engaged in efforts to build the so-called Slovak capital community and refused to open Slovakia to foreign investment (Kucharčíková, 2013, p. 3). In the 1990s FDI volume in the countries of the Visegrad Group was also influenced by the competition of their economies, which had just started transformation, and the Russian crisis of 1998.

Nevertheless, in the period 1990-1999 the Czech Republic, Hungary, and Poland accounted for cumulated FDI inflows amounting to 79% of total FDI into Central and Eastern Europe. In the years 1995-2001 Poland was the single absolute largest recipient of inward FDI, with the Czech Republic being the next absolute largest recipient in all of the Central and Eastern Europe. However, Poland was far from being the most FDI-intensive host economy when nominal FDI flows are deflated by nominal GDP levels (Globerman, Shapiro & Tang, 2004, p. 7).

Data on the dynamics of annual FDI inflow to the countries of the Visegrad Group confirms the increased interest of foreign investors after they joined the EU. This indicates their competitive position improved as a result of EU accession. In Poland, the higher FDI volume was also the effect of lowering the fiscal burden of the corporate income tax, which encouraged investors to declare higher profits in their branches in Poland. While Poland was, as already mentioned, clearly the leader in the region, it should be noted that in 2002 and 2005 the Czech Republic attracted the most capital invested in the Visegrad Group.

Slovakia attracted the least FDI compared to other countries in the Group during the entire transformation period, with the exception of the

years 1995, 2000 and 2002. The main reasons were political developments in Slovakia, legislative barriers to entry, and a weak business environment (Fifeková & Hardy, 2010, p. 9). After 1999, FDI inflow intensified, but once the major privatization projects had taken place, it slowed down again.

In the second half of the first decade of the 21st century Poland was receiving the majority of investment capital in the CEE countries. The record-breaking year was 2007, when the inflow of foreign capital in Poland reached USD 23.5 bn. This was almost 80% higher than in 2004, and over 15% higher than in 2006. In 2008 FDI in Poland dropped by over 37% compared to the preceding year, reflecting the trends on the global market. Such a substantial decrease in investment in Poland could suggest a deep regression with respect to the investment attractiveness of the country. We need to stress, however, that this happened a year after Poland's FDI record-breaking result recorded in 2007, i.e. just before global economic crisis.

The negative impact of the crisis was overcome in Poland in 2011, but in 2012 FDI recorded a dramatic drop by over 82% compared to the previous year. This result was largely influenced by the scale of capital in transit,[4] which in 2012 increased sevenfold globally. Disregarding capital in transit, Poland's FDI inflow in 2012 would reflect the negative impact of crisis, but it would not be such a steep decline.

Since 2008 other Visegrad Group countries have also experienced serious consequences of the global recession. In Hungary reinvestment was significantly reduced, and other capital flows were negative as a result of the increase in reverse borrowings within companies and debt repayment from Hungarian branches to parent companies. FDI flows to Hungary were especially hard hit by the crisis years of 2009 and 2010, both in absolute terms and relative to flows to other countries, such as Poland and the Czech Republic. The 2011-2012 dataset indicates an increase in FDI inflows, however, according to Hungarian National Bank this is mainly due to a large capital in transit flow. A similar situation took place in the Czech Republic, where FDI increased four times in 2012 compared to 2011.

Summing up, since the beginning of transformation until 2012 almost 44% of all FDI directed to Visegrad Group countries was located in Poland, over 23% in the Czech Republic, over 21% in Hungary, and 11% in Slovakia. However, the value of FDI *per capita* has definitely been the highest in the Czech Republic throughout the entire period of 1990-2012.

Investors' Geographic Origin

In analyzing the directions from which FDI flows into the Visegrad Group countries, initial stress should be paid to the very strong economic and trade ties of the region with other EU member states, in particular with the Economic and Monetary Union member states, (euro area, also known as the Eurozone). On average, about 70% of inward FDI in Poland, the Czech Republic, Slovakia, and Hungary comes from the euro area member states. The Baltic States are an exception in Central and Eastern Europe in this respect, as investments originating from euro area represent not more than 35% of the total incoming FDI. Becoming dependent upon one area, even an economically advanced region, may also have negative consequences. They may be particularly painful in times of economic crisis (Białek, 2012).

Having stated the above, we may also note some differences in the origin of foreign capital in the form of FDI reaching the countries of the Visegrad Group. This is the outcome of the various determinants of investors' interest, which have been summarily outlined in the first part of the Chapter.

The Czech economy offers a highly advanced technical infrastructure, skilled labour and a functioning market economy particularly strongly linked with the so-called "old" EU member states, also referred to as the EU-15. But strong trade relationships with the euro area slowed down

economic growth in the Czech Republic in recent years. The authorities are trying to counteract the situation by improving Czech's investment attractiveness by offering a wide array of incentives.

In the period 1993-2011 cumulated FDI inflow into Czech Republic was estimated at over EUR 77 bn. As of 31 December 2011, by the country of origin, the biggest share of foreign capital in the Czech economy originated from the Netherlands (27.4%), Germany (14.9%), and Austria (13.2%). Countries whose total outward FDI exceeded CZK 100 bn (approximately EUR 3.6 bn) also include Luxembourg, France, and Switzerland. The total share of EU-originating FDI investment amounted to 87.6%, with almost 92.5% from Europe in the broadest sense of the term. Hence only 7.5% of foreign capital investment was owned by investors from outside the Old Continent, mainly from the United States and Japan (Foreign Direct Investment in 2011, 2013).

In recent years Hungary has faced serious economic problems. The financial crisis had a strong impact upon the economic performance of the country. Cumulated FDI value at the end of 2011 was about EUR 70 bn. Over 70% originated from the EU, including about 22% from Germany. Similarly to all EU member states, investors from other countries of the Community, in particular from Germany, the Netherlands, Austria, Luxembourg, and France dominated FDI inflow to Hungary. Operators from outside of the EU also represented a substantial share, mainly those from the United States and, to a smaller extent, from South Korea and Japan.

The presence of investors from Central America is also an important aspect in Hungary. That might be the consequence of Hungarian investments in the region in previous years. In Hungary there are, e.g. investors from the construction (Cemex) and automotive (Nemak) industries. Hungary's investment attractiveness was clearly enhanced by a variety of investment incentives addressed mainly to these industries. Besides direct subsidies and allowances, companies were attracted by industrial parks. In Hungary there are more than 200 such parks (Sass, Kalotay, 2012; Central Bank of Hungary, 2013).

Slovakia, despite being one of the smallest countries of Central and Eastern Europe, efficiently and quickly managed to cope with economic crisis. It provides a relatively attractive alternative to foreign investors with its low costs, investment incentives, and organizational support of the public administration. No doubt Slovakia's membership in the euro area (since 2009) is also an advantage in the eyes of investors.

Cumulated FDI value for Slovakia in 2011 was almost EUR 40 bn. Data of the Slovak Investment and Trade development Agency (SARIO) indicates that FDI investment was distributed rather equally across the regions. With respect to the country of capital origin, the period 2002-2012 was clearly dominated by German investments (17%). Substantial shares were also recorded for investment projects from other EU member states (Denmark 6%, France 5%, United Kingdom 5%, the Netherlands 4%, Spain 4%, and Belgium 4%). Slovakia became also the location of non-EU capital, in particular from South Korea (12%) and from the United States (7%) (SARIO, 2012).

Considering its area, GDP, population and resources, Poland is the biggest economy in the Central and East European region. Its successful transformation, large domestic market, relatively low cost of a highly skilled workforce and management staff, and rich catalogue of incentives make Poland the unquestionable leader in attracting and maintaining FDI in the region. The value of cumulated FDI inflow to Poland in the years 1994-2011 exceeded EUR 139 bn.

From the point of view of invested capital, the Netherlands is at the top of the list of foreign investors in Poland. The value of cumulated Dutch investment at the end of 2011 was EUR 26.8 bn. Subsequent runners-up are investors from Germany (EUR 20.4 bn), France (EUR 18.7 bn), Luxembourg (EUR 13.1bn), and the U.S. (EUR 9.3 bn) (Białek, 2012).

In 2011 the largest FDI flow originated from Luxembourg (EUR 4,542 mln), Spain (EUR 4,318 mln), Germany (EUR 3,592 mln), and Sweden (EUR 2,617 mln). There were also cases of divestment, i.e. investors' withdrawals from Poland. These investors were mostly Irish (EUR -2,946 mln) and Swiss (EUR -2,424 mln) (NBP, 2012).

Structure of FDI Flows

As was the case with the origin of capital, the structure of FDI flows to the Visegrad Group countries is similar throughout the group. In all the countries investors from the automotive, electronics, and machinery industries played an important role. However, more in-depth analysis of FDI inflows to individual countries of the Group reveals some differences and specializations in the host countries.

In Poland, like in other Visegrad Group countries, firms with foreign capital are gaining in importance in the economy. Today it is hard to imagine many sectors of the economy without foreign investors, with their knowledge, organization, technology, and capital. This is clearly visible in automotive industry, and in electronics and domestic appliances.

In 2011 there were almost 25,000 economic entities with foreign capital operating in Poland, nearly 8% more than in 2010. In terms of legal arrangements, the group was dominated by limited liability companies (93.1%). Joint stock companies ranked second, but their share was only 3.8%. In 2011 more than 1,500 new entities were established (approximately 200 more than in the preceding year). The majority of new businesses dealt with trade and repairs of motor vehicles (440). New projects were mostly *greenfield* investments (80%).

From the point of view of the size of the businesses invested in, more than 84% were small firms (up to 49 employees), including 66% micro-businesses (employing up to 9 people). The smallest group, less than 5%, was comprised of big companies (employing over 250 people). The majority of businesses (almost 2/3) dealt with the trade and repair of motor vehicles (28.0%), industrial processing (20.1%), the real estate market (9.5%), and construction (9.2%). At the end of 2011 companies with foreign capital employed 1,566,500 people, an increase of 3.2% more compared to 2010.

In 2011, as many as 10,108 companies with foreign capital exported their products or goods and materials. They represented 40.6% of the total number of businesses with foreign capital (41.1% in 2010). Exports to the parent company or to related entities in a capital holding or in a group of companies to which a given entity belongs (so called intra-group exports) accounted for 41.7% of total exports by these companies in 2011 (a decline of 5.6%). Exports to parent companies or related entities prevailed among the manufacturing entities – 83.8%.

In 2011 as many as 46.1% of businesses with foreign capital reported outlays for the purchase of fixed assets in Poland (47.7% in 2010). Their value was PLN 73,704.4 mln, an increase of 19.6% compared to the same value for 2010. The largest amounts were invested by businesses in the manufacturing sector (35.1% of outlays for fixed assets made by all entities with foreign capital), companies dealing with trade and repair of motor vehicles (11.6%), and information and communication (10.4%) (GUS, 2012).

Many foreign investors operating in Poland represent leading multinational corporations. The scope of this publication does not allow to list even a small portion of the largest ones. By way of example however we will mention Amcor Ltd, Strabag, Toyota, France Telecom, Hutchinson, Dell, Peugeot, BSH Bosch und Siemens Hausgerate, IBM, Metro Group AG, Siemens, Volkswagen, FIAT, Indesit, Fujitsu, and Philips (PAIiIZ, 2013).

The two recent decades witnessed a major change in FDI structure in Hungary. At the beginning of the 1990s, direct investments focused predominantly on manufacturing. Then the importance of this sector gradually decreased. In 2000 its

share was still significant and accounted for 47% of all FDI in Hungary. The role of manufacturing continued to decrease to the level oscillating around 25% in 2009, then increased to 30% in 2010. Transport and electric engineering were the most important investment destinations within the manufacturing sector. On the other hand, services have gained in importance in the structure of FDI in Hungary over the last 20 years, in particular wholesale and retail trade, repairs, real estate, IT and business services.

The largest investment projects in Hungary can be divided into two groups. The first includes affiliates of multinational corporations, such as Audi, Nokia, GE, Samsung, Philips, E.ON, Deutsche Telekom (M-Telekom), and Fibria Cellulose. The second group consists of former Hungarian state-owned enterprises privatized through public offers on the stock exchange, where at present a number of majority shareholders are foreign investors, e.g. MOL, OTP Bank, and Richter.

Some sectors of the Hungarian economy, especially manufacturing and services, are dominated by entities with foreign capital. When it comes to vehicles, Hungary is the host country for such renowned global corporations as Japanese Suzuki and German Audi. In 2012 a new plant of German automotive-holding Daimler AG launched production in Hungary. Other automotive corporations, such as American General Motors' and German Opel, specializing in spare parts, also enjoy a substantial share in the Hungarian market. It is also worth mentioning top class German manufacturers of vehicle systems, such as Knorr-Bremse (braking systems) or Robert Bosch (spare parts and accessories).

In Hungary there are also many global leaders in the electronics industry, e.g. American National Instruments, Jabil, and GE, Flextronics from Singapore, Foxconn from Taiwan, Dutch Philips, South-Korean Samsung, German Siemens, and Finnish Nokia.

Leaders in the service sector comprise multinational financial and telecommunication corporations. An example may be MKB bank, with German BayerischeLandesbank as its major shareholder, and CIB Bank owned by Italian IntesaSanpaoloSpA. On the telecommunications market in Hungary one may find, e.g., M-Telekom owned by the German giant Deutsche Telekom and an affiliate of Norwegian Telenor. Operators with foreign capital also have a big share in Hungarian retail trade, with the leading corporations in this area including French Auchan, Cora from Belgium, British Tesco, and German Lidl (Sass, Kolotay, 2012).

In Slovakia the majority of FDI was attracted by the automotive industry, with plants opened by Volkswagen, KIA Motors, and PSA Peugeot Citroen. Investors from the electronics industry are also interested in Slovakia. It is a host country for FDI by Sony, Samsung, Panasonic, and AU Optronics.

Foreign investors have also located their capital in other industries in the Slovak economy, e.g. in machine-building and chemical industries and in telecommunication services. The list of key foreign investors in Slovakia should be supplemented with e.g. U.S. Steel, Whirlpool, IBM, HP, DELL, Siemens, Alcatel, Foxconn, and Soitron (Białek, 2012, SARIO, 2012).

Currently in the Czech Republic there are more than 173,000 businesses with foreign capital. Like in other Visegrad Group countries, the first period after transformation was dominated by investments in manufacturing. Modernization of the economy, upgrading of infrastructure, and human resource development have turned the Czech Republic into an attractive investment location also for services and R&D centres.

According to the Investment and Business Development Agency (CzechInvest), there are at least several industries in the Czech economy where FDI inflows are constantly increasing. As has been mentioned, knowledge-based industries and advanced technologies are among them. These are mostly telecommunication, business support services, aviation, the automotive industry, ma-

chine engineering, equipment and tools, natural sciences, electric engineering and electronics, renewable energy, and nanotechnologies.

Among the over 173,000 businesses with foreign capital in the Czech Republic, the biggest companies are ABB, Continental, DANONE, Ford, Panasonic, Nestlé, IBM, DHL, Astra Zeneca, Rockwell, Procter & Gamble, Renault, Siemens, Lufthansa, Honeywell, and Volkswagen (CzechInvest, 2013; Czech National Bank, 2013).

INVESTMENT ATTRACTIVENESS

Assessment in the Light of Selected Rankings

When analyzing the results of leading international rankings, we may conclude that over the last several years, including the times of crisis and economic downturn, Visegrad Group countries have remained an attractive investment location.

According to The Global Competitiveness Report 2012–2013[5] Poland and Hungary are in transition from economies driven by increasing productivity to innovation-driven economies. The Czech Republic and Slovakia are considered innovation-driven economies. (The Global Competitiveness Report 2012–2013, 2012, p. 10). Between 2004-2012 only Poland markedly improved in the Global Competitiveness Index ranking from 60 to 41, Czech Republic remained stable (+1). Slovakia (-28) and Hungary (-21) lost substantially. From among the countries of the Visegrad Group, the highest ranking positions in the competitiveness ranking[6] in 2012-2013 are occupied by the Czech Republic and Poland, 39th and 41st respectively, while Hungary and Slovakia rank 60th and 71st respectively (The Global Competitiveness Report 2012–2013, 2012, p. 14). This means the economic transformation has brought concrete measurable results, as these countries have managed to achieve higher efficiency in many industries and improve the investment attractiveness of the region. At present, the areas where FDI is expected in these countries are creative industries, strategic services, and R&D.

When analyzing the factors determining the intensity of FDI inflow to Central and Eastern Europe in the years 1996-2010, Mateev & Tsekov (2012) demonstrate that the primary advantages of these countries are low taxes (Czech Republic) and the competitive cost of labour (Slovakia). However, individual countries differ in geopolitical, economic, and cultural terms, hence there are factors which distinguish them from one another, and methods of attracting foreign capital by offering, e.g. well developed infrastructure or establishing special economic zones.

According to the World Bank´s *Doing Business 2013* report the "economies in Central and Eastern Europe have received large inflows of FDI over the past couple of decades because they are seen as entry points into the huge European market and also because they have relatively well-educated labour forces." (2013, p. 49). Macroeconomic forecasts suggest Central Europe will continue to be the fastest growing region in the European Union. Another advantage of these countries consists in their skilful combination of emerging markets with the stability of developed economies.

Studies by Ernst & Young show that, in the opinion of 49% of interviewed investors, in the years to come Central and Eastern Europe will be the most attractive investment spot globally. (E&Y attractiveness survey, Europe, 2013, p. 8). Investors even ranked CEE ahead of Brazil, Russia and India. Countries of the Visegrad Group are the most popular among the countries of the CEE region. Stability, predictability, and a well educated labour force are the location selection criteria most often taken into consideration in the times of recovery. Half of interviewed multinationals also pointed to the cost of labour as a basic element of investment decisions. In this area as well the Visegrad Group countries, despite increases in salaries and wages, remain attractive to foreign investors. It suffices to say that annual wages in

Poland, Hungary and the Czech Republic remain, on average, half of those in Germany, France or the UK (Eurostat, July 2013).

According to E&Y, in 2012 Poland and the Czech Republic combined accounted for 5.8% of all FDI projects globally (2013, p. 15). In addition, Poland was the top improver globally, according to the World Bank's *Doing Business 2013* report, because it has won attention as the fastest growing EU member since 2008, and benefits from a skilled native and migrant workforce. (Doing Business 2013, 2013).

Poland is also a leader according to UNCTAD when it comes to investment attractiveness. Its major competitive advantages are a large and rapidly developing internal market, an educated and flexible workforce, stable banking system, access to international local markets, and the availability of suppliers and partners. Most probably the above mentioned factors gave Poland, as the only member of the Visegrad Group, a place in the group of the top 15 attractive FDI locations in recent years. (World Investment Report, 2010, 2011, 2012, 2013).

Poland is also the only country among the Visegrad Group members included in the basket of 25 countries covered by the FDI Confidence Index.[7] It occupied its highest ranking position, sixth, in 2010, while in 2012 and 2013 ranked 23rd and 19th, respectively (2013, p. 3). The report by A.T. Kearney stresses that Poland is particularly strong in automotive components and vehicle assembly, and is seeing increased activity around its newly built highways. Besides, Poland "is also seeing more knowledge-centered investments, thanks to a large student population, a breadth of language talent, and an EU grant scheme to support such investments" (A.T. Kearney 2013 FDI Confidence Index, 2013, p. 22).

The Visegrad Group countries also occupy high positions in the ranking published in 2013 by Foreign Policy magazine. Its Baseline Profitability Index (BPI) is intended to be an overall guide for all foreign investors and is based on three factors: asset growth, preservation of value, and repatriation of capital. In the BPI ranking Poland is 18th among the most attractive countries in which to invest, while the Czech Republic ranks 22nd, Slovakia 28th, and Hungary 37th.

System of Investment Incentives

The system of investment incentives in place significantly impacts the investment climate in a given economy. It also contributes to increased attractiveness of the host country. Support is most often coordinated by a specialized agency and includes all sorts of tax allowances, favourable settlement rules for investment projects, and also direct subsidies for investors.

Although foreign investors often perceive the CEE as a single area, the countries in the region differ rather substantially with respect to their economic accomplishments, FDI absorption capacity, and their approaches to investment incentives (all of course in line with the EU *acquis communautaire*). Poland and the Czech Republic can be proud of their successes in attracting foreign capital. In the period 2000-2012 cumulated FDI inflow into both countries was the highest in the CEE; it exceeded USD 154 bn in Poland and USD 82 bn in the Czech Republic.

The whole Central and East European region is situated in the centre of the pan-European market, and each of the four countries of the Visegrad Group has its own particular geographical merits.[8] Considering not only the location but, first of all, market determinants, Poland is very well positioned, having definitely the biggest market in the region. It is also economically stable, with a good availability of workforce. However, conditions for running a business in Poland are assessed lower than in the remaining Visegrad Group countries. The Czech Republic has the best air transport connections in the region. The advantages offered by Hungary include a relatively well-developed infrastructure and high quality of human resources. In Slovakia costs are the low-

est and it may become the primary destination of service investments. All countries of Visegrad Group constantly improve their business environment and investors may expect direct support from local and regional authorities.

Poland also offers a wide range of incentives for FDI projects. Investors may benefit from multi-annual support programs, subsidies, real estate tax allowances, or special economic zones. The Ministry of Economy manages a special program[9] designed to enhance innovation and competitiveness in the Polish economy. Its main aim is attracting and supporting FDI in sectors referred to by the OECD as hi-tech sectors.[10] Support is offered only to investors who plan to invest in the following priority industries: automotive, electronics, aviation, biotechnology, modern services, and R&D. The system provides investment support for the cost of creating new jobs (non-refundable employment subsidies) and eligible costs of the new investment (non-refundable investment subsidies).

In Poland there are also 14 special economic zones, and several dozen technology and industrial parks. The latter have become a popular tool for supporting local and regional development through entrepreneurship and innovation support schemes, which establish the framework for cooperation between public administration, businesses, and research centres. Finally, Poland is the largest beneficiary of EU structural funds from among the countries of Central and Eastern Europe. Its cohesion policy budget for the years 2007-2013 exceeded EUR 67 bn. Currently, ongoing discussions concern the new financial perspective for 2014-2020. A major part will be dedicated to companies, with the Polish Information and Foreign Investment Agency (PIFIA), together with local and regional authorities, entrusted with the task of seeking and supporting foreign investors. All these institutions should provide concrete and coherent information to allow an investor to tailor his or her position to ensure that he or she receives the maximum amount of incentives available.

Foreign investors are attracted to the Czech Republic by a rich offer of financial incentives financed with public resources. Investment projects are supported by the Czech government via the CzechInvest agency, and (similar to other EU member states) the assistance may not exceed the amount specified in the regional map of State aid intensity. The ceiling depends on the region where an investment project is taking place. A large portion of the assistance is directed to manufacturing projects. Support consists in, e.g., granting full or partial tax allowances (up to five years of full corporate tax relief for newly established legal entities, and partial corporate tax relief for the expansion of existing production), subsidizing new jobs (up to 2,000 EUR annually for each newly created job), subsidies for training and retraining, and also site support (transferring public land at a favourable price). Incentives are also available for developing export-oriented industries representing high value added.

Since July 2012, when the Act on Investment Incentives was amended, State aid has been expanded to cover technology centres and business support services. Support is available for investment in research, development, and innovation (technology centres) and strategic services centres. The latter are units dealing with selected operations by companies, closely linked with IT technologies and having clear international orientation, e.g., IT software development centres or expert and task-specific ICT centres. On top of that, the Ministry of Industry and Trade launched the program Entrepreneurship and Innovation, which covers 15 various assistance programs and offers, e.g., non-refundable subsidies, preferential loans and guarantees. Similarly to Poland, the Czech Republic receives structural funds under the EU cohesion policy.

In Hungary there are also some instruments providing incentives to investors. These include all sorts of cash subsidies, tax allowances (including 80% reduction of the corporate income tax),

low-interest loans, and land available either free of charge or at reduced prices. The main types of cash incentives related to investments focus on the delivery of an investment project (e.g. purchasing assets, construction works, etc.), creating new jobs and training employees. The Hungarian Government provides a negotiation-based "VIP" subsidy opportunity for investments greater than EUR 10 million with a fixed number of newly created jobs, depending on the purpose and location of the investment. There is also the possibility to subsidize a project from available EU Funds.

In Hungary, priority is given to FDI aimed at the development of the economy, employment, transport, human resources, health and wellness services, environment and energy, public services and the regions. Investors may choose from more than 200 industrial parks, which facilitate the establishment and operation of a business, and offer the support of local authorities, tax allowances, and preferential conditions.

The typical services specifically provided by industrial parks in Hungary include: the provision of basic infrastructure for production (e.g. energy, water and waste-water treatment facilities) and a wide range of other quality services (e.g. banking services, customs administration, consultancy, security guards and office services).The institution entrusted with the task of promoting foreign investment and bilateral trade, as well as assisting EU integration-oriented development of SMEs, is the Hungarian Investment and Trade Agency (HITA).

The last on our list of analyzed countries, Slovakia, also offers a transparent system of incentives. State aid and investment incentives vary and depend on four categories of projects that can be supported: industrial production, technological centres, shared service centres, and tourism. Support is available to investors starting new businesses as well as to those expanding existing initiatives. For each category of projects, there are specific conditions which must be met in order to apply for investment incentives. Incentives consist of, e.g. subsidizing the acquisition of material and immaterial assets, income tax relief, a contribution for new jobs created, and transfer or exchange of real property at a price lower than the general asset value. State aid is available up to 50% of investment and the minimum invested amount depends on the unemployment rate in a given location (it can be even as much as EUR 14 mln).

Recently Slovakia initiated support for the R&D sector by offering a wide array of public subsidies, incentives and programs which have encouraged many investors to transfer their technology and research centres to Slovakia. The first contact point for investors is SARIO. Among its many responsibilities, the most important deal with providing investors with initial information and assistance with their investment.

Special Economic Zones as a Tool to Attract Foreign Investors

Special economic zones, or so-called free trade zones, operate in several countries in Central and Eastern Europe (Romania, Estonia, Latvia, and Lithuania). From among the Visegrad Group countries they operate only in Poland. For this reason below we shall discuss the specificity of Polish special economic zones. Special economic zones (SEZs) are one of many tools designed to attract foreign investors and increase the investment attractiveness of the host country or region

Pursuant to Polish law, a special economic zone is an uninhabited, distinguished territory, where businesses may operate on terms laid down in the law (Ustawa, 1994). A zone may be established to stimulate economic development of a part of the country's territory, in particular by (Ustawa, 1994, Art. 3):

1. Developing specific areas of business activity,
2. Developing new technical and technological solutions and the application thereof in the national economy,

3. Developing exports,
4. Increasing the competitiveness of products and services,
5. Utilizing existing industrial assets and economic infrastructure,
6. Creating new jobs,
7. Utilizing available natural resources in a sustainable and environmentally friendly way.

At present in Poland there are 14 SEZs. As of the end of June 2012, almost 1,500 permits were issued to operators to run businesses in these zones. These entrepreneurs invested almost PLN 82 bn (approximately EUR 20 bn) and employed more than 240,000 people. The main incentives for locating a business in a SEZ include preferential operational terms, developed investment plots, and qualified staff (Special Economic Zones, 2012).

Preferential terms mean the availability of State aid. In the case of SEZs, State aid may be granted in accordance with regulations which specify its allowable intensity for a given area. The aid takes the form of corporate income tax allowance and real estate tax allowances. Allowances and relief are available to entrepreneurs up to 2020 when, pursuant to the amended Act on SEZs, the zones will cease to exist under the current arrangements.

Recent years have witnessed the stabilization and further development of SEZs in Poland. In 2011, 188 permits were issued, an increase of 6% compared to 2010. The most permits were issued in the Kostrzyn-Slubice and Lodz SEZs – 22 each. With respect to investment outlays, in 2011 a slight decrease was recorded (by 3%) compared to the preceding year. Statistics were better for the labour market. In 2011 the number of people employed in SEZs exceeded 240,000 and increased by 7% compared to 2010. In absolute numbers, the zone in Katowice has the highest employment (ca. 48,500), followed by the SEZ in Walbrzych (ca. 31,200), Tarnobrzeg (ca. 28,700), and Lodz (ca. 24,800).

Special economic zones are open to both domestic and foreign investment projects. Ministry of Economy data shows that entities with foreign capital play an important role as sources of investment expenditure in all of the 14 special economic zones. As at 31 December 2010, the total investment outlays amounted to over PLN 73 bn (approx. EUR 17.3 bn), and only 17.3% consisted of Polish capital. In the group of foreign investors, German businesses accounted for the largest share of investment. By the end of 2010 it reached almost PLN 12 bn (approx. EUR 3 bn), i.e., 16.3% of total investment outlays in all the 14 zones. In terms of value, the largest investments were recorded in the Legnica and Lodz Special economic zones. German investors were followed by American (11.5%), Japanese (9.7%), Dutch (9.5%), and Italian (8.5%) business entities. In all the SEZs, the share of EU-based capital was ca. 44% (Ministry of Economy, 2010).

It is worth stressing that SEZs in Poland score high against other similar zones in the world. In the ranking of FDI Magazine, which lists the 50 top special economic zones in the world, five were SEZs from Poland: the SEZ in Katowice ranked 11th, in Lodz 18th, in Walbrzych 22nd, in Pomorska 35th, and in Starachowice 37th. The ranking was dominated by SEZs from the Middle East (23 out of 50), mainly from United Arab Emirates (14), although the zones from Central and Eastern Europe were also noted. They were recognized mostly for good quality infrastructure and well developed networks (www.fdiintelligence.com, 2013).

Special economic zones seem to be a specific location advantage of Poland compared to other Central and Eastern Europe countries, including the Visegrad Group countries. The operational scale and legal framework offered to investors in Poland have not been reproduced in any other country in the CEE region. Slightly similar arrangements, although on a smaller scale, are available only in Lithuania and Latvia. Estonia

and Romania offer access to selected duty free areas. Neither in Bulgaria nor in any other Visegrad Group country can we find specific areas that operate similarly to SEZs. This does not mean, of course, that those countries do not have any investors' support schemes involving State aid. On the contrary, as has been mentioned above, e.g., Czechs grant tax allowances depending on the region and volume of investment expenditure.

Investment Barriers

One of the main obstacles facing investors wishing to pursue economic operations in the Visegrad Group countries is public administration and red tape. The numerous documents and procedures that must be filled out and complied with to start a business, the cost and time of receiving necessary permits and restrictions in access to loans are factors which, no doubt, may impact negatively on the investment attractiveness of a country, and these are not an exclusive list of the formal limitations that impact foreign investors.

The number of days needed to start a business, time needed to construct a production area, number of days required to close a real estate transaction, and the investor protection index (an average of three components: transaction disclosure requirements, availability of legal remedies in case of court proceedings, and the ease of receiving documents necessary for potential shareholder suits) are the most common measures of bureaucracy of an economic system.

In recent years, Poland and Slovakia have enacted a number of reforms aimed at facilitating business operations (both countries are leaders in the region). However, even in these countries there are still many arrangements that need to be modified. According to the World Bank, which publishes the ranking "Ease of Doing Business," the Visegrad Group countries rank only moderately high.[11] The top ranking was awarded to Slovakia (46), followed by Hungary (54), Poland (55), and the Czech Republic (65). It is worth noting that the Visegrad Group countries ranked better than Italy, China or India. Unfortunately, in individual categories of the study, the ranking of Visegrad Group countries is lower. The category "Starting a Business" places Hungary at 52nd place in the world and the Czech Republic, the worst performing country in the group, is ranked 140th. We need to highlight that, in the Visegrad Group, only Slovakia and Poland improved their rankings and Poland was considered the best reformer globally. It was rewarded with the biggest jump in global ranking in the following categories: registering property, paying taxes, enforcing contracts, and resolving insolvency. (Ease of Doing Business 2013, 2013, p.4).

Another barrier to FDI inflow to Central and East European countries is corruption, which is much higher than in the western part of Europe. This raises doubts when it comes to the transparency of decisions made by public officials, awarding contracts via public procurement, or granting authorizations or licenses. Corruption is measured by The World Economic Forum along with the competitiveness index. The higher the index (maximum of 7), the more transparent is the country. For some countries of Central and Eastern Europe the competitiveness index is close to the European average, however, for the majority of countries of the region the index is significantly lower. For Poland it is 4.0 (44th globally), but for Hungary 2.6 (106th), Slovakia – 2.5 (120th), and for the Czech Republic 2.3 (127th).[12] (*The Global Competitiveness Report 2012–2013*, 2012, p. 390).

A similar role is played by the Corruption Perception Index, measured since 1995 by Transparency International. Its main objective is to assess the transparency in the public sector. Currently (2012) the ranking covers 176 states and territories around the world. Assessment is made from 0 to 100, where 0 means the highest corruption/lowest transparency and 100 the lowest corruption/highest transparency. In 2012 the most transpar-

ent countries were: Denmark, Finland, and New Zealand, with an average score of 90. The lowest ranking position was that of Somalia (12), North Korea and Afghanistan (13 each). The Visegrad Group countries were assessed rather well. They ranked in the first half of the ranking and scored better than, e.g., Italy, Bulgaria, Greece, Mexico or Brazil. However, they were overtaken by e.g., Chile, Uruguay, Cyprus, Spain, Portugal, Slovenia, and Taiwan. Similarly as in the ranking of The World Economic Forum, Poland scored the highest among the Visegrad Group countries. It ranked 41st with a score of 58 points. The other Visegrad group countries performed a bit worse, with Hungary ranked 46th (55 points), Czech Republic 54th (49 points), and Slovakia 62nd (46 points) (Corruption Perception Index, 2012).

Protection of intellectual property rights is also a major barrier hindering FDI inflow into the Visegrad Group countries. Available legal solutions, although largely improved compared to previous years, still do not live up to those applied in the most industrialized economies. That hampers hi-tech investment, as foreign companies would put themselves at risk of illegal imitation. As a result, investors are reluctant to transfer their R&D centres to Visegrad host countries. The above-quoted *The Global Competitiveness Report 2012–2013* includes an index of intellectual property protection. Like its other indices, the maximum score is 7, meaning the highest protection. None of the countries in the region has exceeded the EU average (4.9), with Poland and Slovakia below the global average.[13] The Visegrad Group countries' ranking ranged from 48th (Hungary) to 67th (Poland). (The Global Competitiveness Report 2012–2013, 2012, p. 389).

Another determinant of FDI inflow is infrastructure. Its high quality is an important factor in making the location decision concerning an investment project. Infrastructure impacts the cost of transport and contributes to the integration with the EU internal market and links with abroad. Besides transportation network, other types of infrastructure such as IT, telecommunications and energy networks are also important determinants for FDI inflow. When it comes to infrastructure, Visegrad Group countries perform much less favourably than the rest of the EU. In many of them road, highway and railway infrastructure is insufficient and often in need of deep modernization. This is why European Union, in its new budget for 2014 – 2020, again plans to allocate substantial resources for the development and modernization of infrastructure, with an additional EUR 50 bn for a new infrastructural fund allocated to the "Connecting Europe Facility" (CEF), out of which EUR 9.1 bn will be spent on energy and EUR 9.2 bn on telecommunication.[14]

Taxes are also important for business activity. Sometimes they are even decisive for the direction of international expansion. In the light of global crisis, some states, e.g., the Czech Republic and Hungary, increased taxes to raise additional income for their budgets, which surely will not encourage investors to locate their investments there. Poland, for political reasons, does not cut public expenditures, which often forces tax increases.

In conclusion it is worth noting that all the Visegrad Group countries, with the exception of Slovakia, use their own currencies, which for investors may constitute an obstacle, especially if we consider that all the Visegrad Group countries are EU member states. Different currencies introduce an additional risk factor. An autonomous monetary and foreign exchange policy may increase exchange rate volatility, which may restrict FDI inflow and discourage foreign investors. We also need to note that economic policy, including foreign exchange policy, may be subordinated to political goals, which is evidenced by the change in policy of the Hungarian government in 2012-2013. Besides, the relatively small supply of Visegrad domestic currencies on the foreign exchange market may lead to speculation and increase the risk involved in FDI.

FUTURE RESEARCH DIRECTIONS

While the investment attractiveness of the countries of the Visegrad Group has been studied for many years, nevertheless there are areas which still need to be analyzed more deeply. Studies on investment attractiveness at the regional level (i.e. smaller administrative units within a country) remain a challenge to researchers, as they would help better understand the reasons taken into account by entities with foreign capital when making location decisions. Such analyses would provide public administration with information about which incentives are most likely to attract FDI.

The literature rarely discusses the efficiency of State aid instruments in the context of FDI inflow to regions. Which incentives are more and which are less important for investors in a given sector? What is the motivation of multinational corporations when they decide on an FDI in, e.g., the pharmaceutical, automotive or electronics industry? Such studies are very important for the development of an effective policy for attracting investors.

A promising perspective is also delineated in in-depth studies on FDI's impact upon the economy of the host country. Opinions highlighting benefits for countries and regions resulting from FDI, rather common among theoreticians, economic practitioners and politicians, are becoming ever more thoroughly discussed and questioned by many economists. The negative effects of FDI in Central and eastern Europe were analyzed by e.g. Orłowski. According to his estimates, by increasing competition the larger inflow of FDI to Central and Eastern Europe decreased GDP growth in the private sector in these countries during the period 1990–1994, and GDP growth of domestic companies between 1995–2007 (Orłowski, 2010).Thus the final assessment of FDI's real impact on the economy is still unclear. Examples include its impact upon, e.g., the labour market, balance of payments, or the environment. In light of the increased environmental awareness of the general public, the last aspect seems particularly important. On one hand, the threats to the environment (particularly in less developed economies) resulting from the excessive exploitation of natural resources, increased consumption and shifting "contaminating" production processes to countries where environmental regulations are less stringent (the creation of so-called 'pollution havens') are highlighted. On the other hand, investors usually originate from OECD countries, where technological and organizational advancement is high, which may lead to dissemination of good practices across the host countries (Gentry, 1999; Wysokińska, Witkowska, 2004).

In brief, there are many areas which may become subjects for future studies at both the regional and national levels for the entire Visegrad Group. The problem, however, is the limited availability of qualitative and quantitative data at regional and sub-regional levels, which complicates in-depth analyses.

CONCLUSION

International links among businesses do not consist exclusively in the exchange of goods and services. On the contrary, since the second half of the 20th century, and in particular in the past three decades, the flows of production factors have gained in importance, especially the flows of capital. Thus, international capital flows are one of the key phenomena in the modern global economy and have become the subject of numerous studies and analyses. FDI is a very important type of capital outflow, different from the others. It is connected with the emergence of a specific group of businesses – multinational corporations.

As evidenced by the studies, FDI stimulates growth and counteracts short-term economic problems of countries and regions. International capital flows take place when there are imbalances in the global economy, i.e., when there are countries with capital surpluses and countries with

capital shortages. Global capital outflows and FDI originate predominantly from the industrialized countries. They account for ca. 95% of cumulated FDI investments. In imports of capital their share is smaller, but still very high (ca. 80%). The second 'deficit' group is definitely more numerous and its members compete internationally for foreign capital. This group includes the countries of Central and Eastern Europe, which also includes the members of the Visegrad Group (Rymarczyk, 2006; Budnikowski, 2006).

As we stressed in the first part of the Chapter, enterprises may internationalize their operations in many sorts of ways. For sure, exports are the simplest way of expansion to foreign markets. Enterprises may also sell technologies to foreign partners. FDI is a more complex and costly solution. It requires additional outlays connected with taking over an existing business or starting a new one, and ensuring it will continue to operate in a different economic setup. Why then do investors decide to take this step? One of the most comprehensive answers to the question was proposed by the British economist J. H. Dunning in his OLI paradigm.

The potential benefits of FDI are shared between investors and host countries and regions. They touch upon many aspects of the economy. FDI seems particularly important to developing economies as it provides the gateway for the inflow of two factors vital for economic growth: capital and technology. In the literature one may also find arguments against FDI, connected with, e.g., the labour market, balance of payments, or monopolistic practices. However, a review of the empirical studies conducted in many countries and over different periods of time allows for a general conclusion that usually the benefits of FDI inflow exceed the costs, and its overall net effect is positive (Świerkocki, 2004; Budnikowski, 2006; Rymarczyk, 2006).

In the 1990s the countries of the Visegrad Group underwent unprecedented political and economic transformation. Liberalization of the provisions concerning foreign investments opened up their economies to external capital. Opening the national borders of countries which, at that time, suffered from shortages of products and services and offered access to relatively cheap production factors enhanced investors' interest. There were still many legal, administrative or infrastructural barriers, which were and are still being gradually removed. At the same time, various incentives were put in place, e.g., subsidies and special economic zones designed to encourage foreign capital investors to choose a particular location and to pursue business operations there. These processes were reinforced by EU integration, which brought with it also the availability of additional resources from the EU cohesion policy budget. All of the above have made Central and Eastern Europe, and especially the Visegrad Group countries, one of the most attractive FDI locations globally. Thus, in general, the assessment and prognosis is rather positive. This does not mean, however, that public administration has nothing to do to support foreign investors.

Studies by Nikolovová (2012) show, *inter alia*, that the countries of the Visegrad Group seem to benefit a lot from FDI spillovers. The presence of MNEs in these countries is "above the average for Eastern Europe, reinforcing the economic significance of the estimated positive effect." (Nikolovová, 2012, p. 28). The effect is the strongest for industries with lower technological intensity, "where it is consistently significant across all specifications." (Nikolovová, 2012, p. 32).

The inflow of foreign capital usually leads to the creation of new jobs, and this is particularly true of greenfield investment projects. They ensure employment not only when a company starts working but already, indirectly, when it is being constructed. In the 1990s in the Czech Republic, Slovakia, and Poland FDI inflow increased employment in most industrial sectors. The situation was different in Hungary, where in some industries, such as food processing, metallurgy or furniture manufacturing, employment in companies with

foreign capital decreased, while simultaneously there was increased employment in local businesses in the same industries (Mickiewicz, Radosevic & Varblane, 2000).

Moreover, entities with foreign capital are often buyers of local products and services. This is another way FDI may contribute to economic recovery in many regions. This is confirmed by, e.g., direct studies conducted in Poland at the regional level (Dorożyński, Urbaniak, 2011).

Foreign enterprises are usually more inclined to export than companies with exclusively domestic capital, which means they are important for international trade turnover and, as a corollary, impact the balance of payments. Many big multinational corporations present in Visegrad Group countries are also major exporters in the host countries. These are mainly businesses from the automotive, major appliances and audiovisual equipment industries. In Poland in 2010 export operations were carried out by 41% of all companies with foreign capital. (Ministry of Economy, 2012, p. 226).

The positive impact of foreign investors also consists in the dissemination of innovative work organization methods and personnel management, which improves discipline and productivity. Synthetically, this phenomenon is reflected in the labour productivity index, which in the period 2000-2011 increased by ca. 42% for the entire Visegrad Group, which was higher compared to the average for the OECD countries (18%) or for the countries of the euro area (11%).[15] It is also clear that in companies with foreign capital average labour productivity is higher, which is evidenced, e.g., by the data for Poland. In the years 2000-2007 labour productivity in businesses with foreign capital was 64% higher than in businesses with exclusively Polish capital (Hybel, 2011, p. 27).

The role of foreign investors as animators of economic recovery in the Visegrad Group was not limited to manufacturing, services and trade. They also contributed to the boom in construction by showing their interest in locating their R&D and logistics centres in the Visegrad countries. This is undoubtedly a huge advantage of FDI inflow, as Poland is one of the least innovative countries among all of the EU developed economies, which is confirmed by its poor position in all global innovation rankings.[16] According to the *Innovation Union Scoreboard*, which analyzes 27 EU economies, Poland ranks 24th, ahead of only Bulgaria, Romania, and Latvia. The remaining three Visegrad Group countries are referred to as moderate innovators.(Innovation Union Scoreboard 2013, 2013, p. 5.).

In summary, the general assessment of FDI inflow to Poland, the Czech Republic, Hungary, and Slovakia is positive. All these countries introduced significant changes, which made them attractive investment destinations. This, however, should not be taken for granted. One must not forget the competition of other countries and regions in the world. Advantages based only on cheap labour and low operational costs are not enough. This means that public administration should continuously strive to improve the investment attractiveness of regions by, e.g., investing in hard and soft infrastructure.

Studies also show that investors more and more often select a particular location taking into consideration not only the conditions for running a business, but also the standard of living. Hence investment should also be made into social infrastructure, in particular in education, healthcare, sports and leisure, and environmental protection.

All these factors mean that now more than ever the burden of meeting the increasing challenges relating to attracting and retaining foreign investors in regions will fall upon the shoulders of regional and local administrators. The latter are the best placed, with all their competences and resources, to create attractive and favourable conditions for running a business in a given territory. It is also a challenge for researchers, as regional investment attractiveness is very rarely the subject of in-depth studies. Such studies would help better understand the premises upon which entities with

foreign capital base their location decisions, and support public administration in making effective use of budgetary resources.

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KEY TERMS AND DEFINITIONS

Cohesion Policy: One of the goals of economic restructuring and modernization is to increase cohesion between individual areas. Cohesion policy includes actions by public authorities designed to stimulate social and economic development in regions. Its main objective is to restrict economic, social, and territorial disparities, ensuring sustainable growth and enhancing competitiveness and innovation in all regions.

Economic Transformation: Change of an economic system, in particular shifting from a centrally-planned to a market economy, based on a functioning free market, competition, and private business. Centrally-planned economies were in place in most of the Central and East European countries until the end of the 1980s. This made the economy fully dependent on the decisions of central authorities. Private business was limited to the minimum, production assets were fully owned by the state, there were no financial or capital markets, market mechanism did not function, prices were decided by officials, and competition was replaced by a monopoly. Trade with third countries was regulated.

Foreign Direct Investment: A specific type of capital flow, consisting in taking control over a company based in one country by residents of another country by either starting an independent

economic activity from scratch or by acquiring management control over an existing company. Investment may also consist in the acquisition of fixed assets abroad with a view to expand the current operations and to create a joint venture with a foreign entity.

Industrial Park: An area with a real estate complex and technical facilities, usually abandoned by an already liquidated or restructured enterprise. It is usually managed by the local authority, which uses it to create favorable conditions for businesses, especially SMEs.

Portfolio Investment: Acquisition by investors from one country of financial assets (mainly Treasury securities) in another country. Portfolio investment differs from FDI as in the first case an investor satisfies himself with return on her/his capital while in FDI he/she acquires active management interest and responsibility over businesses in a given country.

Special Economic Zone: A geographical area in a given country dedicated for economic operations conducted on specific terms laid down in appropriate legal regulations. Economic zones are created to stimulate the economic growth of a given region through the development of specific industries, implementation of new technologies, creation of new jobs, exports, and managing and modernizing existing infrastructure and industrial assets. Entities authorized to operate within the special zone may expect to benefit from various types of State aid, e.g. income tax allowances.

State Aid: Any action undertaken by state authorities consisting in granting aid, in any form whatsoever, to an individual entrepreneur or to a group of entities, which distorts competition on the market. In the EU State aid is regulated in Art. 107 and 108 TFEU. The following premises must be met (jointly) to reach a finding that we are dealing with incompatible State aid: (1) A measure is an aid to an undertaking; (2) Aid is granted by the State or from the State resources; (3) Aid favors certain undertakings or the production of certain goods; (4) Aid distorts competition or threatens to distorts it; (5) Aid distorts trade among member states; (6)Aid is not covered by any of the Treaty exemptions. An example of aid covered by the Treaty exemption and, as such, compatible with the EU market, is aid to promote economic development of areas where the standard of living is abnormally low or where there is serious underemployment. State aid consists in granting direct financial or in-kind advantages to the beneficiary, e.g. subsidies, grants for equipment, etc. State aid may also consist in the reduction of public and legal liabilities of the beneficiary, e.g., liabilities write-offs.

Visegrad Group: An informal regional alliance of four countries of Central and Eastern Europe, member states of the EU: Poland, Czech Republic, Hungary, and Slovakia. The countries are joined not only because of geographical proximity, but also due to shared similar political fate, history, culture, and tradition. The Group originated in a summit meeting on 15 February1991in the Hungarian town of Visegrad where the Declaration laying down the framework of their cooperation was signed by the Presidents of Poland, Hungary and Czechoslovakia. In the initial period, the Group focused on democracy building, market economy, and aspiring to EU membership. Its present tasks deal with regional cooperation and joint initiatives within the EU in the area of transport infrastructure, power and energy, as well as culture, education, science, and youth mobility.

ENDNOTES

1 In the literature a lot of attention is paid to demonstrating the reverse link: labor market flexibility as an FDI inflow stimulator. An extensive review of literature in this field can be found in Parcon (2008).

2 According to UNCTAD terminology, "developed economies" encompass the twenty-seven member states of the EU, plus Australia,

Bermuda, Canada, Gibraltar, Iceland, Israel, Japan, New Zealand, Norway, Switzerland, and the United States. "Transition economies" encompass six countries of South-East Europe (Albania, Bosnia and Herzegovina, Croatia, The FYR of Macedonia, Montenegro, and Serbia), and the twelve countries of the Commonwealth of Independent States: Armenia, Azerbaijan, Belarus, Georgia, Kazakhstan, Kyrgyzstan, the Republic of Moldova, Russian Federation, Tajikistan, Turkmenistan, Ukraine, and Uzbekistan. All other countries are "developing economies."

[3] The notion and scope of Central and Eastern Europe are defined in many sorts of ways in the existing literature. R.C. Ostergren and J.G. Rice (2004), in their concept of macro-regions, making reference to O. Halecki (1950, 1994), included states independent in the intra-war period (also Austria) situated among Scandinavia, Germany and Italy on the west and Russia on the east into Central and Eastern Europe. Poland is the biggest country in this part of Europe. The American textbook *Europe and the Mediterranen* describes Central Europe as a part of the continent between France in the west and Russia in the east. It includes countries like: Germany, Poland, Czech Republic, Slovakia, and Austria. The British *Europe, regional geography*, considers Switzerland a part of Central Europe. Eastern Europe includes only Russia, while Bulgaria, Romania, Yugoslavia, and Albania belong to the South-Central region (Shackleton, 1969). For the needs of this publication we adopted the most commonly used scope of Central and Eastern Europe, which includes: Poland, Czech Republic, Slovakia, and Hungary (Visegrad Group), Baltic States (Lithuania, Latvia, and Estonia), countries of the former Yugoslavia, Romania, Bulgaria, and Albania. There are controversies over Ukraine and Belarus. In seems certain that in the event of their political convergence with European and Transatlantic structures (more probable in the case of Ukraine), they will be included in the concept of Central and Eastern Europe for the purposes of economic studies. (Bański, 2008).

[4] Capital in transit involves transactions of the so-called 'Special Purpose Entities', which, for tax optimization reasons, transfer funds through certain countries on order of the parent corporation.

[5] The notion of competitiveness, as intended by the WEF combines the twelve pillars of competitiveness with three stages of economic development of a given country: factor-driven economy, efficiency-driven economy, and innovation-driven economy.

[6] The GCI measures the level of competitiveness of an economy, defined as the set of institutions, policies, and factors that determine the level of productivity of an economy.

[7] The FDI Confidence Index is a regular survey of global executives conducted by A.T. Kearney. The Index provides a look at the present and future prospects for international investment flows.

[8] The Czech Republic borders the Western European markets of Germany and Austria. Hungary is closest to the Southern European markets, and also has good access to Western Europe. Poland borders the major Western European markets of Germany and the Baltic Sea, together with access to the Ukraine and the Baltic markets. Slovakia has borders with the other three Central and European states, and access to the Ukraine and the CIS markets. Its capital city is extremely close to Vienna. For more on localization advantages, see Foreign direct investment in Central and Eastern Europe (2011).

[9] Program for supporting investment important for Polish economy for the years 2011–2020.

[10] These industries generate the highest value added and contribute the most to economic development and fostering competitive advantages.

[11] Higher ranking position means simpler and more favorable regulations of business activities, and more and higher quality reforms in individual countries.

[12] Global average is 3.6, EU – 4.03.

[13] Global average is 3.8.

[14] www.eurofundsnews.pl/content/view/15576/104/

[15] Own calculations based on OECD.StatExtracts (as at August 2013).

[16] In the *Global Innovation Index* Poland ranks 44th (28th in Europe), in the *Global Creativity Index 2011* – 41th, in the *Economist Intelligence Unit* – 44th, in *The Global Competitiveness Index 2012–2013* – also 44th, and in the *Knowledge Economy Index* 2012 – 38th.

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Chapter 42
Racial Differences in Financial Socialization and Financial Behaviors of U.S. College Students

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ABSTRACT

This chapter focuses on the effect of race on financial socialization and financial behavior of college students. Data (N = 13,845) were collected from current college students age 18 and over via an online survey throughout the United States during spring and fall of 2008. Results from means comparisons showed significant differences on the financial socialization between Black and White college students. Logistic regression results suggest important relationship exist between race and financial behaviors. Black students were less likely to save and more likely to engage in risky credit card behavior than White students after controlling for the effects of all other variables.

INTRODUCTION

The capacity to manage personal finances has become increasingly important, particularly for college students. Students are now leaving schools without the ability to make critical financial decisions affecting their future lives and thus, are in danger of beginning a downward financial spiral of debt. This is debt that they will not easily repay while in college or even after they have gained fulltime employment in the workplace (Henry, Weber, & Yarbrough, 2001; Grable & Joo, 2006). Henry et al. (2001) revealed that 68% of college students rarely budgeted or did not budget at all.

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In a follow up study, Joo et al. (2003) found that only half of the students paid their credit card bills in full each month and 40% did not know the annual percentage rate of their credit cards. Some researchers concluded that Black students with low income were more likely to engage in responsible financial management behaviors than their White counterparts (e.g. Perry & Morris, 2005). Lyons' (2004) study showed racial differences with students who are having difficulty making credit card payments were more likely to be Black, and/or Hispanic. Her study also found that Black students were also significantly more likely to have credit card balances of $ 1000 or more and not to pay their balances in full each month. Grable and Joo (2006) found that racial differences between Black and White students on financial behaviors; Where Blacks held more credit card debt than others and credit card debt was positively related to negative financial behaviors. Researchers have also speculated that White and Black families save differently and that these differences have important implications for wealth inequality (Brimmer, 1988; Parcel, 1982). Burlew, Banks, McAdoo, and Azibo (1992) suggested that a common goal among Blacks is to have a standard of living comparable to their peers, both Whites and Blacks. This goal might lead to a lower emphasis on savings (Yao, Gutter, & Hanna, 2005).

An analysis of the 2004 Survey of Consumer Finances showed that Black households were significantly less likely to have spent less than their income when compared to Whites. Based on an analysis of the 2004 Survey of Consumer Finances, with 41% of Black households, and 60% of White households reporting that they spent less than they had in income (Bucks, Kennickell, & Moore,2006), and Black families saw a 24.1 percent decline in their median net worth from 2004 to 2007 (Bucks et al., 2009). Also Black households were significantly more likely than White households to have missed or been late on a loan payment (40% versus 18%). Controlling for income and other factors, Black households had higher predicted delinquency rates than White households (Bucks et al. 2009). What is less well known is how financial socialization differs based on racial background. Thus, the current study aims exposure to potential differences in financial socialization between Black and White college students and the effects that these differences may have on financial behaviors (budgeting, saving, and risky credit card usage).This research is important, in that it is vital for Blacks and Whites to gain financial knowledge. A few papers examine the link between knowledge and behavior and authors found strong links between knowledge and behavior (e.g., Borden, Lee, Serido, & Collins, 2008; Hilgert, Hogarth, & Beverly, 2003; Robb, 2011). Both Black and White college students will eventually be responsible for their own finances. If Blacks are missing out on early positive financial socialization opportunities, they may be negatively affected later in life by financial issues, in which they have little knowledge or tools to resolve. By finding out whether or not individuals are socialized differently in the financial realm, we can determine next steps in closing this potential race gap.

THEORETICAL FRAMEWORK

Socialization is often viewed as a social process by which norms, attitudes, motivations, and behaviors are transmitted from specific sources (commonly known as socialization agents) to the learner (Brim, 1966; Hira, 1997; McLeod &O'Keefe, 1972; McNeal, 1987; Moschis, 1981). Children who emulate their parents' behavior through observations provide a good example of social learning (Bandura, 1977; Grossbart, Carlson, & Walsh, 1991; Maccoby, 1992; Mascarenhas & Higby, 1993; Moschis & Churchill, 1978). Based on social learning theory, consumer socialization research suggests that a great deal of consumer behavior, such as spending behavior among adults,

is learned during the adolescent years through the influence of socialization agents such as parents, family members, and other influential individuals and can be taught from generation to generation (Churchill & Moschis, 1979; Moschis & Moore, 1984; Valence, d'Astous, & Fourtier, 1988). Consumer socialization theory explores the effects of both social-structural constraints (the social variables, such as social class, gender, and age, that can have an effect in socialization by influencing learning processes) and socialization agents (that is, parents, peers, school, and/or television,) on the mental and behavioral outcomes (e.g., the process through which parents teach consumer skills to children) (Moschis & Churchill, 1978). Several previous studies have revealed that parents' intentional instruction and reinforcing activities can directly and indirectly impact their children's financial knowledge and behavior. Parents appear to play an important role in the consumer socialization of their offspring, and they are instrumental in teaching them the rational aspects of consumption (Danes, 1994; Drentea & Lavrakas, 2000; Hayhoe et al., 2000; Lyons, Scherpf, & Roberts, 2006; Moschis, 1985).

The cultural-difference version of the socialization hypothesis states that Blacks socialize their children differently because they have a different culture which requires social and other competencies different from those valued in the white culture (Ogbu, 1979; Rong & Brown, 2002). Race and ethnicity is representative of the shared history and socialization of a group and, thus, should impact financial preferences. Differences in socialization among different racial and ethnic groups might also influence preferences such as budgeting or saving behavior (Dilworth-Anderson, Burton, & Johnson, 1993). In particular, a history of less exposure to financial markets and financial information, greater labor force participation instability (Hsueh & Tienda, 1996), discrimination, having lower levels of wealth (Kennickell, Starr-Mcluer, & Surette, 2000; Aizcorbe et al., 2003) and differences in family composition are likely to make Blacks are less likely to engage in positive financial behaviors (Dilworth-Anderson et al., 2005). Therefore, it is expected that Whites are more likely to engage in positive financial behaviors than Blacks. Some differences might be related to other factors such as gender, income, and debt, but if significant differences remain after controlling for these factors in multivariate analyses, the financial socialization explanation presents a plausible alternative. Thus, this research aims to look at differences in financial socialization between Black and White college students and the effects that these differences have on financial behaviors, such as budgeting and saving. In the current study, financial socialization is represented by financial social learning opportunities such as discussing financial matters with parents and peers; or observing their financial behaviors.

Research Questions and Hypotheses

According to previous research (e.g. Chen & Volpe, 1998) we see that various behavior differences in Blacks and Whites may be partially affected by differences in socialization. There is evidence that race differences exist in various areas of financial behavior (e.g. Lyons, 2004). It stands to reason that if people are socialized differently based on race for some behaviors, that they may also be socialized differently for financial behaviors. This study seeks to expand that research to the area of financial socialization and financial behaviors, with the following hypotheses:

1. Exposure to financial social learning opportunities will differ by race of college students.
2. There is a relationship between race and financial behaviors when controlling for social learning opportunities, gender, marital status, income, amount of debt, and financial education.

METHOD

Data and Sample

Data for this study was collected as part of a larger study on the impact of financial education on financial behaviors during the spring and fall semesters of 2008. A stratified random sampling technique based on state policies toward financial education was utilized. Six policy categories were determined using the 2004 National Council on Economic Education report. States were randomly selected from each of the categories, with the target campuses being large state universities. The sampling pool consisted of college students, age 18 and over, from 15 public universities across the United States.

In total, emails were sent out to 172,412 students, with 16,876 students responding to the survey. Students who were not educated in the United States, who were homeschooled, who received a GED, or who did not indicate their state of high school attendance or whether they are Hispanic, Asian, and other ethnicity were removed from the sample, yielding a final sample of 13,845 students (5.3% Blacks, 94.7%Whites). The sample profile is fairly typical, with an average age of 21.3 years. In addition, most students were female (65.6%), most were White (94.7%), and most were unmarried (85.5%).

Measurement of Variables

Dependent Variables

Financial Behaviors: This includes budgeting, saving and risky credit usage behaviors. Budgeting was measured with the question, "Do you currently use a system to manage expenses and avoid overspending?" Saving was measured with the question, "Are you currently depositing/investing money on a regular basis into some sort of account (includes employer plans, mutual funds, individual retirement account (IRA), savings, CDs)?" Responses included yes or no. Credit usage behaviors are based on a score of risky credit card behaviors. Students were asked "how frequently in the past year they had done the following: maxed out their credit, been delinquent, and carried a balance." Responses included 0, 1-2, 3-5, 6 or more, and N/A represent if students doesn't have credit card. For the analyses to each of the risky credit card behavior 1-2, 3-5, 6 or more were combined as 1 which indicated that students have engaged risky credit card behavior and 0 indicated that students have not engaged risky credit card behavior. Then, for the ordinal logistic regression analysis three risky credit card behaviors ("max out," make late payments, and do not pay off credit card balance) combined as 0, (no risky credit card behavior) 1 (engaged one risky credit card behavior), 2 (engaged two risky credit card behavior), and 3 (engaged three risky credit card behavior) with more frequent behaviors indicating higher credit risk scores.

Independent Variables

Demographic Variables: The current study involved the following college students' demographic variables: gender, race, and marital status.

Financial Variables: In this research, financial variables were measured using monthly income, amount of debt, and number of credit cards.

Financial Education: Financial education was measured with the question, "Were you taught about personal finances in high school?" and "Have you ever taken a course, program, or seminar on personal finance issues in your community, religious institution, or 4H-in other words not through school?" Responses were categorical and included yes or no.

Financial Social Learning Opportunities: The financial social learning opportunities score was a composite measure based on four dimensions: discussions with parents, discussions with peers, observing parents and observing peers. The score utilized responses to eight items representing

these four dimensions. Scores for each dimension ranged from 8 to 40. This measure is based on the work of Gutter and Garrison (2008). Students were asked how frequently in the past five years they had discussed the following with their parents and friends or other students: "managing expenses and avoiding over spending," "checking their credit report," "paying bills on time," "saving and investing," "working with a mainstream financial institution," "buying and maintaining health insurance," "auto insurance" and "renters' insurance." A similar set of questions was asked but focusing on observations of the same behaviors. The student answered by using a 5 point scale from 1= never to 5= often. In order to test the reliability of the measure, Cronbach's Alpha was selected. Cronbach's Alpha internal consistency reliability was calculated to be.86 for both discussion with parents and discussion with friends. The inter-item reliability was high for both observing parents (α=.87) and observing friends (α=.86).

Analyses

Preliminary exploration of the research questions included simple bivariate comparisons employing cross-tabulation tables and chi-square test to examine whether or not the profile of the sample, financial socialization, risky credit usage behaviors, and financial behaviors differed by race. For social learning opportunities, each of the four social learning opportunities scores was compared by race via independent sample *t*-test. The results of the *t*-test indicate overall significant race differences for each form of financial socialization. This was followed by binary logistic regression for budgeting, saving and ordinal logistic regression for risky credit card usage behavior. The dependent variables included using a budget, saving, and students' risky credit usage behaviors. The purpose of this analysis was to determine the relationship of race on varying financial behaviors, controlling for financial social learning opportunities, gender, marital status, income, debt and prior financial education. The effect of race on varying risky credit card usage behavior also controlled for credit card number. Specifically, we used logistic regression equations to examine main effects and interaction models. Main effects models included race, gender, marital status, income, debt and prior financial education as predictors of financial behaviors and number of credit card as predictor of risky credit card usage. Interaction models added race by sample characteristics product terms (e.g., RaceXGender) to our main effects model. Interaction analyses addressed whether the effects of college students characteristics on financial behaviors differed between Blacks and Whites. The interaction model and the reduced model were compared to determine whether factors improved the model. This was tested using a likelihood ratio test. The test was significant and the reduced model was rejected in favor of the full (interaction) model.

RESULTS

Comparing Students' Profile by Race

The sample was composed of 94.7% Whites and 5.3% Blacks. Many of the students in both samples reported having a course in personal finance (41.1% of Blacks, 38.8% of Whites) in high school (p>.05). Black students were significantly more likely to have a personal finance education (22.6%) in their communities compared to White students (8.5%) (p<.001). Although the vast majority of both Blacks (74.7%) and Whites (65.1%) were female, there were also significant gender differences by race (p<.001). Most of the students in both samples were single (87.9% of Blacks, 85.3% of Whites) (p>.05). There were also significant differences in income (p<.001), amount of debt (p<.001), and number of credit card (p<.001) between Blacks and Whites with Blacks were more likely to have no income and

more likely to have debt and less likely to holding credit cards than Whites.

For financial discussions with parents, Blacks had an average score of 2.94 and Whites had an average score of 2.73 ($p<.001$), indicating that Blacks had significantly more social learning opportunities where they discussed financial matters with their parents. For financial discussions with peers, Blacks had an average score of 2.38 and Whites had an average score of 2.11 ($p<.001$), indicating that Blacks had significantly more social learning opportunities where they discussed financial matters with their peers. For observing parents' financial behaviors, Blacks had an average score of 3.43 and Whites had an average score of 3.38 ($p>.05$), indicating that Blacks had more social learning opportunities where they observed their parents engaging in positive financial behaviors. However, between Blacks and Whites, there were no significant differences on observing their parents financial behaviors. For observing peers' financial behaviors, Blacks had an average score of 2.19 and Whites had an average score of 2.16 ($p>.05$), indicating that Blacks had more social learning opportunities where they observed their peers engaging in financial behaviors. Again, between Blacks and Whites, there were no significant differences on observing their peers financial behaviors. Results indicate that, in general, Black college students tend to have had more financial social learning opportunities than White college students. Additional *t*-tests were run by social learning topic within each social learning dimension to determine whether there were also significant race differences between exposures to individual topics with within each dimension.

For financial behaviors, each financial behaviors (budgeting, saving, and risky credit card usage behaviors) was tested by race via cross tab analysis with a χ^2 test. The result of the χ^2 test indicated that there were overall significant differences on financial behaviors by race ($p<.001$), except budgeting. The results of the χ^2 test are as follows: 50.8% of Blacks and 48.7% of Whites were budgeting; 42.5% of Blacks and 53.3% of Whites were saving; 23.7% of Blacks and 12.0% of Whites were "max out" their credit; 29.6% of Blacks and 13.8% of Whites make late payments; and 43.3% of Blacks and 29.8% of Whites were do not pay off their credit cards every month. These results indicate that Whites were significantly more likely than Blacks to be saving and Blacks had significantly more risky credit card behaviors than Whites (see Table 1).

Comparing Students' Financial Social Learning Opportunities Topics by Race

The results comparing the social learning topics of Black and White college students are summarized in Table 2. For financial discussions with parents, there were significant race differences in frequency of exposure to all topics, except for "buying/maintaining health insurance." Blacks were significantly more likely than Whites to have had discussions with their parents on all of the statements measuring financial discussion with parents: "managing expenses, avoiding overspending," "checking credit reports," "paying bills on time," "saving and investing money," "working with a mainstream financial institution," "buying and maintaining auto insurance," and "buying and maintaining renters' insurance" ($p<.001$).

For financial discussions with peers, there were significant racial differences in frequency of exposure for all topics. Blacks were significantly more likely than Whites to have had discussions with their peers on all of the statements measuring financial discussion with friends: "managing expenses, avoiding overspending," "checking credit report," "paying bills on time," "saving and investing money," "working with a mainstream financial institution" ($p<.001$), "buying and maintaining health insurance" ($p<.05$), "buying and maintaining auto insurance," and "buying and maintaining renters' insurance" ($p<.001$). This result suggests that students who Blacks were

Table 1. Characteristics of black and white college students

Variable	Mean/Proportion		Significance Test for Difference between Sample
	Whites (n=13,113)	Blacks (n=732)	
Previous Financial Education			
High School	38.8%	41.0%	χ^2=1.37
Community	8.5%	22.6%	χ^2=122.80***
Gender			χ^2=29.34***
Female	65.1%	74.7%	
Male	34.9%	25.3%	
Marital Status			χ^2=3.80
Single	85.3%	87.9%	
Married/Cohabitating	14.7%	12.1%	
Income			χ^2=15.44***
$0	38.3%	45.1%	
$1-$499	35.3%	33.1%	
500-$999	15.8%	14.3%	
$1000 and above	10.1%	7.5%	
Amount of Debt			χ^2=38.78***
$0	77.4%	70.6%	
$1-$999	5.8%	10.4%	
$1000-$4999	4.9%	5.9%	
$5000 and above	9.9%	9.5%	
Not sure	2.0%	3.6%	
Credit Card Number			χ^2=29.24***
0	26.0%	38.3%	
1 and more	74.0%	61.7%	
Social Learning Opportunities Score			
Financial discussions with parents	2.73 (.97)	2.94 (1.08)	t=-5.361***
Financial discussions with peers	2.11 (.81)	2.38 (1.05)	t=-8.044***
Observe parents' behaviors	3.38 (1.09)	3.43 (1.19)	t=-1.121
Observe peers' behaviors	2.16 (.89)	2.19 (1.02)	t=-.758
Financial Behaviors			
Budgeting	48.7%	50.8%	χ^2=.640
Saving	53.3%	42.5%	χ^2=17.49***
"Max out"	12.0%	23.7%	χ^2=35.52***
Make late payments	13.8%	29.6%	χ^2=56.64***
Do not pay off	29.8%	43.3%	χ^2=27.93***

*p<.05, **p<.01, ***p<.001

Table 2. Exposure to social learning topics by race

Variable	Mean Score			*t*-value
	Whites	Blacks	Total	
Discussed Finances with Parents	2.73 (.97)	2.94 (1.08)	2.74 (.97)	-5.361***
Managing expenses and avoiding overspending	3.63 (1.35)	3.86 (1.39)	3.64 (1.35)	-4.291***
Checking credit report	2.02 (1.28)	2.36 (1.51)	2.04 (1.29)	-6.588***
Paying bills on time	3.44 (1.46)	3.71 (1.54)	3.45 (1.47)	-4.638***
Saving and investing money	3.61 (1.34)	3.76 (1.42)	3.62 (1.35)	-2.671**
Working with a mainstream financial institution	2.50 (1.49)	2.72 (1.66)	2.51 (1.50)	-3.650***
Buying and maintaining health insurance	2.31 (1.40)	2.41 (1.55)	2.31 (1.41)	-1.902
Buying and maintaining auto insurance	2.57 (1.43)	2.77 (1.58)	2.58 (1.44)	-3.530***
Buying and maintaining renters insurance	1.74 (1.15)	1.93 (1.41)	1.75 (1.17)	-4.115***
Discussed Finances with Friends	2.11 (.81)	2.38 (1.05)	2.13 (.83)	-8.044***
Managing expenses and avoiding overspending	3.16 (1.35)	3.39 (1.48)	3.18 (1.36)	-4.190***
Checking credit report	1.62 (.98)	1.98 (1.36)	1.64 (1.00)	-9.090***
Paying bills on time	2.61 (1.37)	3.04 (1.55)	2.63 (1.38)	-7.846***
Saving and investing money	2.87 (1.29)	3.19 (1.48)	2.88 (1.30)	-6.335***
Working with a mainstream financial institution	1.73 (1.11)	2.02 (1.41)	1.75 (1.12)	-6.468***
Buying and maintaining health insurance	1.75 (1.11)	1.84 (1.29)	1.75 (1.12)	-1.993*
Buying and maintaining auto insurance	1.72 (1.05)	1.99 (1.37)	1.73 (1.07)	-6.306***
Buying and maintaining renters insurance	1.43 (.85)	1.57 (1.15)	1.44 (.87)	-4.065***
Observed Parents Financial Behaviors	3.38 (1.09)	3.43 (1.19)	3.38 (1.09)	-1.121
Managing expenses and avoiding overspending	4.00 (1.33)	3.92 (1.46)	3.99 (1.34)	1.449
Checking credit report	2.30 (1.59)	2.69 (1.71)	2.32 (1.59)	-5.932***
Paying bills on time	4.16 (1.29)	4.08 (1.35)	4.16 (1.29)	1.595
Saving and investing money	3.89 (1.39)	3.64 (1.55)	3.88 (1.40)	4.422***
Working with a mainstream financial institution	3.44 (1.68)	3.35 (1.75)	3.44 (1.69)	1.314
Buying and maintaining health insurance	3.60 (1.56)	3.62 (1.64)	3.60 (1.56)	-.328
Buying and maintaining auto insurance	3.69 (1.51)	3.85 (1.54)	3.70 (1.51)	-2.575**
Buying and maintaining renters insurance	1.90 (1.61)	2.26 (1.80)	1.92 (1.62)	-5.340***
Observed Friends Financial Behaviors	2.16 (.89)	2.19 (1.02)	2.16 (.90)	-.758
Managing expenses and avoiding overspending	3.12 (1.39)	3.07 (1.51)	3.12 (1.39)	.851
Checking credit report	1.57(1.05)	1.77 (1.30)	1.58 (1.06)	-4.738***
Paying bills on time	2.89 (1.44)	2.81 (1.52)	2.89 (1.45)	1.466
Saving and investing money	2.55 (1.33)	2.59 (1.43)	2.55 (1.33)	-.753
Working with a mainstream financial institution	2.23 (1.45)	2.19 (1.51)	2.23 (1.46)	.657
Buying and maintaining health insurance	1.64 (1.15)	1.66 (1.23)	1.64 (1.15)	-.401
Buying and maintaining auto insurance	1.91 (1.27)	2.03 (1.43)	1.91 (1.28)	-2.476*
Buying and maintaining renters insurance	1.38 (.94)	1.40 (1.07)	1.38 (.94)	-.563

NOTE: Items use a 5-point Likert scale, with higher values indicating more discussed and observed responses. Statistically significant differences were tested using *t*-test.

*$p<.05$, **$p<.01$, $p<.001$

more likely to have engaged in or be engaging in financial discussions with parents and peers.

For observing parents' financial behaviors, there were significant race differences in frequency of exposure to some topics. Blacks were significantly more likely than Whites to have observed their parents with regard to "checking their credit report," "buying and maintaining auto insurance" ($p<.01$), and "buying and maintaining renters insurance" ($p<.001$). However, Whites were significantly more likely than Blacks have observed their parents with regard to "saving and investing money" ($p<.001$). For observing peers' financial behaviors, there were significant race differences in frequency of exposure to only two topics. Blacks were significantly more likely than Whites to have observed their peers with regard to "checking credit report" ($p<.001$) and "buying and maintaining auto insurance" ($p<.05$).

Relationship between Financial Behaviors and Race

This section addresses the second hypotheses and determines the effect of race on varying of financial behaviors, controlling for gender, marital status, income, amount of debt, prior financial education, and financial social learning opportunities. Table 3 summarizes the results of logistic regressions predicting budgeting behavior. As seen in Table 3, there was no significant relationship between race and budgeting. However, there was positive relationship between financial social learning opportunities and budgeting. Students who discussed personal finances more frequently with their parents and peers and more frequently observed their parents' financial behaviors were more likely to be budgeting than those who did not discuss finance with their parents and peers,

Table 3. Logistic regression of budgeting

Variable	Reduced Model		Interaction Model	
	β	Odds Ratio	β	Odds Ratio
Race (Black=1)	-.017	.983	-.011	.989
Gender (Male=1)	-.068	.934	-.058	.944
Marital Status (Single=1)	-.283***	.754	-.300***	.741
Income (Reference=None)				
$1-$499	-.118*	.889	-.103	.902
$500-$999	-.015	.985	.011	1.011
$1000 and above	.329***	1.389	.347***	1.414
Debt (Reference=None)				
$1-$999	-.180	.835	-.160	.852
$1000-$4999	-.115	.891	-.072	.930
$5000 and above	-.018	.982	-.047	.954
Not sure	-.066	.936	-.094	.910
Personal Finance				
High School	.157***	1.170	.161***	1.174
Community	.410***	1.507	.407***	1.503
Social Learning				
Financial discussions with parents	.183***	1.200	.182***	1.200
Financial discussions with peers	.112**	1.118	.085*	1.089

continued on following page

Table 3. Continued

Variable	Reduced Model		Interaction Model	
	β	Odds Ratio	β	Odds Ratio
Observe parents' behaviors	.096***	1.100	.098***	1.103
Observe peers' behaviors	.000	1.000	.020	1.020
Interaction Variables				
Race x gender			-.145	.865
Race x marital status			.343	1.409
Race x income$1-$499			-.488	.614
Race x income$500-$999			-.602	.548
Race x income$1000 and above			-.627	.534
Race x debt$1-$999			-.285	.752
Race x debt$1000-$4999			-1.187*	.305
Race x debt$5000 and above			.874	2.398
Race x debt Not sure			.484	1.622
Race x High School			-.076	.927
Race x Community			-.054	.948
Race x Financial discussions with parents			.081	1.085
Race x Financial discussions with peers			.491**	1.633
Race x Observe parents' behaviors			-.143	.867
Race x Observe peers' behaviors			-.379*	.685
Constant	-.905***	.405	-.901***	.406
χ^2 goodness-of-fit test	291.16***	*df*=16	319.94***	*df*=31
Cox & Snell R^2	.033		.036	
NagelkerkeR^2	.044		.048	
H-L goodness-of-fit test χ^2	6.027>.05	*df*=8	5.3888>.05	*df*=8
Likelihood Ratio Test statistic		-57.566	*p*<.001	

NOTE: Odds ratio and unstandardized coefficients are reported.
*p<.05, **p<.01, ***p<.001

and observed parents' financial behaviors. The odds of budgeting increased 20.0% and 12.0%, respectively, with a one unit increase in the parental and peers discussion, the odds of budgeting increased 10.0% with a one unit increase in the parental observation measures. Thus the more frequently parents modeled budgeting for their children, the greater the odds that students were doing those behaviors as well.

Gender was not a significant predictor for college students to be budgeting. Marital status, however, was a significant predictor of budgeting. Compared to married or cohabiting singles had a 24.6% decrease in the odds of budgeting. Income was a significant predictor of budgeting, but only at the $1-499 and $1000 and above level. Compared to students with no income, students with $1-499 in monthly income were had an 11.1% decrease in the odds of budgeting, however, $1000 and above in monthly income were had about 39.0% increase in the odds of budgeting. As shown by other research (Bernheim, Garrett, & Maki, 1997; Varcoe et al., 2005), prior personal financial education was also significant for students who

had taken personal finance in high school and in their community. Compared to students who had not taken a personal financial class in high school and in their community, students who had taken such a class in high school had a 17.0% increase in the odds of budgeting and students who had taken such a class in their community had about 51.0% increase in the odds of budgeting (Reduced model).

The significant two-way interaction of race and all other independent variables tested in interaction model, we found a statistically significant two-way interaction between race and a $1000-4999 level of debt: $1000-4999 amount of debt had a strong, negative relation with budgeting among Black students as compared to White students. Black students who have $1000-4999 amount of debt were had a 69.5% decreases in the odds of budgeting. We also found statistically significant two-way interactions between race and discussed finance with peers, and race and observe peers' financial behaviors, indicate that discussed finance with peers and observed peers' financial behaviors were more strongly related to budgeting among Black students than White students. Black students who more discussed finance with their peers were had about 63.0% increases in the odds of budgeting. However, Black students who more observed their peers financial behaviors were had about 31.5% decreases in the odds of budgeting (Interaction model).

There was some support for the second hypothesis which proposed a relationship between the likelihood of students' financial behaviors and race when controlling for social learning opportunities, gender, marital status, income, amount of debt, and financial education. As seen in Table 4, there was a negative relationship between students' saving behavior and race, indicate that the odds of saving were 39.6% lower for Blacks than for Whites. There was a positive relationship between financial social learning opportunities and saving behavior. Students who more frequently discussed personal finances with their parents and friends, and observed their parents financial behaviors were more likely to be saving than others. The odds of saving increased by 19.3% for each one-unit increase in the parents discussion measure, the odds of saving increased by 8.2% for each one-unit increase in the peers discussion measure, and the odds of saving increased by 11.7% for each one unit increase in the observing parents behaviors measure.

Table 4. Logistic regression of saving

Variable	Reduced Model		Interaction Model	
	β	Odds Ratio	β	Odds Ratio
Race (Black=1)	-504***	.604	-.130	.878
Gender (Male=1)	-.041	.959	-.034	.967
Marital Status (Single=1)	-.227***	.797	-.230***	.795
Income (Reference=None)				
$1-$499	.318***	1.374	.316***	1.371
$500-$999	.330***	1.391	.340***	1.404
$1000 and above	1.011***	2.748	1.008***	2.740
Debt (Reference=None)				
$1-$999	-.564***	.569	-.554***	.574
$1000-$4999	-.550***	.577	-.548***	.578

continued on following page

Table 4. Continued

Variable	Reduced Model		Interaction Model	
	β	Odds Ratio	β	Odds Ratio
$5000 and above	-.254***	.776	-.245**	.782
Not sure	-.232	.793	-.239	.787
Personal Finance				
High School	.095*	1.100	.081	1.085
Community	.416***	1.516	.400***	1.492
Social Learning				
Financial discussions with parents	.176***	1.193	.176***	1.193
Financial discussions with peers	.079*	1.082	.076*	1.079
Observe parents' behaviors	.111***	1.117	.118***	1.125
Observe peers' behaviors	-.025	.975	-.024	.977
Interaction Variables				
Race x gender			-.254	.776
Race x marital status			.047	1.048
Race x income$1-$499			.078	1.081
Race x income$500-$999			-.285	.752
Race x income$1000 and above			.122	1.130
Race x debt$1-$999			-.115	.891
Race x debt$1000-$4999			-.038	.963
Race x debt$5000 and above			-.342	.710
Race x debt Not sure			.110	1.116
Race x High School			.387	1.472
Race x Community			.201	1.222
Race x Financial discussions with parents			-.021	.979
Race x Financial discussions with peers			.068	1.070
Race x Observe parents' behaviors			-.141	.869
Race x Observe peers' behaviors			-.057	.945
Constant	-.878***	.416	-.892***	.410
χ^2 goodness-of-fit test	419.35***	df=16	426.21***	df=31
Cox & Snell R^2	.047		.048	
NagelkerkeR^2	.063		.064	
H-L goodness-of-fit test χ^2	14.599>.05	df=8	12.217>.05	df=8
Likelihood Ratio Test statistic		-13.718	p>.05	

NOTE: Odds ratio and unstandardized coefficients are reported.
*p<.05, **p<.01, ***p<.001

The regression results show that demographic and financial variables including marital status, income and amount of debt were significant determinants of the likelihood of saving. The odds of saving were 20.3% lower for singles than for married or cohabiting. Students with any income level were more likely than those with no income to be saving. As seen in Table 4, the odds of saving increased with greater income. For instance, the odds of saving were about 175% higher for students with income over $1,000 per month compared with students with no monthly income. As expected the odds of saving decreased with amount of debt. For instance, the odds of saving were 43.1% lower for students with debt $1-999, the odds of saving were 42.3% lower for students with debt $1000-4999, and the odds of saving were 22.4% lower for students with debt $5000 and over compared with students with no debt. Prior personal financial education was also significant for students who had taken personal finance in high school and in their community compared to students who had not taken a personal financial class in high school and in their community, students who had taken such a class in high school had a 10.0% increase in the odds of saving and students who had taken such a class in their community had about 51.6% increase in the odds of saving (Reduced model). The significant two-way interaction terms with race were tested in interaction model, but none were statistically significant (Interaction model).

Table 5 summarizes the results of logistic regressions predicting risky credit card behavior. As seen in Table 5, students who more frequently engaged the risky credit behaviors increased in the expected odds of risky credit card behaviors. When compared, those who engaged no risky credit card behavior and engaged 3 risky credit card behaviors had a 226%, engaged 1 risky credit card had a 356%, and engaged 2 risky credit card had a 484% increase in the expected log odds of risky credit usage. This indicated that students who higher scored of risky credit card behaviors increased in the odds of risky credit card usage. There was positive relationship between race and risky credit card behaviors. This indicates that compared to Whites, Blacks had a 17.4% increase in the expected log odds of risky credit card usage. There was also significant relationship between financial social learning opportunities and risky credit card usage. Students who observed more frequently their parents' financial behaviors were

Table 5. Ordinal logistic regression of risky credit card usage

Variable	Reduced Model		Interaction Model	
	β	Odds Ratio	β	Odds Ratio
Riskycredit=0	.3.264***	333.592	3.313***	293.092
Riskycredit=1	4.563***	632.953	4.616***	555.643
Riskycredit=2	5.841***	984.666	5.900***	869.879
Race (Black=1)	1.174***	91.974	1.180	3.377
Gender (Male=1)	-.141**	6.705	-.128*	5.357
Marital Status (Single=1)	-.278***	16.794	-.286***	17.189
Income (Reference=None)				
$1-$499	.304***	23.769	.295***	21.163
$500-$999	.681***	87.631	.671***	81.278
$1000 and above	.576***	47.517	.607***	50.885
Debt (Reference=None)				

continued on following page

Table 5. Continued

Variable	Reduced Model		Interaction Model	
	β	Odds Ratio	*β*	Odds Ratio
$1-$999	1.235***	167.696	1.225***	152.498
$1000-$4999	1.062***	113.715	1.047***	105.392
$5000 and above	.806***	110.908	.795***	104.137
Not sure	.215	1.277	.250	1.655
Credit card number	3.130***	476.874	3.184***	399.535
Personal Finance				
High School	-.053	1.015	-.061	1.271
Community	-.063	.572	-.048	.299
Social Learning				
Financial discussions with parents	-.042	1.663	-.038	1.307
Financial discussions with peers	.114**	8.745	.119**	8.954
Observe parents' behaviors	-.214***	53.581	-.211***	49.785
Observe peers' behaviors	.063	3.060	.051	1.862
Interaction Variables				
Race x gender			-.549	3.284
Race x marital status			.265	.488
Race x income$1-$499			.351	1.467
Race x income$500-$999			.373	1.068
Race x income$1000 and above			-1.072*	4.579
Race x debt$1-$999			.211	.323
Race x debt$1000-$4999			.147	.089
Race x debt$5000 and above			.367	.732
Race x debt Not sure			-.937	.971
Race x credit card number			-.363	.880
Race x High School			.266	.997
Race x Community			-.101	.109
Race x Financial discussions with parents			-.097	.363
Race x Financial discussions with peers			-.076	.249
Race x Observe parents' behaviors			-.006	.002
Race x Observe peers' behaviors			.221	2.147
χ^2 goodness-of-fit test	2142.84***	*df*=17	2163.83***	*df*=33
Cox & Snell R^2	.235		.237	
NagelkerkeR^2	.272		.274	
Goodness-of-fit test χ^2	31078.00<.05	*df*=23977	31793.18< 05	*df*=23961
Likelihood Ratio Test statistic		-41.988	*p*<.001	

NOTE: Odds ratio and unstandardized coefficients are reported.
*p<.05, **p<.01, ***p<.001

less likely to have risky credit usage behavior than those who did not observe parents' financial behaviors however, students who discussed more frequently personal finances with their peers were more likely to have risky credit card behavior than those who did not discuss finance with their peers. The odds of risky credit card usage decreased 78.6% with a one unit increase in the parental observation measures. For a one unit increase in peers' discussion, the expected ordered log odds of risky credit card usage increases 88.6%. Thus the more frequently parents modeled financial behaviors for their children, the lesser the odds of risky credit card usage.

Gender and marital status was a significant predictor for college students' risky credit card behavior. The ordered logit of risky credit card usage for males were 0.86 lower than females and for single 0.28 lower than married or cohabiting. Students with any income level were more likely than those with no income have risky credit card behavior. As seen in Table 5, the odds of saving were 0.70 higher for students with income $1-499, 0.32 higher for students with income $500-999, and 0.42 higher for students with income over $1,000 per month compared with students with no income. Students with any debt level also were more likely have risky credit card behavior than those with no debt. For every one unit increase with debt $1-999, the expected ordered log odds of risky credit card usage increases about 0.24 for students with debt $1-999, the ordered log odds of risky credit card usage increases 0.06 for students with debt $1000-4999, and the ordered log odds of risky credit card usage increases 0.20 for students with debt $5000 and over compared with students with no debt. Credit card number also was also significant for risky credit card behavior. Compared to students who had not a credit card, students who had one or more credit card had a 213% increase in the odds of risky credit card behavior (Reduced model).

The significant two-way interaction terms with race were tested in interaction model and we found a statistically significant two-way interaction between race and $1000 or over income: $1000 or over income had a stronger, negative relation with respect to risky credit card behavior among black students than among White students. Black students who have $1000 or over income had a 7.2% decreases in the odds of risky credit usage (Interaction model).

CONCLUSION AND IMPLICATIONS

The purpose of the present study examine whether or not there were racial differences in financial socialization and the effects that these differences on financial behaviors of college students. We report several major findings.

As expected, there were several significant differences inpersonal characteristics between the Black and White samples. Black students tended to be had more financial education in their communities than their White counterparts. There were significant differences among the financial resources variables of Blacks and White students. Although the higher levels of the sample reported no income, Blacks reported no income more frequently than did Blacks. For debt, Blacks reported no debt less than did Whites and Blacks more frequently reported debt than did Blacks. White students were more likely to holding credit cards than Black students. Bivariate analyses revealed that White students were saving significantly more than Black students, while Black students were engaging in significantly more risky credit card behaviors than White students. This suggests that Blacks differ from Whites regarding financial behaviors. However, it should be noted that there was no significant difference between Blacks and Whites on budgeting. It can be concluded that there are significant race differences in financial

behaviors among college students, with Blacks being more likely to engage in be risky credit card behaviors and less likely to be saving than Whites.

The first hypothesis stated that exposure to financial social learning opportunities would differ by race in college students. Previous research has noted that parents and peers play an important role in financial socialization (Gutter, Garrison, & Copur, 2010). This study also, focused on parents and peers as financial socialization agents. The results of the independent samples *t*-test between social learning dimensions and race, partly confirm that those who discussed financial matters with parents and peers differ by race, with Blacks being significantly more likely to have discussed financial matters with their parents and peers than Whites.

To further explore this difference, each financial social learning opportunity dimension was broken down by topic to determine whether there were specific race differences in topics discussed or behaviors observed with parents and peers. Consistent with the cultural-difference version of the socialization hypothesis, significant race differences were observed for many topics within each social learning dimension. Black students reported more discussion of finances with parents, on average (i.e., higher scores), on both the overall index and on each component items than Whites, but one of the items, particularly with regard to "buying and maintaining health insurance" was not significant. A similar relationship was found for financial discussions with peers. For this social learning dimension, Blacks significantly tended to have had more discussions with their peers on both the overall index and on each component items.

For observing parents' financial behaviors, Blacks tended to have more overall exposure to observing their parents' behaviors, but there was no significant difference between Blacks and Whites in the overall index. There were some significant racial differences on a few component items with regard to observing parents' behaviors. These included that Blacks were more likely than Whites to have observed parents' behaviors with regard to "checking their parents' credit report" and "buying and maintaining health and auto insurance" behaviors while Whites were more likely than Blacks to have observed "saving and investing money." The implications of Whites being significantly more likely to observe their parents saving and investing money behavior, when compared to Blacks, may be related why Whites are more likely to be saving than Blacks. For observing peers' financial behaviors, there was a significant racial difference on two items. Blacks were more likely than Whites to have observed their peers' behaviors with regard to "checking a credit repor*t*" and "buying and maintaining auto insurance." It can be concluded that there were not significant racial differences in overall exposure to observing parents' and peers' financial behaviors among college students, but there were some statistically significant difference in some topics that included both parents and peers.

The second hypothesis stated that the relationship between race and financial behaviors when controlling for selected demographic and financial characteristics, financial social learning opportunities, and financial education. The results of logistic regression analyses partly support this hypothesis. Consistent with our expectation, in the current study, generally, results of the logistic regression analyses show that financial behaviors tended to be related to race when controlling for all other factors except budgeting. The results confirms the findings of previous studies (e. g. Joo et al., 2003; Grable & Joo, 2006; Gutter, Garrison, & Copur, 2010; Lyons, 2004), Black students were less likely saving than White students and Black students were more likely engaging risky credit card behaviors than White students. Results from the budgeting revealed that financial social learning opportunities except observing peers' financial behaviors, marital status, income, and financial education significantly predicted college students' budgeting. To address whether there were differences in the effects of students

characteristics on budgeting attributed to race, we examined interaction terms with race and each of the students' characteristics. Our findings showed that there were significant interactions found between race and a $1000-4999 level of debt and both financial discussion with peers and observing peers' behaviors. Regarding debt, it was revealed that Black students who have a $1000-4999 level of debt, were significantly less likely to budget than White students those had the same amount of debt. The interaction with Race also interacted with financial discussion with peers and observing peers' behaviors it was discovered that these behaviors predicted in budgeting. It was revealed that among Black students who more discussed finance with their peers were significantly more likely to budget than their Whites counterparts, whereas among Black students who more observed their peers' behavior had significantly less likely budgeting than their Whites counterparts. In particular, we believe that discussions with peers and observing peers' behaviors had a varying influence on the budgeting between Blacks and Whites.

Saving and risky credit card behaviors tended to be related to race when controlling for other factors. Furthermore, in the reduced model, college students' saving behavior tended to be related to financial social learning opportunities except observed peers' financial behaviors, marital status, income, amount of debt and financial education. Additionally, college students' risky credit card behavior tended to be related to financial social learning opportunities except discussed finance with parents and observed peers' financial behaviors, gender, marital status, income, amount of debt, and credit card number. In the interaction model, race interacted with $1000 and over income in predicting risky credit card behavior. Black students who have $1000 and over income reported less likely risky credit card behavior than their White counterparts. In contrast to Perry and Morris' (2005) research, these findings may suggest that Black students, especially among those who are lower income, may engage more risky credit card behavior than White students who have lower income.

In conclusion, overall, the findings from this study highlight the effect of race on financial behaviors. These findings, we believe, move the discussion beyond using race as a proxy for understanding cultural influences on financial issue (Dilworth-Anderson, Burton, & Johnson, 1993). In conformity with theoretical model, in the current study, it is possible to say that differences in cultural values and socialization among Blacks and Whites may influence engaging financial behaviors. As expected, Black students in this study expressed stronger financial socialization as a reason for engaging more negative financial behaviors than White students. Furthermore, Black students reported more discussions of financial issues with their parents and peers while they engage more negative financial behaviors. Having greater financial socialization did not relate to engaging positive financial behaviors for Black students. It may be possible that inappropriate financial behaviors are passed from one generation to another. Additionally, some caution should be made when accepting the notion that Blacks more likely on risky credit card behavior given the emerging literature (Oliver & Shapiro, 1995; Aizcorbe, Kennickell, & Moore, 2003) states that Blacks have lower financial resources such as income as compared to Whites.

Another finding in this study is that financial education also plays an important role in budgeting and saving. Thus, financial education programs for Blacks should begin with a focus on budgeting, saving, and credit practices. Financial education programs should be designed that address the important differences between these groups in financial practices, cultural background and preferred methods of receiving financial education. For Blacks, budgeting, credit management, and saving practices should be the primary focus on financial education efforts. Education on financial behaviors, including the rewards for accepting

short-run volatility in order to obtain long-run investment gains, is very important for Blacks. However, the conclusion of many studies, that financial education is needed, does not answer the question of what type of education, or what approach, will work. A clear finding of the literature review is that there have been few analyses of the effectiveness of previous financial education programs. Existing financial education programs for Blacks seem to have been designed without taking research findings or input from minority communities into account.

Several limitations exist in the study the first one being that the results of this study help to further document solely the racial differences in financial socialization and financial behaviors of college students. Furthermore, For example, future research should attempt to classify individuals into pure help-seeking cohorts based on (a) professional help only, (b) nonprofessional help only, (c) no help only, and (d) a combination of help. In this way, future research can more definitely determine patterns of help-seeking behavior. Research shows that Black students are much more likely drop out of college due to financial reasons (e.g., Grable & Joo, 2006). It might be the reason for Black sample size was too small to differentiate between two groups. Future studies should measure the racial differences on financial socialization and financial behaviors for other emerging adult households, especially those not enrolled in a four-year university. Another limitation is that, this study focused on determining the Black and White college students' financial behaviors influenced by their parents and friends, future studies should investigate other types of financial socialization agents, such as the media, school, and internet's influence on college students' financial behaviors. Finally the data for this study did not lend itself to explore additional racial or ethnic subgroups; future research should consider exploring socialization of other groups of interest.

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KEY TERMS AND DEFINITIONS

Certificate of Deposit (CD): A time deposit, a financial product commonly sold in the United States by banks, thrift institutions, and credit unions.

Chi-Square: The distribution of the sum of the squares of a set of normally distributed random variables. A chi-squared test, also referred to as chi-square test or X^2 test, is any statistical hypothesis test in which the sampling distribution of the test statistic is a chi-squared distribution when the null hypothesis is true.

Financial Behavior: It can be defined as any human behavior that is relevant to money management. Common financial behaviors include use of cash, credit, and saving.

Financial Socialization: It covers many dimensions of money handling, e.g., earning, spending, saving, borrowing, and sharing behaviors are learned during adolescent years through the influence of socialization agents such as parents, family members, peers, school, and other influential individuals and that financial behaviors can be passed on from generation to generation.

Individual Retirement Account (IRA): A form of "individual retirement plan," provided by many financial institutions, that provides tax advantages for retirement savings in the United States.

Logistic Regression or Logit Regression: A type of regression analysis used for predicting the outcome of a categorical dependent variable (a dependent variable that can take on a limited number of values, whose magnitudes are not meaningful but whose ordering of magnitudes may or may not be meaningful) based on one or more predictor variables.

Socialization: It is often viewed as a social process by which norms, attitudes, motivations, and behaviors are transmitted from specific sources (commonly known as socialization agents) to the learner.

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Chapter 43
Explaining International Land Transactions in Africa

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ABSTRACT

Rising global food prices and demand for biofuels have recently heightened global interests in agricultural land resources in Africa, resulting in increased International Land Transactions (ILTs). While opponents of ILTs have dubbed it "land grabbing," proponents welcome the opening of Africa's agriculture to foreign direct investment. Limited empirical work exists explaining the motivations of investor and host countries. This chapter attempts to expand the literature by providing an empirical explanation of country land targeting behavior. As the debate on "land grabbing" intensifies, understanding motivations of various actors in the land market becomes relevant.

1. INTRODUCTION

We define International Land Transactions (ILTs) as "substantive land purchase or lease arrangements, or agreements, which involve participants from more than one nation." Each transaction involves at least one host country (on the sale side of the market) and one buyer entity (which can be a foreign government, business, group of individuals or institutional investors, or combinations thereof). ILTs range from outright International Land Acquisitions (ILAs) to International Land Leases (ILLs). ILTs have recently become an important issue of concern (Mann and Smaller 2010; Aarts 2009; Robertson and Per 2010; Borras and Franco 2010a; Braun and Meinzen-Dick 2009), especially amongst international equity- and fairness-based organizations, Western donor countries and international financial organizations. However, little is known about why some African countries are targeted for land transactions and why some host governments may be more interested than others. This chapter focuses on these issues.

The United Nations Food and Agriculture Organization (FAO) estimates that between 2007 and 2010, some 20 million hectares of African land was acquired by foreign entities, with many such acquisitions involving more than 10,000

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hectares and several more than 500,000 hectares (see Graham et al. 2010). The International Food Policy Research Institute (IFPRI) suggests that approximately 20 million hectares changed hands in the form of land grabs between 2005 and 2009 (see Borras et al. 2010b; Braun and Meinzen-Dick 2009). The World Bank similarly reports that 45 million hectares changed hands globally and that half of the global transactions have taken place in Africa (Deininger et al. 2011). Cotula et al. (2009) report that sub-Saharan Africa has become the site of the most speculative land deals, while Zoomers (2011) and Visser and Spoor (2011) indicate that major areas in Africa are being targeted for commodity and fuel crops investments and ecosystem services.

ILTs are certainly nothing new in many parts of the world.[1] For decades, governments and businesses have ventured into other countries to acquire or lease land for a variety of reasons.[2] However, the recent spike in the frequency of ILTs has sparked significant debate about the causes and appropriateness of these activities (Duanglak 2010; Cotula et al. 2009; Mann and Smaller 2010; Daniel and Mittal 2009). The scope and magnitude of ILTs were dismal in Africa until more recent years. The fact that Africa, a continent where most countries face significant food security challenges and which has previously been passed over by large-scale global private and public investors, is the focus of most deals is intriguing. In fact, most participants in the debate on ILTs in Africa have largely dubbed it "land grabbing," which connotes that these transactions are driven by motives tied to the control of productive resources for speculative purposes and/or exploitation of local people and governments (Daniel and Mittal 2009; Li 2011). Opponents of ILTs often cite the high degree of asymmetry in the knowledge bases of targeted countries (sellers) and targeting countries (buyers) which puts the former at a disadvantage at the negotiating table (Schutter 2011).

One rationale for equating the large-scale incidents of ILTs in Africa to "land grabbing" is the fact that these activities spiked following the global food and commodity prices of 2007/2008. Another is that the incidence is heavily focused on Africa. The economic assumption behind this thinking, of course, is that when resource prices rise significantly, alternatives become attractive, and buyers shift more of their land demand toward those places that had previously been considered more risky, or less valuable. This storyline fits well with the African situation in that it explains ILTs in the context of a global competition for resources. The concept of "land grabbing" then becomes relevant only if one can prove that this shift of focus towards Africa goes well beyond the normal location substitution with respect to input source, and that resource buyers also have speculative motives which encourage them to hoard more land (or resources) than would be typical given the impetus of global price hikes and resource shortage. Proving "hoarding" or "speculative" behavior requires evidence of interest in long-term capital gains, which has not been provided in the literature. While some of the actors in ILTs in Africa may indeed have speculative motives, it is plausible that the motivations of others are consistent with standard optimal business or government behavior, which seeks to maximize food security and access to critical assets for food production.

Whether or not ILT activities in Africa qualify as land grabs, the major international organizations have dubbed it as such. The World Bank (WB), the Millennium Challenge Corporation (MCC), the Alliance for a Green Revolution in Africa (AGRA), the US Agency for International Development (USAID), the United Nations Food and Agricultural Organization (FAO), and the International Food Policy Research Institute (IFPRI) are among the many organizations that have devoted significant efforts (meetings, conferences and reports) to the "land grabbing" issue. Similarly, foundations such as the Bill and Melinda Gates Foundation, the Howard G. Buffet Foundation and the Omidyar Network have been active in the

issue, based on concerns about the possible ills of "land grabbing." The concern about ILTs has extended to international research organizations as well as support organizations such as Action Aid International, Heifer International, Oxfam, Global Witness, World Cocoa Foundation, Landesa, the Right and Resources Initiatives and the World Resources Institute.[3]

International organizations, donor country governments and foundations who tend to view these contentious ILT issue as a problem are advocating for greater monitoring of the phenomenon and the creation of best practices that would maximize the benefits to host countries. In a general sense, these groups represent the opposition to large-scale ILTs, as they are currently occurring. Investment groups and host countries, however, have not fully embraced attempts by international organizations to define frameworks for responsible ILTs being proposed and demanded by international organizations. While these groups have not outright rejected oversight proposals, their opposition to what is perceived in what is a normal market activity is palpable. One investment banker proposed an alternative term to be used in describing what otherwise would be referred to as "land grabbing" - "price-gap arbitrage." This seems to suggest adherence to free market behavior by international investors. In light of the above differences, ILTs in Africa have become contentious, one that intellectual and policy leaders in land use, land tenure and sustainable resource management have determined to be of significant importance.[4] Greater research to clarify many of the contentious issues is not only important, but timely as well.

Empirical evidence of the harmful or negative effects of ILTs is lacking, obviously due to the fact that the heightened incidence of this issue is recent, and not enough time has passed to allow sufficient ex-post analysis in Africa. Better understanding of the incidence of ILTs in Africa, the geographic expression of such activities, the characteristics of targeted countries, and the characteristics of targeting entities will improve understanding of the motivations behind these transactions and perhaps shed some light on the equity implications. The idea is to explore potential adverse effects based on better understanding of motivations. The issue of ILTs is too important for scholars and policy makers to wait for future impact assessment.

Given the recent emergence of the issue at the forefront, much of the global discourse has offered not much more than emotional response to the issue. To provide insights to concerned entities and countries engaged in ILTs, it is important to first understand ILTs, their structure and implications to host and investing countries and entities. Research must address the concerns of key actors in this arena, in addition to providing information that can be used for capacity building and education to strengthen the institutional and human capital capacity of African countries as they manage ILTs. By understanding the motivations, one can gain significant insights not only into the desirability of ILTs, but also how to structure their provisions to be mutually beneficial. Attempts to explain the motivations of participating countries on the buy and sell sides have been limited.

Explaining ILTs in Africa through the modeling of the behavior of buyers and sellers is the subject of this paper. The approach employed is to better understand the etiology of ILTs before we declare them to be a moral challenge. The remainder of this paper is organized as follows. First, we review existing literature on ILTs in order to gain insights that are useful in the development of theories and hypothesis about the motivations of various actors in the process. Second, to provide a proper economic context within which ILTs can be better understood, a theoretical framework is developed and explained to characterize the behavior of land targeting entities and host countries. Third, to provide empirical evidence about the driving forces behind the demand and supply of agricultural lands in Africa under ILTs, an empirical econometric model is developed. Fourth, this model,

which aggregates the motivations of all buyers in the demand side of the market, is estimated. Fifth, the chapter discusses the nature and types of data collected to estimate the empirical model developed. Finally, discussions of the findings from the analysis of the incidence of ILTs in Africa are provided, along with conclusions and policy suggestions.

2. UNDERSTANDING INTERNATIONAL LAND TRANSACTIONS

In this section, we delve into existing literature on ILTs in order to highlight priority issues requiring greater understanding and to establish a background for our modeling efforts to explain ILTs. The analysis starts with the complexity of ILTs, the reasons provided for the occurrence of ILTs, explanations of where ILT activities are likely to take place, explanations of the characteristics of the demand side of the market, explanations of the characteristics of seller side of the market, explanations of the motivations of various actors and other issues that are central to the ILT debate.

The issues surrounding ILTs are obviously complex, albeit their apparent simplicity. First, ILTs involve varying types of host countries with various characteristics, interests and motivations (Duangklad 2010). Second, ILTs involve a variety of buyer types, with varying types of actors and motivations (Spieldoch 2009; Visser and Spoor 2010). Third, and consequently, given these diverse seller and buyers, and interests and motivations, the structure of ILTs tend to vary from lease arrangements to actual purchases, from pure acquisition of land to collateral investments to beef-up productive capacity, and from schemes designed to feed the export of products back to the homelands of investors to ameliorate food security challenges (Schutter 2011), or enhance the performance of food firms (McMichael 2011), to those designed to enhance supplies to local markets. An understanding of the diverse interests in and motivations for ILTs will go a long way in helping policymakers and interested parties in learning how to best engage to enhance the efficacy of present and future land transactions.

2.1. Concerns and Opportunities in ILTs

In this section, we summarize some of the reasons for concerns about ILTs. One primary concern is long-term food security in Africa. Opponents caution that the significant incidence of change in control of productive resources could lead to a major food crisis in Africa (Graham et al. 2010; Cotula et al. 2009; Oppeln and Schneider 2009). Another reason is the potential for "land grabbing" to interfere with the right to feed oneself by diverting the potential for food for local consumption to be redirected toward exports (Graham et al. 2010; Schutter 2009). Another concern centers around speculative land deals whereby collateral investments in productive activity never gets made. The argument is that productive land can become tied-up in speculative endeavor, resulting in idling of land resources and hampering local agricultural production.

Some concerns have been raised about the isolation of foreign-held agricultural operations even when collateral investments are made to produce agricultural products. Many have argued that these land transactions need to feature strong provisions to tie the activities of investors to capacity building activities in the host country (training local farmers, sub-contracting with local farmers, developing rural infrastructure, improving transportations facilities, improving storage capacity and enhancing market operations). Investments in land, labor, capital and technology in host countries would more likely yield better results than investments in land that do not spillover to the rest of the economy (Li 2011). A related issue is the intended market for the products produced, if in fact the foreign-held agricultural operation actually

produces anything. If strong arrangements are in place to ensure that a certain proportion of the products are directed to domestic markets, these agricultural operations will essentially compete with local agriculture.

Another concern is the tendency for these transactions to compromise domestic land tenure arrangements (Berry 2002; Mann and Smaller 2010; Braun and Meinzen-Dick 2009). To the extent to which fewer quantities of land remain in the hands of local indigenous people and are under the control of foreign entities, the property rights of local people are compromised. In some cases, these land transactions occur at higher levels of government, undermining the right of indigenous people. This scenario, while expedient for investors, compromises even the potential for the acquired land to be usable in actual production. In some parts of Africa, a federal or state driven land transaction may mean little in terms of actual ownership, especially when local land owners believe the land belongs to them. Similarly, in cases where the transactions involve local government but not higher levels of government, it is difficult to obtain legitimate titles.

Other concerns include: asymmetries in information and knowledge about how to optimally structure deals and transaction terms; expertise gap between trained land investors and local officials who may not have adequate expertise to negotiate on multimillion dollar deals (Schutter 2011); lack of transparency and potential for corruption (Aarts 2009); the possibility that investments may not enhance agricultural productivity or benefit local farmers and peasants (Mann and Smaller 2010); the diversity of motives of buyers and the fact that host countries may not be well equipped to structure deals that recognize various investor motives; and the possibility that local land interest groups, who must ultimately cooperate for transactions to be successful, may not be engaged (Robertson and Pinstrup-Anderson 2010).

The literature also cites other relevant factors of concern related to ILTs. First is the issue of whether or not ILTs are ultimately beneficial to host countries. The literature suggest that host countries which sell land might be encouraged to do so because the buyers bring in Foreign Direct Investment (FDI) in the land purchase or on production equipment, which are often difficult for developing countries to attract (Visser and Spoor 2010). In the case of the latter, foreign investment to enhance the capacity of purchased land can result in collateral agricultural activities that can enhance local production, technology diffusion, employment, and workforce development. However, whether or not these investments are appropriate depends on the extent to which the host country benefits. The benefits range from local increase in agricultural productivity, increased agricultural production, the employment of local workers, the improvement of the talent pool of local agricultural workers, the increased supply of food to domestic consumers and the reduction of food insecurity, and possibly even poverty. Evidence is lacking as to whether or not these benefits accrue (see Li 2011), but then whether these benefits accrue is a convoluted issue related to the existence of strong agency problems and the potential for corruption in some countries.[5]

2.2. Characteristics of the Demand Side of ILTs and Deal Structures

The literature identifies some of the characteristics of buyer nations who participate in the sale or long-term lease of land and how these relate to the benefits to them (Visser and Spoor 2011). With respect to types of land purchasers and motivations, the following types have been identified as major players: (1) foreign governments whose interests are food security in their own countries; (2) apostles or agents of foreign governments whose interests align with the foreign government but might be willing to take more of a portfolio or asset management approach (these include sovereign wealth funds and investment companies); (3) investment banks and private equity firms

who see market and portfolio opportunities in assembling land and working with corporations to get access to such lands for both investment and production purposes; (4) global food and energy companies who seek productive capacity closer to projected high demand emerging countries; and (5) individual/family investors who again see the upside and gains from strategic investments that farmlands in Africa offer.

The motivations above translate into alternative ways by which deals can be structured. The variability in the motivations and behavior of targeting entities suggest that ILTs are not generic, and that each transaction is different and unique. For example, participating buyer countries range from those interested in food and energy security to those interested in speculation; while seller countries ranged from places that have not engaged much in any international transaction, especially trade in agricultural commodities, to places that are actively involved in exports.[6]

These motivations are expressed through various structural arrangements for ILTs. Entities motivated by food or energy security must obviously make investments in production, and possibly in human capital development. In other words, the ILT may ultimately result in such investments as biofuel refineries, irrigation systems, biofuel crop production, storage capacity, training centers, road infrastructure and other investments that would exploit the gap between current and potential levels of productivity. These types of investments represent deeper FDIs and may have better potential to benefit the host country, depending on how they are structured. For example, if the host country is able to extract long-term training of human resources and the targeting of some of the products toward domestic markets from foreign investors, local food and energy productivity and security can be enhanced.

Entities interested in arbitrage, however, will most likely stop at the acquisition or lease level, and would most likely focus on an exit strategy that involves flipping the land to others who will make long-term investments. These arrangements, however, can be detrimental if they constrain the ability to use the land and facilitate idling. Another dimension of structural arrangements is whether or not the land is leased or outright purchased, and whether the lease arrangement is short-term or long-term. Obviously, while long-term leases facilitate enough protection for the lessee to encourage long-term investments, they also represent forgone productive opportunities and unnecessary tied down of resources that could be put to alternative uses. Outright sales also do have pros and cons related to "hoarding" without necessary long-term investment and productive use.

2.3. Why Africa and Why Now?

Various studies in the literature have attempted to explain the larger issue of why Africa and why now. Despite Africa's significant land mass (30.3 million square kms), the Sahara (9 million square kms) and Kalahari Deserts (900,000 square kms) constrain the continent's cultivation capacity. Low levels of human capital development and land productivity also characterize the agricultural sector in Africa. However, the existence of 2-3 growing seasons in much of Africa suggests significant land productivity potential in agriculture. Prior to 2007, this potential was largely overlooked globally as Africa did not engage in significant export of agricultural or bio-energy raw materials, and as advanced economies and donors focused largely on addressing food, health and poverty issues in Africa. So, land in Africa was viewed largely from the perspective of land tenure and the potential role it can play in enhancing people's access to capital, wealth and the means of production. It was also viewed from the perspective of how the enhancement of human capital and technical inputs can be used to transform Africa. Large scale commercial farming is yet to materialize in a significant way in most African countries.

However, in few places, evidence exists to suggest significant potential for growth in pro-

ductivity. For example, the recent migration of some Southern African farmers to parts of West Africa yielded enhancements in the productivities of such expatriate farmers, suggesting significant upside to improving production/productivity through human capital and agricultural technology enhancements. Today, many countries in Africa are open for FDI, welcoming opportunities for revenue, investments and economic activities, particularly in agriculture. Productivity and land value gaps between Africa and the rest of the world seems to have intensified significant surge in interest in African agricultural land resources and may have enabled African countries to tap these FDI opportunities.

With respect to why now, the potential for African agriculture to feed the world was a non-issue until the global spike in the price of food and natural resources in 2007 and 2008 (Deninger et al. 2011; Visser and Spoor 2011). Among the reasons for the growing interest in Africa were the global energy crisis (sharp rises in the price of energy resources) (Cotola et al. 2008; Boamah 2011; Borras and Franco 2010), rapid increases in income and wealth of countries previously designated as developing, and entrance of two major players (China and India) with combined population of approximately 2.7 billion people in to the market for energy and food (Braun and Meinzen-Dick 2009), the threat to food supply of net food importing countries, greater concern about long-term food supplies (Robertsonn and Pinstrup-Anderson 2010), food price volatility (Aarts 2009), development aid deficits (Cotula et al. 2009), and scarce water resources (Mann and Smaller 2010). Africa's potential is significant, but the cost of acquisition of land is low. For those who believe that this is a new opportunity to optimize Africa's productive use of land and to beef-up human capital, management capacity, trade capacity, food security, infrastructure development and economic buoyancy, ILTs can be seen as alternatives.

Hitherto, the African land market has been largely obscure from the global radar screen. However, the recent surge in interest has created a dilemma. While the international organizations mentioned earlier were concerned about how to increase productivity and secure land tenure designed to improve property rights, provide people with a means of production, increasing wealth, growing agricultural productivity and alleviate poverty, the issue of "land grabbing" seems to have risen to the forefront. The magnitude of ILTs, as they occur today, has brought in large number of actors who are seeking greater insights not only into motivations for ILTs, but also their consequences and impacts.

3. CONCEPTUAL FRAMEWORK

As mentioned above, ILTs involve various motivations both on the part of the selling country and various buyers from targeting countries. When a transaction occurs, it is likely to be the result of a market clearing activity. We recognize the host country representative (local/state/national government) as the primary market agent on the supply-side of the market. We recognize three alternative types of actors on the demand side:

1. A foreign government seeking to acquire land for the purpose of maximizing agricultural production through combination of in-country land resources and acquired/controlled foreign land resources;
2. A private company seeking to maximize food production from a variety of alternative production places given the market for the products; and
3. A private equity or investment firm (or individuals similarly motivated) who seek to maximize the value of their long-term investment through land hoarding.

To provide a theoretical framework to explain the land management behavior of host countries in dealing with targeting entities, a theoretical discussion is provided next. We start first with the land management decision of a host country, followed by players on the demand side.

3.1. Host Country: Value Maximization from Agricultural Land Management

Consider a host country with known amounts of agricultural land resources. The host country attempts to manage its land resources optimally by deciding on three broader uses of the land: for domestic production; export-oriented production and land potentially made available for international investment opportunities. A part of the agricultural land may lay idle at any time. We assume that the objective of the host country is to maximize the value of its agricultural land resources under alternative agricultural uses.

Let the value of land in agriculture for local production (V_{agt}) be:

$$V_{agt} = \int_{t}^{\infty} e^{-it}\left[P_{it}.f_l\left(L_{at}, x_t, q_t, T_t; \theta_t\right)\right]dt \qquad (1)$$

V_{agt} is the value of land in local agricultural uses at time t, P_{lt} is the net price for local agricultural products, $f_l(\bullet)$ is the production function characterizing local agriculture, with inputs of farmland (L_{at}), a vector of other agricultural inputs (x_t), land quality (q_t), technology (T_t), and other factors that determine the value of agriculture in the host country (θ_t).

Let the value of land in agriculture devoted for export production ($V_{\theta xt}$) be:

$$V_{\theta xt} = \int_{t}^{\infty} e^{-it}\left[P_{\theta t}.f_\theta\left(L_{at}, x_t, q_t, T_t; \theta_t\right)\right]dt, \qquad (2)$$

where the net export price of agricultural products is ($P_{\theta t}$) and $f_\theta(\bullet)$ is the production function in export-oriented agriculture. Let the value of agricultural land available for potential foreign acquisition (V_{aqt}) be:

$$V_{aqt} = \int_{\tau}^{\tau'} e^{-it}\left[r\left(t,z\right)\left(L_{at}\right)\right]dt, \qquad (3)$$

where the lease value of per unit of farmland at time (t) and location (z) is (r). For land purchases, r would be the present value of the stream of benefits from farmland. Consider the possibility that idled land has an opportunity cost. Let the opportunity cost of idle land (V_{appt}) be:

$$V_{oppt} = \int_{\tau}^{\tau'} e^{-it}\left[\delta, f\left(L - L_a, x_t, q_t, T_t; \theta_t\right)\right]dt \qquad (4)$$

Total arable land is L and the per unit opportunity cost is δ. The parameter δ represents the best alternative use value of host country's farmland if employed in productive uses.

Therefore, given the above factors, the land management objective of a host country is to maximize the value of agricultural lands. This is expressed in Box 1.

The condition for agricultural land value maximization, given agricultural land use choices, is shown in Equation (6). The relationship implies that host countries can optimally manage agricultural land resources such that land available for international acquisition would need to sufficiently compensate the opportunity costs of local uses. This, of course, depends on existing agricultural land uses before land transfers to foreign holders.

$$\frac{\partial V}{\partial L_a} = -\left[P_{it} f_{lL_a}^{'} + P_{\theta t} f_{\theta L_a}^{'} + \delta f_{L_a}^{'}\right] = r \qquad (6)$$

Box 1. Equation 5

$$\underset{(L_a)}{Max} V = \int_{t}^{\infty} e^{-it}\left[P_{it}.f_l\left(L_{at},x_t,q_t,T_t;\theta_t\right)\right]dt + \int_{t}^{\infty} e^{-it}\left[P_{\theta t}.f_\theta\left(L_{at},x_t,q_t,T_t;\theta_t\right)\right]dt + \int_{\tau}^{\tau'} e^{-it}\left[r(t,z)\left(L_{at}\right)\right]dt - \int_{\tau}^{\tau'} e^{-it}\left[\delta, f\left(L-L_a,x_t,q_t,T_t;\theta_t\right)\right]dt$$

From Equation (6), note that the lease rate for land under different uses is equivalent to the value losses in their alternative uses. Equation (7) further illustrates this fact (Box 2).

From Equation (7), the optimal lease rate for land diverted from current agricultural production is the marginal product value $\left(P_{lt}f_{lL_a}^{'}\right)$ of the land in its use. Similarly, the lease rate for land diverted from export-oriented production is the marginal product value, evaluated at net export prices. Most of the argument about acquisition of farmland in Africa rests on the argument that land supply comes from idle land resources. Idle lands are perhaps politically more feasible to divert, and offer a better chance at maximizing their value through alternative productive uses. The optimal lease rate for idle farmlands is the marginal value product evaluated at the opportunity costs of the idle land (δ) in alternative uses. Given the fact that net agricultural prices are low in many host countries and more importantly – agricultural productivity of African farms is quite low, the lease value per hectare of land is likely to be meager.

Therefore, the implicit supply function of agricultural land is given as:

$$L_a = L_a(P_{it}, P_{\theta t}, r, \delta, T, q: \theta) \tag{8}$$

3.2. Investing Country/Company: Value Maximization from Agricultural Land Management

Let the value of land in agriculture for local production in a representative targeting country at time *t* be:

$$V_{at}^{'} = \int_{t}^{\infty} e^{-it}\left[P_{it}^{'}.f_l\left(L_{at}^{'},x_t^{'},q_t^{'},T_t^{'};\theta_{at}^{'}\right)\right]dt, \tag{9}$$

where $V_{at}^{'}$ is the value of land in local agriculture in time *t*, $P_{lt}^{'}$ is the net price for local agricultural products, $f(.)$ is the production function which is assumed to be concave and twice differentiable, with inputs farmland $\left(L_{at}^{'}\right)$, other agricultural inputs $\left(x_t^{'}\right)$, land quality $\left(q_t^{'}\right)$, technology $\left(T_t^{'}\right)$ and other factors that determine the value of agriculture $\left(\theta_t^{'}\right)$.

Similarly, let the value of land in agriculture for export $\left(V_{\theta t}^{'}\right)$ be:

Box 2. Equation 7

$$\frac{\partial V}{\partial L_a} \rightarrow \begin{cases} -P_{lt}f_{lL_a}^{'} = r, & \text{if farmland in domestic production is targeted} \\ -P_{\theta t}f_{\theta L_a}^{'} = r, & \text{if farmland in export production is targeted} \\ -\delta f_{L_a}^{'} = r, & \text{if idle farmland is targeted} \end{cases}$$

$$V_{\theta t}^{'} = \int_{t}^{\infty} e^{-it} \left[P_{\theta t}^{'}.f_{\theta} \left(L_{at}^{'}, x_{t}^{'}, q_{t}^{'}, T_{t}^{'}; \theta_{t}^{'} \right) \right] dt, \tag{10}$$

where the net export value of agricultural produce is $\left(P_{\theta t}^{'}\right)$. Let T denote the time that commences the planning horizon of the targeting country/company in a land acquisition transaction, while $T^{'}$ represent the end of the planning horizon. Therefore, the value of agricultural land with potential availability of foreign acquisition $\left(V_{qt}^{'}\right)$ is:

$$V_{qt}^{'} = \int_{t}^{\infty} e^{-it} \left[\theta.f \left(L_{at}, x_{t}^{'}, q_{t}^{'}, T_{t}^{'}; \theta_{t}^{'} \right) - r\left(t,z\right)._{} L_{a} \right] dt, \tag{11}$$

where the lease value of per unit land at time (t) and location (z) is (r) and the value of production in leased lands is θ.

The objective of the targeting country is to maximize the value $\left(V^{'}\right)$ of agricultural lands, including international acquisition opportunities (see Box 3).

Equation (12) is maximized under the following condition:

$$\frac{\partial V^{'}}{\partial L_{a}} = -\left[P_{it}^{'} f_{L_{a}^{'}}^{'} + P_{\theta t}^{'} f_{L_{a}^{'}}^{'} \right] = \theta f_{L_{a}}^{'} - r \tag{13}$$

Equation (13) shows that investment in lands in Africa is a decision between what the investment means in terms of value in the host country in local production $\left(P_{lt} f_{L_{a}^{'}}^{'}\right)$ or export potential $\left(P_{\theta t} f_{L_{a}^{'}}^{'}\right)$ and the alternative use of investment (or lease payment) funds for lease-adjusted gains $\left(\theta f_{L_{a}}^{'} - r\right)$. In addition, Equation (13) also shows that foreign investment in agricultural land is based on what invested funds yield in alternative local uses. Equation (14) illustrates this point.

$$\frac{\partial V^{'}}{\partial L_{a}} \rightarrow \begin{cases} -P_{it} f_{L_{a}^{'}}^{'} = \theta f_{L_{a}}^{'} - r, \\ \quad \text{compared to domestic production} \\ -P_{\theta t} f_{L_{a}^{'}}^{'} = \theta f_{L_{a}}^{'} - r, \\ \quad \text{compared toexport production} \end{cases} \tag{14}$$

Therefore, the implicit demand function of agricultural land is given as:

$$L_{a} = L_{a} \left(P_{it}^{'}, P_{\theta t}^{'}, r, \theta, T, q; \theta \right).$$

3.3. Speculative Land Holdings

Consider next the behavior of international land investors for productive and speculative purposes. We assume that the objective of speculative land investors is to maximize the value of acquired agricultural land resources both through produc-

Box 3. Equation 12

$$\underset{(L_{a})}{Max} V^{'} = \int_{t}^{\infty} e^{-it} \left[P_{it}^{'}.f \left(L_{at}^{'}, x_{t}^{'}, q_{t}^{'}, T_{t}^{'}; \theta_{t}^{'} \right) \right] dt + \int_{t}^{\infty} e^{-it} \left[P_{\theta t}^{'}. \left(L_{at}^{'}, x_{t}^{'}, q_{t}^{'}, T_{t}^{'}; \theta_{t}^{'} \right) \right] dt + \int_{\tau}^{\tau^{'}} e^{-it} \left[\theta.f \left(L_{at}, x_{t}^{'}, q_{t}^{'}, T_{t}^{'}; \theta_{t}^{'} \right) - r\left(t,z\right)._{} L_{at} \right] dt$$

tive uses (until future sale or lease of land) and capital gains upon eventual sale of land. Let the value of land acquired for speculative purposes, but temporarily farmed for domestic supply in a host country (V_{agst}) be:

$$V_{agst} = \int_{t}^{\infty} e^{-it}\left[P_{it}.f\left(L_{at}, x_t, q_t, T_t; \theta_t\right)\right]dt. \tag{15}$$

Let the value of land acquired for speculative purposes, but temporarily farmed for export markets (V_{exst}) be:

$$V_{exst} = \int_{t}^{\infty} e^{-it}\left[P_{et}.f\left(L_{at}, x_t, q_t, T_t; \theta_t\right)\right]dt. \tag{16}$$

We assume that speculators are likely to purchase land rather than lease it, since leased lands are unlikely to be sub-leased to third parties. Hence, in land lease arrangements, speculative behavior is likely to be centered on commodities, while in land purchases, speculation can emanate both from commodities and land values. As such, once initial land acquisition decisions are made under either lease or purchase arrangements, land speculation is likely to be related to the latter. Therefore, we present next the issue of speculation related to land purchases.

Let the speculative value of land holdings (V_{spct}) be:

$$V_{spct} = \int_{t}^{T} e^{-it}\left[k\left(P_A\right)\left(L_a\right)\right]dt, \tag{17}$$

where k is the rate of appreciation of land values (P_A). Let the opportunity cost of capital tied in speculative land holdings in Africa (V_{opct}) be:

$$V_{opct} = \int_{t}^{T} e^{-it}\left[i\left(P_A\right)\left(L_a\right)\right]dt. \tag{18}$$

The parameter i is the best alternative rate of return on capital. Therefore, the objective function of speculative land holders is shown in Box 4.

The first-order condition for maximization is:

$$\frac{\partial V'}{\partial L_a} = \left[P_{it} + P_{\theta t}\right] f'_{L_a} + kP_A = iP_A \tag{20}$$

Equation (20) expresses that speculative land investments take place if the productive value of acquired lands (for domestic and export markets) and anticipated capital gains at least fully compensate the opportunity cost of invested capital.

4. DATA, ECONOMETRIC MODEL, AND ESTIMATION

As mentioned above, ILTs are nothing new, but the high incidence of such transactions in Africa is largely what has triggered the most

Box 4. Equation 19

$$\underset{(L_a)}{Max} V' = \int_{t}^{\infty} e^{-it}\left[P_{it}.f\left(L_{at}, x_t, q_t, T_t; \theta_t\right)\right]dt + \int_{t}^{\infty} e^{-it}\left[P_{\theta t}.f\left(L_{at}, x_t, q_t, T_t; \theta_t\right)\right]dt + \int_{t}^{T} e^{-it}\left[k\left(P_A\right)\left(L_a\right)\right]dt - \int_{t}^{T} e^{-it}\left[i\left(P_A\right)\left(L_a\right)\right]dt$$

recent concerns. Data on the incidence of ILTs in Africa, although available, probably do not capture all transactions that have occurred. Grain, a small international not-for-profit organization, was one of the first to draw attention to the land grab issue in 2008 when it published its report titled "Seized! The 2008 Land Grab for Food and Financial Security" (http://www.grain.org/article/entries/93-seized-the-2008-landgrab-for-food-and-financial-security). It reported specific transactions by targeting country and targeted country, respectively, across the globe. It reported details on over 100 land transactions targeting food security in 2008 alone, providing details on specific targeting countries, targeted countries, transaction costs and land mass involved. The International Food Policy Research Institute (IFPRI) published a report in 2009 which highlighted over 100 transactions globally for the period July 2007–April 2009. The report also indicated recent agricultural funds that are created to target international land transactions. In June 2009, the Federal Ministry for Economic Cooperation and Development of the Republic of Germany issued a report on the battle for land as a scarce resource, listing international land transactions in Africa, Asia and other countries as at June 2009, listing transactions in 25 countries and highlighting the fact that countries such as Madagascar and the Sudan involved a large number of transactions.

In 2010, the Oakland Institute published a report which summarized a number of case studies for the period 2000 to 2010, with a focus on the roles of the International Finance Corporation. Similarly, Graham et al. (2010), on behalf of Food First Information and Action Network (FIAN), published "Land Grab Study" which reported on over 100 transactions in Africa and highlighted the nature and characteristics of each transaction. Deininger et al. (2011) of the World Bank published a study which began to organize the incidence of ILTs by targeting country or firm, targeted country, motivations and intended purpose. It also correlated these transactions with various causal factors highlighting the distribution of valuable land globally and how these relate to the incidence of ILTs.

We collated the data on ILTs from the above and other sources to develop a comprehensive database on known ILTs. We particularly focused on Africa, which is the reported epicenter of the "land grabbing" phenomenon. Given our interest in modeling what triggers a transaction to happen, our dependent variable is binary in nature and takes on the value of 1 if a transaction happened in a country, and 0 otherwise. In essence, we focused on the probability of a transaction happening in a country, not on the size or frequency of the transactions or the price of the transaction. Independent variables in our model include factors that have been identified, or suggested by previous studies, including our theoretical model. In essence, in our proposed regression, we set each hypothesized driver of an ILT up to be detected as a relevant determining factor.

Despite the plethora of data on transactions, very little empirical evidence exists to support how and why ILTs happen. Consequently, the debate about ILTs have centered around preconceived notions and emotionally-based conclusions (Deininger 2011). The two prior studies that attempted to explain why some countries are targeted for land acquisition deals do not provide sufficient basis for understanding ILTs.[7] While informative, two limitations exist.

First, the decision of why host countries sell land leases (or allow purchases) is largely ignored, as is the motivation of the targeting entities in international land transactions. This shortcoming emanates from limited efforts in integrating economic theory in the analysis of the behavior of agents in the demand and supply side of the land transaction in Africa. By simply treating host countries as mere suppliers of land, and targeting countries as strategic players who seek to enhance their interests, most of the prevailing work offers limited insights on the underlying motivations on both sides of the transaction.

Second, the limited inclusion of factors in the empirical analysis has also limited the ability to broadly explain why some countries are targeted. For instance, one would expect that institutional quality, trade history, water supply, food security, soil fertility, agricultural capital, GDP per capita and other factors to also be relevant factors that may explain targeting behavior. But these considerations were excluded from prior empirical studies.

The main focus of this paper is therefore the identification of a broad range of factors that lead to country targeting behavior in land transactions in Africa. The driving factors are discovered based on observations about whether a country is engaged in international land transactions or not. A logit econometric modeling approach offers an ideal mechanism for identifying driving factors given binary incidence data. The logit model is specified as:

$$P\left[T=1 \mid X\right]=\frac{1}{1+\exp\left(-X\beta\right)} \tag{21}$$

In Equation (21) T=1 if a country is targeted for land acquisition and T=0 otherwise; X is a vector of determining factors for a country to be targeted, and β is a vector of coefficients. The log-likelihood function is:

$$L\left[L\left(\beta\right)\right]= -\sum\left(1-T\right)\sum X\beta-\sum\ln\left(1+\exp(-X\beta)\right) \tag{22}$$

The logit econometric model is shown in Box 5.

The dependent variable is whether international land acquisition occurred in country or not; the independent variables are: percent of agricultural land to total land (*AglandP*), net agricultural trade (*NAgTr*), agricultural value added (*AgValAd*), constrained soil fertility (*SoilF*), processed agricultural import (*PAgIm*), processed agricultural export (*PAgExp*), total agricultural export (*AgExp*), per capita gross domestic product (*GDPPC*), degree of property rights (*PropR*), corruption perception index (*Corup*), agricultural capital (*AgCap*), gross non-food productivity index (*NFoodPI*), gross food productivity index (*FoodPI*), paved roads (Paved), human development index (*HDev*), land equipped for irrigation (*Irrig*), undernourishment (*UndNour*) and food aid dependence (*FoodAid*). See Table 1 for descriptive statistics and source of the previous data.

The econometric model is estimated using logistic regression. Heteroskedasticity and multicollinearity problems are addressed by carefully selecting relevant variables and estimating coefficients using corrected standard errors. The correction is conducted through White's procedure. Alternative model structures are also tested to verify the robustness of the estimated coefficients.

5. RESULTS AND DISCUSSION

We attempt to explain the country-targeting behavior of African land investor entities by incorporating the following categories of factors: characteristics of the agricultural sector; natural resources characteristics; agricultural trade; agricultural technology and development;

Box 5. Equation 23

$$\begin{aligned}P\left(LandAq\right)=\alpha&+\beta_1 AglandP+\beta_2 AgValAd+\beta_3 PAg\,\mathrm{Im}+\beta_4 PAgExp+\beta_5 Rain+\beta_6 SoilF\\&+\beta_7 NAgTr+\beta_8 AgExp+\beta_9 FoodPI+\beta_{10} AgCap+\beta_{11} Irrig+\beta_{12} Paved+\beta_{13} GDPPC\\&+\beta_{14} HDev+\beta_{15} Corup+\beta_{16} NFoodPI+\beta_{17} PropR+\beta_{18} UndNour+\beta_{19} FoodAid+\varepsilon\end{aligned}$$

Table 1. Data description and descriptive statistics

Description of Variables	Source of Data	Mean	Std. Dev.
1 if country is targeted, 0 otherwise	7, 8, 9, 10, 11, other	0.49	0.51
Agricultural land (% of total land)	1	47.65	23.54
Processed agricultural import	2	68.89	19.90
Processed agricultural export	2	42.86	34.53
Rainfall	1	791.51	627.17
Area of severely constrained soil fertility	1	6885.06	7835.66
Net agricultural trade	1	-171.45	803.51
Total agricultural export	1	-0.04	0.73
Gross food productivity index	1	114.68	21.66
Agricultural capital	1	-253.13	12548.24
Land equipped for irrigation	1	26.38	60.95
Paved ways	5	12,005.90	2,0251.29
GDP per capita	2	2121.086	3,459.418
Human development index	3	48.76	16.72
Corruption	4	2.87	1.07
Gross non-food productivity index	1	100.67	53.25
Property right	6	27.45	18.18
Undernourished	1	26.22	19.54
Food aid dependence (food aid received per person)	12		

Sources: 1 = FAO; 2 = World Bank; 3= UNDP; 4 = Transparency International; 5 = CIA – the World Factbook; 6 = International Property Rights; 7 = IFPRI; 8 = The Oakland Institute; 9 = Federal Ministry for Economic Cooperation and Development, Germany; 10 = FoodFirst and Action Network; 11 = GRAIN; 12 = World Food Program.

infrastructure development; economic and social performance; property right protection and food security. Table 2 summarizes the list of variables, along with estimated coefficients. Findings are discussed next.

5.1. Characteristics of the Agricultural Sector

To evaluate whether or not the characteristics of the agricultural sector itself explains the incidence of ILTs in a country, four factors are considered: Agricultural land (% of total land); agricultural value added; processed agricultural imports and processed agricultural exports. Agricultural trade experience of African countries enhances the chance of ILTs occurring, perhaps because trade experience signals better access of local agricultural to international markets. The fact that the export element of trade is significant and import is not makes this argument more valid. Land investors are not necessarily planning to import-substitute for the targeted country, so may not weigh import patterns significantly. But exports experience is found to be important predictor of country targeting behavior. Compared to countries with poor agricultural exports, countries with exports experience are 1.062 times more likely to be targeted, with the likelihood increasing as the value of exports expands.

Similarly, agricultural value added is a significant factor. Countries with agricultural sector generating better value added are also likely to be targeted. Countries with better agricultural value

Table 2. Estimation results for ILT behavioral logit model

Variables	Coefficient	P-value	Likelihoods
Characteristics of the Agricultural Sector			
Agricultural land (% of total land)	-0.135**	0.039	0.874
Agricultural value added	0.089*	0.076	1.093
Processed agricultural import	-0.060	0.491	-
Processed agricultural export	0.047**	0.042	1.048
Natural Resources Characteristics			
Rainfall	0.004*	0.092	1.004
Area of severely constrained soil fertility	0.001	0.161	-
Agricultural Trade			
Net agricultural trade	0.003*	0.057	1.003
Total agricultural export	-0.015	0.854	-
Agricultural Technology and Development			
Gross food productivity index	0.106**	0.036	1.112
Agricultural capital	0.001*	0.082	1.001
Land equipped for irrigation	-0.061*	0.067	0.941
Infrastructure Development			
Paved ways	-0.0001	0.321	-
Economic and Social Performance			
GDP per capita	-0.002*	0.065	0.998
Human development	0.284**	0.030	1.328
Corruption	0.472	0.663	-
Gross non-food productivity index	0.057*	0.093	1.059
Property Right Protection			
Property right	0.073**	0.041	1.076
Food Security			
Undernourished	0.074	0.333	-
Food aid dependence	-320.004*	0.097	≈ 0
Constant	-41.002	0.092	
Psuedo R-squared	0.67		
Log pseudo-likelihood ratio	-10.24		
Percent correctly predicted	92%		
N	51		

Note: * means significant at the 10% level, ** at the 5% level and *** at the 1% level.

added are 1.151 times more likely to be targeted than countries with poor agricultural value added. Value added can be a proxy for good agricultural land in a country.

Since most of the argument of host countries about ILTs suggests that they are leasing or selling idle lands, we introduced a crude measure of idle land (the reverse of percent cultivated land). Results suggest that as the share of agricultural land

in use increases (hence idle land decreases), the incidence of targeting a country decreases 1.126 times. In other words, it is not necessarily the amount of cultivated land that determines targeting behavior, but the amount of unused idle land. All in all, the characteristics of the agricultural sector are prime determinants of being targeted.

5.2. Natural Resources Characteristics

Whether or not the characteristics and condition of natural resources determines the targeting behavior of countries is a relevant question. It is plausible to hypothesize that natural resources tied to the effective operation of agricultural lands can determine interest in a country's land resources. Two factors are considered: amount of rainfall, as a proxy for water resource abundance; and severely constrained soil fertility. Water and soil are, of course, key elements of productive agricultural areas. Results suggest that rainfall is marginally relevant, while the condition of degraded soil in a country is not. A country with a millimeter better rainfall potential is 1.004 times more likely to be targeted. The fact that water is important, but marginally so may suggest that while water is a consideration, it is a consideration at the margin. This may be perhaps due to the collateral investments in water technologies in large farms that may require less reliance on rain-fed agriculture, which is dependent on the volume of rainfall. It may also be due to the fact that ground water resources may effectively be utilized, thus reducing reliance on rainfalls. However, rainfall profile of a country still remains important.

The condition of the soil at the country level was not a significant factor. One reason for this may be that investors can target fertile pockets of land in the host country, even when there are large areas with degraded soil quality. Another could be the possibility that application of fertilizer and other chemical inputs can mitigate the state of degraded soils.

5.3. Agricultural Trade

Whether or not total agricultural imports and exports of countries encourage or discourage interest in their land is a relevant policy issue. Agricultural trade offers a valuable opportunity to connect local producers with global agricultural markets, potentially enhancing agricultural viability in host countries. Results suggest that net agricultural trade (value of agricultural exports minus imports) is a significant factor in explaining country targeting behavior. In fact, countries with better net agricultural trade are 1.004 times more likely to be targeted than countries that do not, the total effect depending on the level of net surplus. From this finding, it is plausible to extend the notion that access to developing countries' agricultural products in developed countries will enhance the likelihood of their agricultural land resources being targeted by investors.

5.4. Agricultural Technology and Development

Agricultural technology and agricultural sector development may encourage a host country to utilize much of its agricultural resources, and perhaps be less interested in land investments than would otherwise be the case. To test these hypotheses, three factors are considered: food productivity index; capitalization of agriculture and land equipped for irrigation. Findings suggest that while agricultural capitalization increases the likelihood of the country being targeted (by 1.001 times), land equipped for irrigation actually decreases it (by 1.056). However, the productivity of local agriculture was not a significant factor. These results may suggest a number of things. First, investors may already be targeting where productivity is low, realizing that these provides a tremendous upside for increased productivity by applying needed management, inputs and technology. Second, the fact that greater capitalization of agriculture attracts ILTs suggests an affinity for

more modern agriculture where human capital and equipment are present and where other support services exist. Third, the negative coefficient of irrigation again suggests an interest in benefiting from the upside. Investors simply target places where the deployment of irrigation technology can increase productivity.

5.5. Infrastructure Development

Countries in Africa differ in the degree of infrastructure development. Whether or not this disparity has implications for ILTs is tested by incorporating the development of paved roads as an explanatory variable. The statistical insignificance of these variables suggests that investors are not looking for places where infrastructure exists, to the contrary, they may be looking for places where infrastructure investment can make the difference.

5.6. Economic, Social, and Institutional Conditions

Studies on determinants of foreign direct investment flows to Africa often cite the importance of economic, social and institutional factors as relevant determinants (Wheeler and Mody 1992, Thomsen 2005, Asiedu 2005, Naude and Krugell 2007). Whether or not these factors also determine investment in agricultural land resources is an open question. To test the effect of economic and social conditions on country targeting behavior, four factors are considered as proxies: GDP per capita; human development; corruption and non-food productivity. Results indicate that the productivity of the non-agricultural sector is not a driving factor in targeting a country. Surprisingly, a country's corruption record is not statistically significant. The insignificance of corruption challenges one of the concerns typically put for the by opponents of ILTs, suggesting that these deals are not borne out of nor encouraged by corruption. One explanation for this is that since corruption is generally a problem in Africa, marginal differences across countries may not make that much of a difference in terms of where investment on agricultural land resources may go within Africa. Overall, interest in host country land resources seems to be motivated by factors other than non-agricultural sector productivity and corruption record.

However, degree of human development and stage of economic development matter. Countries with better human development are 1.369 times more likely to attract interest in their agricultural land resources than those with poor human development. Human development may signal availability of quality labor pool that can be gainfully employed in modern agricultural production and distribution. The stage of economic development is also relevant. Counties with higher per capita GDP are less likely to attract investment in their land resources. Poor countries are less able to fully utilize their natural resources, including agricultural lands. Therefore, poor countries are more likely to be targeted than African countries with higher per capita GDP.

5.7. Property Rights Protection

Investment in any asset is predicated on the knowledge, or perception, about property rights protection. Countries with poor record on property right issues are less likely to attract investment in their land resources, even with rich agricultural lands. Results confirm this observation. Countries with better property rights protection are 1.091 times more likely to be targeted than countries with poor property rights. Obviously, investors are looking for environments that protect their investments.

5.8. Food Security

One central debate in "land grabbing" discussions is whether or not the state of food security is exacerbated by ILTs. While resolving this debate requires time-series data and causality modeling, association between state of food security and

ILTs can be informative in this debate. The finding in this study suggest that countries with food insecurity are likely to be targeted, compared with countries that are relatively food secure. In fact, it is estimated that food insecurity increases the likelihood of ILTs 1.093 times. Food insecurity may push governments to explore alternative avenues to attain long-term food security, including inviting foreign investment in agriculture as a potential solution. Poor countries may also be interested in land lease revenues to augment their hard currency reserves crucial to importing capital goods to support development efforts. Therefore, vulnerability in food security enhances the likelihood of being targeted. This highlights the potential for food insecure countries to structure ILTs and the products of foreign operated farms to address local food security concerns by setting aside some production for domestic consumption.

The role of food aid dependence on land transactions is also evaluated. Food aid may provide a false sense of food security, particularly for countries that have reliably received it for years, but can also signal inability of local producers to meet local demand. Whether or not food aid is disruptive to local producers has been a subject of intense debate in the literature, but the role in land transactions is not sufficiently explored. Findings in this study show a negative relationship, suggesting that countries with strong dependence on food aid (measured by food aid received per capita) are less likely to engage in land transactions. But this relationship is weak, as the likelihood of this happening is close to zero. In other words, like food insecurity, reliance on foreign food aid does not encourage ILTs.

6. CONCLUSION

This paper explores the issue of international land transactions in Africa. Rising global food prices and the increased demand for biofuels have recently spiked speculative and investment interests in agricultural land resources in Africa. While opponents of ILTs have dubbed it "land grabbing" and are proposing mechanisms to monitor and regulate land transactions in Africa, proponents, including investing and host countries, welcome the opening of Africa's agriculture for foreign direct investment. The limited empirical work explaining, through supported theory, the motivations of investor and host countries in engaging in land transactions have largely limited rational debate about the issue. This paper attempts to close this gap by providing a theoretical explanation of the motivations of parties and empirically explaining the country targeting behavior of investors to better understand the systemic structure of where land deals are likely to occur.

Results from this study suggest that whether or not a country is targeted is predicated on the characteristics of the agricultural sector (in terms of degree of agricultural land potential utilized, agricultural value added and processed agricultural exports), characteristics of natural resources (water and soil conditions), agricultural trade (net export position in agricultural commodities), agricultural technology and development (capitalization and irrigation intensity), economic and social conditions (stage of development and human development), property rights protection and state of food security (degree of malnutrition and aid dependence) are relevant factors that explain the incidence of ILTs.

The policy implications of these findings is that countries that have poor economic and agricultural sector development, and with good land resources, are likely to be interested in foreign investment in their land resources as a solution to their agricultural sector problems. While foreign investment in agriculture can be optimally structured, including conditions outlined in the theoretical section of this paper, the fact that most deals are not structured in ways that meet the agricultural sector challenges of host countries (output retention clause, optimal lease determination, optimal contract longevity, etc) is a cause of concern. This study offers some insights on which countries are

likely to be targeted, and how host countries may potentially structure beneficial land deals. As the debate on "land grabbing" intensifies, identifying parameters for beneficial deal structuring can offer alternative framework for land policy related to ILTs.

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ENDNOTES

1. For example, foreign ownership of US agricultural land has been well documented. Several studies have explored the adequacy or inadequacy of such foreign ownerships (Lapping and Lecko 1983; Dobitz and Kirby 1989; Krupa and Ross 1996). The general consensus is that such acquisitions are not necessarily threats, but are normal aspect of foreign company expression of interest in the best productive resources in order to achieve company growth and other objectives. Other countries where international land ownership has drawn significant attention include Australia, Canada, Brazil, and Belize.
2. Reasons typically cited in the literature include food security, speculation, increased production capacity, control of resources and long-term investments.
3. One of the intriguing aspects of ILTs is the involvement of private and corporate financial and investment banking organizations, as well as sovereign wealth funds. A significant percentage of recent land acquisitions have been made by Asian, Gulf region and European-based companies that typically would not make significant investments in Africa, let alone in African farmland. A range of companies have been directly or indirectly involved in ILTs. These include Altima Partners, Renaissance Capital, EKO Asset Management Partners, Pine Street Alternative Asset Management LLC, Emergent Asset Management Ltd, EBG Capital AG, Agland Investment Services, Global Impact Investment Network, and TIAA-CREF. These companies tend to look at these transactions as natural extensions of rational portfolio management strategies and as opportunities for optimizing returns on the investments of company owners and shareholders. Similarly, host countries tend to be in favor of these transactions, obviously since they are participating in them.
4. Indeed, ILT was an important part of the agenda for the 2011 World Bank conference on Land and Poverty. It was immediately followed by a meeting of over 50 stakeholders from various organizations, organized in Washington by the USAID and the Millennium Challenge Corporation.
5. Considering the existence of strong agency problems in some of the host countries, the issue of corruption is also frequently raised, with the implication that one of the motives for a host country to participate is personal – government representatives engaging in these transactions for personal gains and not in the interest of the people they represent.

6. Some motives of host countries relate to long-term development of export capacity or capacity to exploit agricultural export potential. The fact that these transactions have involved places with significant food security concerns and places with high levels of capacity to feed themselves also suggest that long-term food security issues are at play. Nevertheless, it suffices to say that a number of factors affect host country's participation and that the supply side of the market may have argument that typically would not be considered in traditional modeling of the supply side of the land market.
7. Deininger et al. (2011) included statistical analysis of the factors that lead to the likelihood of being targeted. Some of the factors considered were amount of unused land, yield gap and two measures of governance – investment protection and land tenure security. Results from this study suggest a negative impact of rural land tenure on land acquisition, weak effect of Doing Business rank and that investors with media exposure are more likely to target countries having large cultivable land. The study also empirically examines the factors that increase the chance of a country being targeted. The study considered non-forested non-cultivated suitable land (which positively influences the likelihood of being targeted), yield gap (with negative influence), rural land tenure recognition (with negative influence), and investment protection (with negative influence).

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Chapter 44
The Behavior Intention of Tunisian Banks' Customers on using Internet Banking

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ABSTRACT

This paper examines empirically the factors affecting the adoption of internet banking in Tunisia using the Theory of Acceptance Model (TAM) and the Theory of Planned Behavior (TPB). Security and privacy construct were selected as additional factors because of their potent influence on the use of internet banking system. For this purpose, a Structural Equation Modelling (SEM) is employed to examine the inter-correlations among the seven proposed constructs. A survey involving a total of 284 respondents is conducted and confirmatory factor analysis used to determine the measurement efficacies. This study confirms the appropriateness of TAM, TPB, and the security and privacy construct in predicting intention to use internet banking in a Tunisian banking environment. This research reveals that TAM and TPB could be used to provide a solid theoretical foundation of internet banking in Tunisian acceptance case. The study contributes to the literature of internet banking in Tunisia.

1. INTRODUCTION

The Internet has a profound influence on the banking industry. The adoption of internet by Banks can offer a new market such as internet banking services (henceforth IB). These new channels, the internet banking services, are considered now as a new important channel in addition to the traditional ones. The automated teller machine (ATM), Phone-banking, Telebanking, PC-banking among others are the most important IB services proposed by contemporary Banks (Daniel, 1999; Chang, 2003; "Online banking goes mainstream," 2003).

The adoption of technology has led to greater productivity, profitability, and efficiency, faster service and customer satisfaction, convenience and flexibility, 24x7 operations, and space and cost savings. Banks' decision makers have recognized

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the importance of the adoption of IB on reduction costs and banks performance and have tried to develop strategies in order to grow consumer internet banking demand. Thus, understanding factors affecting the adoption of internet banking in Tunisia seems an important task for Banks' decision makers. This helps Banks to adopt a better marketing strategies to increase the use of IB in the Tunisia country.

This paper investigates the behavior intention of Tunisian banks' customers to use the IB. We use the Theory of Acceptance Model (TAM) and the Theory of Planned Behavior (TPB)

in order to investigate the internet banking acceptance system. Seven constructs was used to identify factors that influence intention to adopt Internet banking in Tunisia: perceived use, perceived ease of use, subjective norm, perceived behavior control, security and privacy, and attitude. Security and privacy were selected as additional factor to the TAM and TPB constructs because of their important influence on the use internet banking system. To do that, we collect data from bank customers in Tunisia. Two hundred eighty four usable responses are considered and Equation Structural Model (SEM) is used to fit data to the basic proposed model.

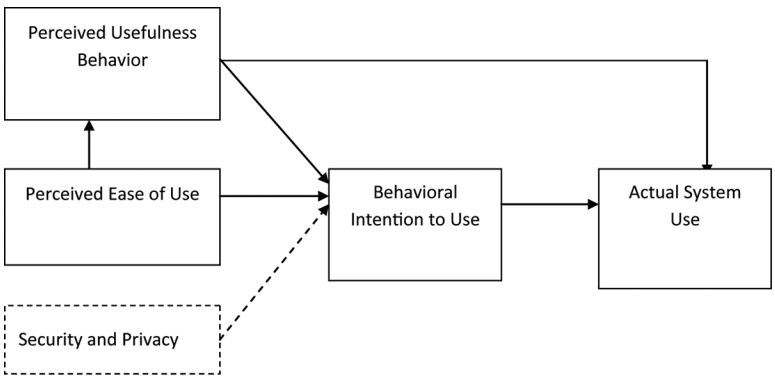
The remainder of the paper is set out in four sections. First, we provide a literature review of earlier studies of factors influencing consumers' use of IB and set the proposed hypothesis for this work. Then, we report the empirical methodology that was employed. Afterwards, we provide empirical findings and discuss results according to the conceptual framework of the TAM of internet banking. Finally, we conclude and suggest future research directions.

2. LITERATURE REVIEW AND HYPOTHESIS DEVELOPMENT

2.1. The Theory of Acceptance Model (TAM)

The majority of empirical works that have investigated the intention to use IB have been conducted using the Theory of Acceptance Model (TAM) (Davis, 1992; Hsu, 2004; Hsu et al., 2006). The TAM has been developed originally by Davis (1989). A graphic representation of the TAM is given in Figure 1. Following this theory, two theoretical constructs, Perceived Usefulness (PU) and Perceived Ease Of Use (PEOU), are considered as fundamental determinants of computer system use in organization. The first construct, the PU, reflects a person's belief in the use of technology. The second construct, The PEOU,

Figure 1. The TAM following Davis (1989) and Venkatesh et al. (2003) in solid line, and security and Privacy construct; Salisbury et al. (2001) in dash line.



reflects the person's belief of facility of use of the technology. These two factors are the most commonly used in the empirical literature (Davis, 1989; Venkatesh & Davis, 2000; Fagan et al., 2008; Hsu et al., 2006; Huang, 2008; Norazah & Norbayah, 2009; Norazah et al., 2008). Lederer et al. (2000), Moon and Kim (2001), and Wadie and Charfeddine (2011) among others have tested the TAM and have showed that the two constructs, PU and PEOU, influence positively the attitude and the attention to use Online Banking. Moreover, perceived of usefulness is supposed to be influenced by the perceived of ease of use.

In order to investigate the TAM, we emit the following 5 hypotheses,

H1: Perceived usefulness positively influences the intention to use IB.
H2: Attitude positively influence positively influences the intention to use IB.
H3: Perceived usefulness positively influences attitudes towards the use of IB.
H4: Perceived ease of use positively influences attitudes towards the use of IB.
H5: Perceived ease of use positively influences the perceived usefulness of the use of IB.

In addition, a new construct is introduced to the TAM. Following Salisbury et al. (2001), Miyazaki and Fernandez (2001), and Nissenbaum (2004), security and privacy is considered as an important factor that influence the use of IB, see for instance Godwin (2001) and Aladwani (2001).

The importance of security and privacy concerns in online banking environment has been broadly discussed and reported in many studies. Godwin (2001) reported that privacy and security concerns were found to be a major barrier to Internet shopping. This concern has been extended to the Internet banking environment. Security has been widely recognized as one of the main obstacles to the adoption of electronic banking (Aladwani, 2001), and privacy issues have proven important barriers to the use of online services (Westin & Maurici, 1998). White and Nteli (2004) reports that the level of increase of internet banking usage for banking purposes has not changed in the UK because of the continuing consumer fear about security. In a study about the adoption of internet banking (Sathye, 1999) reports that privacy and security were found to be significant obstacles to the adoption of online banking in Australia. Therefore, the following new hypothesis will be introduced to the TAM.

H6: Security and privacy positively influences the perceived usefulness of the use of IB.

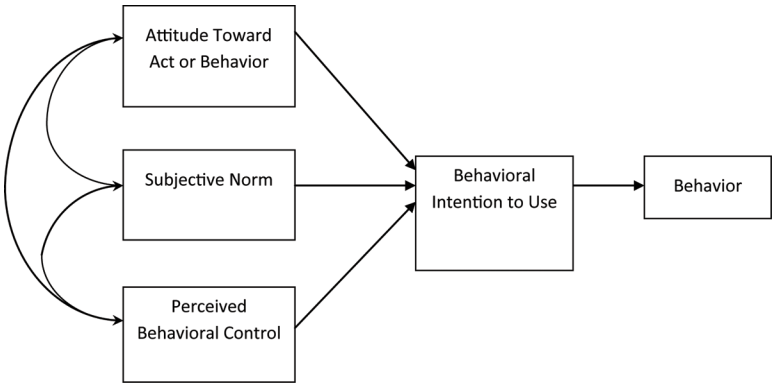
2.2. The Theory of Planned Behavior (TPB)

The Theory of Planned Behavior (TPB) was proposed by Ajzen (1985, 1991) as an extension of the theory of reasoned action (Fishbein & Ajzen, 1975). Figure 2 reports a graphic representation of the TPB. Following this theory, individuals do not have complete control over their behaviour (Ajzen, 1991). The TPB suggests that individual behaviour is determined by behavioural intentions. Theses laters are considered as a function of three constructs: the individual attitude toward the behavior, the subjective norms surrounding the performance of the behavior, and Perceived behavioral control. This later construct indicates that a person's motivation is influenced by how difficult the behaviors are perceived to be, as well as the perception of how successfully the individual can, or cannot, performs the activity. Perceived behavioral control can influence behavior directly or indirectly through behavioral intentions.

To investigate the TPB, we emit the following two hypotheses:

H7: Subjective norm positively influences the intention to use online banking.
H8: Perceived behavior control positively influences the intention to use online banking.

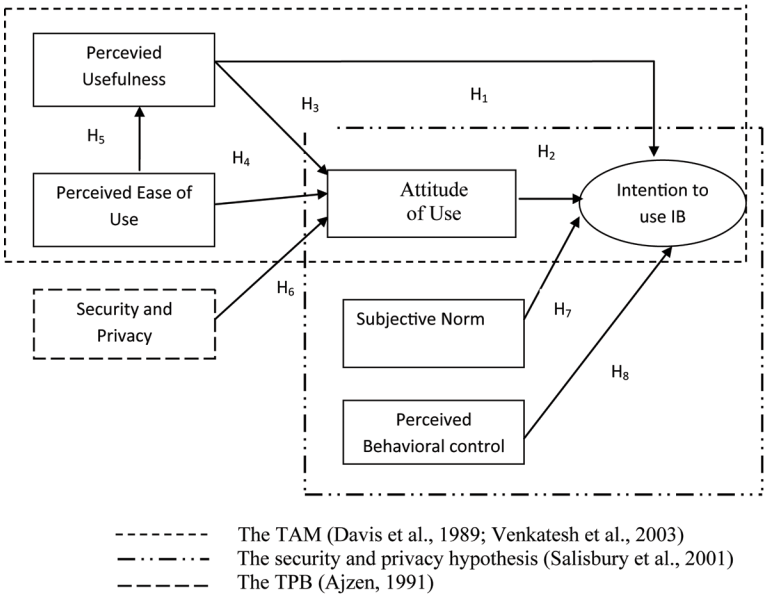
Figure 2. TPB (Ajzen, 1985, 1991)



2.3. Research Model and Hypothesis

We use the two theories described in the previous section in order to develop our main research model and proposed hypothesis. By combining the TAM and the TPB in addition to the security and privacy construct we propose our main research model as described in Figure 3. The proposed model includes five independent variables, perceived of usefulness, perceived ease of use, security and privacy, subjective norm, and perceived behavioral control, one intervening variable, the attitude of use, and the intention to use as the dependent variable. Our main object in this paper is to test the strength of the eight hypothesized relationships embedded in the theoretical model. Precisely, we investigate the robustness of the proposed model in predicting customers' intention to adopt Internet banking in Tunisia. The eight hypotheses that we want to test in the empirical investigation are reported in Figure 3.

Figure 3. Proposed research model



In order to investigate the proposed research model, we follow a two step procedure as suggested by Anderson and Gerbing (1988) and Koufteros (1999). First, we estimate the measurement model in order to assess convergence and discriminant validity. Then, we examined the structural model in order to assess if the parameter estimates are expected to exhibit the correct sign and size, and to be consistent with underlying theory.

3. METHODOLOGY

3.1. Data

3.1.1. Measures

Questionnaire items were adapted from prior studies, which are described as follows. Perceived usefulness (Cheng et al., 2006), perceived ease of use (Cheng et al., 2006), attitude (Cheng et al., 2006), intention (Cheng et al., 2006), subjective norm (Wu & Chen, 2005), perceived behavior control (Wu & Chen, 2005), and security and privacy (Pikkaraienen et al., 2004). In the questionnaire, the respondents were required to rate their level of agreement with a Five-point Likert scales with end points of "strongly disagree" and "strongly agree" in order to examine participant's responses to these statements. The demographics characteristics were measured in terms of gender, age, education, occupation, and experience using online banking.

3.1.2. Sample Profile

Data collection took place in April 2011. The questionnaire was administered by meeting the respondents on a one-to-one. The respondents engaged in this study, were if they used the internet and had a bank account. The questionnaires were distributed to 284 respondents randomly selected. Sample demographic are depicted in Table 1. Participants in the study were composed of 54.22% male and 45.78% female. Majority of the respondents were between 18 and 30 years old, which was 42.25% of the total respondents. Majority of the respondents were college or university graduates (87.32%). 89.34% of the respondents posses personal computers whereas only 9.7% on them don't. Moreover, 90.1% have internet access.

3.2. Exploratory Factor Analysis

In order to investigate the uni-dimensionality of constructs, an exploratory factorial analysis (EFA) was conducted on the collected data. The principal components extraction method was adopted and the results were submitted to the Varimax rotation method. In the first step of the analysis, one item that didn't have well defined factorial loads in their respective construct (Hair et al., 1998).

Table 1. Demographic statistics

Means	Value	Frequency	Percentage (%)
Gender	Male	154	54.22
	Female	130	45.78
Age	18 to 30	120	42.25
	31 to 40	94	33.09
	41 to 50	66	24.26
Education Level	Primary	8	2.82
	Secondary	28	9.86
	College/ University	248	87.32
Possession computer	Yes	254	89.34
	No	30	10.66
Occupation	Executives	154	54.22
	Middle-staff employees	36	12.67
	Blue-collar workers	10	3.52
	Independents	14	4.93
	Students	70	24.64
Internet Access	Yes	266	90.1
	No	18	9.9

Based on these criteria, only one item (SP6) had to be dropped from the subsequent analysis. Thus from the 26 initial items, 25 are retained for the analysis[1].

The results of the Cronbach's alpha is reported at column 6 of Table 2. All obtained values range between 0.747 and 0.916 except for the PBC construct which have a value of 0.661. In order to keep the general form of the basic model, we decide to keep this construct.

3.3. Confirmatory Factor Analysis (Measurement Model)

To evaluate reliability and validity of the final measurement model, we use the following three criteria as suggested by Fornell and Larcker (1981).

1. All indicators factor loading should be significant and exceed 0.5,

Table 2. Construct reliability and convergent validity

Constructs	Items	Factor Loading	t-Value	Average Variance Extracted	Cronbach's Alpha
Perceived usefulness	PU1	0.58	7.46	0.455	0.797
	PU2	0.63	8.57		
	PU3	0.68	6.30		
	PU4	0.79	6.66		
Perceived ease of use	PEOU1	0.95	6.51	0.624	0.747
	PEOU2	0.81	7.57		
	PEOU3	0.56	5.64		
Security and privacy	SP1	0.95	7.18	0.845	0.838
	SP2	0.90	10.12		
	SP3	1.08	10.39		
	SP4	0.83	8.55		
	SP5	0.81	8.48		
Attitude	ATT1	0.72	7.55	0.680	0.838
	ATT2	0.87	10.47		
	ATT3	0.83	8.11		
	ATT4	0.87	9.30		
Subjective norm	SN1	0.91	15.78	0.781	0.916
	SN2	0.86	14.83		
	SN3	0.88	16.20		
Perceived behavioral control	PBC1	0.69	6.29	0.575	0.661
	PBC2	0.79	4.87		
	PBC3	0.79	5.56		
Intention to use IB	INT1	0.91	11.18	0.746	0.856
	INT2	0.85	10.13		
	INT3	0.83	9.09		

2. Average variance extracted (AVE) by each construct should exceed the variance due to measurement error for the construct (e.g., AVE should exceed 0.5).

As shown in Table 2, all obtained value of the factor loading exceed the 0.5 and where significant at the 1% level. This indicates convergent validity for all latent variables. The result of AVE are well above 0.5 except for the first construct where the AVE is equal to 0.455. This result shows that discriminant validity is supported for all constructs (Fornell & Larcker, 1982).

3.4. Structural Equation Model (SEM)

3.4.1. Model Testing

The final measurement model reached or succeeded all recommended thresholds, with a scaled (χ_2/df) equal to 1.47, a goodness-of-fit index (GFI) of 0.92, the root mean square error of approximation (RMSEA) is 0.062, the comparative fit index (CFI) is 0.96, the normed fit index (NFI) is 0.92 and the relative Fit index (RFI) is 0.90. The results are reported in Table 3.

For the three AIC, CAIC and ECVI indices, by comparison, means that we compare the estimated model to the saturated model and the independent model. The values of the AIC, CAIC and ECVI for the saturated and independent models are respectively 650, 1935.64, 4.61 and 5394.57, 5493.46, and 38.26. For these three last indices, the results indicate that the three indices are adequate.

3.4.2. Hypothesis Testing Results

In order to test previous proposed hypothesis H1 to H8, we estimate the following structural model using the Lisrel 8.8. The results are reported in Figure 4. For each parameter β_i we report the level of significance where *,** and *** indicate respectively the 10%, 5% and 1% level.

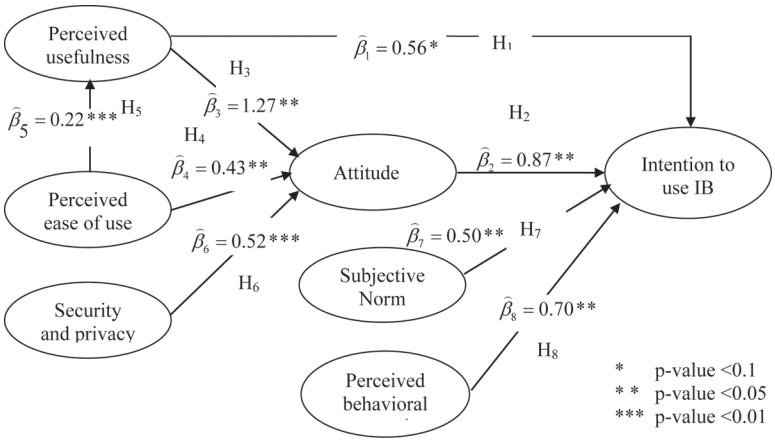
H_1: $INT=\beta_1*PU+\xi_1$
H_2: $INT=\beta_2*ATT+\xi_2$
H_3: $ATT=\beta_3*PU+\xi_3$
H_4: $ATT=\beta_4*PEOU+\xi_4$
H_5: $PU=\beta_5*PEOU+\xi_5$
H_6: $ATT=\beta_6*SP+\xi_6$
H_7: $INT=\beta_7*SN+\xi_7$
H_8: $INT=\beta_8*PBC+\xi_8$

The result of the estimation of this model is reported in Figure 4 where $\widehat{\beta}_i$ for $i\in\{1,2,\ldots,8\}$ is the estimated values of β_i. In this study, obtained empirical results show that the intention to use internet banking is primarily and positively affected by attitude ($\widehat{\beta}_2 = 0.87$, $p<0.05$), less so by perceived behavioral control ($\widehat{\beta}_8 = 0.70$, $p<0.05$), perceived usefulness ($\widehat{\beta}_4 = 0.56$, $p<0.1$), and subjective norms ($\widehat{\beta}_7 = 0.50$; $p<0.05$). As a result, Hypotheses 2, 4, 7, and 8, are all supported. Attitude was predicted by PU ($\widehat{\beta}_1 = 1.27$, $p < 0.05$), PEOU ($\widehat{\beta}_5 = 0.43$, $p < 0.05$), and security and privacy ($\widehat{\beta}_6 = 0.52$, $p < 0.01$). These findings validate Hypotheses 1, 5, and 6 respectively.

Table 3. Results of Goodness of Fit

Fit Indices	Suggested	Obtained
Absolute Indices		
Scaled χ_2 (χ_2/df)	> 1 and < 5	1.47
Goodness of Fit Index (GFI)	> 0.9	0.92
Root Mean Square Error of Approximation (RMSEA)	< 0.08	0.062
Incrementals Indices		
Comparative Fit Index CFI	> 0.9	0.96
Normed Fit Index NFI	> 0.9	0.92
Relative Fit Index RFI	> 0.9	0.90
Parcimonie Indices		
AIC	The lower by comparaison	530.86
CAIC	The lower by comparaison	799.86
Expected Cross-Validation Index ECVI	The lower by comparaison	3.76

Figure 4. Estimation results of the research model



3.5. Discussion, Conclusion and Limitations, and Futures Research

3.5.1. Discussion

The results of this study provide support for the conceptual model presented in Figure 3 and for the hypotheses regarding the directional linkage among variables. Our results suggest that perceived usefulness determines attitude by itself ($\beta_3 = 1.27**$). In fact, the PU has an indirect influence, via attitude, on behavioral intention to use internet banking. This is consistent with the findings of previous studies (Davis, 1989; Davis et al., 1992; Gefen & Straub, 2000; Taylor & Todd, 1995; Venkatesh & Davis, 2000), which indicated that perceived usefulness has both direct and indirect influences on behavioral intentions toward system use. Perceived ease of use does not have a direct impact on intention to use internet banking, although it affects the perceived usefulness ($\beta_5 = 0.22***$), which in turn impacts intention to use. This is also consistent with the previous studies of Davis et al. (1989), Pikkarainen (2004), Chan and Lu (2004) and Wang et al. (2005), who found that perceived ease of use is highly associated with perceived usefulness in the adoption of technological products and services.

Moreover, attitude is predicted jointly by, perceived ease of use ($\beta_4 = 0.43**$), security and privacy ($\beta_6 = 0.52***$). Attitude has a significant impact ($\beta_2 = 0.87**$) and appears to be the first positive determinant of intention to adopt internet banking. Previous researchers have suggested that the inclusion of attitude is not meaningful (Heijden, 2003) but our research suggests otherwise. Further, the results also indicate that, subjective norms, are found to have a significant relationship with intention ($\beta_7 = 0.50**$) to adopt Internet banking. The result is in line with previous studies Taylor and Todd (1995), Venkatesh et al. (2000), and Amin et al. (2007) that found social norm to be a significant factor for information system acceptance. In reality, the decision to use internet banking sometimes influenced by the external environment such people around the individual. Another finding from this study that the perceived behavioral control have a positive influence ($\beta_8 = 0.70**$) to the intention to use internet banking. This is in line with the previous findings of Tan and Teo (2000) and Shih and Fang (2004), which founded significant relationship between perceived behavioral control and internet banking setting. Finally, security and privacy also has a significant impact ($\beta_6 = 0.52***$), on the internet banking. This is consistent with the findings

of Sathye (1999), Chung and Paynter (2001), Sohail and Shanmugham (2004), Gerrard and Cunningham (2003), Sayar and Wolfe (2007), and Sohail and Shaikh (2007), which have reported that these factors have positive influences on the acceptance, of information system.

4. CONCLUSION

Theoretically, this study confirms the appropriateness of TAM and TPB in predicting intention to use internet banking in a Tunisian banking environment. This research reveals that TAM could be used to provide a solid theoretical foundation of internet banking in Tunisian case. Security and privacy were selected as additional factors to TAM and TPB construct because of their potential influence on the use electronic system. The result of the statistical analysis showed that all the seven factors used to explain intention to use internet banking have a positive and significance influence on the adoption of the system. The result of this study clearly reflects that users find internet banking system useful, and easy to use. Attitude, perceived behavior control and perceived usefulness are the critical factor in explaining users' adoption of internet banking. In order, to promote the use of internet banking by Tunisian customers financial institutions in Tunisia could take several actions. First, internet banking professional should create a positive perceptions among its customers regarding of internet banking services. Creating positive perceptions might be adequately achieved by offering free information without any charges or at minimum charges. To promote internet banking, there is a need to devise new marketing campaign so as to target more elderly people informing them of the facilities of this service and to make this technology easy to use. Also, banks should promote the advantages that online banking when compared to traditional ways of banking. Finally, banks in Tunisia should ensure that security and privacy of the internet banking systems are properly developed and users should also be made aware of their systems are secured and personal information is protected.

4.1. Limitations and Future Research

Although the results can be considered statistically significant, this research has some limitations; the first is the sample size comprised with 284 people. Future research requires a larger sample for the purpose of higher accuracy. Second, other factors such as convenience, confidence, cost, and experience were not taken into consideration and warrant the need for future research in the field of Internet banking adoption.

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ENDNOTES

[1] The results of the KMO, the factors contribution using the ACP and the Varimax for unidemnsality can be obtained upon request from the authors.

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APPENDIX

Survey Instrument

Please rate the questions from regarding the bank's Website service (Table 4) on the following scale: (1) Strongly Disagree; (2) Disagree; (3) Sans Opinion; (4) Agree; (5) Strongly Agree.

Table 4.

N°	Item	(1)	(2)	(3)	(4)	(5)
Perceived Usefulness						
PU1	I think that using the online banking would enable me to accomplish my tasks more quickly.	(1)	(2)	(3)	(4)	(5)
PU2	I think that using the online banking would make it easier for me to carry out my tasks.	(1)	(2)	(3)	(4)	(5)
PU3	I think the online banking is useful.	(1)	(2)	(3)	(4)	(5)
PU4	Overall, I think that using the online banking is advantageous.	(1)	(2)	(3)	(4)	(5)
Perceived Ease of Use						
PEOU1	I think that learning to use online banking would be easy.	(1)	(2)	(3)	(4)	(5)
PEOU2	I think that interaction with online banking does not require a lot of mental effort.	(1)	(2)	(3)	(4)	(5)
PEOU3	I think that it is easy to use online banking to accomplish my banking tasks.	(1)	(2)	(3)	(4)	(5)
Security and Privacy						
SP1	I trust in the technology an online bank is using	(1)	(2)	(3)	(4)	(5)
SP2	I trust in the ability of an online bank to protect my privacy	(1)	(2)	(3)	(4)	(5)
SP3	I trust in an online bank as a bank	(1)	(2)	(3)	(4)	(5)
SP4	Using an online bank is financially secure	(1)	(2)	(3)	(4)	(5)
SP5	I am not worried about the security of an online bank	(1)	(2)	(3)	(4)	(5)
SP6	Matters of security have no influence on using an online bank	(1)	(2)	(3)	(4)	(5)
Attitude						
ATT1	I think that using online banking is a good idea.	(1)	(2)	(3)	(4)	(5)
ATT2	I think that using online banking for financial transactions would be a wise idea.	(1)	(2)	(3)	(4)	(5)
ATT3	I think that using online banking is pleasant.	(1)	(2)	(3)	(4)	(5)
ATT4	In my opinion, it is desirable to use online banking.	(1)	(2)	(3)	(4)	(5)
Subjective Norm						
NS1	People who are important to me would think that I should use online banking.	(1)	(2)	(3)	(4)	(5)
NS2	People who influence me would think that I should use online banking.	(1)	(2)	(3)	(4)	(5)
NS3	People whose opinions are valued to me would prefer that I should use online banking.	(1)	(2)	(3)	(4)	(5)
Perceived Behavior Control						
PBC1	I think that I would be able to use the online banking well for financial transactions.	(1)	(2)	(3)	(4)	(5)
PBC2	I think that using online banking would be entirely within my control.	(1)	(2)	(3)	(4)	(5)
PBC3	I think that I have the resources, knowledge, and ability to use online banking.	(1)	(2)	(3)	(4)	(5)

continued on following page

Table 4. Continued

N°	Item	(1)	(2)	(3)	(4)	(5)
Intention to Use						
INT1	I would use the online banking for my banking needs.	(1)	(2)	(3)	(4)	(5)
INT2	Using the online banking for handling my banking transactions is something I would do.	(1)	(2)	(3)	(4)	(5)
INT4	I would see myself using the online banking for handling my banking transactions.	(1)	(2)	(3)	(4)	(5)
Demographics Characteristics						
D1	Are you a male or a female? Male Female					
D2	What is your age range? 18 to 30 31 to 40 41 to 50					
D3	Do you own or have access to a computer? Yes No					
D4	Do you have Internet access at home? Yes No					
D5	What is your highest educational level attained? Primary Secondary College/University					
D6	Which bank/s do you use for majority of your Internet banking services? ……					

Acronyms of Banks

AB: Amen Bank
ATB: Arab Tunisian Bank
ATTIJARIBANK: Attijaribank
BFT: Banque Franco Tunisienne
BH: Banque de l'Habitat
BIAT: Banque Internationale Arabe de Tunisie
BNA: Banque Nationale Agricole
BT: Banque de Tunisie
BTE: Banque de Tunisie et des Emarates
BTK: Banque Tuniso Koweitienne
BTS: Banques Tunisiennes de Solidarité
BZ: Banque Zitouna
STB: Société Tunisienne des Banques
TQB: Tunisian Qatari Bank
UBCI: Union bancaire pour le Commerce et l'Industrie
UIB: Union International des Banques

Chapter 45
An Investigation of Greek Firms' Compliance to IFRS Mandatory Disclosure Requirements

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ABSTRACT

The paper investigates the compliance with IFRS disclosure requirements and ultimately the quality of financial statements. Using a checklist based on the IFRS disclosure requirements, a compliance score was calculated for a sample of 58 listed, non-finance, Greek firms for the 2006 and 2008 financial statements. Disclosure compliance was measured under the "dichotomous approach" and the "partial compliance unweighted method." Subsequently, univariate tests and a multivariate regression model were used to investigate what firm characteristics are related with disclosure compliance. Closely-held firms exhibit higher compliance rate, while disclosure compliance is not associated with firms' profitability, leverage and size. There is a positive association between the engagement of a Big-4 international auditing firm and the compliance rate. This study can be of interest to accounting regulators who set disclosure requirements and capital market participants by providing indication regarding Greek firms' compliance with IFRS disclosure requirements. In addition, it examines the disclosure compliance with the important disclosure items of all IFRS rather than focusing in the disclosure items of specific IFRS. By adopting both approaches proposed in literature for measuring compliance, the authors enhance the robustness of the findings of this study, while the authors provide empirical evidence concerning the extent to which the two approaches provide significantly different results. The authors found that the two methods do not produce significantly different results.

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1. INTRODUCTION

This paper investigates the extent of Greek companies' compliance to disclosure requirements laid out in International Financial Reporting Standards (IFRS) as well as some of the factors that may explain compliance. The disclosures included in the published financial statements of a sample of 58 Greek firms have been examined. In order to enhance the robustness of the findings of this study the compliance rate has been calculated by employing two approaches proposed in the literature, i.e. the "dichotomous approach" and the "partial compliance unweigheted method."

Most of the studies concerning disclosure quality concentrate on voluntary disclosure and cover the period before 2005 when the application of IFRS was not mandatory. From January 1st 2005 onwards the listed companies in all EU countries have had to prepare their financial statements in accordance with IFRS. That development changed structurally the accounting environment of most EU countries, including Greece. This study focuses on mandatory disclosure and covers the period after 2005 when the application of IFRS is mandatory. Furthermore, within this study we examine the disclosure compliance with the most important disclosure items of all IFRS, while many studies have examined the disclosure compliance with specific IFRS. As a result the total number of information items that were examined in this study is significantly higher comparing to disclosure items examined in previous studies. The Greek business environment possesses certain characteristics that provide the researcher the opportunity to investigate the factors that influence disclosure compliance within a context which is quite different from that prevailing in many developed countries. In Greece, as in many European countries (e.g. France, Italy), the ownership structure of the majority of the firms is characterized by a high level of concentration (Nobes & Parker, 2000), while the main providers of funds for Greek companies are the banks. Furthermore, in Greece there is a close linkage between tax accounting and financial reporting. These factors are generally not associated with high disclosure compliance and high quality published financial statements (Nobes & Parker, 2000). Indeed, Leuz et al. (2003) show that Greek companies appear to engage in some of the most extreme earnings management practices in the world. Bhattacharya et al. (2003) provide similar evidence, since in their study Greek firms are the most engaged in earnings management among firms from 34 countries. Florou and Galarniotis (2007) found that the corporate governance transparency of Greek firms is low while the compliance of Greek firms with corporate governance disclosure requirements provided by the Greek legislation is also low (51,8%). They conclude that Greek firms are reluctant to disclose information regarding their governance practices. On the basis of this discussion we would expect that the compliance of Greek firms with the IFRS disclosure requirements would not be particularly high. This study by adopting both approaches proposed in the literature for measuring disclosure compliance provides empirical evidence concerning the extent to which the two methods provide significantly different results. These two approaches in measuring disclosure compliance are considered to provide quite different results (see, Street & Gray, 2001; Tsalavoutas et al., 2010).

The findings of statistical analysis suggest that ownership structure and the type of the external auditor applied are significant factors explaining compliance. Leverage, size and profitability appear to have less explanatory power. Furthermore, we found that the two methods for measuring disclosure compliance do not produce significantly results.

The rest of this paper proceeds as follows. In Section 2 we develop the hypotheses to be tested while in section 3 the sample and the research design followed in this article are described. Section 4 reports the results of the empirical investigation undertaken for the purposes of this study. Section 5 summarizes and concludes the paper.

2. HYPOTHESIS DEVELOPMENT

This paper adopts agency theory as a conceptual framework to examine the compliance of Greek listed firms with IFRS disclosure requirements. The information asymmetry between agents and principals is the fundamental issue upon which agency theory is developed (Jensen and Meckling, 1976). Information asymmetry emerges when the principal has a limited ability to oversee agent's actions and performance (Setyadi et al., 2011). Within this context, firms' managers (agents), due to their ability to conceal possible performance deficiencies from firms' owners (principals), are likely to behave opportunistically by decreasing their performance and evading responsibilities. This conflict of interest between principal and agent gives rise to agency costs. When, owners and creditors cannot observe managers actions directly, they have a motive to impose costly monitoring systems that oversee managers' actions. The significance of agency costs is associated with certain firms' characteristics. The characteristics of the firm that are examined in this study relate to the financial performance of the firms and certain aspects of their corporate governance structures.

2.1. Leverage and Disclosure Compliance

According to agency theory, the creditors of highly leveraged firms have strong incentives to prompt management to disclose more information (Amran et al., 2009). More leveraged firms tend to be more speculative and riskier while the debt-holders have greater power over the financial structure of such firms (Oliveira et al., 2011). On the other hand, it has been argued that creditors can obtain the information they need by sources other than annual reports (Leuz et al., 2004). Importantly, in Greece as in other European countries (e.g. France, Germany), bank credit plays a dominant role in the financing of business enterprises. Banks developed a close relationship with many companies, while in certain cases they own part of the firm's share capital. Thus, banks in many instances may directly obtain any relevant financial information, without having to rely upon publicly disclosed data. Consequently, the importance of public accounting information may further diminish. Within this context, the demand for high quality disclosure is not expected to be high. Nevertheless, consistently with the arguments of agency theory we test the hypothesis:

H1: The rate of disclosure compliance is positively associated with the firm's leverage

2.2. Ownership Status and Disclosure Compliance

Ownership structure has been hypothesized to be associated with the disclosure compliance of a firm (Soderstrom & Sun, 2007); for those firms in which ownership is concentrated in the hands of a relatively small number of shareholders who actively control the firm's management, managers can communicate any important information directly to shareholders without having to use published financial statements (Klassen, 1997). As a result lower disclosure compliance is expected for closely held firms. According to Birt et al. (2006) in more concentrated ownership structures there is less need for corporate disclosures since the major shareholders can actively monitor and control firms' management. On the other hand, Barako et al. (2006) argue that in the more diffused ownership structures small shareholders may face difficulties in monitoring firms' management. Within this context higher level of disclosure can be expected from widely-held firms. As mentioned above the ownership structure of most Greek firms is highly concentrated, particularly in the form of family ownership. In most cases, the owners are actively involved in their companies' administration by occupying important posts within the organizational structure of their firms (Sykianakis, 2004; Tzovas, 2006). Managers

can communicate information regarding firm's performance directly to their superior owner-managers without having to rely upon financial statements. Under these circumstances, there are no strong incentives for firms to provide high quality financial disclosures. The provision of information has been identified as a factor that contributes in the protection of shareholders' interests from opportunistic, self-interested and managerial behaviour (La Porta et al., 1998). The national legal rules can be an additional mechanism that complements shareholders' protection (Florou & Galarniotis 2007). The voting and dividend rights provided by the Greek legislation are quite significant. In particular, La Porta et al. (1998) found that Greece is one of only 11 (out of 49) countries that "impose genuinely one-share one-vote rules." Furthermore, is one of only seven (out of 49) countries, where firms have the legal obligation to pay as dividends a certain proportion of their profits. It can be argued, therefore, that Greek legislation provides significant protection to shareholders' interests. As a consequence, the role of accounting information as protection mechanism of shareholders' interest may not be crucial. Within this context, the demand for more accounting information may not be particularly high. On the basis of the above analysis, the association between disclosure compliance and the level of ownership concentration it can be hypothesised to be negative.

It should be pointed out that when the ownership is so concentrated that a single shareholder effectively controls the company the agency problem may shift away from the manager vs. owner problem, to minority shareholders vs. controlling shareholders problem (Setyadi et al., 2011). When large shareholders control firms they pursue policies that aim to increase their benefits at the expense of minority shareholders (Shleifer & Vishny, 1997). Jensen and Meckling (1976) argue that convergence of interest can occur between outside investors and large shareholders when outside investors believe that large shareholders aim to maximize firm value. In this case outside investors will impose fewer contractual constraints in the firm. Within this context the agency costs will be low and the larger shareholders will not have strong incentives to manipulate and/or withhold information. On the contrary they will have incentives to maintain level of disclosure consistent with the maximisation of the value of the firm. As a consequence, the association between owners' holdings and disclosure will be positive (Oliveira et al., 2011). Given the opposing arguments that have been developed concerning the impact that ownership structure may have upon disclosure compliance we do not predict a particular sign regarding the association between the two variables and we test the hypothesis:

H2: The rate of disclosure compliance is associated with the firm's ownership structure.

2.3. Corporate Size and Disclosure

According to Cooke (1989) the size of a firm is a variable that can explain, to a considerable extent, the quality of firm's disclosures. Larger firms are expected to possess the resources that are necessary for the preparation of an event such as the introduction of IFRS (Jones & Higgins, 2006). Furthermore, the financial statements of larger firms are more likely to be thoroughly examined and analysed by financial analysts and shareholders. As a result, considerable pressure is exercised to larger firms to improve the quality of their disclosure (Hossain & Adams, 1995). Within this context we test the hypothesis:

H3: The rate of disclosure compliance is higher for larger firms

2.4. Profitability and Disclosure

The compliance of a firm to the disclosure requirements prescribed by particular accounting standards is affected by the profitability of the

firm (Palmer, 2008). When the introduction of a new or a revised accounting standard is expected to adversely affect firms' income, companies are more concerned about issues relating to the implementation of the new standard and the way they will communicate to their shareholders their continuing underlying profitability (Jones & Higgins, 2006). According to agency theory the managers of profitable firms will disclose financial information to the external users of accounts in order to advance their interests. They will disclose detailed information in order to continue in their positions and their compensation arrangements. On the basis of the political costs theory, it can be argued that the firms with large political visibility will have an incentive to disclose more information in order to justify the level of their profits (Inchausti, 1997). Within this context, it is expected that the more profitable firms will have higher compliance rates than the less profitable firms (Inchausti, 1997; Palmer, 2008). We test the hypothesis that:

H4: The rate of disclosure compliance is positively associated with the firm's profitability.

2.5. Auditor Type

The level of compliance with disclosure requirements is associated with the type of external auditors appointed (Street & Gray, 2001; Glaum & Street, 2003; Ali et al., 2004; Setyadi et al., 2011). In particular, it is argued that there is a positive association between the engagement of Big-4 international auditing firms and the level of a firm's disclosure compliance. The choice of external auditor is a mechanism that aims to minimize agency costs. The companies audited by the major auditing firms have significant agency costs and they attempt to reduce these costs by employing the major auditing firms (Setyadi et al., 2011). Tsalavoutas and Evans (2010) found that only companies with non Big-4 auditors faced significant impact on net profit and liquidity on transition to IFRS. Chalmers and Godfrey (2004) argue that, in order to maintain their reputation and to avoid reputational costs, the larger and well-known auditing firms are more likely to demand higher levels of disclosure. Furthermore, the major international auditing firms have greater knowledge about IAS (Lopes & Rodrigues, 2007). In fact, Tsalavoutas and Evans (2010) found that the Greek firms that had experienced a smooth transition to IFRS, were the firms that were audited by Big-4 international auditing firms.

H5: The disclosure compliance is predicted to be higher in companies audited by the Big-4 auditing firms.

3. RESEARCH DESIGN

3.1. Sample Selection

The financial statements of a sample of Greek listed non-finance firms for the financial years 2006 and 2008 were examined. The year 2006 was the second year of compulsory application of IFRS for Greek firms. In order to smooth the progress of adoption of IFRS by Greek firms, in the first year of IFRS application (i.e. 2005), a number of exceptions were (unofficially) granted to firms with respect to the disclosures that they should include in their financial statements. These exceptions were over and above the exceptions allowed by IFRS1 for the first time adoption of IFRS. Therefore, if the present analysis was based on the 2005 financial statements, its results may not be indicative of the actual compliance of Greek firms. From 2009 onwards IFRS were subject of continuous revisions, while a number of revisions that had been decided in earlier periods became effective gradually after 2009. Thus, we decided to restrict our analysis in the financial statements of the periods 2006 and 2008.

3.2. Data Source

The disclosures included in published financial statements of sample of 58 Greek firms have been examined. The sample does not include firms from the financial sector. The firms included in the sample of listed firms were chosen in order to be representative of the (other) main sectors of the Greek Economy. The focus of this paper is compliance with the disclosure requirements of all IFRS; this would require testing whether a firm complies with more than 1,500 items, which are not necessarily applicable in all sectors. Furthermore, checking the compliance of a company with all such requirements would be open to substantial bias because the authors could not be certain whether a disclosure requirement was pertinent to the specific company. On the other hand, there is a question regarding which are the most important disclosures. For this reason, this study uses the disclosures included in the proposal (as it then was) for a Standard for Small and Medium Sized Entities. This document supposedly focuses on the most important disclosure items. The total number of information items that were examined in this study is 436, which is significantly higher comparing to disclosure items examined in previous studies. For instance, Glaum and Street (2003) used an IAS disclosure checklist containing 153 items and a US GAAP one contained 144 items. Hodgdon et al. (2008) employed a disclosure list made up from 209 disclosure items and Setyadi et al. (2011) used a 29 item index.

3.3. Measurement of the Variables

3.3.1. Dependent Variable

For each category of disclosure it has determined which elements should be disclosed. Subsequently it has been examined whether the sample firms made the appropriate disclosures in their annual report. An issue with scoring disclosures in financial statements is whether or not an undisclosed information item is applicable to a sample firm. Several measures have been proposed in literature for dealing with this problem. Cooke (1989) proposed annual reports to be thoroughly examined before they were scored in order to determine whether the undisclosed information items were indeed inapplicable to the companies. Furthermore, the applicability of some items was determined by logical reasoning (Owusu-Ansah, 2000). For instance, it is sensible to expect a firm to disclose its accounting policy for securities valuation, if it owns a portfolio of securities. Both measures were adopted in this study.

With respect to the measuring of disclosure compliance two approaches are proposed in the literature. The most common approach, known also as the "dichotomous approach," adopts an unweigheted disclosure index (see Ali et al., 2004).The disclosure compliance of a company is depicted as the value a compliance ratio computed for each company. The compliance ratio is the ratio of what a company disclosed in its annual report to what it is obliged to disclose for each category of disclosure. For each item of disclosure there are three possibilities: the information item is disclosed in the annual reports (OK); the information item is not disclosed item in the annual reports because it is not applicable in the particular company (non applicable NA); the information item is not disclosed item in the annual reports despite the fact it is applicable in the particular company and this company should disclose it (non-mentioned, NM). Thus, disclosure ratio under the dichotomous approach has been calculated as follows:

$$C_j = \frac{T = \sum_{i=1}^{n} di}{M = \sum_{i=1}^{m} di} \quad (1)$$

where C_j = the total compliance score for each company and $0 \leq C_j \leq 1$; T = is the total number of items disclosed () by company j; and M = the

maximum number of applicable disclosure items for company *j* that could have been disclosed.

This approach gives equal weight to the specific items required to be disclosed by all standards. As a consequence, it gives greater weight to standards that require more items to be disclosed (Tsalavoutas et al., 2010). Although, this method has been employed in most studies examining disclosure compliance, it appears to have the serious limitation that does not treat each standard equally (Tsalavoutas et al., 2010). Given that some standards require a large number of items to be disclosed while others a few items, the standards that require more items to be disclosed are not treated equally with these standards that require few items to be disclosed (Al-Shiab, 2008).

An alternative approach proposed in the literature is the "partial compliance unweighted method" (see Street & Gray, 2001; Al-Shiab 2008). This approach is based on the assumption that each standard is of equal importance and gives equal weight to each standard (Tsalavoutas et al., 2010). Under this approach, the compliance rate of each entity is measured by adding the degree of each standard and the diving the total by the number of standards applicable to each company. Street and Gray (2001) found different significant associations under each method between disclosure compliance and a number of independent variables. Similarly, Tsalavoutas et al. (2010) found that the two methods produce significantly different results. They believe that the simultaneous application of the two methods will provide more robust results. Within this study we adopted both measures of disclosure compliance.

Under the "partial compliance unweighted method" the compliance with each standard is calculated separately. Then the sum of these compliance scores (X) is divided by the total number of applicable standards (R) for each sample firm j. Thus the compliance score for each firm is calculated as follows:

$$PC_j = \frac{\sum_{i=1} X_i}{R_j} \quad (2)$$

where PC_j is the total compliance score for each company and $0 \leq PC_j \leq 1$.

3.3.2. Independent Variables

In accordance with the hypotheses developed above, the present study uses five independent variables in order to explain the disclosure compliance of the sample firms: size, leverage, profitability, ownership structure and auditor type. Two metric variables were considered as measures of size. The first one is equity (EQUITY), which is depicted by the end of year total equity of the reporting firm. The second variable is assets (ASSETS) and it is measured by the logarithm of a firm's total assets. Profitability is depicted by three metric measures of profitability; income, Return on Equity (ROE) and Return on Assets (ROA). Income (PROFITS) is measured by net income after tax at the end of the fiscal year for each firm. ROE is the ratio of total income after tax divided by the average of equity. It should be noted that in the case where equity is negative this variable is not defined. The last measure of profitability is ROA, which comprises the ratio of income divided by the average of assets. Leverage (LEV) is measured by the debt ratio of each firm in the sample. The debt ratio is calculated as the proportion of total debt to equity.

A dummy variable has been used in order to indicate the ownership status of the sample firms. The dummy variable takes the value 1 when the firm is characterised by concentrated ownership and 0 otherwise. In order to determine the ownership structure of a firm a combination of criteria has been employed based upon the proportion of share capital owned by major shareholders and the composition of the board of directors. In particular, if three shareholders control 70% or more

of firm's share capital the firm is characterised as a closely-held firm, and three shareholders control 50% or more of firm's share capital the firm is characterised as a closely-held firm, and one shareholder owns 20% or more than of share capital and no other shareholder owns more than 5% of share capital the firm is characterised by concentrated ownership. When none of the above criteria are met, the sample firm is characterised as a firm with diffused ownership. Finally, the remaining firms are categorised as closely held ones only if a firm meets at least one of the above criteria and one or more of the major shareholders participate in the board of directors.

A dummy variable has been used in order to indicate the type of the external auditor employed. The dummy variable takes the value 1 when the auditing firm is a Big-4 firm and 0 otherwise.

Table 1 presents the definitions of the independent variables.

3.4. Research Method

The statistical analysis has been conducted for both measures of disclosure compliance presented above on an individual year basis (i.e. year 2006 and year 2008) and for the pooled-sample as well. The univariate analysis aiming to examine the association between the compliance rate and each individual independent variable has been followed by a multivariate analysis. The multivariate analysis aims to identify the accumulated effect of the independent variables on the compliance ratio of the sample-firms. In particular, it has been examined the association between the disclosure compliance of the sample firms with the firms' size, leverage, profitability, ownership status and the type of the external auditor employed.

For the purposes of the multivariate analysis the following model has been estimated for each of periods 2006 and 2008 and for the pooled sample as well.

$$CR = C + (\beta 1 \text{ X } ASSETS) + (\beta 2 \text{ X } ROE) + (\beta 3 \text{ X } LEV) + (\beta 4 \text{ X } OWNS) + (\beta 5 \text{ X } AUDTYPE) \quad (3)$$

where CR = compliance rate, other variables as defined in Table 1.

Table 1. Independent variables

Variable	Description	Variable Name
Measures of Size		
Equity	the end of year total equity of the reporting firm	EQUITY
Assets	logarithm of total assets	ASSETS
Measures of Profitability		
Income	the after tax income	PROFITS
ROE	income divided by equity*	ROE
ROA	income divided by assets	ROA
Leverage		
Debt ratio	total debt to total equity	LEV
Ownership Structure		
Ownership structure	concentrated vs. diffuse ownership of share capital	OWNS
Auditor Type		
Auditor type	Auditor type is measured by the presence of Big-4 auditors	AUDTYPE

*It should be noted that in the case where equity is negative the variable ROE is not defined

4. RESULTS

4.1. Descriptive Statistics

Descriptive statistics for the firms in the pooled sample for years 2006 and 2008 are provided in Table 2. The average compliance rate under the "dichotomous approach" is 75%, while under the "partial compliance unweighted method" the compliance rate is 71.2%. It should be noted that the average compliance rate under the "dichotomous approach" for the year 2006 is 74.91%, while under the "partial compliance unweigheted method" the compliance rate is 70.9%. For 2008 the average compliance rate under the "dichotomous approach" is 75.55% and under "partial compliance unweighted method" the compliance rate is 71.57%. These results indicate that about a quarter of the required items are not disclosed by the firms in the sample on average.

The observed compliance rate raises some questions regarding audit quality and the enforcement of regulations in Greece especially since the financial statements of the companies in our sample were not qualified for inadequate disclosure.

Previous research has indicated that two methods for measuring disclosure compliance produce significantly different results (see Tsalavoutas et al., 2010). In our sample, the compliance rate under the "partial compliance unweighted method" is lower comparing to the compliance rate under the "dichotomous approach." It has been examined the association between the results provided by the two methods. The results of the Spearman's correlation test suggest that the results provided by the two methods employed for measuring disclosure compliance are correlated. In particular, for 2006 the value of the Spearman's correlation rho is 0.87 (significant at 5%), while for 2008 the value of the Spearman's correlation rho t is 0.95 (significant at 5%). These results suggest that the two methods do not produce significantly different results. This finding is not in line with the findings

Table 2. Descriptive statistics for pooled sample (2006-2008)

Variables	Mean	Median	Max	Min	Std. Dev.
Compliance rate - Dichotomous approach(%)	75.2	76.4	91.9	49.0	9.2
Compliance rate -PC unweighted method (%)	71.2	73.8	92.3	42.0	11.5
ASSETS	687,104.9	102,991.0	14,000,007.0	11,782.0	2,358,292.0
EQUITY	242,061.5	32,102.4	5,078,431.0	-78,954.7	836,132.6
PROFITS	14,202.0	1.420.5	730,800.0	-305,879.0	96,579.3
ROA (%)	1.4	2.1	30.5	-61.5	9.4
ROE (%)	4.8	5.7	103.7	-105.6	20.0
Leverage (%)	60.0	62.9	142.3	5.9	20.6

Compliance rate - Dichotomous approach (%): is measured by the total compliance score for each company divided by the total number of items disclosed.

Compliance rate - PC unweighted method (%): is measured by the sum of the compliance scores for each standard divided by the total number of applicable standards (*R*) for each sample firm.

Assets: is measured by the logarithm of the total assets of firm *i* in fiscal year *t.*

EQUITY: is measured by the end of year total equity of firm *i* in fiscal year *t.*

PROFITS: is measured by net income after tax at the end of the fiscal year *t* for firm *i.*

ROE: Return on equity of company *i* for fiscal year *t*. It should be noted that that in the case where equity is negative the variable ROE is not defined.

ROA: is measured by the net income of firm *i* divided by the average of assets for firm *i* at period *t* and period *t-1*.

Leverage: Debt ratio of firm *i* in fiscal year *t.*

of Tsalavoutas et al. (2010) who found that the two methods produce significantly different results.

Under both measures of disclosure compliance the disclosure compliance of the sample firms for year 2006 does not differ significantly from the disclosure compliance for year 2008 (Table 3). The lack of improvement in the disclosure compliance suggests that the experience those Greek firms might have acquired regarding the implementation of IFRS did not affect significantly their compliance with IFRS disclosure requirements.

4.2. Univariate Analysis

In Table 4 the results of the univariate analysis concerning the association between the disclosure compliance and the independent variables for each individual year and for the pooled-sample are presented.

4.2.1. Corporate Size and Disclosure

As it can be seen in Table 4, for 2006 firms' size as measured by the log of total assets is associated with disclosure compliance under both approaches used in order to measure the dependent variable. When size is measured by total equity the association is significant only under the "dichotomous approach." For year 2008 there is a positive but not significant association between both measures of compliance and both measures of size. For the pooled-sample the association between the variables of interest does not appear to be significant. Overall, these findings provide weak evidence in favour of hypothesis 3 that the rate of compliance is higher for bigger firms. These findings are not in line with the findings of previous research that found a significant association between the two variables (see, Inchausti, 1997; Oliveira et al., 2011; Setyadi, 2011). Within the context of Greece, Florou and Galarniotis (2007) found that corporate governance quality increases with firms' size. On the other hand, they did not find any systematic pattern regarding the aggregate level of non-disclosure by firm size and found positive relationship between size and disclosure compliance.

4.2.2. Profitability and Disclosure

The rank correlation coefficients between the three measures of profitability used in this study and the compliance rate measured under the "dichotomous approach," presented in Table 4, are positive but not significant at the 5% level. This holds both for 2006 and 2008 and for the pooled-sample. Similar are the results when disclosure compliance is measured under "partial compliance unweighted method." These findings provide no evidence in favour of hypothesis 4 that the level of compliance is associated with profitability. Previous research provides mixed evidence regarding the association of the two variables. Wallace and Naser (1995) found that the profitability of firm affects its compliance to disclosure requirements. On the other hand, Palmer (2008) found limited support for the hypothesis that more profitable firms disclose more information. Inchausti (1997), Dunmontier and Raffourmier (1998) and Street and Bryant (2000) do not provide evidence to support the argument that the rate of firm's compliance is associated with its profitability.

Table 3. Compliance rate by year

	Compliance Rate % 2006	Compliance Rate % 2008	Test of Difference (T-Test)
Dichotomous approach	74.9	75.5	-0.3734
Partial compliance unweighted method	70.9	71.5	-0.3167

Table 4. Correlation coefficient among compliance rate and independent variables

Year 2006	**Compliance Rate**	**Compliance Rate**
	Dichotomous Approach	**PC Unweight Method**
	Size	
ASSETS	0.240*	0.222*
EQUITY	0.271*	0.195
	Profitability	
PROFITS	0.186	0.190
ROE	0.014	0.017
ROA	0.058	0.033
	Leverage	
LEVERAGE	-0.084	0.050
Year 2008	**Compliance Rate**	**Compliance Rate**
	Dichotomous Approach	**PC Unweight Method**
	Size	
ASSETS	0.122	0.143
EQUITY	0.137	0.132
	Profitability	
PROFITS	0.047	0.013
ROE	0.105	0.049
ROA	0.101	0.060
	Leverage	
LEVERAGE	-0.050	-0.006
Pooled Sample (2006-2008)	**Compliance Rate**	**Compliance Rate**
	Dichotomous Approach	**PC Unweight Method**
	Size	
ASSETS	0.171	0.162
EQUITY	0.184	0.135
	Profitability	
PROFITS	0.111	0.067
ROE	0.060	0.016
ROA	0.080	0.030
	Leverage	
LEVERAGE	-0.050	0.029

* Significant at 5% level

Assets: is measured by the logarithm of the total assets of firm *i* in fiscal year *t.*

EQUITY: is measured by the end of year total equity of firm *i* in fiscal year *t.*

PROFITS: is measured by net income after tax at the end of the fiscal year *t* for firm *i.*

ROE: Return on equity of company *i* for fiscal year *t*. It should be noted that that in the case where equity is negative the variable ROE is not defined.

ROA: is measured by the net income of firm *i* divided by the average of assets for firm *i* at period *t* and period *t-1*.

Leverage: Debt ratio of firm *i* in fiscal year *t.*

4.2.3. Leverage and Disclosure Compliance

No significant association is observed between leverage and compliance ratio when the latter is measured under the "dichotomous approach." This holds both for years 2006 and 2008 and for the pooled-sample. When the compliance is measured using the "partial compliance unweighted method" the results are similar. This provides no evidence in favour of hypothesis 1 that the level of compliance is associated with leverage. This result is consistent with the findings of previous research that found little evidence to support the hypothesis that there is a significant association between corporate disclosures and leverage (Abraham & Cox, 2007; Amran et al., 2009; Linsley & Shrives, 2006; Mohobbot, 2005). Oliveira et al. (2011) found that firms' leverage is important in explaining the risk related disclosure.

4.2.4. Ownership Structure and Disclosure Compliance

The concentrated ownership firms exhibit a higher compliance rate comparing to the diffused-ownership firms. This holds under both approaches being used in order to measure disclosure compliance. Yet this association is statistically significant only for year 2008 under the "partial compliance unweighted method" (see Table 5). A further statistical analysis being conducted by using the non-parametric Pearson chi-square test indicated that no significant association exists between the disclosure compliance and the ownership status of the sample firms. It should be noted that previous research has indicated that the widely-held firms comply better with the disclosure requirements of IFRS (Klassen, 1997; Birt et al., 2006; Soderstrom & Sun, 2007). On the other hand, Mohobbot (2005), Oliveira et al. (2011) and Setyadi(2011) found no relation between firms' ownership structure and level of disclosure, while Abraham and Cox (2007) provide mixed evidence regarding the association between firms' disclosure compliance and their ownership structure. Kajuter (2006) and Lajili (2007) found negative association between owners' holdings and disclosure.

4.2.5. Auditor Type and Disclosure Compliance

The firms that employ one of the Big-4 international auditing firms exhibit a higher compliance rate comparing to the firms that appoint other auditing firms. This association is statistically significant for 2006 under both approaches being used in order to measure disclosure compliance (see Table 6). The application of the non-parametric Pearson chi-square test provided similar results. In particular, under the dichotomous approach the value of the Pearson chi-square test for the year

Table 5. Ownership structure and disclosure compliance

Dichotomous Approach			
	Concentrated Ownership	**Diffuse Ownership**	**Test of Difference (p-Values)**
2006	0.756 (obs=42)	0.730 (obs=16)	0.349
2008	0.767 (obs=43)	0.721 (obs=15)	0.107
Partial Compliance Unweighted Method			
	Concentrated Ownership	**Diffuse Ownership**	**Test of Difference (p-Values)**
2006	0.717 (obs=42)	0.687 (obs=16)	0.285
2008	0.736 (obs= 43)	0.656 (obs=15)	0.043 *

* significant at 5% level

2006 was 10.70 (significant at the 1% level) while for the same year under the "partial compliance unweighted method" the value of the Pearson chi-square test was 6.74 (significant at the 1% level). These results provide evidence in support of the hypothesis 5. These findings are in line with the findings of previous research. Inchausti (1997), Glaum and Street (2003) and Oliveira (2011) found positive relationship between disclosure and auditor type. On the other hand, Setyadi et al.(2011) found no relation between firms' auditor type and level of disclosure.

4.3. Multivariate Analysis

Multiple regression analysis was used for multivariate testing of the hypotheses; the dependent variable, compliance rate, was regressed against the independent variables of Size, Profitability, Leverage and dummy variables for ownership status and auditor type. Assets were chosen as a proxy for size in order to be consistent with previous studies, while profitability is measured by reference to ROE.

Given the small size of the sample, the skewed distribution of the explanatory variables and therefore the possible presence of outliers that would make the analysis unreliable, a non-parametric estimation technique was used, namely quantile regression (Koenker & Hallock, 2001). This technique differs from traditional OLS because instead of minimizing the sum of squared residuals, the objective function is to minimize the mean absolute deviation (MAD). Regression results when the dependant variable is measured under the "dichotomous approach" are presented in Table 7. Panels A and B report estimated coefficients and standard errors for the 2006 and 2008 samples correspondingly. The estimated coefficients and standard errors for the pooled-sample are presented in Panel C.

Regression results when the dependent variable is measured under the "partial compliance unweighted method" are presented in Table 8. Panels A and B report estimated coefficients and standard errors for the 2006 and 2008 samples correspondingly. The estimated coefficients and standard errors for the pooled-sample are presented in Panel C.

In line with the findings of the univariate analysis the profitability and the leverage of sample firms do not appear to influence their disclosure compliance. Similarly, size is not associated with the disclosure compliance, although the univariate analysis has indicated that for 2006 the larger are more likely to comply with the IFRS disclosure requirements. The ownership status and the type of the external auditor appointed of the sample firms are factors are more likely to explain their compliance with the disclosure requirements provided by IFRS. In particular it appears that concentrated-ownership firms achieve higher compliance rates

Table 6. Auditor type and disclosure compliance

Dichotomous Approach			
	Big-4 Auditing Firms	**Other Auditing Firms**	**Test of Difference (p-Values)**
2006	0.810 (obs=17)	0.723 (obs=41)	0.000 *
2008	0.783 (obs=16)	0.744 (obs=16)	0.169
Partial Compliance Unweighted Method			
	Big-4 Auditing Firms	**Other Auditing Firms**	**Test of Difference (p-Values)**
2006	0.772 (obs=17)	0.682 (obs=41)	0.000 *
2008	0.750 (obs= 16)	0.702 (obs=42)	0.221

* Significant at 5% level

Table 7. Regression of size, profitability, leverage, ownership status and auditor type on disclosure compliance (dichotomous approach)

$CR = C + (\beta 1 \text{ X } ASSETS) + (\beta 2 \text{ X } ROE) + (\beta 3 \text{ X } LEV) + (\beta 4 \text{ X } OWNS) + (\beta 5 \text{ X } AUDTYPE)$			
Variables	**2006**	**2008**	**Pooled Sample**
Constant	0.730* (0.162)	0.678* (0.173)	0.657* (0.122)
Assets	-0.003 (0.015)	0.004 (0.016)	0.004 (0.011)
ROE	0.006 (0.093)	0.006 (0.105)	0.041 (0.067)
Leverage	0.009 (0.096)	-0.105 (0.114)	-0.060 (0.073)
Ownership	0.032 (0.038)	0.118* (0.044)	0.083* (0.026)
Auditor Type	0.111* (0.049)	0.051 (0.052)	0.061 (0.036)
Pseudo R^2	**0.13**	**0.16**	**0.11**

* Significant at 5% level. Standard errors in parentheses

Compliance rate - Dichotomous approach (%): is measured by the total compliance score for each company divided by the total number of items disclosed.

Assets: is measured by the logarithm of the total assets of firm *i* in fiscal year *t.*

ROE: Return on equity of company *i* for fiscal year *t*. It should be noted that that in the case where equity is negative the variable ROE is not defined.

Leverage: Debt ratio of firm *i* in fiscal year *t.*

Ownership: equal to 1 for concentrated ownership and 0 otherwise.

Auditor type: equal to 1 when the auditor of the firm is a Big-4 audit company and 0 otherwise.

Table 8. Regression of size, profitability, leverage, ownership status and auditor type on disclosure compliance (Partial compliance unweighted method)

$CR = C + (\beta 1 \text{ X } ASSETS) + (\beta 2 \text{ X } ROE) + (\beta 3 \text{ X } LEV) + (\beta 4 \text{ X } OWNS) + (\beta 5 \text{ X } AUDTYPE)$			
Variables	**2006**	**2008**	**Pooled Sample**
Constant	0.671* (0.158)	0.462* (0.263)	0.474* (0.130)
Assets	-0.004 (0.014)	0.010 (0.024)	0.013 (0.011)
ROE	0.044 (0.090)	-0.010 (0.160)	0.091 (0.072)
Leverage	0.039 (0.093)	-0.035 (0.173)	-0.005 (0.077)
Ownership	0.039 (0.037)	0.201* (0.067)	0.0831* (0.031)
Auditor Type	0.116* (0.047)	0.072 (0.078)	0.054 (0.039)
Pseudo R^2	**0.15**	**0.17**	**0.11**

* Significant at 5% level. Standard errors in parentheses

Compliance rate -PC unweighted method (%): is measured by the sum of the compliance scores for each standard divided by the total number of applicable standards (*R*) for each sample firm.

Assets: is measured by the logarithm of the total assets of firm *i* in fiscal year *t.*

ROE: Return on equity of company *i* for fiscal year *t*. It should be noted that that in the case where equity is negative the variable ROE is not defined.

Leverage: Debt ratio of firm *i* in fiscal year *t.*

Ownership: equal to 1 for concentrated ownership and 0 otherwise.

Auditor type: equal to 1 when the auditor of the firm is a Big-4 audit company and 0 otherwise

compared to widely-held firms. This association is statistically significant for year 2008 and for the pooled-sample under both measures of disclosure compliance. The univariate analysis has found a significant association for year 2008 only under the "partial compliance unweighted method." These findings support Hypothesis 2 that firms' disclosure compliance can be associated with the ownership structure. Yet the observed relationship does not support the widely accepted contention that the widely-held firms comply better with the accounting standards' disclosure requirements. In fact, it appears that closely held firms are more likely to comply with disclosure requirements. The observed relationship can be explained within the context of agency theory. The major shareholders aim to maximize firm's value and as a consequence the agency costs are low. As mentioned earlier when major shareholders aim to maximize firm's value a positive association is expected between owners' holdings and disclosure.

With respect with the type of external auditor appointed it appears that the firms that employ one of the Big-4 international auditing firms exhibit a higher compliance rate comparing to the firms

that appoint other auditing firms. This association is statistically significant for the year 2006 under both measures of disclosure compliance. These results are similar with those provided by the univariate analysis. These findings support Hypothesis 5 that the disclosure compliance is higher in companies audited by the Big-4 auditing firms. Results regarding the auditor type are consistent with the findings of previous research. The fact that the association is significant for year 2006 suggests that the local auditing firms, and in general smaller auditing firms, might not have possessed in that year the superior knowledge and experience that the Big-4 international auditing firms possessed with respect to the application of IFRS and the auditing of financial statements prepared according to IFRS. As a consequence the disclosure compliance of the firms audited by Big-4 international auditing firms was higher comparing to the disclosure compliance of firms being audited by local auditing firms. However, by 2008 that gap between Big-4 international auditing firms and local auditing firms regarding the expertise upon the application of IFRS might have narrowed.

It should be pointed out that the two methods employed for measuring disclosure compliance do not produce significantly different results. In fact, we found similar association between the dependent variable (disclosure compliance) and the independent variables under each method employed for measuring dependent variable. This holds for both the univariate and the multivariate analysis. As mentioned previous research has indicated that the two methods can produce quite different results.

5. CONCLUSION

The objective of this article is to examine the compliance of Greek firms to the IFRS disclosure requirements. We examine the relation between disclosure compliance and certain firms' characteristics for a sample of 58 Greek listed firms for 2006 and 2008. In order to examine the association between disclosure compliance and a range of firm's characteristics, a compliance rate has been estimated under two approaches proposed in the literature, which are the "dichotomous approach" and the "partial compliance unweighted method." Prior research has indicated that these two methods can produce significantly different results.

It appears that for the sample firms the ownership structure and the type of external auditor appointed are the most important factors in explaining disclosure compliance. Contrary to the findings of previous research, it seems that the closely-held firms exhibit higher compliance rate comparing to the widely held ones. Results regarding the auditor type are consistent with the findings of previous research, which indicated that firms that are being audited by one of the Big-4 international auditing firms comply better with the disclosure requirements of IFRS. On the other hand, the leverage of a firm its profitability and its size do not appear to be statistically significant variables in explaining disclosure compliance. It should be noted that the results were similar under both methods employed in this study for measuring disclosure compliance. This finding is not in line with the findings of previous research that found that the two methods provide significantly different results.

The findings of this study add to our knowledge regarding the factors that explain the disclosure compliance of Greek firms. Given the similarities of Greek business environment with the environment prevailing in other European countries the findings of this study can be useful to researchers that examine disclosure compliance in other European countries. Moreover, while prior research has examined the association between disclosure compliance and firms' characteristics, mainly in a voluntary setting, we add to our understanding of the firm characteristics associated with disclosure compliance in mandatory environment. In addition this study examines the disclosure

compliance with the important disclosure items of all IFRS rather than focusing in the disclosure items of specific IFRS.

This study contributes to the knowledge base that accounting regulators can use to determine the extent to which Greek firms comply with the disclosure requirements of IFRS and will assist in future directions in developing mechanisms that will monitor the implementation of IFRS.

Additional research could extent the time period under investigation by examining the period after 2009. The deep recession that plagues recently Greek economy since 2009 has eroded Greek firms' profitability and their equity. A further research may be required in order to investigate Greek firms' disclosure compliance under the prevailing adverse environment. Incorporating more explanatory variables and expanding the size of the sample can enrich this analysis.

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Chapter 46
Corruption's Effect on Foreign Direct Investment:
The Case of Bosnia and Herzegovina

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ABSTRACT

This study introduces a new perspective on the role of corruption in investment growth and provides quantitative estimates of the impact of corruption on the investment inflows. Motivated by these issues, the main objective of this article is to empirically reexamine the effects of corruption on foreign direct investment (FDI) inflows in Bosnia and Herzegovina, by incorporating a further link between corruption and investment inflows as new understanding investment concepts. Using data from Transparency International report, World Bank and National Banking Statistical data, it is manifested in a cross sectional setting that corruption has a negative and significant impact on the foreign direct investment inflows. The new model of eliminated unexpected risk involved managing corruption's effect on investments. One has to immediately consider the linkage between corruption and investment inflows and to learn how to manage this phenomenon like old risk of a new model.

1. INTRODUCTION

A thorough understanding of the causes and consequences of corruption is an ever more pressing problem in the context of the challenges that supranational identities such as the European Union have to face in the forthcoming integration process of the transition countries. Only through this process will it be possible to find policy recommendations that target the problem precisely and discover viable solutions to the adverse effects of corruption such as the problem of income gap between the rich and poor regions of the world, which is for the most part due to the poor growth performance of the latter group. From a global perspective, it is extremely important to understand what role corruption plays in relation to growth, in order to come one step closer to the solution of the aforementioned problems.

Before proceeding further it is a good idea to define corruption for the purposes of this study. Corruption is commonly defined as the misuse

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of public power for private benefit. The act often consists of paying bribes to public officials by private beneficiaries as compensation for the abuse. However, not all acts of corruption result in the payment of bribes. A powerful minister can locate a new investment project in his home town unsuitable for that particular activity or he could influence the sanctioning of big business loans to his relatives and friends and still not take any direct bribe. This is indirect cash and capital inflows.

Hence, corruption was claimed to have a beneficial face that made Pareto efficiency tenable. This is known as the greasing the wheel argument and was supported by Leff (1964) and Huntington (1968) among many others. Holding the line, on the other side of the argument was the Nobel laureate Gunnar Myrdal. For example, Myrdal (1968) argued that bribes were a source of inefficiency, and even the sheer possibility of collecting bribes was enough to induce the bureaucracy to create artificial bottlenecks. To put it differently, corruption provided the wrong incentives. As such, it would then be expected to sand the wheels. Papers that have been mentioned so far mainly included theoretical approach and did not offer much in the way of state of the art mathematical treatments of this subject. In the 1980s corruption started taking its due share from a more formal treatment. One relevant example is Lui (1985) where in the context of a queuing model it was shown that corruption induced efficient outcomes in that the ones with the highest willingness to pay bribes were exactly the ones who had the highest opportunity costs of waiting.[1]

Corruption was also seen as a classical example of a phenomenon that is observable, but not measurable, Dogan and Kazancigil (1994). This picture changed drastically with the seminal work of Mauro (1995) that provided us with the first empirical treatment of the relationship between corruption and growth by using a cross-sectional analysis.

The presence of corruption causes substantial economic costs on an economy. Corruption is a double edged sword; it reduces both the volume and efficiency of investment and thus economic growth. This note identifies a simple concept of the macroeconomic efficiency of investment, establishes its linkage with corruption and estimates the relationship between them.

The aim of this paper is to highlight the relationship between corruption and the inflows of foreign direct investment in detail for the case of Bosnia and Herzegovina. However, to make motivation in this venture clear, it is necessary to say a few words on the relationship between corruption and growth, especially concerning the history of this topic. That corruption is one of the most ancient problems of mankind is well-known. However, how it affects economic growth has always been subject to debate. Under what can be termed as "greasing versus sanding the wheels debate," scholars have forwarded ideas in either direction. In the first wave of the literature, it was not uncommon to argue that bribes act as speed money and help avoid bureaucratic efficiencies.

As mentioned above, first aim is to take a general look at this aforementioned relationship with using indicators of corruption. As expected, the regressions testify to a strong negative impact of corruption on FDI Inflows. Having done this, then decompose the corruption variable and test whether or not different perceptions of corruption have statistically different impact on the FDI Inflows. The answer to this question is also affirmative. The theoretical and empirical analysis suggests that the main fields through which the impact of corruption on FDI flows materializes are the crucial elements of business environment. In this case, granting of import/export permits, access to public utilities, annual tax payments and judicial decisions, are the most appropriate. The efficiency of investment variables computed by the authors and Transparency International's Corruption Perception Indices are used as data. The note concludes that substantial gains in terms of economic growth could be achieved if corruption is combating.

Third aim is to show new model for measuring corruption effects on FDI. The results of Bosnia and Herzegovina model for measuring corruption impacts to the inflows of foreign direct investment will bring new lesson for understanding bad side of this phenomenon called corruption (cancer of economy).

As for the organization of the paper, Section 2 reviews the literature, Section 3 introduces the hypotheses, Section 4 introduces *causes of corruption in Bosnia and Herzegovina,* Section 5 introduces the results of Bosnia and Herzegovina model for measuring corruption impacts to the FDI, Section 6 presents the findings and discussion and Section 7 brings the conclusion.

2. LITERATURE REVIEW

2.1. Linkages between Efficiency of Investment and Corruption

In the recent past there have been a number of studies that have reported quantitative results on the effect of corruption on economic variables. These studies have used cross-section analysis of available corruption indices and relevant economic indicators.

Examining the relationship between FDI and the risk factor of the host country, Wheeler and Mody (1992) fail to find a significant relation. The justification of citing this study here is that the authors used a country risk variable that included corruption among others; moreover, this overall variable was highly correlated with corruption. Hines (1995) is a study based on US outward investment data, which leads to the conclusion that FDI is negatively related to the level of corruption. Hines, however, suggests that this is due to the U.S. Foreign Corrupt Practices Act of 1977.

Wei (2000) investigates whether or not FDI flows from US and other source countries are statistically different by using data on bilateral flows between 14 source countries and 45 host countries for the years 1990 and 1991. He concludes that corruption has a negative and significant impact on the levels of FDI, and that this impact does not vary according to the source country.

Smarynzka and Wei (2000) argue that host country corruption induces foreign investors to favor joint ventures over wholly owned firms. Lambsdorff and Cornelius (2000) maintain a negative impact of corruption on FDI for a sample of African countries. Wei and Wu (2001) is another study investigating the relationship between corruption and capital flows. The main conclusion of this paper is that corruption impacts on the composition of capital inflows in a way that reduces FDI, and increases the countries' reliance on bank loans. This, in turn, makes the country in question more vulnerable towards financial/ currency crises.

Habib and Zurawicki (2001) examine the impact of corruption on both foreign direct investments and local investments. Accordingly, corruption has a stronger negative impact on FDI than on local investments. Lambsdorff (2002) asks the question of how corruption influences on the persistent capital flows. This study breaks down investment into two broad categories: domestic savings and net capital inflows. A significant negative impact of corruption on the latter variable is proven. Yet, no distinction is made between different forms of capital inflows. In order to identify potential channels of influence, this study also controls certain institutional variables such as the bureaucratic quality, civil liberty, government stability, and the law and order tradition of a country. A somewhat surprising result emerges in that the author finds all but the last variable to matter for attracting capital inflows.

On the flip side of the coin are a series of studies which remain inconclusive on the above mentioned link. Using cross-sectional data, Alesina and Weder (1999) fail to produce a significant parameter estimate for the corruption variable on FDI in spite of trying a series of model specifications. Working on data for Sub-Saharan Africa,

Okeahalam and Bah (1998) also produce inconclusive results. To wrap up, it is fair to say that the literature has produced mixed results regarding the impact of corruption on FDI.

For the purpose of this research, in addition to previous research on this subject, the results of a survey conducted recently were also taken into consideration and will be specified later. The pioneering effort in this area was the study by Mauro (1995) who found that corruption lowers investment and thereby economic growth. Later, the study by Tanzi and Davoodi (1997) further extended and elaborated this line of causality by showing that corruption increases public investment while reducing its productivity.

The relationship between corruption and investment has long been a contentious area of research. Two deep and broad presumptions can be made regarding the effect of corruption on the efficiency of investment (EII). First, corruption distorts the sectoral allocation of investible resources by diverting resources from potentially productive sectors to unproductive sectors and thereby decreasing the overall output-generating capacity of the investment. A good example of the phenomenon in recent times has been the acquisition of large volumes of loans by many entrepreneurs in South East Europe countries by colluding with bank officials. These resources, sometimes obtained by fraudulent means, were often invested in unproductive sectors or activities, which contributed to the increase in non-performing loans and the eventual contraction of gross domestic product (GDP) during the recent global economic crisis. A review of various forms of corruption, their causes and consequences can be found in Tanzi (1998) and Rose- Ackerman (1996). However, irrespective of the types or forms of corruption, it needs no argument that, as the act involves subjective misuse of power, it is both bad and illegal. In addition, the act distorts the purpose for which the discretionary power was given to the person who abuses it. These distortions inflict considerable costs on the economy.

Rose-Ackerman (1996) also notes that for business people in Eastern Europe payoffs are often necessary to obtain credit. Thus investments are made not on the basis of their rates of return but on the capacity of the entrepreneur to pay bribes.

The concept of FDI is a measure of foreign ownership of productive assets, such as factories, mines and land. Increasing foreign investment can be used as one measure of growing economic globalization. Representing the net inflows of foreign direct investment as a percentage of gross domestic product (GDP) makes the model to evaluate the impact of corruption on FDI efficient. The largest flows of foreign investment occur between the industrialized countries (North America, North West Europe and Japan). But flows to non-industrialized countries are increasing.

Bribes, which are often the major part in any act of corruption, increase the cost of production which ultimately gets reflected in a higher output price increase, reduction in demand and the eventual reduction in the incremental output capital ratio for the activity. Rose-Ackerman (l996) notes that a corrupt firm may bribe officials to win a contract and once selected it may pay again for the opportunity to charge an inflated price or to skimp on quality. Also, when firms and entrepreneurs are selected to undertake investment projects on the basis of their ability to establish crony contacts and pay bribes, there is no guarantee that the most efficient firm will be chosen. In fact, the efficient but unscrupulous entrepreneurs will almost always be rejected. Inefficiency and unfairness as the costs of corruption have been ably discussed by Rose-Ackerman (1996). Ultimately, the inefficiency will manifest itself as an output price increase and lead to a reduction of the incremental output capital ratio of the activity or sector. The above discussion lead us to formulate the following hypothesis: an increase in corruption will lower the efficiency of investment.

It means that when CPI increases or the level of corruption decreases there is a significant (with

a probability of more than 95 per cent) increase in the efficiency of investment.

Efficiency of investment (EII) during any period under investigation is defined as the ratio of the annual average growth of real GDP to the annual average growth of real investment. The variable EII for a particular country represents the efficiency (productivity) of total investment during a period in generating value added and depends on how total investible resources are allocated between various sectors of the economy and the sectoral incremental output capital ratios. The latter can be taken as a measure of sectoral rates of return in a macro sense; higher values signifying higher returns and thus higher productivity of investment.

2.2. Corruption Effects on FDI

The first data about corruption was created by Business International (BI) (1984), a subsidiary of The Economist Intelligence Unit. The data set measures "the degree to which business transactions involve corrupt payments" on a scale of 1 to 10 for the period 1980 to 1983 and covers nearly 7o countries. Before this, corruption indices could have been derived from the Institutional Quality indices but these were not widely available.

World Economic Forum in Switzerland produced Global Competitiveness Report, a business publication which consists of a survey of top and project managers in the most dynamic firms of a large number of countries. Political Risk Services Group (PRSG) also started reporting corruption data and the measure of corruption for the countries.

Following theoretical arguments pointing to the damage corruption inflicts on the economy, several studies looked at the impact of corruption on the inflows of foreign direct investment. Many authors corroborated the assumption that corruption is a detriment to FDI and hence a liability to the host economy.

Based upon general economic studies showing the adverse impact of corruption on economic growth, inflation and investment, it follows that the logic would generally apply to foreign investors as well.

The first studies attempted then to isolate and estimate the overall impact of corruption on FDI. Expected, the format applied to such analysis was based upon the gravity models in which corruption as an independent variable was used along with the control variables such as the GDP of the host country and its growth rate, the GDP per capita, tax and exchange rates, labor market conditions (wages, unemployment), the degree of internationalization of the recipient economy, distance from the global markets, and political risk. Some variations also included other factors such as availability of the natural resources, the historical ties (metropolis–former colony), technological development and others. It is very important to emphasize that the scope of the initial studies was constrained due to the data limitations. First databases pertaining to corruption covered no more than 40 countries. The data did not permit any longitudinal analysis. Because the number of observations available was limited, the number of variables to be included in econometric models also had to be small as not to violate the statistical rules. The first results from this research did not confirm the expected relationship between variables of model. This was caused by the study which was taken for US firms developed by Wheeler and Mody (1992). The results show there is no significant negative relationship between the size of foreign direct investment and the risk factor of the host country, a composite measure which beyond twelve other indicators also includes corruption. A later study showed an overall insignificant effect of corruption on incoming FDI. However, at the same time, this work pointed to a negative impact of corruption on the FDI originating from the USA after 1977. This result was attributed to the effectiveness of the US Foreign Corrupt Practice Act (FCPA)[2]. Thus, it was not the corruption per se which acted as a detriment to the US outgoing FDI, but rather a perspective of being (severely) punished

if caught by home country authorities. This distinction is still important today as it hints to why corruption is a deterrent. In addition, American investors tend to be no more averse to corruption in host countries than (on the average) investors from OECD countries with a possible exception of Japan.

Empirical studies suggest that corruption is, indeed, associated with a misallocation and misappropriation of public expenditures which are often inflated as a result.[3] Gupta et al. (2000) find that corruption has the effect of reducing the provision of education and health care, and of increasing infant mortality. Mauro (1997) presents evidence that corruption distorts public expenditures away from growth-promoting areas (like education and health) towards other types of projects (e.g., infrastructure investment) that are less productivity-enhancing. In a similar vein, Tanzi and Davoodi (1997) find that corruption leads to a diversion of public funds to where bribes are easiest to collect, implying a bias in the composition of public spending towards low-productivity projects (e.g., large-scale construction) at the expense of value-enhancing investments (e.g., maintenance of the existing infrastructure). The same authors conclude that, as a result of corruption, the amount of public investment tends to rise, while the quality of this investment tends to fall, where the latter are measured for example by the number of paved roads in bad condition and power supply faults.

Empirical results based on investigation from foreign firms of Asia and Latin America show the relationship between indicators of governance and foreign direct investment. Using a sample of countries from Asia and Latin America, that what was demonstrated is about link between corruption, ultimately, and foreign direct investment and its negative correlation. Following theoretical and empirical arguments pointing to the damage corruption inflicts on the economy, several empirical research looked at the impact of corruption on the inflows of foreign direct investment by controlling variables positively correlated with FDI (the rule of law, control of corruption, regulatory quality, government effectiveness, and political stability). The analysis indicates that US firms are less likely to invest in countries where bribery, as measured by the Corruption Perception Index (CPI), is widespread. Many authors examined US Foreign Direct Investment (FDI) outflows with respect to the level of corruption (in the form of bribery) in 42 recipient countries over a five-year period. As might be expected, the size of the foreign market is found to be a more robust factor determining US outward investment, with larger economies attracting more investment. The level of bribery, while significant by itself, loses its importance when included with other economies and cultural variables. The findings are discussed in the context of the Foreign Direct Practices Act (FCPA), which makes it illegal for US firms to bribe foreign officials to obtain business advantages.

It is important to emphasize that valuable inputs into understanding the impact of corruption were gradually produced not only by academics but also through the studies sponsored by business consulting companies. One of them –Control Risks- sponsored a survey which specifically asked a very pointed and differently phrased question: did you hold back from an otherwise attractive foreign investment on account of a country's reputation for corruption? After this research many opinions were nearer the truth. A positive answer was provided by roughly the same percentage of the European and US companies and averaged 39%.[4]

By the late 1990s, additional analyses helped to detail the overall understanding of the impact of corruption on the FDI, while some other studies focused on more specific aspects. From the perspective of composition effects of public expenditures, Deverajan et al (1996) have shown that public capital expenditure has a negative effect on growth for developing countries and the effect gets dramatically reversed if the sample is for developed countries. They explain their result by suggesting that "expenditures which are normally considered productive could become

unproductive if there is an excessive amount of them" and conclude by saying that "developing country governments have been misallocating their resources" by excessive capital spending. This result has been recently supported by Ghosh and Gregoriou (2007) in an optimal fiscal policy framework, again for developing countries. Interestingly as a suggestion for future work they posit a role for corruption in assuming away possible positive returns from public investment in developing countries. As for the first issue, the new studies attempted to estimate the evil of corruption with respect to FDI. In that respect, the quantitative models demonstrated to what extent corruption is a detriment to FDI relative to other factors.

In a series of studies, the general perception of the harmfulness of corruption and related phenomena received additional support. For example, the effect of non-transparency to foreign investors was tested. The notion of non-transparency combined corruption, unstable economic policies, weak and poorly enforced property rights, and inefficient government institutions that increase the risk and uncertainty associated with business. The corresponding scale was adopted from the International Country Risk Guide published by the US-based Political Risk Services (PRS). The results showed that a high level of non-transparency decreased the flow of foreign investment to the host country.

Further, corruption was shown to be detrimental in a number of ways and linked to other institutional phenomenon. For example, market entry has been shown to deteriorate with high levels of corruption. Empirical studies were proof that countries with heavier regulation of entry have higher corruption and larger unofficial economies. While not specifically concerned with the international enterprises, the results of the study in question certainly prove of their relevance to FDI.

Using data on foreign and local direct investments Habib and Zurawicki (2002) analyze the effect of corruption on bilateral FDI flows using a sample of seven source countries and 89 host countries. They hypothesize that the greater the absolute difference in the corruption level between the source and the host countries, the smaller the FDI inflows for the host countries. They regressed bilateral FDI on a set of control variables including the absolute difference between the corruption levels in the source and host countries. They find that foreign firms tend to avoid situations where corruption is visibly present because corruption is considered immoral and might be an important cause of inefficiency.

It is interesting, though, that the business cost of corruption does not need to be prohibitive and consequently moderates its effect on FDI. Kaufmann (1997) reported surveys in Ukraine on the amount of illegal payment made for various business activities. His results suggest that the payments, on average, amounted to a small percent of total sales. If this is true of most situations then corruption may not be a major deterrent for FDI. Showing the evil of corruption in relative terms (for example, compared to taxing profits) has been a useful method to show the role of various factors affecting FDI. This approach has been pioneered by the World Bank since 1991.[5]

All these studies use a cross-sectional methodology to test the relationship between corruption levels and FDI inflows, and ignore the fact that corruption is a complex phenomenon. Corruption is correlated with many other characteristics of the host country such as the quality of institutions, lack of competition, and cultural values. Also, there may be time-invariant unobserved effects that vary across countries and are correlated with corruption. Obviously, failing to hold all these factors constant, the estimated effects may be biased in either direction. These studies also have ignored the fact that corruption is not necessarily an independent variable. In particular, the level of corruption may be affected by other variables in the host country as the level of development, level of FDI inflows, quality of institutions and cultural values.

2.3. Consequences of Corruption

Persistent myths refer to corruption as the second best solution in view of inefficient government regulation or to its role as "the grease in the wheels of commerce." Some of the authors present and then demolishe arguments about efficiency of corruption's deals. Kaufmann (1998) lays to rest the "grease" argument (while corruption can make one transaction easier, it gives rise to a demand for more corruption - almost like adding sand to the machine, which will then require more grease.

We can say with some certainty that corruption is not good for economic growth and for economic development. It is quite possible that countries marked with bureaucratic corruption (not the efficiency of the allocation process, such as East European countries, witnessed a rapid fall of foreign direct investment because of a high level of corruption.[6]

Corruption changes prices and, hence, the equilibrium due to shifts in the supply and demand of public services. Corruption introduces distortions in factor markets. While corruption affects the whole economy, it seems to target the poor. First, consistent with current research which points to benefits for the poor from economic growth, corruption hurts the poor by lowering an economy's growth rate. Second, corruption introduces costs and benefits that create a bias against the poor. Third, corruption can be causally linked to the worsening of income distribution.

A high level of corruption is trying to demolish the whole world economy, inflow of cash, industry, increase inflation by delivering high prices because of "return of corruption costs," lack of cash for workers, decline in working spirit, morale and good will for individuals. Because of all these bad things linked with corruption, all of us have to fight this social disease.

3. RESEARCH HYPOTHESES

Starting from the theoretical bases, research topic, and established aims, as well as from the previous and current empirical research results, the following hypotheses are formulated:

H1 – H6: Corruption and non-market rules have a negative impact on inflow of Foreign Direct Investment. These non-market rules are: spread and amount of corruption in public and private business (H1), likeliness to demand special and illegal payments in high and low levels of government (H2), lack of qualitative industrial products (H3), increase of net-exports (H4), decrease of government spending (H5) and increase of gross domestic production GDP (H6);

H7: Corruption consciousness about the consequences of corruption has a positive effect on individuals' behavior about the negative effect of corruption's on Foreign Direct Investment.

4. CAUSES OF CORRUPTION IN BOSNIA AND HERZEGOVINA

According to Conclusions on Bosnia and Herzegovina[7], Bosnia and Herzegovina has made limited progress in addressing the *political criteria*. The need for an effective coordination mechanism between various levels of government for the transposition, implementation and enforcement of EU laws remains to be addressed as a matter of priority so as to enable the country to speak with one voice on EU issues and make an effective use of EU's pre-accession assistance.

Strengthening the functionality and coordination mechanisms of the institutions remains an issue to be addressed as a matter of priority. It can be the first cause of corruption.

According to data obtained by the public opinion survey in Table 1 as the main causes of corruption aside the lawlessness and lack of rule of law, elsewhere there are moral and dishonesty, and the third is the general poverty. It is clear that these are the causes of the different groups. It would be expected to be generally perceived poverty as the main cause of corruption. That would be some sort of justification for all those involved in corruption and thus supplement the budget.

The *economy* of Bosnia and Herzegovina grew by 1.3% in 2011, supported by reviving domestic demand and – to a lesser extent – still growing external demand. The recovery process was reversed in early 2012 as a consequence of the worsened economic environment. Unemployment remained at very high levels. Some fiscal consolidation took place as a result of increased revenues and some expenditure cuts. However, the quality of public finances remained low and the fiscal sustainability was severely hampered by the protracted adoption of the State-level budget and of a medium-term fiscal strategy. The weakened consensus on economic and fiscal policy essentials had a negative impact on reforms at the country level. A new two-year IMF Stand-By Arrangement has been agreed to support the country's efforts to counter the effects of the worsening external environment and tackle external and domestic vulnerabilities[8].

Table 1. Causes of corruption in Bosnia and Herzegovina

Cause	Yes (%)	No (%)
general poverty	49	51
immorality and dishonesty	45.3	54.7
inefficiency of the judicial system	27.8	72.3
legacy of the previous communist system	7.9	92.1
bad legislation	22.9	77.1
war	24.5	75.5
political system	18.6	81.4
economic system	5.4	94.6
lack of clear administrative	16.5	83.5
low salaries of civil officials	8.3	91.7
lawlessness, lack of rule of law	54.7	45.3
mixing in the flow state	3.2	96.8
Human nature, such people are everywhere	10.5	89.5
something else	0.3	99.7
Do not know/refused	0.3	99.7

Source: Transparency International BIH, 2001

Bosnia and Herzegovina made limited progress in aligning its legislation and policies with *European standards* (in the areas of free movement of goods, competition, intellectual property, research and a number of justice, freedom and security-related matters), *internal market* areas and area of *movement of persons, services and right of establishment.*

Growth model of Bosnia and Herzegovina is implementation of the institutional environment and the strengthening of institutions with the aim of attracting foreign direct investment. The next section of paper analysis what are effects of corruption for inflows of foreign direct investment using the model for measuring *the impact of corruption on the economic development of Bosnia and Herzegovina.*

5. MODEL FOR MEASURING THE IMPACT OF CORRUPTION ON THE ECONOMIC DEVELOPMENT OF BOSNIA AND HERZEGOVINA

Empirical evidence around the world shows that corruption reduces FDI. The results of research in *Bosnia and Herzegovina* evaluate the same conclusion.

Selected for this study is a linear one-dimensional model presented by equation:

$$Y = f(x) + e \quad (1)$$

Y= dependent variable (FDI)

X= independent variable (Corruption Perception Index - CPI)
e = random variable

The model for measuring the adverse impact of corruption on economic development of Bosnia and Herzegovina have 5 time intervals or periods of observation- five consecutive years, from 2007-2011.

If it has a set of values (xi, yi) variables X and Y (see Table 2), it is possible to write down the model:

$$Yi = a + bxi + ei;\ i = 1,2,....n \quad (2)$$

$$\hat{y}i = a + bxi$$

$$ei = yi - \hat{y}i$$

residual deviations ei.

Criteria for the selection of parameter estimation using least squares is: if it has a set of values (xi, yi) variables X and Y, it is possible to write down the model:

$$\sum_{i=1}^{n} = \left(yi - \hat{y}i\right)^2 = \min \quad (3)$$

Model parameters are:

$$b = \frac{\sum_{i=1}^{n} \times i{\cdot}Yi - n\ Y}{\sum_{i=1}^{n} i^2 - n\,'^2}, a = y\,' - bx$$

The number of observations is n = 5 (for the period from 2007 to 2011):

$$X' = \frac{\Sigma_{i-0}^{n} x}{n} \qquad X' = 3.18 \quad (4)$$

$$y' = \frac{\Sigma_{i=0}^{n} y}{n} \quad (5)$$

$$y' = \frac{2711.15}{5} = 542.23$$

$$b = \frac{\Sigma_{i=1}^{n} \times i \cdot Yi - nX'Y'}{\Sigma_{i=1}^{n} Xi^2 - nX^2} \quad (6)$$

$$b = \frac{8772.89 - 5 \cdot 3.18 \cdot 542.23}{50.61 - 5 \cdot (3.18)^2} = \frac{8772.89 - 8621.46}{50.61 - 5 \cdot 10.11}$$
$$= \frac{151.43}{50.61 - 50.56} = \frac{151.43}{0.05} = 3028.6$$

Table 2. Estimation of model parameters for the dependent variable (FDI) and the independent variable (extent of corruption) in the case of Bosnia and Herzegovina

Bosnia and Herzegovina Year	**FDI↔Y (mil.€)**	**CPI↔X Corruption Perception Index**	**Y•X (FDI•CPI)**	**CPI²**
2007	1333.17	3.3	4399.46	10.89
2008	685.84	3.2	2194.68	10.24
2009	180.46	3.0	541.38	9.0
2010	220.97	3.2	707.10	10.24
2011	290.71	3.2	930.27	10.24
Total	2711.15	15.9	8772.89	50.61

Source: author's calculations

$$a = y' - b \cdot x' \quad (7)$$

$$a = -9088.71$$

Regression function with estimated numerically expressed parameters now has the form:

$$\hat{y} = a + bx$$

$$\hat{y} = -9088.71 + 3028.6\,x$$

Explanation: The function f (x) is expressed in the upper shape of the minus sign in front of the b·x points to the already fixed and empirical results proved negative functional relationship between the dependent variables of FDI (which in this model indicate INVESTMENT) and the independent variables CPI (which in this model represent the level of corruption in Bosnia and Herzegovina).

In the event of a unit increase in the value of the independent variables x, or until the manifestation of corruption, the regression function decreases the amount of a plus x multiplied by regression coefficient b:

$$\hat{y} = a + bx$$

Data were obtained by mathematical formulas which can be found in Table 2.

Based on this analysis of processed data, obtained by measurement, we can calculate the coefficient of variation of the dependent variable Y (see Table 3).

Based on Table 3 it is showed that the model for measuring the impact of corruption on Foreign Direct Investment of Bosnia and Herzegovina is representative.

Correlation analysis presents a group of statistical methods used to measure the strength of relation (correlation) between two variables. Correlation analysis in this model is used for a qualitative view of the model and variables for identifying and describing the relationship. Computational procedure for determining the degree of correlation between the observed phenomena (correlation coefficient r) is calculated using the formula:

$$r = \sqrt{R^2} \quad (8)$$

$$R^2 = \frac{\Sigma_{i=0}^{n}(Y)}{\Sigma_{i=0}^{n}(\hat{y})} \quad (9)$$

$$R^2 = \frac{2711.15}{2711.19} = 0.99 = 0.99$$

$$r = \sqrt{0.99} = 0.99 = 0.99$$

Direction of relationship is negative because minus a plus b, which means that this function is the negative direction and that an increase in one variable (the level of corruption) will decrease the other, observed variable (FDI).

As can be inferred from Table 4, $R^2 = 0.99$, $r = 0.99$, so it follows that the relationship between the actual Foreign Direct Investment and corruption in Bosnia and Herzegovina is almost fully cured, negative direction and a linear function of the model equations. According to Chadock scale, there is a very strong correlation between variables if $0.64 < R^2 < 1$ (See Table 4).

Table 3. Representative model to evaluate the impact of corruption on FDI of Bosnia and Herzegovina

Bosnia and Herzegovina			
Year	**X (CPI)**	**Ŷ**	**Y (FDI)**
2007	3.3	905.67	1333.17
2008	3.2	602.81	685.84
2009	3.0	-2.91	180.46
2010	3.2	602.81	220.97
2011	3.2	602.81	290.71
Total	15.9	2711.19	2711.15

Source: Author's calculations

Table 4. Chadock's scale

R^2	r	Interpretation
0	0	absence of connections
0.00 – 0.25	0.00 – 0.50	weak link
0.25 – 0.64	0.50 – 0.80	links moderate
0.64 - 1	0.80 – 1	relationship
1	1	fully cured

Source: www.efos.hr/nastavnici/jhorvat

6. FINDINGS AND DISCUSSIONS

Considering capital flows as a general category, which also includes foreign direct investment among others, it can be argued that corruption affects the composition of capital flows in such a way that in turn, the probability of financial crises increases. The mechanism functions as follows: Corruption has a negative impact on FDI. In other words, it distorts the composition of capital flows by reducing the share of foreign direct investment in favor of short-term capital flows, such as bank loans. The second link is the one between this specific composition of capital flows-poor in FDI- and the increased likelihood of currency crises.

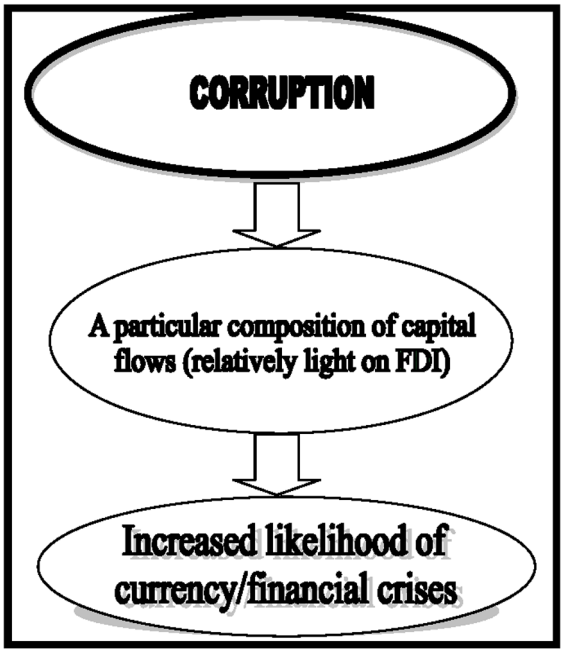
Figure 1 summarizes this argument. This latter link has been relatively well-researched, and it stands as a clear assertion that the lower the share of FDI within the total capital flows, the higher the likelihood of crises (Frankel & Rose, 1996; Radelet & Sachs, 1998; Rodrik & Velasco, 1999).

For testing the hypothesis regarding the effect of corruption on the efficiency of investment, we have estimated cross-section regression equations with efficiency of investment (EII) during the period 2007-2011 as the dependent variable and Transparency International's 2011 Corruption Perception Index (CPI) for 10 countries as the independent variable. Annual indexes of perceived corruption have been prepared by the organization Transparency International.

Corruption is seen as having negative effects on an economy, while FDI has been shown to be beneficial. Research combining the variables of FDI and corruption is lacking in transitional economies, partly due to the fact that it is a fairly new area, the lack of information and the diversity among the countries. Also, research on corruption tends to generalize its causes and effects among countries. Although this is helpful when looking at economic impacts, it is less so when examining ways to find solutions. Corruption can become very much a part of a country's life and the causes and effects can be seen in its history and society. Since there are different types of corruption, there will also be different solutions.

In a 1995 study on investment and loan risk information, Ades and Di Tella found that an increase of $4,400 US in per capita income would improve a country's ranking on a corruption index by two points out of ten. They also found that increased competition would lead to an improvement on the corruption scale. These

Figure 1. A basic sketch of the link between corruption, capital flows and financial crises
Source: author's research



studies show a link between the development of an economy and corruption and they also show that corruption has a strong economic dimension. Paolo Mauro's 1997 study on 67 countries found that if a country could heighten the efficiency of its administration and improve its corruption score from 4 out of 10 to 6 out 10, the rate of investment would increase by 3% and the growth rate would increase by 0.5%. The study done by Shang-Jin Wei shows that decreasing Singapore's corruption score of 10 to that of Mexico's 3.25, would have the same economic effects of raising the tax rate by 21%. This empirical evidence shows there is a correlation between corruption and growth and between FDI and corruption.

The lowest level of corruption corresponds to an index 10 and the highest level being designated as 0.2. These indices are based on a "poll of polls" compiled by a team of researchers at Göttingen University. The questions asked to selected business people and the local population included spread and amount of corruption in public and private business (H1), likeliness to demand special and illegal payments in high and low levels of government (H2), lack of qualitative industrial products (H3), increase of net-exports (H4), decrease of government spending (H5) and increase of gross domestic production GDP (H6).

Foreign direct investment are the net inflows of investment to acquire a lasting management interest (10 percent or more of voting stock) in an enterprise operating in an economy other than that of the investor. It is the sum of equity capital, reinvestment of earnings, other long-term capital, and short-term capital as shown in the balance of payments. Table 5 shows net inflows (new investment inflows less disinvestment) in the reporting economy from foreign investors, and is divided by GDP.

Because of the linkage between inflow of foreign direct investment and level of corruption, the research was made for the same countries about corruption for this period and for 2011 (Table 6).

7. CONCLUSION

The paper will show foreign direct investment in Bosnia and Herzegovina as a country from the region that adopted the European legal entities, improved investment environment and strengthened the fight against corruption through the process of accession to the European Union. *First,* the linkages between efficiency of investment

Table 5. Foreign direct investment (% of GDP)

Country Name	2007	2008	2009	2010
Albania	6.2	7.4	8.0	9.4
Bosnia and Herzegovina	13.6	5.3	1.4	1.4
Bulgaria	31.4	19.3	7.0	4.5
Croatia	8.4	8.6	4.5	0,5
Italy	1.9	-0.4	0.8	0,5
Kosovo	12.9	9.5	7.5	7.4
Macedonia	8.6	6.0	3.1	3.2
Montenegro	25.5	21.2	36.9	18.5
Slovenia	3.2	3.5	-1.3	0.8
Turkey	3.4	2.7	1.4	1.3

Source: World Bank and National Banking Statistical data

Table 6. Level of corruption (CPI) for 10 mentioned countries

Country Name	2007	2008	2009	2010	2011
Albania	2.9	3.4	3.2	3.3	3.1
Bosnia and Herzegovina	2.9	3.3	3.2	3.2	3.2
Bulgaria	4.1	3.6	3.8	3.6	3.3
Croatia	4.1	4.4	4.1	4.1	4.0
Italy	5.2	4.8	4.3	3.9	3.9
Kosovo	*	*	*[9]	2.8	2.9
Macedonia	3.3	3.6	3.8	4.1	3.9
Montenegro	3.3	3.4	3.9	3.7	4.0
Slovenia	6.6	6.7	6.6	6.4	5.9
Turkey	4.1	4.6	4.4	4.4	4.2

Source: Transparency International

and corruption is analyzed. After this corruption effects on FDI is shown. Beside others, Foreign Direct Investment is a key indicator for economic growth and development of Bosnia and Herzegovina and it reflects the value of total flows of foreign capital delivered within a certain period in the national economy. The dominant current definition of a direct investment entity, prescribed for balance-of payments compilations by the International Monetary Fund (1993), and endorsed by the OECD (1996), avoids the notion of control by the investor in favor of a much vaguer concept. "Direct investment is the category of international investment that reflects the objective of a resident entity in one economy obtaining a lasting interest in an enterprise resident in another economy. (The resident entity is the direct investor and the enterprise is the direct investment enterprise).

The lasting interest implies the existence of a long-term relationship between the direct investor and the enterprise and a significant degree of influence by the investor on the management of the enterprise" (IMF, 1993, p 86)[10].

Consequences of corruption was the part which lead to research hypotheses and finally to causes of corruption in Bosnia and Herzegovina. In the case of the new EU member state (NMS), exactly Bosnia and Herzegovina, the dominance of negative over positive spill-over effects can be explained by the specificities of FDI in the period following transition.

The empirical evidence provided in the study suggests that corruption decreases some investment and reduces its positive effect on economic growth. If we consider data for Bosnia and Hezegovina about the flows of FDI for period 2007-2011[11], and on the other side if we put Bosnia and Hezegovina CPI for the same years, and link these two variables to "wheel," we will see that it cannot go "hand by hand." In other words, only the countries with lower corruption can enjoy the efficient return on investment such that it raises growth. But in highly corrupt countries, the returns from investment are reduced by the corrupt agents in the economy and hence foreign direct investment fails to generate higher growth. In addition to its direct negative impact and indirect impact through reducing the returns to foreign investment, corruption has another indirect negative effect on growth through reducing private investment. These results suggest that the policies to deter corruption and to increase the efficiency of foreign direct investment could give very positive impulses to the economic growth. Based on these insights, we view our analysis as a promising step towards understanding an issue that is dominating the international development arena.

The new model for measuring the impact of corruption on the economic development of Bosnia and Herzegovina will show that corruption level can have a significant impact on FDI and this is a very strong correlation between this two variables ($0.64< R^2 <1$); and lead to impact on domestic trade, GDP and economic growth, employment/unemployment, investment, and the rest of economy through spillover effect.

Depending on whether FDI and export are substitutes, i.e. FDI and import substitutes, i.e. complements, the positive or negative effect in foreign trade balance can be determined. The impact of FDI on GDP and employment depends on complementarity of export and FDI. Will, and to what extent, FDI affect growth and economic development depends on level of corruption, efficiency of administration and security of business conditions.

Admittedly, much more research is required in this field. Yet, the initial results from this paper are suggestive of the areas that reformers need to address primarily if their aim is to make progress in attracting more foreign direct investment to their countries by combating corruption.

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ENDNOTES

1 Beck and Maher (1986), Lien (1986) also presented models in the same vein. On the other side of the argument, Shleifer and Vishny (1993) were pressing for the idea that corruption is harmful for growth.

2 The U.S. Foreign Corrupt Practices Act of 1977 ("FCPA") generally prohibits U.S. companies and citizens, foreign companies listed on a U.S. stock exchange, or any person acting while in the United States, from corruptly paying or offering to pay, directly or indirectly, money or anything of value to a foreign official to obtain or retain business (the "Anti bribery Provisions"). The FCPA also requires "issuers" (any company including foreign companies) with securities traded on a U.S. exchange or otherwise required to file periodic reports with the Securities and Exchange Commission ("SEC")) to keep books and records that accurately reflect business transactions and to maintain effective internal controls (the "Books and Records and Internal Control Provisions). The complete text of the Foreign Corrupt Practices Act (FCPA) can be found at the U.S. Department of Justice's website translated into 15 languages (http://www.justice.gov/).

3 In general, the incentives and opportunities to engage in corruption are greatest in areas of public procurement that involve large-scale expenditures, complex technologies and monopolistic power. For example, purchases of military hardware (specialised, high technology goods produced by a limited number of firms) offer greater scope for rent-seeking than purchases of medical supplies (standardised products sold in open markets by a large number of firms).

4 The percentage has not changed much since then. See Control Risks 2007, International Business Attitudes to Corruption Survey 2006, http://www.controlrisks.com/pdf/corruption_survey_2006_V3.pdf.

5 The World Bank identifies corruption as "the most single obstacle to economic development"!

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7 Extract from the Communication from the Commission to the European Parliament and the Council "Enlargement Strategy and Main Challenges 2012-2013," COM(2012)600 (final).

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9 No data.

10 http://www.imf.org/external/research/index.aspx

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Section 4
Managerial Impact

This section presents strategies, methods, and words of caution for managers and organizational leaders invested in Banking, Finance, and Accounting institutions. More than any other industry, the individuals in charge of banks and other financial firms have a tremendous impact on the stability of not only their own organization, but all organizations to which they have ties. As such, careful consideration of risk management and corporate investment strategies is critical to success. This section's 12 chapters examine the managerial impact of key topics in the field of Banking, Finance, and Accounting.

Chapter 47
Fund Manager Overconfidence and Investment Narratives

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ABSTRACT

This chapter proposes a novel approach to measuring fund manager overconfidence and its impact on investment performance. Among numerous behavioural biases identified in financial agents, overconfidence is perhaps most widely studied. Abundant research suggests that overconfidence can have a significant value-diminishing impact on financial decisions taken by small investors, but very few studies have sought to measure the overconfidence of professional investors. This study investigates more than 4600 US equity mutual funds and demonstrates why the proxies commonly used to measure investor overconfidence cannot be readily applied to fund managers, hence the usefulness of the content analysis approach as an alternative. A number of potential proxies for overconfidence including overoptimism, excessive certainty, and excessive self-reference are measured across fund manager reports. The findings suggest that superior past performance boosts overconfidence, which is, in turn, associated with diminished future investment returns. In addition, word frequency analysis is conducted to shed light on the genre and tone fund managers employ in their investment narratives and how this interplays with their demonstrated level of overconfidence.

1. INTRODUCTION

Traditional finance often uses theoretical models predominantly assuming that economic agents are rational, i.e., efficient and unbiased information processors who constantly seek to maximise their utility. It is now widely agreed that these appealingly simple assumptions are quite inaccurate (Barberis & Thaler, 2003). Behavioural finance, on the other hand, assumes that investors are often subject to behavioural biases that can negatively affect their financial decisions. These biases and heuristics, which are typically grounded in the cognitive psychology literature, are being increasingly applied in financial contexts. Indeed, studies in behavioural finance often lead to conclusions that significantly resonate with what professionals in the finance industry experience and "know" at a deeper and perhaps unconscious level (Taffler & Tuckett, 2010).

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In this context, studying investor psychology is of paramount importance. Hirschleifer (2001), among others, provides a detailed survey of studies linking investor psychology to asset pricing and argues that this issue lies at "the heart of the grand debate in finance spanning the last two decades." While a complete understanding of investor psychology requires familiarity with a wide range of individual and group behaviours, a few psychological traits are often recognized as highly influential in shaping investors decisions. The overconfidence effect clearly belongs to this list.

The overconfidence effect, due to its broadness and importance, has been widely influential outside the field of psychology (Daniel, Hirshleifer & Subrahmanyam, 1998; Statman, Thorley & Vorkink, 2006; Garcia, Sangiorgi & Urošević, 2007). The role of overconfidence in influencing the behaviour of economic agents and, by extension, the functioning of financial markets, is an emerging, increasingly important and widely researched topic. In fact, it has been suggested that in the field of judgment and decision-making, no problem is "more prevalent and more potentially catastrophic than overconfidence" (Plous, 1993).

To properly understand overconfidence, it is appropriate to start from the closely related concept of "optimism." Optimism seems to be an integral part of the human psyche. From the perspective of evolutionary processes, it is proposed that optimism must have brought the early humans important benefits, and therefore, in the course of thousands of years of evolution, it has become part of the genetic hardwiring of the human brain. Apart from this evolutionary perspective, it is now widely known that humans constantly learn about themselves and their abilities by observing the consequences of their actions. In doing so, most people overestimate the degree to which they play a role in their own successes. This tendency is often amplified by an illusion of control, i.e. by thinking that one can control or influence an outcome. The overconfidence resulting from this mechanism can have several negative consequences for decision-making, as I will discuss in detail in the literature review. In fact, many researchers cite overconfidence as an explanation for wars, strikes, litigations, entrepreneurial failures and, not surprisingly, stock market bubbles (Glaser, Noth & Weber, 2007; Moore & Healy, 2008).

A large body of literature has more recently focused on the overconfidence of corporate managers, and its impact on corporate investment decisions in areas such as capital structure and M&A activity (see Malmendier & Tate, 2005; Malmendier & Tate, 2008; Malmendier, Tate & Yan, 2011; Gervais, Heaton & Odean, 2011). The questions asked in this chapter, however, concern the impact of overconfidence on professional investors, which is a far less studied topic. The underlying research questions are motivated by three large areas of literature, i.e. studies of mutual fund performance and persistence, studies of financial accounting narratives and business communication, and studies of professional investor psychology. In particular, the following research questions are asked in this chapter:

1. Can fund manager overconfidence be robustly measured through content analysis of investment narratives?
2. How does a fund manager's prior investment performance affect his or her overconfidence?
3. Do fund managers strategically change the tone of their investment narratives to justify their prior investment outcomes and express views on future investment outcomes?

As financial agents, professional investors often operate in an environment that is significantly different from the assumptions of conventional models. Conventional finance views financial agents in terms of "rational" actors in the marketplace who use formal methods of asset valuation in an attempt to identify those stocks or other assets which may be mispriced; even though, on the other hand, markets are viewed traditionally

as efficient. In contrast, the world of the *real* investment manager is one where she is swamped by information, is subject to acute information asymmetry, is under intense competition, and, in the end, has to rely to a large extent on subjective judgment, intuition and "gut feeling." Added to this are the many imponderables which are outside her control, may largely drive her investment performance, and are intangible from an external viewer's perspective (Holland, 2009). Ultimately, the professional investment manager is required to do a job which is very difficult if not impossible to do, and is under constant threat of dismissal if the returns she earns are not deemed satisfactory.

This chapter argues that such environmental forces can, in a subtle way and through time, feed into professional investors' overconfidence, and indirectly affect how they make investment decisions. This chapter attempts to take a mixed methods research approach. Prior research has found significant potential in applying mixed methods research strategies in the accounting and finance domain. The key strengths of mixed methods research include both testing and building theories through extension of existing theories as well as convergence and contradiction of findings.

The chapter is organised as follows. Section 2 introduces the background, the core constructs and variables, and discusses the challenges of measuring overconfidence. Section 3 introduces the data and its sources, and provides relevant descriptive statistics. Section 4 empirically explores how past investment performance affects the overconfidence of fund managers, and the genre and tone of their investment narratives. Finally, section 5 concludes the chapter, and discusses research implications as well as areas for further work.

2. BACKGROUND

Humans constantly learn about themselves and their abilities by observing the consequences of their actions; in doing so, most people overestimate the degree to which they play a role in their own successes. A number of constructs need to be clearly differentiated in this discussion. For example, Van den Steen (2002) provides a comprehensive categorization for this purpose: *Self-serving attribution* bias refers to the fact that people attribute success to their own dispositions and skills, while they attribute failure to external forces or bad luck; ego-centric or *self-centric* bias refers to the fact that individuals taking part in a joint endeavor relatively over-estimate their contribution to a good outcome; *overconfidence* relates to the fact that people over-estimate the accuracy of their estimates and predictions; *overoptimism* refers to the fact that individuals tend to be overoptimistic about future events and the consequences of their actions; and finally, *illusion of control* people think they have more influence than they actually do over the outcome of a random or partially random event.

Prior psychology literature has produced two different types of explanation for overconfidence and its associated effects. From one perspective, these phenomena have been interpreted in the context of motivational biases, the argument being that individuals are motivated to hold unrealistically positive self-perceptions in order to increase their own happiness and well-being. The core assumption is, of course, that people seek to maximize their happiness in a utilitarian way. Alternatively, a different, perhaps complementary, view is put forward by cognitive psychologists who argue that people generally expect to succeed, and they often accept responsibility for their expected outcomes. Hence, in combination of the two effects, people tend be prone to self-serving attribution bias.

Importantly, this self-serving attribution bias can, in turn, produce overconfidence. Gervais and Odean (2001) explain that investors may falsely attribute superior past performance to their own skill, and inferior past performance to chance, which produces overconfidence. Overestimation of one's investment skill can, in this manner, result in excessive trading, as documented by

Odean (1999). Despite the extensive literature examining attribution and overconfidence among ordinary individuals, corporate executives, traders, and retail investors, there are few studies that can claim to have examined the role of such biases in subsequent fund manager performance. In particular, due to the fact that the bulk of investment in financial markets is made by institutional investors, any link between a professional asset manager's performance and her potential overconfidence or susceptibility to self-attribution bias can be of considerable importance, both to the academic literature and the investment industry.

The overconfidence effect is commonly measured in psychology through laboratory-type experiments (for a review see Hoffrage, 2004; Eshraghi, 2012). However, few of these experimental approaches are robust when it comes to gauging investor overconfidence, not least because of issues concerning ecological validity. Thus, researchers often resort to indirect effects proxying for overconfidence among investors. For example, trading activity is a commonly used proxy of investor overconfidence (Barber & Odean, 2000). However, while this measure clearly works for retail investors, it cannot be as easily used for fund managers. Fund managers do not necessarily engage in excessive trading due to overconfidence; rather, they may have to increase their turnover after a rise in fund inflows, which usually follows good past performance. Putz and Ruenzi (2011) control for this effect in their examination of the turnover of US equity mutual funds over the period 1994-2004. The authors conclude that fund managers indeed trade more after good past performance, and their higher trading is driven by individual portfolio performance. This is consistent with superior past performance producing task-specific overconfidence. In a similar way, Chow, Lin, Lin and Weng (2009) examine a sample of equity mutual funds, and show that fund managers behave overconfidently conditional on prior performance. They also demonstrate that such behavior deteriorates subsequent performance. However, one should note that other potential confounding factors may affect managerial trades, such as incentive for window-dressing, tax-management issues, preference for liquidity and changing investment styles to attract fund flows, thus reducing the robustness of trading activity as a proxy for overconfidence.

Another proxy recently used in the literature for measuring overconfidence is *Active Share*. Active Share refers to the share of portfolio holdings that differ from benchmark index holdings, and is introduced as a new measure of active portfolio management by Cremers and Petajisto (2009). Using this measure, Choi and Lou (2010) are able to show that mutual fund managers are typically susceptible to the self-serving attribution bias. However, Active Share is not a "clean" measure of overconfidence either. A similar set of confounding variables can influence the way fund managers choose to arrange their portfolios. In addition, defining the optimal benchmark portfolio against which to measure Active Share is not trivial.

A more straightforward way of measuring overconfidence may, of course, be to examine the actual estimates and predictions of fund managers about their subsequent performance. Willis (2001), for example, investigates annual earnings forecasts that are publicly released in conjunction with mutual fund manager stock recommendations, thereby finding evidence of excess optimism. Gort, Wang and Siegrist (2008) examine overconfidence using a similar method, and conclude that the pension fund managers in their sample provide excessively narrow confidence intervals when asked to forecast future returns or estimate past returns of various assets. However, since their approach requires questionnaire-type surveys attempting to measure fund manager confidence intervals, it cannot be readily used for a large sample of respondents and is subject to the usual robustness concerns associated with this type of secondary data collection.

In this chapter, a novel approach for measuring professional investor overconfidence is suggested, i.e., studying the narratives in investment company annual reports. The three proxies for indirectly measuring overconfidence are overoptimism, excessive certainty and excessive self-reference. The DICTION software is used to extract the first two variables. Predominantly, the optimism and certainty master variables are used. In DICTION, optimism is defined as, "language endorsing some person, group, concept or event or highlighting their positive entailments." The formula used for calculating "net optimism" is: *[praise + satisfaction + inspiration] - [blame + hardship + denial]*; in other words, "optimism" minus "pessimism." DICTION defines certainty as "language indicating resoluteness, inflexibility, and completeness and a tendency to speak ex cathedra." The DICTION formula for certainty is: *[tenacity + leveling + collectives + insistence] - [numerical terms + ambivalence + self reference + variety]*. I use the adjustment proposed in Demers and Vega (2010) to include numerical terms as adding to rather than subtracting from the certainty score.

The third proxy used for overconfidence is *self-reference,* which is defined as the normalized frequency of first-person singular and plural pronouns in each narrative (I, me, my, mine, we, us, our, ours), which can be derived from DICTION with a simple calculation. One can also explore the possibility of constructing a meta-variable comprising some or all of the above overconfidence proxies. Since the face validity of these variables is debatable, the usefulness of such an overconfidence meta-variable will be evaluated on an empirical basis.

As explained above, the sample narratives are sourced from investment company annual reports. The importance of studying finance and accounting narratives is illustrated by the growing emphasis on the objectivity of accounting literature as a means of communicating financial performance. The narratives studied here merit close attention as they are essential parts of the organizational sense-making process among the firm's stakeholders (Gabriel, 2000).

In terms of structure and intended purpose, investment company annual reports are comparable to corporate annual reports. Stanton and Stanton (2002) cite a study which demonstrates that corporate annual reports have become "a highly sophisticated product of the corporate design environment, the main purpose of which is to proactively construct a particular visibility and meaning rather than revealing what was there." This is consistent with the inherent reflexivity of language, i.e. language both mirrors and constructs (construes) reality in a desired way Fairclough and Holes (1995). In other words, as Hines (1988) suggests, people create a picture of an organization, they think and act on the basis of that picture, and "by responding to that picture of reality, they make it so."

There exists a substantial body of literature examining corporate annual reports from various perspectives. Researchers often investigate sections of, or even the whole annual report and focus on themes such as impression management, marketing, organizational legitimacy, political economy, accountability, etc. Stanton and Stanton (2002) provide a comprehensive review of this vast literature by categorizing 70 of the most "useable studies" in the field. The focus of these studies has been extremely wide, with no one particular area dominating the attention of the cited authors.

The annual report studies investigating narratives and stories appear to agree on a number of shared patterns: the way a story is told by the narrator, as well as what the story says, both matter. Linguistic theory provides "a range of language choices and constructions that report preparers can use to pursue their goals without misinformation or complex language" (ibid) and, as such, the choice of verb structures, themes, subjects, context, cohesion and condensations all determine meaning, as Thomas (1997) explains.

Just as importantly, narrative theories discuss different sets of factors that influence meaning, (Stanton & Stanton, 2002). These include the sources of meaning, the narrative structure, the reader interaction with the text, the existence of different narrators and different genres (modes of narration e.g. epistles, lessons, sermons, essays and question-and-answer dialogues).

Prior research also concurs that language can often be used to obfuscate bad news and thus blur distinctions on the causes of poor performance. Courtis (2004) defines obfuscation as "a narrative writing technique that obscures the intended message, or confuses, distracts or perplexes readers, leaving them bewildered or muddled." Narrators often achieve this effect through "the use of esoteric or obscurantist vocabulary and/or gobbledygook, extraneous and non-relevant information, long sentences with complex grammatical structures and/or high variability in reading ease, and convoluted and/or spurious argumentation."

I also take note of the methodology recommended for analysing CEO communication by Craig, Garrot and Amernic (2001) and Amernic, Craig and Tourish (2010). The former study states that any attempt at "close reading" CEO narratives should reveal (1) the metaphors used by, (2) the ideology adhered to, and (3) the rhetoric implemented by the CEO as well as any (4) critical 'silences', (5) dichotomies and (6) false distinctions made by the executive. The latter study adds to this list (7) the CEO's mindset and (8) the CEO's attitude to risk exposure and risk management. In brief, managers are equipped with an increasingly "complex arsenal of communication tools" including selection and integration of narratives, language, images, graphs etc. to create, what Jameson (2000) calls, a hyperstructure that effectively engages the audience as part of the story. Finally, it is important not to forget that the narrator is an implicit audience of his or her own story.

3. THE STRUCTURE OF FUND MANAGER NARRATIVES

This section provides information about the sources as well as a general outline of the data used in this study. The mutual fund performance data used in this research is sourced from the CRSP Survivor-Bias-Free Mutual Fund Database. This database, widely used in the finance and accounting literature, is designed to facilitate research on the historical performance of open-ended US mutual funds. It claims to be "the only complete database of both active and inactive mutual funds" and distinguishes itself by providing survivor-bias-free data. The mutual fund annual reports are sourced from the Electronic Data-Gathering, Analysis, and Retrieval (hereinafter EDGAR), a publicly available database provided by the US Securities and Exchange Commission (hereinafter SEC). It performs automated collection, validation, indexing, acceptance and forwarding of submissions by companies and, in some cases, individuals who are legally required to file forms with the SEC.

It is important to discuss the issue of *authorship* of mutual fund annual reports. Firstly, according to the conventions in the mutual fund industry, fund managers often write their own reports and commentaries, which may then be edited by in-house editors only to check spelling and grammar, and to ensure presentational consistency with other sections of the annual report. In other words, the in-house editors are mostly concerned with the professional presentation of the annual report as a whole document and are much less concerned with the core thematic elements, sentence structure and other rhetorical features of the fund manager narratives. Secondly, similar to the prevailing practice in CEO communication, fund managers are signatories of their reports and assume legal responsibility for their content. Amernic, Craig and Tourish (2010) argue that this acts as an incentive for them to closely scrutinise and approve the final version of the narrative before signature

and publication. More importantly, they argue, "whether or not a CEO is actively involved in composing a letter to stockholders does not matter: the words in the CEO's letter are symbolic and emblematic, and the reader takes them to be the CEO's own." Clearly, a similar proposition can be made about fund managers.

The question of authorship can be further examined by investigating the variations between individual fund manager reports within the same investment company. This is, if we assume that the content of fund manager reports and the writing style of fund managers are substantially influenced by organizational factors or the role of in-house editors, we should expect to find a somewhat homogeneous set of fund manager narratives in each company's annual report regardless of who the fund manager is. This, however, does not appear to be the case. In order to study the extent of cross-sectional variation in fund manager reports, I randomly select 50 such reports from five different investment companies. The results of cross-comparisons across a range of DICTION variables as well as readability and tone indicate that there is indeed a significant level of within-sample variation that can be attributed to individual fund manager characteristics. A more robust test that would control for the types of funds in cross-comparisons can further confirm this observation.

For illustration purposes, a sample fund manager narrative is provided in Box 1, extracted from the 2007 annual report of a large-cap equity mutual fund. From a sense-making perspective, it is interesting to observe how the fund manager seeks to manage the impression of the fund and its performance.

The sample of mutual funds used in this study covers *all actively managed equity mutual funds with a unique manager and complete returns data for at least three consecutive years during the 2003-09 period*. Annual reports with no substantial fund manager commentary, i.e., less than 200 words, are removed from this sample. Thus, for the purpose of the panel data analysis, I arrive at 4,659 unique actively managed equity mutual funds that have a unique fund manager and complete returns data for at least three years during the sample period, and have corresponding fund manager commentaries. This yields the main sample for most of the empirical tests in this chapter. Table 1 reports summary statistics on the total actively managed equity mutual funds that have a corresponding match in the CRSP database. The statistics provided are related to the annual performance on an absolute basis, fund size, expenses and turnover. Definitions of these measures are also listed.

This study specifically looks at *optimism*, *certainty* and *self-reference* of fund manager commentaries to infer the overconfidence of their corresponding managers. Table 2 summarises the descriptives used in this study based on the main sample.

I also calculate Pearson's correlations among the overconfidence measures derived from the narratives and the risk factors embedded in the Carhart (1997) asset pricing model (see Eshraghi, 2012 for a discussion on this). Importantly, the cross-correlations between the overconfidence proxies suggest that optimism and certainty are to some extent associated measures of overconfidence (r=0.416) and they are both positively correlated with momentum (previous one-year return), i.e. a fund manager experiencing positive prior returns is likely to grow more optimistic about her future performance as well as more resolute in her tone of voice. There is an also significant correlation between optimism and self-reference (r=0.755) which is consistent with the expectations and the empirical evidence demonstrated in this chapter.

In addition, the relatively low correlations between the proxies and the Carhart risk factors suggest fund manager overconfidence, as measured here, is not directly driven by any intrinsic fund characteristics and associated risk factors. Particularly in the case of momentum, one can argue that a large part of the variation in optimism

Box 1.

Dear Fellow Blue Chip 35 Fund Shareholder,

For the six months ending June 30, 2007, our Fund appreciated 4.04%, beating our primary market benchmark–quite an accomplishment in a market dominated by small- and mid-size stocks–but lagging our peer benchmark. The S&P 500 Index rose 3.16%, and the Lipper Large-Cap Core Funds Index rose 5.35%. Considering we had a "headwind" of almost two percentage points due to the size of our holdings versus our primary market benchmark, we are quite pleased.

Even more positive was our relative performance in the market downturn of the full fiscal year ending June 30, 2007. While declining a significant 18.77%, we provided a sizable cushion relative to our performance benchmarks–just at the time when it counted the most (from a risk perspective). The S&P 500 Index declined 26.21% for the fiscal year, and the Lipper Large-Cap Core Funds Index declined 25.69%. Primary reasons for this outperformance were: a) a slight tailwind by way of company size on the way down, b) significant benefit from our "roughly equal weighted" indexing strategy, which performs particularly well in a precipitous market fall and recovery, c) a flight to "blue chip" quality in the first three quarters of the fiscal year, and d) a particularly well-timed re-composition of Bridgeway Ultra-Large 35 Index in March, when we added Goldman Sachs, Schlumberger, McDonalds, and 3M Company; all have beaten the broader market since adding them.

After strong large company dominating years in 2005 and 2006, small and especially ultra-small stocks came back with a vengeance in the June quarter. We were able to beat our primary market benchmark over the last six-month period in spite of this disadvantage. Since a primary determinant of our performance relative to the S&P 500 Index is size dominance, i.e. whether small or large stocks are leading in the marketplace, it is helpful to review this data often. Our informal goal is to outperform the S&P 500 in the vast majority of calendar years in which ultra-large companies beat ultra-small ones (We have done this every calendar year since inception) and (we believe, due to the structure of our index) in half the years that ultra-small ones beat ultra-large ones. This latter goal is no mean feat, but we have accomplished it in four of eight calendar years since inception and appear headed for another one in 2007.

The primary reason for our strong six-month (January-June) period performance was our "roughly equal weighting strategy," which requires us to invest more in the stocks that have gone down the most. Our quarterly rebalancing that took place in late March was fortuitously near the March 9 market bottom. The stocks that had declined the most from July 2006 through early March 2007 were typically the ones that bounced back the most in the June quarter. The recent market performance really showcased the advantages, especially by way of risk control, of our roughly equal weighting strategy (see section on risk below). An environment least friendly to this strategy would be a long and steady market appreciation, such as in the late 1990's, or one of steady and prolonged decline. However, we hope our large company advantage would more than offset the weighting strategy disadvantage in some of these periods, as was true in 1998 and 1999.

Our annual performance tells the story of a) the worst bear market in the last seven decades, b) one that was led by large financial stocks, and c) one that didn't offer many places to hide. At the other end of the spectrum are three financial firms we might rather like to forget. We wrote up the experience of AIG in our semi-annual report in December 2006. In our March report, we wrote about McDonalds, "Personally, we don't like adding a consumer non-cyclical company at what looks like might be a market bottom . . . but we follow statistical procedures which pretty much ensure this company is added." So far, following the discipline of our process has worked out well, as the stock has outperformed the broader market in spite of a correct call (at least so far) on the direction of the market since March 31, 2007.

is not explained by momentum. In other words, the implication is that the overconfidence measure used in this study is capable of capturing an effect distinct from other previously studied risk factors that influence investment performance.

4. OVERCONFIDENCE AND TONE OF FUND MANAGER NARRATIVES

In this section, I empirically investigate how past investment results influence fund manager overconfidence and tone. In order to test the impact of past investment performance on overconfidence, I rank the funds in each year on prior-year Carhart alphas and form decile portfolios. Then, I combine all the extreme (top and bottom) deciles across 2003-2009 and use the t-test with unequal variance to measure the difference between the two groups. The results are displayed in Table 3 (Panel A). I reiterate this analysis based on funds ranked by prior three-year alphas (Panel B).

It can be inferred that prior positive performance, both during the previous one-year and previous three-year periods, generates excess optimism as well as certainty as expected and

Table 1. Summary statistics of the sample mutual funds

Year	Number	Average Return (% per year)	Total Net Assets ($million)	Expense Ratio (% per year)	Turnover (% per year)
2003	2169	30.2	295.2	1.5	86.3
2004	2201	38.0	336.6	1.6	91.9
2005	2287	32.6	385.0	1.4	105.2
2006	2490	25.4	439.9	1.5	92.0
2007	2355	-18.9	485.2	1.5	133.6
2008	2612	-25.1	377.6	1.3	125.6
2009	2549	-10.6	441.4	1.4	108.7
Mean	2380	10.2	394.4	1.5	106.2
Median	2355	25.4	385.0	1.5	105.2
SD	173	27.2	65.9	0.1	18.9

Absolute Return: Daily, monthly, and annual returns values are calculated in CRSP as a change in NAV (net asset value) including reinvested dividends from one period to the next. NAVs are net of all management expenses and 12b-1 fees (12b-1 fee denotes the ratio of the total assets attributed to marketing and distribution costs. It represents the actual fee paid in the most recently completed fiscal year as reported in the Annual Report Statement of Operations. Front and rear load fees are excluded). **TNA:** Total net assets as of the last trading day of each month, averaged for each year. **Expense Ratio:** Expense Ratio as of the most recently completed fiscal year. It represents the ratio of total investment that shareholders pay for the fund's operating expenses, which include 12b-1 fees. **Turnover:** Fund turnover ratio. It is defined as the minimum of aggregated sales or aggregated purchases of securities, divided by the average 12-month total net assets of the fund.

the difference between the extreme deciles for both variables is significant at the 5% level. In fact, funds belonging to the top decile of Carhart alpha have a mean optimism that is, on average, about three standard deviations higher than the funds belonging to the bottom decile in the case of previous one-year alpha. The difference between the two deciles when funds are ranked by previous three-year alphas is similar but less pronounced. The effect of prior performance on fund manager certainty is also similar. The difference between the funds in the two extreme deciles in terms of self-reference is also significant in the case of previous one-year alpha and suggests that high-performing fund managers tend to refer to themselves more often their poor-performing counterparts.

I also investigate the investment narratives from the perspective of genre theory. By studying the corpus-linguistic features of fund manager reports, I demonstrate how different groups of fund managers develop the core message in their narratives in very different ways (i.e. genres) in light of past performance. The notion of genre is grounded in organizational communications.

Table 2. Descriptive statistics of overconfidence proxies

	Mean	SD	Min	1st Quarter	Med	3rd Quarter	Max
Optimism	52.20	2.11	43.50	49.28	51.58	55.42	64.16
Certainty	47.25	1.37	44.39	46.14	46.92	48.15	51.97
Self-Reference	1.13	0.18	0.74	0.99	1.04	1.28	1.76

This table reports the distribution of selected overconfidence proxies based on the content analysis of fund manager narrative, as well as positive/negative tone and readability. Optimism and certainty are computed by Diction, and certainty is adjusted according to Demers and Vega (2010). The optimism scores are based on the fund outlook section, the self-reference scores are based on the past-performance discussion section and certainty scores are based on the whole narrative.

Table 3. Variation of fund manager overconfidence in extreme portfolios sorted on prior Carhart alphas

Panel A	Top Decile of Carhart Alpha (PR1YR)		Bottom Decile of Carhart Alpha (PR1YR)		t-Test with Unequal VaR
	Mean	SD	Mean	SD	
Optimism	55.931	2.097	49.737	1.95	2.544**
Certainty	51.013	2.25	45.634	2.210	2.339**
Self-Reference	1.944	0.249	1.095	0.254	1.895*

Panel B	Top Decile of Carhart Alpha (PR3YR)		Bottom Decile of Carhart Alpha (PR3YR)		t-Test with Unequal VaR
	Mean	SD	Mean	SD	
Optimism	54.140	2.115	50.206	2.18.	2.218**
Certainty	51.637	2.047	45.792	2.306	1.982**
Self-Reference	2.043	0.285	1.266	0.262	1.635

This table compares the top and bottom deciles formed by sorting the funds in each year on prior-year Carhart alphas and combining all the extreme deciles across 2003-2009. *, **, *** indicate significance at 10%, 5%, and 1% levels based on two-tailed tests.

Miller (1984) defines genre as "typified rhetorical actions based in recurrent situations." Genres exist at different levels of abstraction, and can be identified in very broad as well as very specific contexts. For instance, Rutherford (2005) identifies the narrative section of UK corporate annual reports (also known as the Operating and Financial Review) as a middle-range genre of corporate communications between organizations and their stakeholders. In a similar way, I argue that the fund manager narratives can be treated as an impactful genre of corporate communication between the fund manager and the investors with its own distinct sub-genres. I use *word-frequency analysis* to demonstrate which sub-genres exist in fund manager narratives and discuss their links to past and expected future investment performance.

Word-frequency analysis is part of an increasingly versatile and modern methodological toolbox in corpus linguistics. As an empirical methodology, corpus linguistics seeks to analyse actual patterns of language use by employing a large, systematically organized body of texts known as the corpus (Rutherford, 2005). It can be used in textual analysis to distinguish between different genres, as well as explore features of individual genres. In the context of this research, word-frequency analysis is primarily used to identify the different sub-genres used in the fund manager's communication of performance results.

The sample used in this section consists of all actively-managed equity mutual funds with unique managers and complete returns data during 2003-09 that have significant fund manager commentaries in their annual reports. The average length of each fund manager commentary is 692 words (about two pages). Therefore, on average, the whole corpus under study consists of around 700,000 words for each year.

I investigate the trend of certain corpus-linguistic features of fund manager commentaries throughout the sample period, and, in particular, focus on 2006 and 2008. These two years reflect, to a large extent, opposite snapshots of the overall economic environment affecting the mutual fund industry, as proxied by leading market indices. In other words, while 2006 is a sufficiently good proxy for a bullish year with regards to the US and global financial markets, 2008 can be treated as a bearish year in the same context.

Based on the funds' broad investment style denoted by their *Lipper Objective Code*, I sub-

divide the sample funds into two categories of *value-oriented* and *growth-oriented* funds. Value-oriented funds normally seek a high level of current income through investing in income-producing stocks, bonds, and money market instruments. Growth-oriented funds normally invest in companies with long-term earnings expected to grow significantly faster than the earnings of the stocks represented in the major unmanaged stock indices. I also divide the funds, based on prior-year absolute annual returns into *loss-making* (negative return), *least-profitable* (bottom decile positive return) and *most profitable* (top decile positive return) categories. The number of funds in each category changes during the sample years. Finally, I divide the funds based on size (total net assets) into the *smallest* (bottom decile) and *largest* (top decile) categories. Hence, I end up with seven categories for the purpose of corpus-linguistic analysis.

The first stage of the analysis explores the frequency of eligible words across all the sample annual reports. Similar to the methodology used by Rutherford (2005), the following word groups are excluded from the analysis in order to make a list of eligible words:

1. Frequently occurring grammatical elements such as articles, conjunctions, pronouns, and common verbs;
2. Days, months and years;
3. Numbers, including monetary amounts, in words, figures and denominations.

Rutherford also manually removes specific company and product names, but this is clearly not feasible in my much larger sample. However, these specific words should not introduce any significant bias in my analysis as they often include the name of the fund discussed in each commentary and therefore, in aggregate, are not expected to appear among high-frequency words.

Table 4 lists the average 50 most frequently used eligible words across the sampled commentaries. I merge all the fund manager commentaries to arrive at a master corpus document for each year. Then, I determine the highest-frequency words in each year and average them across the years.

The word "fund" is the most frequently used word in the corpus closely followed by the pronoun "we." This is an interesting observation as the higher occurrence of the latter relative to the former may be an alternative proxy for self-reference and possibly even fund manager narcissism. I define a simple ratio by dividing the number of "we" instances by the number of "fund" instances for each narrative. For the whole sample, this ratio is equal to 0.824.[1] Higher values of the ratio (particularly more than 1.016 which is one standard deviation larger than its mean) can signal fund manager narcissistic tendencies. As expected, this ratio is highly correlated (0.831) with my standard self-reference measure which looks at the frequency of all first-person singular and plural pronouns.

Next, I investigate the linguistic features of the fund manager narratives through the sample years. The mutual fund industry experienced two rather distinct economic macro-environments during the sample period, i.e. the bullish years of 2003-2006 and the bearish, volatile years of 2007-2009. In this context, it is interesting to observe the impact of the economy and other external factors on the lexical features of fund manager reports. Table 5 demonstrates a number of these measures and lists the 10 most frequently used words in the commentaries each year.

A number of interesting observations can be made here. During the bullish years, with the exception of 2006, fund managers more frequently refer to themselves by mentioning "we" rather than the "fund," while the reverse pattern emerges during the bearish years. The difference in word frequencies is significant at the 5% level using the t-test with unequal variance.

Similarly, fund managers appear to write more frequently about their often "strong" record of "performance" or "growth" during the pre-2007 years. On the contrary, during the 2007-2009 pe-

Table 4. Highest frequency eligible words commonly used in fund manager narratives

Instances	Frequency	Word
11312	1.63%	fund
9323	1.34%	we
7086	1.02%	year
5967	0.86%	market
5594	0.80%	performance
4973	0.71%	funds
4973	0.71%	growth
3605	0.52%	investment
3232	0.46%	interest
3232	0.46%	stock
3108	0.45%	index
3108	0.45%	sector
3108	0.45%	stocks
2984	0.43%	companies
2984	0.43%	consumer
2984	0.43%	economy
2859	0.41%	strong
2859	0.41%	years
2735	0.39%	S&P
2735	0.39%	technology
2611	0.38%	prices
2362	0.34%	past
2362	0.34%	portfolio
2362	0.34%	value
2238	0.32%	believe
2238	0.32%	higher

Instances	Frequency	Word
2113	0.30%	holdings
1989	0.29%	opportunities
1865	0.27%	current
1865	0.27%	information
1740	0.25%	fiscal
1740	0.25%	fund's
1740	0.25%	industry
1740	0.25%	long-term
1740	0.25%	positive
1616	0.23%	inflation
1616	0.23%	period
1492	0.21%	economic
1492	0.21%	profit(s)
1492	0.21%	new
1492	0.21%	returns
1492	0.21%	return
1492	0.21%	services
1367	0.20%	products
1367	0.20%	returned
1367	0.20%	shareholder
1304	0.19%	loss(es)
1243	0.18%	because
1243	0.18%	business
1243	0.18%	data
1243	0.18%	earnings
1243	0.18%	lower

riod, fund managers make more frequent citations of the "market" as well as the "economy," possibly for the self-serving purpose of projecting relatively less glorious performance on external factors. The causation word "because" makes two notable appearances among the 10 highest-frequency words in 2007 and 2008. This can possibly be attributed to the fund manager's preference to "talk him/herself out" of explaining an undesirable investment outcomes by advancing more causal arguments.[2] The word "index" is also cited more frequently during the "bearish" years, for the likely reason of making relative performance comparisons.

The frequency of individual keywords across different categories is also worth investigating. In making pair-wise comparisons, I use the Mann-Whitney U test, a powerful, non-categorical, nonparametric test of between-subject differences, to find the differences between frequencies that are significant at the 5% level. Table 6 shows the frequencies of individual words on the consolidated 50 highest-frequency wordlist where there

Table 5. Corpus-linguistic features of fund manager investment narratives

	2003	2004	2005	2006	2007	2008	2009
Total Words (tokens)	594	552	636	679	729	795	860
Distinct Words (types)	2049	1833	2232	2370	2223	2202	2511
Type/Token Ratio	3.45	3.32	3.51	3.49	3.05	2.77	2.92
Words per Sentence	9.8	10.2	9.5	11.0	12.4	13.9	13.5
Characters per Word	5.7	6.4	6.1	7.0	6.9	7.9	7.6
10 Highest-Frequency Words	we fund performance growth year stock strong believe higher interest	we fund growth investment performance strong stocks market funds index	we fund performance strong growth investment believe market economy stock	fund we year performance strong growth funds higher stock market	fund we market index economy investment because performance value funds	fund we year market index economy sector value because investment	fund we market year economy funds index investment interest stock

are significant differences in frequency among the seven groups of mutual funds. The word-frequencies reported in Table 6 are averaged across the sample years and normalised based on a 10,000-word document.

With regards to *financial terms*, "market" is more frequently used among funds with negative absolute returns, and the least profitable funds in the positive return category. The same pattern holds for "economy." Although no firm conclusion can be drawn from this observation, it seems to suggest that fund managers, in aggregate, refer to the market and the economy as external performance detractors in a self-serving way, which is consistent with the anecdotal evidence based on close-reading mutual funds. The usage frequency of "index" yields a similar conclusion, i.e. fund managers tend to make benchmark comparisons more frequently when performance is in the negative domain, and in doing so they strategically shift the reader's attention away from the fact that they have lost money by investing in the fund.

Table 6. Word-frequency analysis of positive and negative tone

Words	Loss-Making	Least Profitable	Most Profitable	Average	Loss-Making vs. Least Profitable	Least Profitable vs. Most Profitable	Loss-Making vs. Most Profitable
Positive Words	625.6	618.1	735.2	626.5		*	*
Negative Words	251.0	260.5	187.8	255.4			*
"Up" Words	115.5	115.3	129.7	120.2		*	
"Down" Words	52.8	51.0	37.5	45.7			*

In contrast, "performance" is used more often by the most profitable funds and less so by least profitable funds and loss-making funds. This can be due to the same self-serving attribution bias that leads fund managers to take ownership of favourable performance results. Not surprisingly, "growth" is used more frequently by growth-oriented funds, but also more so by most profitable funds. It is, however, difficult to attach significance to the latter, since "growth" may refer to a rise in assets as well as returns, both in the past fiscal year and the anticipated future.

Continuing on to *performance terms*, we can observe that the triad of "strong," "higher" and "positive" is used more frequently by the most profitable funds. However, the least profitable funds, and even loss-making funds do not use these terms less frequently. This may be associated with the tendency of fund managers to report negative news in the false positive format (i.e. "the fund did not benefit from positive performance" instead of "our returns were negative"). In fact, the usage frequency of "not" is itself suggestive of the well-documented *Pollyanna effect* which can be defined as "the tendency to use evaluatively positive words more frequently and diversely than evaluatively negative words in communicating" (Boucher and Osgood, 1968). With regards to the usage of "profit(s)" and "loss(es)," the results are similar to Rutherford (2005). Loss-making funds refer to profits more frequently than to losses, and they even make more references to profits than least profitable funds, which provides further support for the Pollyanna hypothesis. I will test the Pollyanna hypothesis more robustly later in this section.

The use of *self-reference* terms in the commentaries is consistent with the pattern observed in the longitudinal study in Table 6. In other words, loss-making funds tend to use "fund" much more frequently than "we" while they begin to refer to themselves using a personal pronoun when performance improves. This is, of course, a clear manifestation of the self-serving attribution bias inherent, more or less, in all economic agents, and by extension, in professional investors.

Finally, some *other terms* in Table 6 merit attention. Loss-making fund managers, compared to their counterparts who have returned a profit, tend to talk more frequently about lost "opportunities" as well "opportunities" for growth in the future. The same applies to growth-oriented funds versus value-oriented funds. Loss-making funds managers also cite "long term" more frequently in comparison. Both of these observations may suggest the same strategy of focusing the reader's attention on more positive messages. In addition, the word "because" is used more often in the negative domain, for the likely purpose of advancing causal arguments to justify sub-par performance.

I also use Henry (2008)'s list of positive and negative words to search for instances of positivity/negativity in the study corpus using the same categories of funds in terms of performance, i.e., loss making, least profitable and most profitable. In addition, I explore two relevant categories, i.e., "up" words which generally connote growth or elevation and include "higher" "increase," "increased," "more," "over" and "up"; and "down" words which include "decrease," "decreased," "lower," "reduced" and "reduction." The word frequencies are averaged across all the sample years and normalised for a document length of 10,000 words. The results are illustrated in Table 7.

The results reported in Table 7 suggest that positive words are more often used in fund manager commentaries than negative words (almost 2.4 times as much, which is slightly less than the 3 times proportion Rutherford (2005) found for corporate annual reports), which is another clear manifestation of the Pollyanna effect. This effect is stronger among loss-making funds compared to least profitable funds, i.e. the fund managers in the former group tend to use more positive words in order to "sugarcoat" the undesirable message they have to communicate to their clients in the commentaries. The results for "up" words and "down" words are similar.

Table 7. Word frequency analysis of investment narratives belonging to different fund categories

Words		Word Frequencies per 10,000 Words								Statistically Significant Differences in Word Frequency				
		Loss-Making	Least Profitable	Most Profitable	Smallest	Largest	Value-Oriented	Growth-Oriented	Average	Loss-Making vs. Least Profitable	Least Profitable vs. Most Profitable	Loss-Making vs. Most Profitable	Smallest vs. Largest	Value vs. Growth
Financial Terms	Market	105.6	70.4	54.6	64.0	98.8	79.3	82.1	83.2	*	*		*	
	Performance	65.2	90.1	102.9	85.5	79.9	66.4	81.3	79.7	*		*		
	Growth	60.6	85.8	99.2	84.7	66.2	40.8	105.5	71.1			*	*	*
	Index	64.9	35.7	49.9	44.1	49.3	38.8	40.1	44.6	*	*			
Performance Terms	Strong	37.2	43.0	49.1	35.5	39.8	30.3	48.9	40.8			*		
	Higher	28.8	37.0	38.0	32.4	32.9	28.1	33.6	32.5	*		*		
	Positive	20.0	30.9	35.5	22.0	24.4	20.4	27.6	24.5			*		*
	Profit(s)	34.1	16.7	35..9	21.7	24.4	18.0	21.3	21.4	*	*			
	Loss(es)	29.5	13.6	10.0	25.9	10.9	26.8	14.1	18.8	*		*		
Self-Reference	Fund(s)	311.0	251.5	189.5	245.4	235.5	229.9	231.0	234.4	*		*		
	We	76.6	135.1	199.0	145.2	151.7	156.7	125.4	133.7			*		
Other Terms	Opportunities	39.1	29.0	28.5	25.5	27.2	20.3	32.8	29.2			*		*
	Long-Term	40.4	32.5	21.4	25.9	22.2	21.3	28.3	25.0	*				
	Because	30.6	25.2	15.9	14.4	20.3	19.6	26.9	18.3	*		*		
	Not	38.6	25.0	19.9	27.1	27.3	22.6	26.9	24.4	*		*		

5. DISCUSSION

In this chapter, the dynamic relationship between the overconfidence of fund managers, the past performance of their funds and the tone of their investment narratives were studied. We observed that over optimism and self-reference are likely to be more representative indicators of overconfidence than certainty, possibly due to the fact that fund managers commonly write their reports in a resolute tone by normal practice. The word frequency analysis of investment narratives demonstrated that key differences exist in the *tone* and *genre* of fund manager commentaries whose corresponding funds have experienced varying degrees of past investment performance.

It is of course clear that fund managers do not operate in a context-free world. Holland (2009) identifies a number of important intangibles in the work environment of fund managers. These include:

1. "Increasing significance of knowledge intensive processes, assets or intangibles in creating value within the enterprise, and within its immediate network of corporate alliances, suppliers, distributors, and customers.
2. Increasing use of technology within these value creation processes.
3. Major changes in the corporate value creation process such that knowledge creation, articulation, processing and leveraging, has become a central survival activity for multinational companies.
4. Changes in corporate structure from top heavy, multi-layered managerial hierarchies to flat hierarchies, and to companies establishing alliance and networks with companies in the same industry and with suppliers and distributors.
5. Increased internationalization or globalization of companies and industries.
6. Radical changes in corporate strategy arising from the above forces."

Further research can address a number of limitations in the content analysis process. Fundamentally, content analysis is based on the assumption that the language people choose to express themselves in contains information about the nature of their psychological states. A large body of literature on narrative analysis, both in psychology and more specifically in the area of accounting and finance, is built on this core assumption. The alternative assumption, however, is that environmental circumstances may shape verbal and written communication in a way that may render the underlying psychological states of individuals untraceable.

Firstly, a weakness of computer-assisted content analysis using the "bag-of-words" method is that word frequencies and word categories are relied on to imply intended meaning. This approach is of course not perfectly accurate, yet it is a compromise that allows researchers to analyse large amounts of textual data in a practical way. To circumvent associated problems, I have attempted to triangulate the results of computer-assisted analysis with manual coding and close-reading methodologies on random control samples of the annual reports.

Secondly, any content analysis program has to deal with the issue of homographs. While DICTION has a built-in feature that enables it to make context-dependent judgements on homographs, and therefore is superior to most other comparable packages, human coding can obviously lead to more accurate results.

Thirdly, DICTION makes use of pre-defined dictionaries, which may not always be perfectly tuned to specific research needs. The program also allows user-defined dictionaries that clearly increase flexibility. Although the current study has not taken advantage of this feature, this should not have contributed to any significant inaccuracy since almost all of the fund rankings and comparisons performed are within sample, and therefore such biases should have mostly cancelled out in the process.

Fourthly, for each of the content analysis variables, DICTION specifies thresholds and declares values exceeding those thresholds as "out of range," assuming a normal distribution for the underlying scores. While this is a useful feature, researchers should examine the distribution normality of the content analysis scores beforehand (a step taken in this study). More importantly, DICTION thresholds are by definition static whereas, ideally, the researcher can improve the accuracy of the results by defining dynamic thresholds for time-series data depending on market environment and investor sentiment at any given observation date.

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KEY TERMS AND DEFINITIONS

Content Analysis: A social sciences methodology for studying the content of (mostly written) communication.

Decision Making: The process of selecting of a course of action among several alternatives.

Fund Manager: A person responsible for implementing a fund's investing strategy and managing its asset portfolio.

Investor Psychology: The study of investor mind and behavior.

Overconfidence: The attribute of having greater certainty than circumstances warrant.

ENDNOTES

1. Fund managers often tend to refer to their own fund under management in singular format and the competition or the industry in plural. Hence, instances of the word "funds" are not considered in calculating this ratio.
2. Li (2008) demonstrates that a higher frequency of causation words (such as "because") in the Management Discussion and Analysis of corporate annual reports is associated with less persistent earnings.

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Chapter 48
Modern Risk Management Techniques in Banking Sector

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ABSTRACT

Risk management as a very rapid emerging subject has been affected by several happenings in the world. There are many studies covering risk definition, risk types, and risk management, plus there are many contemporary approaches in order to calculate the risk incurred by the companies due to their transactions. In the modern business life, since the transactions have become very fast and their risk exposure increases, the companies, especially the financial institutions, started to use new techniques to measure the probable effects of the risks that they have taken while undertaking the transactions. In this chapter, the authors show two techniques as the contemporary approaches to risk management. These are operations research and statistics. They know that these two concepts are very detailed and sophisticated tools, which require software for better results. The banks have been investing in these solutions, and they are designing new organizations to handle these issues. Thus, the authors introduce these techniques very briefly with using some banking practices for better understanding.

INTRODUCTION

The Chinese word for "crisis" represents "danger" and "opportunity," which shows "risk" and "gain" are sisters.

As the entire world becomes more united and many countries began to be the part of international trade, they have enacted many laws in order to sustain the continuity of these transactions. They have agreed on the financial deregulations which are the main milestone to open the local country for international transactions by allowing imports and exports. These happenings were firstly welcomed by the local people since the imported goods more easily provided and the public was benefiting from the competition due to the different brands in the same sector. This is the main advantage of financial deregulations and open market transactions.

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However, as the transactions become more fast, they became also uncontrollable. Due to this uncontrollable structure of the transactions, many speculators have invested into many emerging markets in order to benefit from the high interest gain. For instance US investors have converted their local currency to emerging countries' currencies in order to buy their currencies which have a yield of 50-100% in the mid-1990s. This led to unbelievable profits which were impossible to be earned in US in one year period.

Not only the foreign investors but also the local individuals and also the banks have done the same in order to reach big profits. However, since the type of these investments were portfolio investments rather than direct investments such as real estate or project investments which reduce unemployment, they have not added value in the financial strength of the country. Thus, they did not increase the welfare of the public in that country. For example, the unemployment was very volatile and has not decreased to the accepted rates; the GDP per person has not reached the developed countries' figures. These were the frequent sayings against financial deregulations and globalization. However, after any bad happening about the political or economic structure of the country it was seen that the portfolio investments have left the country. This shows that these funds may cause may financial disability if they are not ruled or managed in a clear way.

Therefore, many emerging countries like Argentina, Mexico, Brazil, Turkey etc. have entered into crises environments. This showed that the reserves of the central banks were not enough and the financial strengths of the local banks were not able to satisfy the needs of these portfolio investors. Furthermore, the banking sectors of many emerging markets had entered into a very tough competition which brings the financial weaknesses. The financial weaknesses of the banks were stemming from two main causes; insufficient liquidity and capital. This was the result of the aggressive growth strategies of the banks by ignoring risk management.

As it is mentioned in the below paragraphs, the need for risk management has been understood after the crises happened in several emerging countries. Therefore these countries started to pay more attention to risk management and they have implemented new techniques in order to prevent big losses of especially banking sector. They have realized that if banking sector goes under financial distress not only financial sector but also many sectors have been badly affected from these happenings. This put stress on the financial regulators of different countries to implement new acts and regulations involving different and modern risk management techniques to be imposed on the banks and other financial sector actors.

In this chapter we will try to show what these techniques are and how these techniques can be used by the banks. However before going forward that stage we need to show what risk is and how risk management should be defined in banking sector. Afterwards, we will be dealing with the risk types imposed on banking sector. The risk types will be purchase power risk, interest rate risk, market risk, politic risk, FX risk, liquidity risk, credit risk, operational risk, financial risk, management risk and company and industry risk. In order to manage risk by mitigating it, there would be several business tools relying on operations research and statistics. The definitions, theory and examples of these techniques will be clearly explained throughout the chapter.

WHAT IS RISK AND RISK MANAGEMENT?

Before going forward into the deep details of this study, we should define what risk is and what the usage of risk management is. Since we are living in a very complex world with a wide variety of transactions, we need more sophisticated decision making tools than before. Since the variety

of transactions increase rapidly the outcomes of the decisions vary accordingly. Each decision may lead to different outcome which may contain undeserved consequences. These undeserved consequences are defined as risk. If we define risk in a very brief way, we can use the following definition (Arnoldi, 2009);

Risk is the potential danger.

If we make the definition wider, we would say;

Risk is the possibility of something bad happening or to do something although there is a chance of a bad result.

For example, if a bank lends a credit facility to a customer, in case of no repayment, this bank is risking the amount lent. The bank is monitoring the customer payment behaviors until the payment comes; this amount is seen as the risk of the bank.

As it is shown at the beginning of the chapter and in Figure 1, the Chinese character (pronounced "Wei Ji"), like many Chinese characters, is composed of two individual characters, each one with a different meaning. The first character means "danger" and the second means "opportunity." When combined, they mean "crisis." The word "crisis" is commonly associated with "a situation that has reached an extremely difficult or dangerous point" with special attention paid to the element of danger in the situation. However, a key sense of the word crisis is that it refers to a "turning point for better or worse." To better understand the relationship between "Wei Ji," it will help to substitute "risk" for "danger" and "return" for "opportunity" to relate the concepts more closely to finance. This shows that risk and return are sisters and you cannot avoid one of them to have the other.

What we generally know about risk are:

- We are all confronted with risks in the contemporary social or business life.
- Risk cannot be totally avoided.
- Risk should be welcomed or taken into consideration in order to be a candidate for gains.
- Each decision includes risk of not taking other decisions.

This shows that risk is not only a financial subject but also a very strong social issue which is very important of each and every individual's or institution's life.

After, we have given the definition of risk; we need to say that risk should be controlled by somehow in order to project the happenings in the future. This, statement leads us to another concept which is "risk management."

For many social analysts, politicians, and academics risk management is the management of environmental and nuclear risks that appear to threaten our existence. For the bankers and financial officers it is the sophisticated use of techniques like currency hedging, interest rate swaps, credit repayments etc. For the insurance buyers and sellers it is coordination of insurable risks and the reduction of insurance costs.

If we make a general definition without considering its functions we can say that (Gallati, 2003).

Risk management is the process of protecting an organization from potential asset or income loss.

Figure 1. Chinese word for crisis

The procedure of the related subject can be illustrated as follows. As it is shown in Figure 2, the company should use each and every opportunity of improving the existing risk management of the organization. This is due to the change happening around the company and among the business life. Furthermore, if we discuss the main phases of risk management we need to talk about:

- Establishing the context.
- Identification of risks.
- Analysis of risks.
- Evaluation of the risks and their probable consequences.
- Treating the risk.

This is a closed loop and surely repeated continuously (The University of Newcastle Australia, 2013).

There has been evolved a new and emerging subject called Enterprise risk management (ERM) which brings new approach to risk management. We know that enterprise risk can include a variety of factors with potential impact on an organizations activities, processes and resources. External factors can result from economic change, financial market developments and dangers arising in political, legal, technological and demographic environments (Olson, 2008).These all combined factors constitute the enterprise risk management's approach.

The main differences between traditional risk management and ERM are depicted in Table 1.

TYPES OF RISKS

The risks facing an organization and its operations can result from factors both external and internal to the organization. According to Federation of European Risk Management Associations (FERMA) Figure 3 summarizes examples of key risks in these areas and shows that some specific risks can have both external and internal drivers and therefore overlap the two areas. They can be categorized further into types of risk such

Figure 2. Risk management

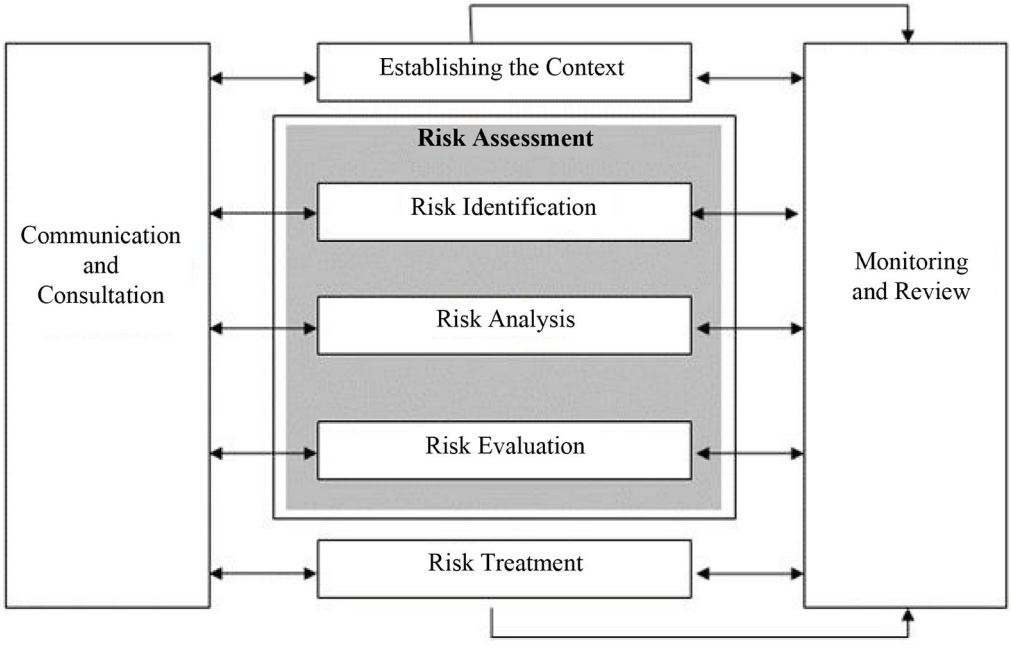


Table 1. Differences between traditional risk management and ERM

Traditional Risk Management	ERM
Risk as individual hazards	Risk viewed in the context of business strategy
Risk identification and assessment	Risk portfolio development
Focus on discrete risks	Focus on critical risks
Risk mitigation	Risk optimization
Risk limits	Risk strategy
Risk with no owners	Defined risk responsibilities
Haphazard risk quantification	Monitoring and measurement of risks

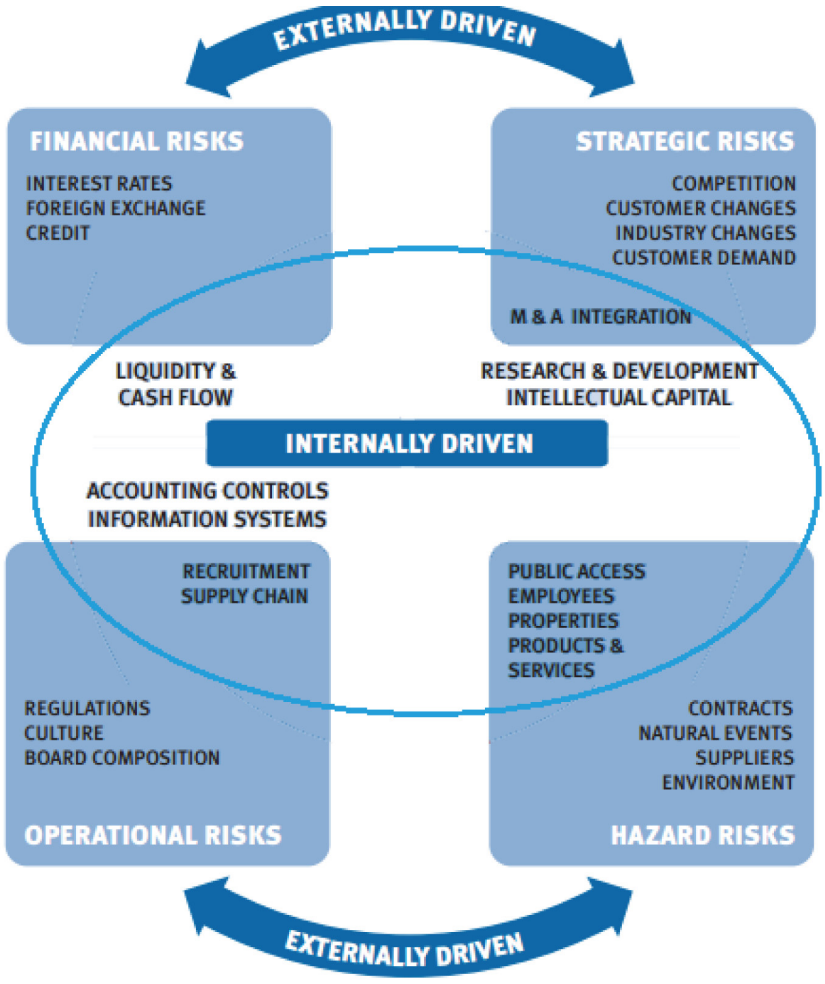
Source: Olson & Wu (ibid)

as strategic, financial, operational, hazard, etc. (FERMA, 2013).

Before going more detail, we can talk on two main types of risks (Megginson, 2008):

- **Systematic Risk:** This is the uncontrollable risk which is originated from the market conditions. This risk can be named as market risk and it has an effect on all investments in that market. This risk is an externally driven risk which cannot be mitigated through diversification.
- **Unsystematic Risk:** The risk of the investment itself is defined as the unsystematic

Figure 3. Type of risks

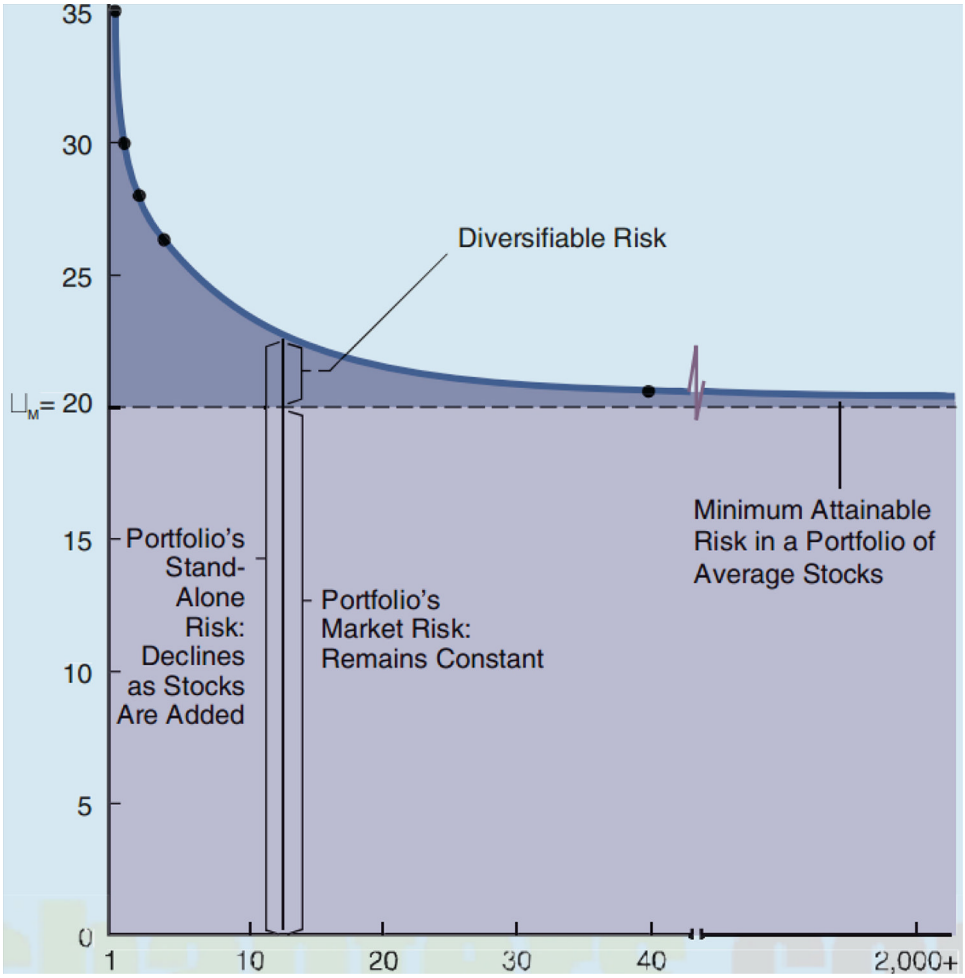


risk. This is driven by internal factors and can be mitigated through diversification. The diversifiable risk is depicted as per Figure 4.

After defining the systematic and unsystematic risks we should go forward to define the types of the risks standing under these risks. Under unsystematic risks we have management, industry, liquidity, credit and operational risks. However, the last three can be also categorized under systematic risks as per some other financial books.

- **Management Risk:** This is the risks associated with ineffective, destructive or underperforming management, which hurts shareholders and the company or fund being managed.
- **Industry Risk:** This is the chance that a set of factors particular to an industry group drags down the industry's overall performance. For example a tax increase in the automobile industry may adversely affect the profits of the automobile producers due to the sharp decline in the sales volume (Maheshwari, 2008).

Figure 4. Systematic and unsystematic risks



- **Liquidity Risk:** Liquidity is generally defined as the ability of a financial firm to meet its debt obligations without incurring unacceptably large losses. An example is a firm preferring to repay its outstanding one-month commercial paper obligations by issuing new commercial paper instead of by selling assets. Thus, "liquidity risk" is the risk that a firm will not be able to meet its current and future cash flow and collateral needs, both expected and unexpected, without materially affecting its daily operations or overall financial condition. Financial firms are especially sensitive to funding liquidity risk since debt maturity transformation (for example, funding longer-term loans or asset purchases with shorter-term deposits or debt obligations) is one of their key business areas (Federal Reserve Bank of San Francisco, 2013).
- **Default or Credit Risk:** Credit risk is most simply defined as the potential that a bank borrower or counterparty will fail to meet its obligations in accordance with agreed terms. The goal of credit risk management is to maximize a bank's risk-adjusted rate of return by maintaining credit risk exposure within acceptable parameters. Banks need to manage the credit risk inherent in the entire portfolio as well as the risk in individual credits or transactions. Banks should also consider the relationships between credit risk and other risks. The effective management of credit risk is a critical component of a comprehensive approach to risk management and essential to the long-term success of any banking organization(Basel Committee of Banking Supervision, 1999).

We can say that when a credit is utilized, since there is a potential threat of default of the capital and the interest/profit, each credit amount is named as risk. This type of risk can be also named as customer risk or default risk. In order to reduce the risk, the banks are demanding down payments or placing pledges on the tangible assets.

- **Operational Risk:** Operational risk is "the risk of direct or indirect loss resulting from inadequate or failed internal processes, people and systems or from external events."(Basel Committee of Banking Supervision, 1999: 4) The most important types of operational risk involve breakdowns in internal controls and corporate governance. Such breakdowns can lead to financial losses through error, fraud, or failure to perform in a timely manner or cause the interests of the bank to be compromised in some other way, for example, by its dealers, lending officers or other staff exceeding their authority or conducting business in an unethical or risky manner. Other aspects of operational risk include major failure of information technology systems or events such as major fires or other disasters (Basel Committee of Banking Supervision, 1999).

The systematic risks are as follows:

- **Market Risk:** In most of the financial literature market risk and systematic risk is used instead of each other. Market risk is the possibility that financial markets will drop in value and create a ripple effect in one's investment. Market risk arises because market prices in general move up and down consistently for some time. There are many market related risks that a company should try to manage or mitigate during risk management (Maheshwari, 2008). These are depicted as follows.
- **Interest Rate Risk:** This risk arises for the holder of an interest bearing position. This is the exposure of a bank's financial condition to adverse movements in interest

rates. Accepting this risk is a normal part of banking and can be an important source of profitability and shareholder value. However, excessive interest rate risk can pose a significant threat to a bank's earnings and capital base. Changes in interest rates affect a bank's earnings by changing its net interest income and the level of other interestsensitive income and operating expenses. Changes in interest rates also affect the underlying value of the bank's assets, liabilities and off-balance sheet instruments because the present value of future cash flows (and in some cases, the cash flows themselves) change when interest rates change. Accordingly, an effective risk management process that maintains interest rate risk within prudent levels is essential to the safety and soundness of banks (Basel Committee on Banking Supervision, 1997).

- **Currency (FX) Risk:** It is the risk that arises from the possible movements in the value of the foreign currencies. It arises from three different environments (Jorion, 2003);currency float in which the external value of the currency is free to move, to depreciate or appreciate; fixed currency system in which the external value of the currency is fixed to another currency and the changes in the currency regime in which the movements from pegged to floating or vice versa, affects the value of the currency.
- **Political Risk:** With increasing interaction of the world's markets, political climates around the world can affect the value of domestic and international investments. A period of instability may decrease the value of the investments and a stability period may increase the wealth of people by increasing the value of the investments (Maheshwari, 2008).Other than stability and instability there might be the risks related to the political regime followed by the rulers of the country. The political risks arises when the rulers choose the following paths:
  - Nationalization.
  - Partial nationalization.
  - Limitation of the activities.
  - Limitation on the acquisitions and mergers.
  - Uncertainties in the laws (especially in tax laws.)

  These risks are all called as political risks.

- **Equity Risk:** This risk arises for the holder of an equity position. An example of this risk is a bank that has purchased shares/ equities in a company. A loss arises when the share/equity is fixed at a lower market value.
- **Commodity Value Risk:** This risk that arises for the holder of a commodity position. An example of commodity risk is a bank that has purchased gold. A loss for the bank arises when the price of gold is fixed at a lower level in the commodities markets.
- **Settlement and Counterparty Risk:** It is the risk that arises on transactions in interest rates, currency, equities or commodities that have not yet been settled. An example is a bank that has purchased a share from another bank that is not the issuer of the share, but which has to deliver the share to the purchaser against payment. A loss arises for either party in the transaction if settlement does not occur.
- **Purchase Power Risk:** This risk is related to the inflation in a country. If the inflation which is defined as the continuous increases in the overall prices in an economy, is higher than the average income increase.

MODERN RISK MANAGEMENT TECHNIQUES

After defining risk, risk management and the types of risk we now will try to explain what the modern risk management techniques are and how they are used to forecast the possible outcomes of different transactions.

As we already know, the decision making under risk has drawn much attention in many different social sciences, especially in economics and management. In economics, the microeconomic problem concerning consumers and firms under the uncertainty circumstance must be solved on the basis of the theory of the decision making under risk. Moreover, in management, modeling the decision making under risk is a key problem of the risk management and decision science.

The first technique that is applied under uncertain and risky situation is Operations Research. This is an interdisciplinary branch of mathematics (especially applied mathematics) used to provide a scientific base for management to take timely and effective decisions to their problems. It tries to avoid undesired consequences from taking decisions merely by guessing or by using thumb rules (Operations Research Society of America, 1987). It uses methods like mathematical modeling, statistics, and algorithms to arrive at optimal or good decisions in complex problems which are concerned with optimizing the maxima (profit, faster assembly line, greater crop yield, higher bandwidth, etc.) or minima (cost loss, lowering of risk, etc) of some objective function.

As it is seen from the definition, the related technique is mainly used for optimizing the decision making. This will decrease the uncertainty and of course mitigate the risk. Nevertheless, although this technique is useful for reducing the risk, since the computations are mainly dependent on the previous data or personal experiences, this doesn't mean that the risk is totally avoided.

The second one is Statistics, Statistics is the study of how to collect, organize, analyze and interpret numerical information from data. Descriptive statistics involves methods of organizing, picturing and summarizing information from data. Inferential statistics involves methods of using information from a sample to draw conclusions about the population.

One of the main concepts of statistics is standard deviation. This is the main item that is being used in the calculation of risk. Moreover, risk is defined as the standard deviation of the average real annual returns (Siegel, 2002). Therefore, if the standard deviation of A type financial instrument is more than B type financial instrument, it is said that A type is more riskier than the B type.

Operations Research

As it is seen from the definition made a few paragraphs ago, the related technique is mainly used for optimizing the decision making. This will decrease the uncertainty and of course mitigate the risk. Nevertheless, although this technique is useful for reducing the risk, since the computations are mainly dependent on the previous data or personal experiences, this doesn't mean that the risk is totally avoided.

Decisions that lend themselves to display in a decision table also lend them to display in a decision tree. The decision tree is a graphical display of the decisions process that indicates decision alternatives and their respective probabilities and pay offs for each combination of alternative(Shah & Gor, 2007). The decision tree classifier is one of the possible approaches to multi-stage decision making. The basic idea involved in any multi-stage approach is to break up a complex decision into a union of several simpler decisions. This is done by a decision tree in which each internal node denotes a test on an attribute; each branch represents an outcome of the test (Han & Kamber, 2001).

Figure 5. A decision tree

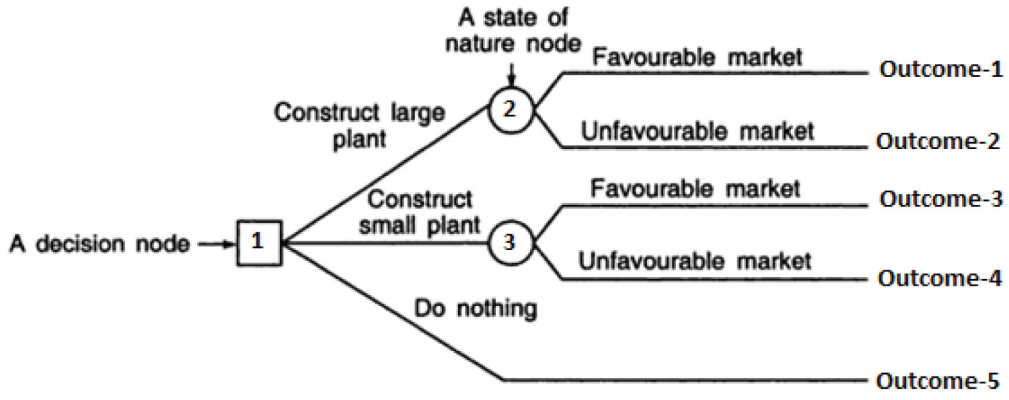


Figure 5 shows a basic decision tree.

The circular nodes which are also called as state of nature node show uncertain conditions where square nodes which are called as decision nodes represent the decision making activity under certain conditions. Therefore, the nodes; 2 and 3 stand for uncertain events where 1 stands for certain conditions.

For business, this technique is mainly dealing with the calculation of expected utility or expected monetary value of the project. The formulas are depicted as follows (Taha, 1997).

$$E(V) = \sum_{i=0}^{n} P_i \text{ x } V_i$$

or

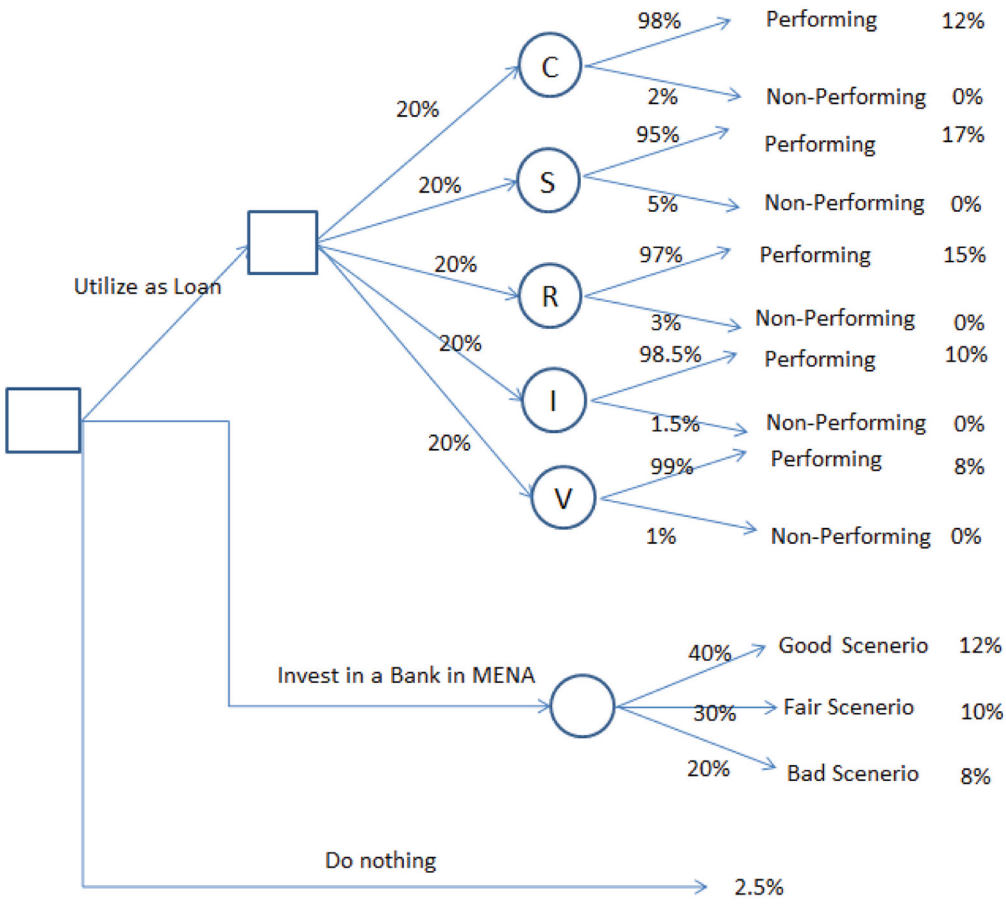
$$E(U) = \sum_{i=0}^{n} P_i \text{ x } U_i \quad (1)$$

where, i: Event number; P_i: The probability corresponds to same event; V_i: The value or return of the event i; U_i: The utility of the event i.

Box 1

Halech Bank is a multinational commercial bank that mainly operates in corporate, small business, retail, investment and VIP banking. The stakeholders are putting 1 million USD equity to be used in banking channels which is expected to bring about 2.5% (risk free return) return in one year time period. If the bank utilizes this amount to the existing banking channels the probability of default would be 2%, 5%, 3%, 1.5% and 1% for corporate, small business, retail, investment and VIP banking respectively. The returns would be 12%, 17%, 15%, 10% and 8% for corporate, small business, retail, investment and VIP banking respectively. The utilizations would be made evenly across all banking channels. Other than investing into the bank for utilizing as loans, the stakeholders and the management are in different between buying a new bank in MENA region which would generate 10% return with a probability of 40%, 8% with a probability of 30% and 12% with a possibility of 20%. The bank management is in different between these decisions and opts for to make the decision with decision trees. The management has drawn a decision tree as depicted in Figure 6.

Figure 6. Halech Bank decision tree



The expected values of decision nodes are calculated as follows:

$E(V)_{utilize\ as\ loan}$ = 20% x (98% x 12% + 2% x 0%) + 20% x (95% x 17% + 5% x 0%) + 20% x (97% x 15% + 3% x 0%) + 20% x (98.5% x 10% + 1.5% x 0%) + 20% x (99% x 8% + 1% x 0%)

$E(V)_{invest\ in\ a\ bank\ MENA}$ = 40% x 12% + 30% x 10% + 20% x 8%

$E(V)_{do\ nothing}$ = 2.5%

$E(V)_{utilize\ as\ loan}$ = 12.05%

$E(V)_{invest\ in\ a\ bank\ MENA}$ = 9.4%

$E(V)_{do\ nothing}$ = 2.5%

Since the $E(V)_{utilize\ as\ loan}$ has the biggest return the bank management should prefer to use this capital in utilizing loans.

Box 2

Pasha Bank has two investment alternatives which are mostly about new banking channels. These are a new mobile branch and a new digital technology branch. Both investments have only two years economic life due to the new discoveries in technology which would possible make these two investments obsolete in two year time. The

Table 2. Pasha Bank channel alternatives

	Mobile Branch	Digital Branch
Economic Life	2 years	2 years
Investment cost	USD 1 million	USD 750 thousand
Expected Cash Flows/Year	USD 250 thousand 10% probability	USD 150 thousand 10% probability
	USD 500 thousand 40% probability	USD 350 thousand 40% probability
	USD 750 thousand 50% probability	USD 500 thousand 50% probabiity

expected rate of return is 10% p.a. and the details of the investment are depicted as per Table 2.

They need to see the NPV (net present value)[1] of each investment on a decision tree

$E(V)_{mobile\ branch}$ = 10% x (10% x 250 + 40% x 500 + 50% x 750) x 0.8264^2 + 250 x 0.909^3) + 40% x (10% x 250 + 40% x 500 + 50% x 750) x 0.8264 + 500 x 0.909) + 50% x (10% x 250 + 40% x 500 + 50% x 750) x 0.8264 + 750 x 0.909) = USD 1,041.24 thousand

$E(V)_{digital\ branch}$ = 10% x (10% x 150 + 40% x 350 + 50% x 500) x 0.8264 + 150 x 0.909) + 40% x (10% x 150 + 40% x 350 + 50% x 500) x 0.8264 + 350 x 0.909) + 50% x (10% x 150 + 40% x 350 + 50% x 500) x 0.8264 + 500 x 0.909) = USD 702.84 thousand

The $NPV_{mobile\ branch}$ = 1,041.24 – 1,000.00 = + USD 41.24 thousand

The $NPV_{digital\ branch}$ = 702.84 – 750.00 = - USD 47.16 thousand

Mobile branch is the most feasible alternative.

To sum up, when we come to risk management, it is for sure that these decision trees will mitigate the risk incurred. This is because it is helping to decrease the uncertainty. The managers are more aware of what will happen in the future by considering the previous information on the probability of the different and possible outcomes.

Statistics

In risk management, statistics have been widely used in order to understand and mitigate risk. There are various applications of statistics in risk management but most of them are based on the variation of the assets' prices. Therefore the term variance and standard deviation are commonly used in this area. Standard deviation is the square root of variance and the formula is depicted as follows (Spiegel & Lindstrom, 2000):

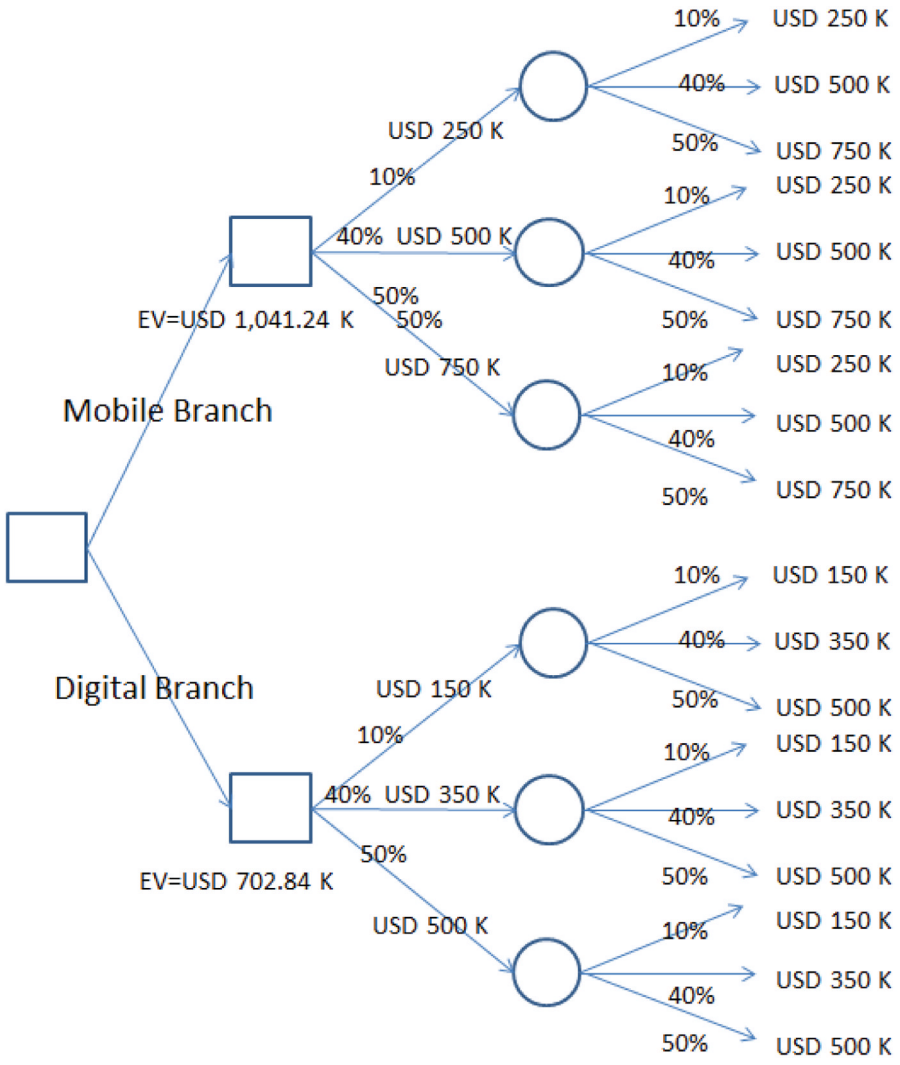
$$\sigma\sqrt{\frac{\sum_{j=1}^{N}(X_j - \bar{X})^2}{N}} \qquad (2)$$

where; σ represents standard deviation; X_j represents j^{th} datum in the population; X represents the average of all data in the population; and N represents the number of data in the population.

In this chapter we will show how the bank management uses statistics and of course standard deviation and variance to understand the possibilities of different scenarios which are probable to happen in the future.

The first major technique is called as VaR (value at risk). VaR is a statistical concept which shows the maximum loss that an institution can be confident it would lose on a portfolio of assets due to normal market movements (Penza, Bansal, 2001). As it is in the definition, VaR analysis is a powerful analysis to manage market risk. In order to compute the standard deviation for VaR

Figure 7. Pasha Bank decision tree



analysis we can use the following formula (the number of work days in 1 year is almost 252) to show the relationship between daily and annual standard deviations

$$\sigma_{annual} = \sigma_{daily} \times \sqrt{252} \quad (3)$$

This also shows that:

$$VaR_{annual} = VaR_{daily} \times \sqrt{252} \quad (4)$$

$\sqrt{252} = 15.87$ means that σ_{daily} is almost 6.3% of σ_{annual}.

Furthermore, we can also understand that since:

$$\sigma_{monthly} = \sigma_{daily} \text{ x } \sqrt{22} \; ; \; \sqrt{22} = 4{,}69$$

The daily standard deviation is 22% of the monthly standard deviation.

When we come to the VaR analysis we can use the following formula:

VaR = The market value of the financial position x Volatility

Volatility = σ x Z score of an accepted confident interval

This financial position can be anything including FX, stocks, commodities etc. Therefore, any position held by the bank can be analyzed using this method of statistics.

If we go deep into the detail we can convert the formula to the following formulas:

VaR = The market value of the foreign currency position x Volatility in FX

VaR = The market value of the stock position x Volatility in Index

VaR = The market value of the bond x Volatility in bond return

We will show it in a banking sector scenario as follows.

Box 3

Canaria Bank which is a Spanish Bank has a long position of USD 12.5 million, the bank wants to see how the VaR would be in one year time for this long position. The board of directors hates speculation so they have always demanded square position from the bank management. The bank management tries to show that the annual VaR is not so big to be scared. They have hired a consultancy firm and they wanted them to calculate the VaR of this position in one year time. The calculations of the firm are as follows:

They have taken the last 20 working days USD exchange rates against Euro *(EUR 1 = USD 1,30..)* which is shown in Table 3.

The standard deviation is calculated as 1.06% as per the formula (2). They have used a confident interval of 95% which corresponds to 1.65 as Z score (shown in Table 4).

VaR = The market value of the foreign currency position x Volatility in FX.

VaR= USD 12.5 million x 1.06% x 1.65.

VaR = USD 218.6 thousand.

But this is calculated for only 20 working days. Therefore we need to convert it to 252 working days which is almost 1 year.

As per Formula (3)

$$VaR = VaR \times \sqrt{\frac{252}{20}}$$

$$VaR = \text{USD } 218.6 \text{ thousand} \times \sqrt{\frac{252}{20}}$$

$$VaR_{annual} = \text{USD } 775.9 \text{ thousand}$$

Other than VaR Analysis, there are many other methods can be used in banking based on statistics. We will introduce one other technique related to statistics in order to show how banking industry is so close to statistic applications. As we all know that like any other company, the banks are making financial planning and budgeting before the beginning of the New Year. Their main purpose is to find out how much profit to be earned in the

Table 3. USD vs Euro exchange rates

Dates	Exchange Rate	Dates	Exchange Rate
29-Apr	1.3018	14-May	1.2970
30-Apr	1.3090	15-May	1.2987
2-May	1.3075	16-May	1.2887
3-May	1.3167	17-May	1.2874
6-May	1.3109	20-May	1.2864
7-May	1.3107	21-May	1.2863
8-May	1.3099	22-May	1.2871
9-May	1.3125	23-May	1.2932
10-May	1.3145	24-May	1.2882
13-May	1.3007	27-May	1.2961

Table 4. Z Table

Z	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
1.1	0.8643	0.8665	0.8686	0.8708	0.8729	0.8749	0.8770	0.8790	0.8810	0.8830
1.2	0.8849	0.8869	0.8888	0.8907	0.8925	0.8944	0.8962	0.8980	0.8997	0.9015
1.3	0.9032	0.9049	0.9066	0.9082	0.9099	0.9115	0.9131	0.9147	0.9162	0.9177
1.4	0.9192	0.9207	0.9222	0.9236	0.9251	0.9265	0.9279	0.9292	0.9306	0.9319
1.5	0.9332	0.9345	0.9357	0.9370	0.9382	0.9394	0.9406	0.9418	0.9429	0.9441
1.6	0.9452	0.9463	0.9474	0.9484	0.9495	0.9505	0.9515	0.9525	0.9535	0.9545
1.7	0.9554	0.9564	0.9573	0.9582	0.9591	0.9599	0.9608	0.9616	0.9625	0.9633
1.8	0.9641	0.9649	0.9656	0.9664	0.9671	0.9678	0.9686	0.9693	0.9699	0.9706
1.9	0.9713	0.9719	0.9726	0.9732	0.9738	0.9744	0.9750	0.9756	0.9761	0.9767
2.0	0.9772	0.9778	0.9783	0.9788	0.9793	0.9798	0.9803	0.9808	0.9812	0.9817

coming year having last 4-5 years trend in hand. This analysis of course is made with sophistical analyses with very detailed calculations and having many other factors affecting the bank's performance. Here, we will only show a very basic example to understand how regression analysis is used to estimate the coming year's performance with the last 5 years data.

Regression analysis is a very common and widely used analysis which is used in a very wide scope of business decisions. This analysis is the study of the data in which a relationship between data sets has been analyzed. There are independent variable(s) which are represented by x_n which are assumed that they have direct impact on the dependent variable called "y" (Sen, Srivastava, 1990). The regression model has the following formula.

$$Y = B + \sum_{n=1}^{n} AnXn$$

where; Y represents the dependent variable, X represents the independent variable.

Box 4

Tarabia Bank management and the stockholders have a conflict on the coming years profit budget. The management as the operations side knows that the coming year's profit would not be as much as the stockholders are expecting. The stockholders are thinking that they have invested in this bank 10 years ago and this is the time to see sufficient returns after a decade time. Therefore, they have agreed on hiring a consultancy agency to make a feasible but efficient budget for the bank for the coming year.

The firm has suggested using the last 5 years figures in order to understand the following year's performances. They have also suggested regression analysis which is a very powerful technique of statistics. They have investigated the results of the last five years in detail and they have decided to use income statements of the last five years (Table 5) to forecast the next three years' figures.

They have used MS excel to forecast the new year's figures with a very simple way.

Step 1: Input Data to Excel.
Step 2: Select Data (Figure 8).
Step 3: Move the Mouse to the bottom-right most (Column F, Row 12) expand it to the three left columns (Figure 9).

The forecasted values are listed under the years 2013, 2014 and 2015. If we want to see the equations we can use the following technique.

Table 5. Tarabia bank income statements

	2008	2009	2010	2011	2012
Interest Revenue	2,785,584	2,987,461	2,813,874	3,535,559	4,806,433
Interest Expenses	1,528,419	1,123,190	1,025,457	1,655,215	2,336,515
Net Interest Gain (rev.-exp.)	1,257,165	1,864,271	1,788,417	1,880,344	2,469,918
Net Commission Gain	228,958	291,561	313,912	42,522	482,226
Other Revenue	83,056	243,917	255,736	782,780	228,799
Operation Profit	1,569,179	2,399,749	2,358,065	2,705,646	3,180,943
Provisions	36,253	691,863	506,431	452,552	727,519
Other Expenses	1,139,274	930,391	1,072,156	2,161,405	149,7825
Earning before Tax	393,652	777,495	779,478	91,689	955,599
Tax	-51,189	-17,271	-163,187	-199,534	-235,918
Net Profit	342,463	604,785	616,291	1,060,809	719,681

Figure 8. Excel calculations-select data

	A	B	C	D	E	F	G	H	I
1		2008	2009	2010	2011	2012	2013	2014	2015
2	I. Interest Revenue	2,785,584	2,987,461	2,813,874	3,535,559	4,806,433	4,762,721	5,221,701	5,680,680
3	II. Interest Expenses	1,528,419	1,123,190	1,025,457	1,655,215	2,336,515	2,178,224	2,393,046	2,607,868
4	III. Net Interest Gain (I - II)	1,257,165	1,864,271	1,788,417	1,880,344	2,469,918	2,584,497	2,828,655	3,072,813
5	IV. Net Commission Gain	228,958	291,561	313,912	42,522	482,226	349,085	374,835	400,584
6	V. Other Revenue	83,056	243,917	255,736	782,780	228,799	567,962	650,997	734,032
7	VI. Operation Profit	1,569,179	2,399,749	2,358,065	2,705,646	3,180,943	3,501,544	3,854,486	4,207,429
8	VII. Provisions	36,253	691,863	506,431	452,552	727,519	825,890	940,212	1,054,534
9	VIII. Other Expenses	1,139,274	930,391	1,072,156	2,161,405	1,497,825	1,944,645	2,139,457	2,334,268
10	IX. Earning Before Tax	393,652	777,495	779,478	91,689	955,599	731,009	774,818	818,627
11	X. Tax	-51,189	-17,271	-163,187	-199,534	-235,918	-298,936	-354,108	-409,280
12	XI. Net Profit	342,463	604,785	616,291	1,060,809	719,681	1,031,944	1,152,990	1,274,036

Step 1: Draw the charts of each item. To do that, go to insert menu, select line and select 2-D line (Figure 10).

Step 2: The drawn figure is in Figure 11. Right Click on each line, select Add Trendline. Afterwards, click on "Linear," "Display equation on Chart" and "Display R-squared Value on Chart."(Figure 12-13)

R^2which is an indicator of the accuracy of the model calculated through the regression analysis has a value range of 0 to 1. As the R^2 value increases the accuracy of the model increases. This means that the regression models for the first three items are more accurate than the last two items. This means that the bank will achieve a net profit amount of 1,031,944, 1,152,990 and 1,274,036 in the coming three years.

CONCLUSION

Here in this study we have tried to show the modern risk management techniques which have been used by the banks so far in order to make more accurate estimations for the consequences of the banking

Figure 9. Excel calculations–expand data

	A	B	C	D	E	F	G	H	I
1		2008	2009	2010	2011	2012	2013	2014	2015
2	I. Interest Revenue	2,785,584	2,987,461	2,813,874	3,535,559	4,806,433	4,762,721		
3	II. Interest Expenses	1,528,419	1,123,190	1,025,457	1,655,215	2,336,515	2,178,224		
4	III. Net Interest Gain (I - II)	1,257,165	1,864,271	1,788,417	1,880,344	2,469,918	2,584,497		
5	IV. Net Commission Gain	228,958	291,561	313,912	42,522	482,226	349,085		
6	V. Other Revenue	83,056	243,917	255,736	782,780	228,799	567,962		
7	VI. Operation Profit	1,569,179	2,399,749	2,358,065	2,705,646	3,180,943	3,501,544		
8	VII. Provisions	36,253	691,863	506,431	452,552	727,519	825,890		
9	VIII. Other Expenses	1,139,274	930,391	1,072,156	2,161,405	1,497,825	1,944,645		
10	IX. Earning Before Tax	393,652	777,495	779,478	91,689	955,599	731,009		
11	X. Tax	-51,189	-17,271	-163,187	-199,534	-235,918	-298,936		
12	XI. Net Profit	342,463	604,785	616,291	1,060,809	719,681	1,031,944		

	A	B	C	D	E	F	G	H	I
1		2008	2009	2010	2011	2012	2013	2014	2015
2	I. Interest Revenue	2,785,584	2,987,461	2,813,874	3,535,559	4,806,433	4,762,721	5,221,701	
3	II. Interest Expenses	1,528,419	1,123,190	1,025,457	1,655,215	2,336,515	2,178,224	2,393,046	
4	III. Net Interest Gain (I - II)	1,257,165	1,864,271	1,788,417	1,880,344	2,469,918	2,584,497	2,828,655	
5	IV. Net Commission Gain	228,958	291,561	313,912	42,522	482,226	349,085	374,835	
6	V. Other Revenue	83,056	243,917	255,736	782,780	228,799	567,962	650,997	
7	VI. Operation Profit	1,569,179	2,399,749	2,358,065	2,705,646	3,180,943	3,501,544	3,854,486	
8	VII. Provisions	36,253	691,863	506,431	452,552	727,519	825,890	940,212	
9	VIII. Other Expenses	1,139,274	930,391	1,072,156	2,161,405	1,497,825	1,944,645	2,139,457	
10	IX. Earning Before Tax	393,652	777,495	779,478	91,689	955,599	731,009	774,818	
11	X. Tax	-51,189	-17,271	-163,187	-199,534	-235,918	-298,936	-354,108	
12	XI. Net Profit	342,463	604,785	616,291	1,060,809	719,681	1,031,944	1,152,990	

	A	B	C	D	E	F	G	H	I
1		2008	2009	2010	2011	2012	2013	2014	2015
2	I. Interest Revenue	2,785,584	2,987,461	2,813,874	3,535,559	4,806,433	4,762,721	5,221,701	5,680,680
3	II. Interest Expenses	1,528,419	1,123,190	1,025,457	1,655,215	2,336,515	2,178,224	2,393,046	2,607,868
4	III. Net Interest Gain (I - II)	1,257,165	1,864,271	1,788,417	1,880,344	2,469,918	2,584,497	2,828,655	3,072,813
5	IV. Net Commission Gain	228,958	291,561	313,912	42,522	482,226	349,085	374,835	400,584
6	V. Other Revenue	83,056	243,917	255,736	782,780	228,799	567,962	650,997	734,032
7	VI. Operation Profit	1,569,179	2,399,749	2,358,065	2,705,646	3,180,943	3,501,544	3,854,486	4,207,429
8	VII. Provisions	36,253	691,863	506,431	452,552	727,519	825,890	940,212	1,054,534
9	VIII. Other Expenses	1,139,274	930,391	1,072,156	2,161,405	1,497,825	1,944,645	2,139,457	2,334,268
10	IX. Earning Before Tax	393,652	777,495	779,478	91,689	955,599	731,009	774,818	818,627
11	X. Tax	-51,189	-17,271	-163,187	-199,534	-235,918	-298,936	-354,108	-409,280
12	XI. Net Profit	342,463	604,785	616,291	1,060,809	719,681	1,031,944	1,152,990	1,274,036

transactions. Before doing that, we have defined what risk and risk management are. As we have shown in the beginning of the chapter the risk was defined as the possibility of something bad happening or to do something although there is a chance of a bad result. Moreover, the risk management was defined as the process of protecting one's person or organization from potential asset or income loss.

Afterwards, we have shown the types of risks which have been gathered under both systematic and unsystematic risks. As it was explained throughout the chapter, the systematic risks were defined as the uncontrollable risks which are originated from the market conditions. However, there are other risks called unsystematic risks which are mainly originated from the operations of the company itself. All of these risks have been explained briefly throughout the chapter.

Figure 10. Excel calculations–draw line

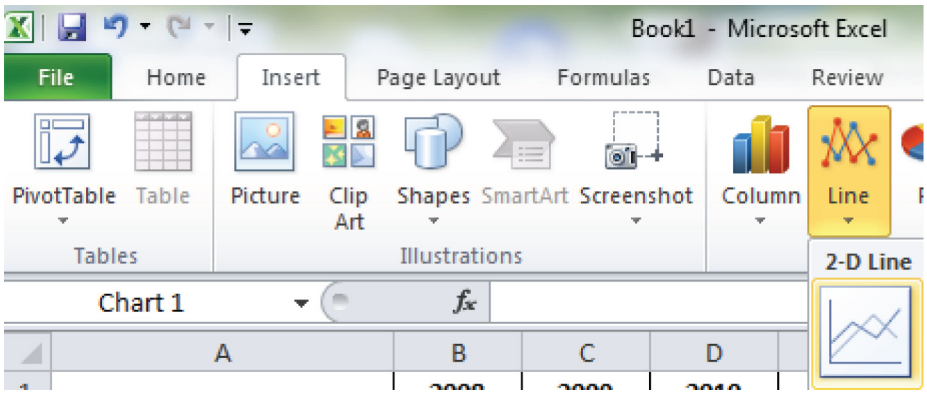
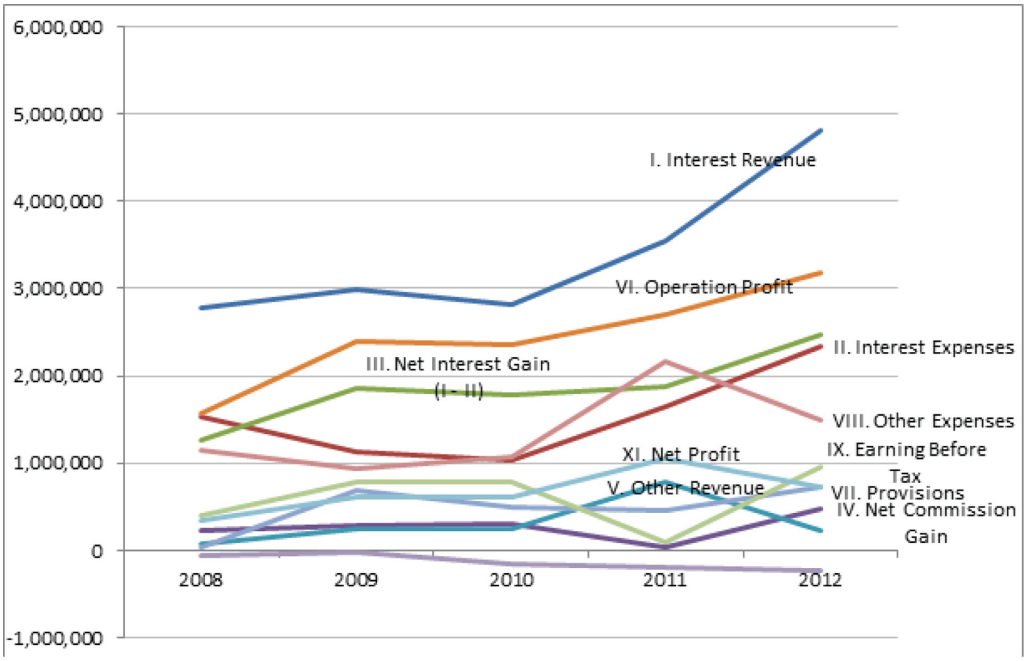


Figure 11. Tarabia Bank income statement items



After defining risk, risk management and types of risks, we have introduced contemporary risk management techniques. As we know that there are many other techniques other than these two techniques, we have restricted our study with only operations research and statistics. Moreover we know that both operations research and statistics cover a wide scope of business decisions thus what we have expressed here in this study is only a sample when we compare it the whole concept of these two techniques.

As it was mentioned in the study with the literature review and the examples, both operations research and statistics have been getting more importance in the modern financial applications. Since banks are one of the most important actors in the financial system both techniques have been started to be used by these institutions in order to mitigate and manage risk.

Figure 12. Excel calculations–add trendline

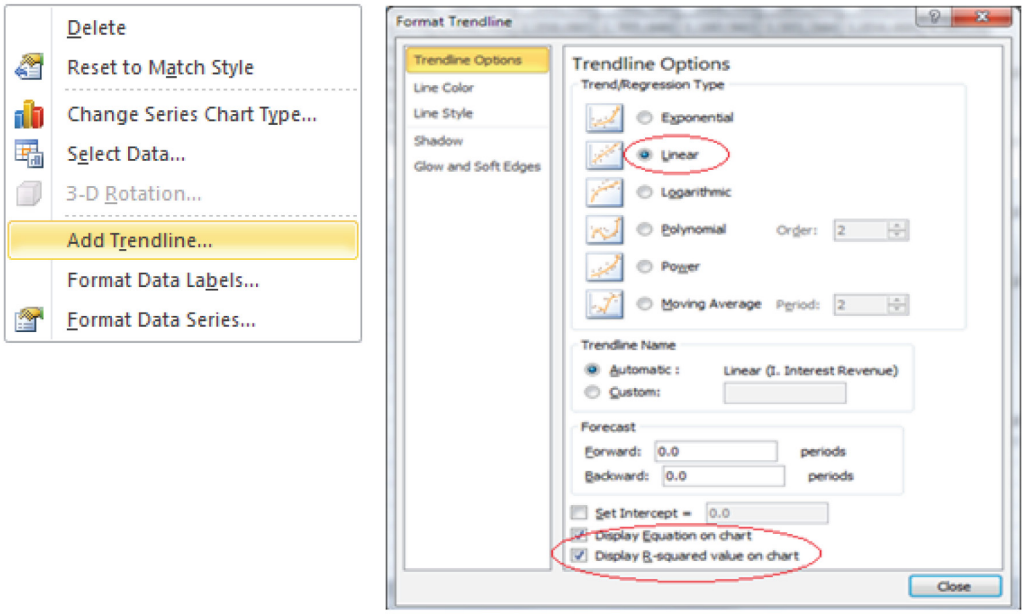
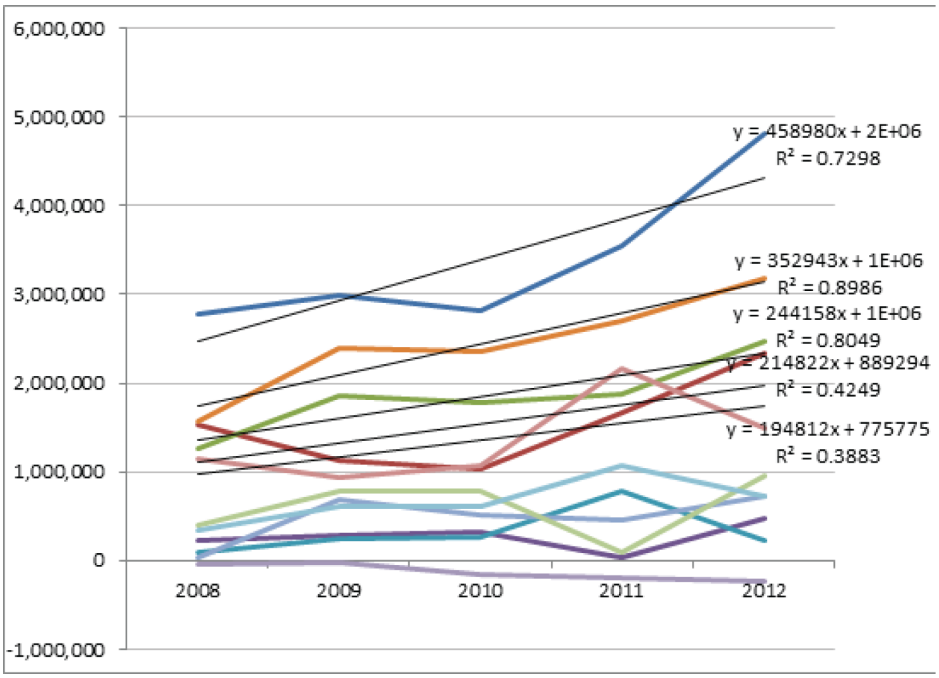


Figure 13. Tarabia Bank income statement regression models



As these are emerging subjects, there would be many researches to be conducted upon these two techniques. The banks would be more interested in more sophisticated aspects of both operations research and statistics. We have started to see many applications regarding statistics. The Basel Accords and all principles adopted with several amendments by Basel Banking Committee have shown that statistics have started to be used in managing different types of risks which have direct influence on the banking risks. As statistics have been used in all empirical analysis which has been done upon different aspects of sciences, the researchers are very close to these applications. However, since there are many techniques in statistics there is a very long way to go to calculate and estimate the risks more accurately in the future. Furthermore, there would be many other different statistical and operational research based analysis to be developed and the banking sector would make of these techniques more clearly in the future.

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KEY TERMS AND DEFINITIONS

Industry Risk: The chance that a set of factors particular to an industry group drags down the industry's overall performance. For example a tax increase in the automobile industry may adversely affect the profits of the automobile producers due to the sharp decline in the sales volume.

Management Risk: The risks associated with ineffective, destructive or underperforming management, which hurts shareholders and the company or fund being managed.

Systematic Risk: The uncontrollable risk which is originated from the market conditions. This risk can be named as market risk and it has an effect on all investments in that market. This risk is an externally driven risk which cannot be mitigated through diversification.

Unsystematic Risk: The risk of the investment itself. This is driven by internal factors and can be mitigated through diversification.

ENDNOTES

1. NPV is the difference between the present values of all future cash flows and the initial investment cost. A positive NPV shows that the project is feasible. The more the NPV the more economical the Project.
2. 2 year interest factor of 10% which is used to convert USD 1 future cash flow to two years before. It is $1/(1+0.1)^2$
3. 1 year interest factor of 10% which is used to convert USD 1 future cash flow to one year before. It is $1/(1+0.1)^1$

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Chapter 49
Managing Customer Knowledge in Service Economy:
Proposing a Conceptual Model of CKM for Services

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ABSTRACT

In the age of service and knowledge economy, firms have realized that obtaining, managing, and sharing customer knowledge can be a valuable resource to have advantages over their competitors. However, the review of the literature of Customer Knowledge Management (CKM) area suggests that firms often fail in applying the true notion of CKM, thinking it only as a new technological innovation related to IT. Moreover, the terms Knowledge Management (KM), Customer Relationship Management (CRM), and Customer Knowledge Management (CKM) are not well differentiated in the extant academic literature. This chapter aims to present a conceptual differentiation between these terms by analyzing and comparing the various components of KM, CRM, and CKM. The effort has been made in the chapter to map CKM practices in the Indian service market by presenting case studies of two Indian commercial banks. The authors also made an attempt to propose a conceptual framework of CKM, which can be applied in service firms to successfully implement CKM practices in their organizations.

1. INTRODUCTION

In the increasingly competitive economy, providing superior value to customers has become a hallmark of businesses all over. However, this task of providing superior value is not easy anymore as customers have become more informed and aware of the product and services at their disposal. To compete effectively in today's marketplace, organizations must seek innovative methods of doing

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business and quickly react to customer demand. Marketplace has become more competitive, complex and intense with the increase in globalization and opening of economy.

Successful organizations world over are relying heavily on knowledge as a critical driver of business success and possibly an essential asset of business survival in the age of globalization (Davenport & Prusak, 2000). Amongst the various emerging trends in businesses, managing customer knowledge for establishment of long term rewarding relationship with the customers is catching up thick and fast (Zhang, 2001). Companies have identified that customer knowledge is important for all businesses and it is at the origin of most improvements in customer value.

Companies know that relationships with the customers can be highly rewarding in case they are managed effectively and knowledge flow seamlessly between the customers and the organization. This will lead to co-creation of services maintaining a win-win situation for both the parties. To leverage on this resource i.e. knowledge from the customers, companies have started taking a leap forward from the normal path of customer relationship management by integrating customer relationship management and knowledge management. Resultant of this integration and organizational approach of co-creation of values is Customer Knowledge Management (CKM). CKM can be generally considered as the process of capturing, sharing, transferring and applying the data, information and knowledge related with customers for the benefit of organization as well as the customers.

Despite the growing awareness and interest in CKM, firms are grappling up with the issue of getting the things right and getting the desired outcome. The frameworks present in the literature do not sufficiently guide the organizational leaders and managers to collaborate with the customers in a manner to bring the desired value. Specifically, this research is an attempt to propose a comprehensive model to guide the managers on 'how' part of management of customer knowledge.

Describing further, the objectives of the research reported in this paper are (a) to define Customer Relationship Management (CRM), Knowledge Management (KM) and Customer Knowledge Management (CKM); (b) to bring out the difference between CRM, KM and CKM; and (c) to propose a conceptual model of customer knowledge management for services. The remainder of this paper is structured as follows. The next section presents the literature, definitions of the three key terms which form the genesis of this paper, CRM, KM and CRM are presented to develop an understanding among the readers. Section three elaborates the key differences in each of the three against the key differentiating factors such as vision, objectives, outcomes, etc. A conceptual framework is proposed in section four. Section five discusses two Indian case studies from service industry using customer knowledge management efficiently and effectively to gain competitive advantage. Following that, discussions and managerial implications are presented in section six.

2. DEFINITIONS: CUSTOMER RELATIONSHIP MANAGEMENT, KNOWLEDGE MANAGEMENT, CUSTOMER KNOWLEDGE MANAGEMENT

It is imperative that, prior to discussing the detailed model and dwelling into the role of customer knowledge management in services, the definitions of each of the concepts like customer relationship management, knowledge management and customer knowledge management is discussed in detail. This discussion will lead to a common understanding of each of these definitions and a summary of definitions from the literature will form basis of the proposed model.

2.1 Customer Relationship Management

Extant literature has proposed a number of definitions of customer relationship management over past two decades. Customer relationship management has garnered the interest of both academic and practitioner community with the emergence of thought that customers are the key drivers of business growth and gaining economic edge. Several of the these definitions as we observe from the literature define CRM from a technology point of few while authors like Payne and Frow (2005) have pointed out that CRM should be positioned in the broad strategic context. According to them a strategic and holistic approach to CRM should emphasize upon the selective management of customer relationship to create value for stakeholders (Payne and Frow, 2005). The above view is also present in the writings of other authors like Glazer (1997) and Swift (2001), where they argue that customer relationships should be managed selectively and strategically to bring rewards to the stakeholders.

The most comprehensive and widely accepted definition of customer relationship management is the one proposed by Payne and Frow (2005, p. 168); they define customer relationship management as

[…] a strategic approach that is concerned with creating improved shareholder value through the development of appropriate relationships with key customers and customer segments. CRM unites the potential of relationship marketing strategies and IT to create profitable, long-term relationships with customers and other key stakeholders.

CRM provides enhanced opportunities to use data and information to both understand customers and co create value with them. This requires a cross-functional integration of processes, people, operations, and marketing capabilities that is enabled through information, technology, and application. (p.168)

Authors like Payne and Frow (2005) and Parvatiyar and Sheth (2001) argue that CRM focuses on establishing, maintaining, and enhancing long-term relationships with attractive customers. Parvatiyar and Sheth (2001) also proposed that CRM is

[…]a comprehensive strategy and process of acquiring, retaining and partnering with selective customers to create superior value for the company and the customer. (p. 5)

Morgan et al. (2009) summarized that role of CRM is to

[…] identify attractive customers and prospects, initiate and maintain relationships with attractive customers, and leverage these relationships into customer level profits.

In consistent with broader marketing and strategic frameworks we define customer relationship management as a strategically motivated objective of a business to develop long term sustainable relationships with the customers which can bring rewards to the firm in the form of increased reputation, increased profit share and providing win-win situation for all the stakeholders.

2.2 Knowledge Management

Both, scholars and practitioners have realized that markets shift, technology proliferates, competitors multiply and products become obsolete overnight. This realization has brought the phenomenon of organizational knowledge management to the forefront of scholarly and practitioner attention. With this surge of interest in knowledge management lot of scholarly worked started appearing in academic journals. However, despite a huge volume of literature now available, there is no readily acceptable definition of knowledge management.

According to Jennex (2005), Knowledge management is

[…] the practice of selectively applying knowledge from previous experiences of decision making to current and future decision making activities with the express purpose of improving organization's effectiveness. (p. 7)

Definitions given by organizations are also suggestive of their efforts of management of knowledge. IBM and Lotus define knowledge management as

[…] a discipline that systematically leverages content and expertise to provide innovation, responsiveness, competency, and efficiency. (Pohs et al., 2001)

Literature is replete with the definitions of KM, but if analyzed systematically these can lead to one common understanding. KM can be understood as a deliberate and systematic effort of an organization to enable effective planning, improved innovation, better decision making, improved problem solving and subsequently increasing organizational performance through identification, selection, capture, storage, dissemination and application of knowledge.

2.3 Customer Knowledge Management

In an age of stiff competition, there is little reason to doubt that customer knowledge is an important asset for all businesses (Rowley, 2002). Customer knowledge management (CKM) refers to the management of organizational knowledge on the customer side. To attain the objective of long term relationship of CRM companies need to capture the customer-related knowledge. Garcia-Murillo and Annabi (2002) advocated the need of knowledge management as the regular practices in CRM and marketing fail to acquire, transfer, and utilize customer knowledge.

Gebert et al. (2003), in their work, suggested that knowledge flows in customer relation management processes can be classified into three categories. These can be understood as three CKM strategies: management of knowledge for customers, management of knowledge from customers, management of knowledge about customers. Management of knowledge for customers refers to the strategies in which flow of knowledge from organization to customers is managed. Horovitz (2000) contends that continuous flow of knowledge from organization is required to help customers in making an informed buying decision. This will also lead to support in the usage of product or service. Management of knowledge from customers essentially refers to the strategies which help in the flow of knowledge from customers to the organization. This includes feedback and grievance reporting mechanism. Knowledge acquired from customers by means of this strategy is useful in enhancing the quality of services as well as in developing the new services (Garcia-Murillo & Annabi, 2002; Zanjani et al., 2008). Management of knowledge about customers refers to strategies that organizations use to manage knowledge about customers. This encompasses customers past transactions, buying preferences, future needs, change in buying behavior and ongoing trends (Gebert et al., 2003).

3. CRM, KM, AND CKM: IDENTIFYING DIFFERENCES

Before proceeding further there is a need to understand how CRM, KM and CKM are different from each other. Summarily, CKM is said to be an integrated approach evolving out of customer relationship management and knowledge management. Customer approach to knowledge management with a motivation to establish long term relationship for the creation of value for all the stakeholders can be understood as CKM.

Where Customer Relationship Management emerged as an amalgamation of relationship marketing and information technology approach

(Gebert et al., 2003) aimed at gaining the customer and establishing a long term relationship. Knowledge Management gained importance in the information age with the amalgamation of several disciplines (Pandey & Dutta, 2013) like philosophy, social science, management science, knowledge engineering, information systems, etc. (Kakabadse et al., 2003) to manage the knowledge within the employees, teams, company and group of company i.e. inter-firm management of knowledge. Customer knowledge management is an emergent theme in concurrent management literature evolving from the amalgamation of two practitioner disciplines of CRM and KM, this evolution is primarily focused on the management of customer experiences, creativity, satisfaction/dissatisfaction with products or services (Gibbert et al., 2002). Differences on these are marked clearly in Table 1.

4. IMPORTANCE OF CUSTOMER KNOWLEDGE IN BANKING SERVICES: CASE STUDIES OF

In this section we present case studies of two large commercial banks in India, one public sector and the other being a private sector bank. Private bank discussed in the case implemented Knowledge Management systems and practices at first and

Table 1. Differences between CRM, KM and CKM

Differentiating Factor	CRM	KM	CKM
Vision	To develop a long lasting relationship with the customers	To develop a culture of sharing, unlocking the knowledge present with the employees about processes, practices, customers, best practices, etc.	Co-creating value in tandem with the customers. Direct engagement of customers
Objective	Managing and nurturing customer base for the company	Managing knowledge of know-how, know-why and know-what essentially present within the organization for achieving competitive advantage	Collaborating with customer for greater value creation. Knowledge for customers, from customers and about customers come to forefront
Consequences	Customer retention	Cost saving in reinventing the things, build up to innovative products and services	Customer value addition to the company.
Information	Data – about customers, minimalistic value attached	Know how of processes and practices mostly on employee side	Customer experiences
Role of customers	Moderate or captive, mostly tied to product or service by loyalty schemes.	Very low or passive	High and active engagement. Partner in value creation
Role of Employees	Little, if it involves work like providing an information in catalogue or brochure upon request from the customer	Low, if the focus is on creation of knowledge within which is mostly the case.	High, active engagement with the customers in gathering knowledge through repeated and multiple conversations with the customers.
Role of Organization	Thrust on building long term relationship with the customers	Focus on encouraging and building a culture of knowledge sharing among the employees. Incentivizing sharing and learning outcomes	Encouraging customers to become partners in the creation of value for themselves and also the organization.

then slowly evolved with the integrated practices of Customer Knowledge Management. Public sector bank recently implemented the integrated KM system which is capable of addressing all the issues relating to the management of customer knowledge.

Case 1: ICICI Bank

ICICI is a large Indian multinational bank headquartered in Mumbai. It is the second largest bank in India by assets and third largest by market capitalization. Knowledge Management initiative in the bank started back in the year 2000 when the size of the bank and the customer base were small. With the growth that the bank was pegged to it was necessary to have a KM strategy in place to maintain the knowledge base. ICICI's KM intranet portal – WiseGuy came as an answer to be a one stop place to capture, disseminate, discuss and amalgamate all knowledge within the organization and best practices from outside. In order to maintain long lasting customer relationship, the bank started installing customer knowledge databases with the help of knowledge management initiatives.

With the increased importance of managing customer knowledge, top management inducted several other features. There is a daily update feature on the portal which is known as Daily Dose consisting headlines, market happenings and customer appreciation. Query board which is a central, interactive repository of frequently asked questions features customer credit queries, customer requirement queries. The interactive feature has made the communication a two way process. Customer service team and staff which are directly responsible for handling the customers can share almost everything related to customer complaints, service quality issues, and customer satisfaction terms. Customer satisfaction benchmarks and those achieving it are also a regular feature on the intranet.

Case 2: Union Bank of India (UBI)

Union Bank of India is one of the largest public sector banks in India. UBI started catching up with the current competition in the banking industry slowly with the repositioning exercise in the year 2008. Engagement with the young customers was not an easy exercise for the bank. It started with a huge marketing campaign to revive its identity as a trusted banker, maintaining its equity with the existing customers and gaining new customers.

The idea of having a KM solution to grab service preferences of customers as a form of customer knowledge came late to the UBI. Having implemented a comprehensive KM solution earlier this year (2013) in April, UBI has taken baby steps to develop a fully grown customer knowledge management processes and practices. The current system developed by Infosys Technologies as implementation partners allows the bank to effectively handle customer query and provide solutions as required. WebSphere Portal which is company intranet is now allowing the bank to handle more customer query more efficiently. More knowledge is made available for the customers about the services; more knowledge from the customers is being received about the customer satisfaction level, issues in using services, etc. This portal is also helping the bank in managing knowledge about customers by updating the choice of services made in the past, likelihood of usage of services in future and also preferences.

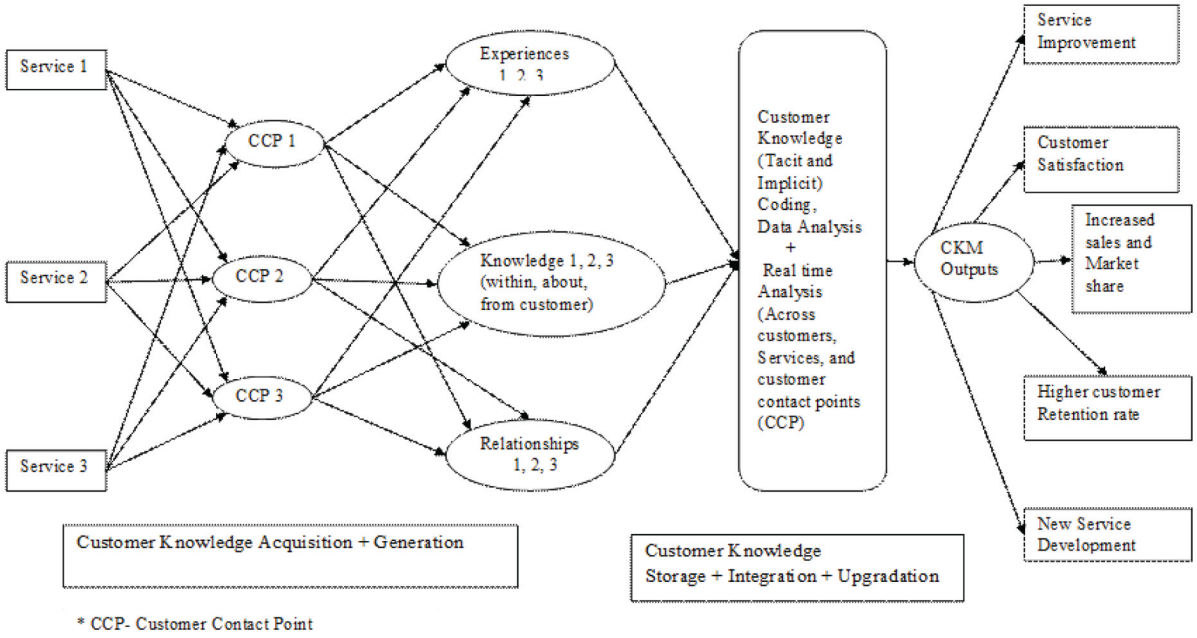
The cases presented above are from one industry but at a different maturity level. At one hand there is a private sector bank which has a decade old system in place to manage knowledge present inside and outside the bank. On the other there is a public sector bank which recently underwent a rebranding exercise and started taking cognition of factors like attracting and building long term relationships with the ever demanding young customers. The point that needs to be understood here is that the management of knowledge, especially

from the customers is not an easy task. Establishing and maintaining a long term and rewarding relationship is a major challenge. Involving customers in co-creation of value should be dealt with high level of carefulness.

5. CONCEPTUAL MODEL OF CUSTOMER KNOWLEDGE MANAGEMENT

In light of the above two cases from Indian banking sector it can be said that the level of CKM maturity has not been attained which can said to be holistic. The processes are in nascent phase and need to be worked upon from the existing ones to achieve long term benefits. From the sections above, it is also clear that customer knowledge management is concerned with the acquisition, developing, sharing and maintaining of customer knowledge in order to maximize customer value. Whereas, customer knowledge can be referred as the experience, value (social, economical, and rational), situational information and relationships which are needed, produced or possessed to enhance the value perception of the customers with respect to service provider firms (Hualin & Zhongdong, 2010). Customer knowledge may also be seen as knowledge about customers whether it may be potential customers, customer segments or individual customers; and knowledge possessed by customers. It is different from customer data and customer information in a sense that it can be either explicit and structured or tacit in mind of employees and customers (Sedighi et al., 2007). However, effective utilization of all customer data, information is very much essential to gain the key insights about need, want and preference about customers and hence customer knowledge. Therefore in this section, we have proposed a conceptual model (see Figure 1) to understand the various processes or stages of customer knowledge management. The stages are discussed in the following subsections.

Figure 1. Conceptual model for customer knowledge management



5.1. Customer Knowledge Acquisition

This is the first stage of CKM process: acquiring the customer knowledge. A customer may purchase a service from different contact points (for example, in the model it is CCP-1, CCP-2, and CCP-3) of a firm. Also he or she uses these contacts points for different services (in the model it is 1, 2, and 3).Therefore, when the customer and the service personnel at these contact points come together, they both bring their knowledge and experiences to the interaction. In some cases customers exactly know what they want from the service provider. However, there are cases when the service personnel have to provoke the customer to assess the actual needs of the customer.

In the context of customer knowledge management, the role of the service personnel changes considerably and, instead of just providing basic information about the enquiry or availability of a service, they have to listen the customers' need and interact with them to know more about their service choices and preferences with caring attitude (Garcia-Murillo & Annabi, 2002). Thus at each customer contact point, service personnel can gather knowledge from the customer about: service preferences and requirements; service attributes that appeal to the customer; and trends of service offerings of that particular service industry. The service firm must acquire the knowledge across customer contact points or channels, across service types and across customers.

5.2. Customer Knowledge Generation

Apart from acquiring customer knowledge, service firms must also try for customer knowledge generation. It can be done through primary as well as secondary data sources. Firms launch various awareness programs to make the customer familiar with the service offerings. While doing these activities, CKM requires getting the knowledge about choices and preferences of the customers for existing and proposed new service offering by own firm as well as service offerings by the competitors (Romano Jr. & Fjermestad, 2003). Offline as well as online surveys are also done to get insights of existing customers of the firm. Text mining techniques also play an important role in customer knowledge creation through social media. In the era of Internet, firms garner great amount of information and knowledge about customers through blogs, tweets, and Facebook updates.

5.3. Customer Knowledge Storage and Integration

At this stage of CKM, firms store the customer knowledge gained from various sources and prepare vast databases of customer preferences, needs, wants, frequency of purchasing the service, switches of service users, competitor service offerings etc. on regional as well as national level. These databases are stored for the further analysis to achieve higher level of understanding about the customers. Data mining techniques are used to extract or detect the knowledge of hidden customer characteristics and behaviors from these large databases (Ngai, Xiu, & Chau, 2009). In data mining, a model is developed from the data (Carrier & Povel, 2003). During data mining the types of data modeling frequently used are association; classification; clustering; forecasting; regression; sequence discovery; and visualization (Carrier & Povel, 2003; Turban et al., 2007). The firm should choose data mining techniques based upon the data characteristics and business requirement.

Association model establishes relationships among items existing together in a given record (Ahmad, 2004). The examples of this type of data modeling are market based analysis and cross selling programs (Nagai et al., 2009). Classification model is used to predict future customer behavior

by classifying the data into various classes based on certain criteria (Chen, Hsu, & Chou, 2003). The tools used in this data model may be decision trees and neural network analysis (Nagai et al., 2009). In clustering, homogeneous groups are formed from a heterogeneous population. A similarity of characteristics within the group and differences in the characteristics across the groups can be observed. Discriminant analysis and K-mean clustering are used in this type of modeling for customer segmentation. In forecasting, future value is estimated based on current records. Survival analysis is an example of this type of data modeling. Regression analysis is used for the modeling of causal relationships and testing the hypotheses regarding business models. Linear, logistic, probit, and LPM models are the some examples of regression analysis. Sequence discovery is nothing but a kind of trend analysis of a variable over time (Mitra, Pal, & Mitra, 2002). The tools used in it are plotting, graphical representation and set theory. Visualization technique is used to view the complex pattern of the data (Shaw et al., 2001). 3D graphs are an example of this type of data modeling. By these techniques firms successfully integrates the data from all the data bases and customer knowledge is stored for the further use.

5.4. Customer Knowledge Upgradation

In upgradation stage new knowledge from data analysis and other sources are updated in customer databases. These updates are conveyed to all the service centers and customer contact points for further verification. If these do not hold true in majority of the cases, these are resent to knowledge storage centers to check the abnormality of the data and used for niche services after confirmation of finding no abnormality. There are installed numbers of check points to analyze the authenticity of a data set.

5.5. CKM Outcomes

After all the process of customer knowledge management is done, a firm is in a position to successfully predict the behaviors and characteristics of service customer. Accordingly it can match and even take completive advantages over its rivals by adding new features or attributes to its service offerings that compel customers the most. Customer knowledge management helps in maintaining long lasting relationship with the customer by knowing his or her preferences better than the competitors. Thus the customer retention rates of the firm become high and the firm can now focus on acquiring new customer bases which in turn increase the market share of the firm. CKM also helps for the development of new service types which a firm lacks and for which there is a high demand in the market. Therefore, CKM helps the firm in service improvement, customer satisfaction, developing new service offerings and increasing customer retention rate and market share.

6. DISCUSSIONS AND MANAGERIAL IMPLICATIONS

Management of knowledge has become one of the most important issues for organizations to gain competitive advantage. The unprecedented change in the sophistication level of customer demand and ever changing preferences has led to a paradigm change in CRM and KM towards a dynamic customer centric approach leading to the evolution of CKM.

In practice, the management of knowledge is a huge managerial challenge. As pointed out by Davenport and Klahr (1998), customer knowledge is one of the most complex types of knowledge because it is taken from various sources, it has a contextual meaning, it is dynamic, and changes rapidly. Identifying this level of complexity associ-

ated with management of customer knowledge, this paper made an attempt to synthesize the literature on three parallel strands i.e. customer relationship management, knowledge management and customer knowledge management and distinguished the three based on some key differentiators. This research also made an attempt to propose a conceptual model of CKM for a better management of customer knowledge.

The proposed CKM model specifies the need of a cohesive process approach where customer knowledge can be acquired, stored, integrated and upgraded in a two way manner with participation from the company's employees and the customers. This kind of cohesion will lead to improved service quality, satisfaction level, retention rate and also bring in innovative services. This model demands for an increased coordination among the service personnel, because in the complex Web of managing knowledge the knowledge may already exist with another service personal and reinventing the wheel in such case will lead to reduced efficiency. Top management must understand that they need to champion the cause by providing support to the service personnel as well as those overseeing the operations of customer knowledge management. Effective reward and recognition policies should be devised to encourage the employees to co-create value in association with the customers. Finally, it should also be understood that the returns will be long term and provide competitive edge to the firm and hence sustained efforts are a precondition to achieve success with the CKM efforts.

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KEY TERMS AND DEFINITIONS

Customer Knowledge: Understanding your customers, their needs, wants, and aims. It is essential if a business is to align its processes, products, and services to build real customer relationships. It includes intimate and tacit knowledge such as that of key account managers, and distant or analytic knowledge including database information about sales, web-behaviour, or other analytical pieces of data.

Customer Knowledge Management: A strategic initiative employed by companies to acquire intelligence from their customers as it relates to their organization. Companies using CKM will effect organizational and behavioral changes based on knowledge obtained from their customers.

Knowledge Management (KM): The process of capturing, developing, sharing, and effectively using organisational knowledge. It refers to a multi-disciplined approach to achieving organisational objectives by making the best use of knowledge.

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Chapter 50
Impact Evaluation of Customer Knowledge Process on Customer Knowledge Expansion: An Empirical Study in Jordanian Banking Sector

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ABSTRACT

The article aim is to investigate how Customer Knowledge Processes used in practice by Jordanian banks to achieve customer knowledge expansion. The empirical study is based on a sample of the data collected from 165 respondents, drawn randomly from six banks. The results show that the seven selected factors (Customer Knowledge Codification, Customer Knowledge Representation, Customer Knowledge Sharing, Customer Knowledge Application, Design of Customer Knowledge, Execution of Knowledge from Customer, and Verify of Knowledge from Customer) have a significant impact on Customer Knowledge Expansion. The findings did reveal the potential relationship between the customer knowledge processes and customer knowledge expansion. It also provides advice for the Information Technology (IT) Industry as to how an analytical knowledge process from customers should be taken into account in developing countries to attain proper customer knowledge expansion because of cultural, social and educational disparities.

1. INTRODUCTION

In order to have a new knowledge economy and business, organizations are now facing major challenges due to external pressures as well as the nature of the workplace. This gives rises to the necessity of improvement of a strategic, comprehensive, holistic and adoption Knowledge Management (KM) to enhance the process and get competitive advantage.

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The globalization introduces many challenges, to meet these challenges, companies may require being innovative by introducing new ideas. Obviously, this trend is magnified by the rapid development of Customer Relationship Management (CRM) systems and the adoption of the customer-centric orientation (Stefanou et al., 2003).

They are concerned with the expansion of customers; Based on that Knowledge has become strategic resource of organization and the basis of competitive advantage. In addition, it has been recognized as an important asset for sustaining a competitive advantage (Papoutsakis & Vallès, 2006).

Customer expansion plays the role of expanding the organizations customer base through word of mouth marketing and active interactions with the company (Park & Kim, 2003). As well, Bibiano and Pastor (2006) describe the Evolution phase refer to the integration of more capabilities into the CRM system.

Undoubtedly, Customer Knowledge Management (CKM) creates new knowledge sharing platforms and processes between companies and their customers. It is a continuous strategic process by which companies enable their customers to move from passive information sources and recipients of products and services to empowered knowledge partners (Gibbert et al., 2002). Through, review and study of selected fundamentals related literature, that focuses on developed countries and accordingly based on cultural, educational, technological, social and economical factors applicable to advanced Western societies rather than developing countries.

Our study is therefore special, because it addresses one of the important issues in Middle Eastern area because the adoption and use of IT is new for most businesses (Nehari Talet et al., 2010). We strongly consider that our study will assist and provide guidance for the IT Industry, and researchers as to how a logical knowledge process from customers should be kept in mind in developing countries to help in order to attain customer knowledge expansion.

This paper is organized as follows. In the next section, we review relevant literature; section three proposes the research model and hypotheses, section four is about the research methodology in which we discuss the design of the questionnaire, sample, data collection, hypotheses analysis and results. The last piece of this paper is our conclusion.

2. LITERATURE REVIEW

2.1. Concept of Customer Knowledge

Study of the KM process is important for the organization to validate the objective. Therefore, CRM process can be considered as knowledge oriented process with the characteristics of knowledge intensity and process complexity (Lin et al., 2006). For a deeper understanding of the KM processes, an attempt to express the hidden meaning of data, information and knowledge is necessary. Data mean a set of discrete and objective facts concerning events. Therefore, they can be construed as a structured record of transactions within an organization. Information is data with attributes of relevance and purpose, usually having the format of a document or visual and/or audible message. Knowledge is linked to the capacity for action. It is intuitive, therefore hard to define. It is linked to the users' values and experience, being strongly connected to model recognition, analogies and implicit rules (Joia, 2000).

Customer knowledge managers seek opportunities for connecting with their customers as equal co-creators of organizational value. This is also in stark contrast to the desire to maintain and care for an existing customer base (Gibbert et al., 2002). The literature shows that managers concentrate on how to produce expansion for the company through attain new customers and through engaging in an active and value-creating dialogue with them, and

are much less concerned with customer expansion information. Furthermore, Gebert et al. (2002) maintains that CRM and KM have been gaining recently wide interest in business environment. It is an approach that is used to capture, create, and apply knowledge to make the CRM process successful (Alryalat et al., 2007).

2.2. Customer Knowledge Flows

To become more innovative, responsive to customers and adaptable to change, leading organizations are learning how to learn from high numbers of knowledgeable people. Today, Knowledge Flow continues to concentrate its efforts on innovations that are customer-focused, trustworthy, and dynamic and intelligent. When customers, suppliers and staff willingly share expertise and experiences with one another, customers are loyal, everyone wins and business advantage is undeniable. Technology and humans must interact in effective CRM processes that bring the latest knowledge from all stakeholders to the management of customer relationships. However, experience has also shown that CRM is more than a technology issue. It is not just about software for organizing customer data. It is about changing the processes, interactions and culture of all of the partners in order to satisfy the ever-changing needs of the customer relationship and to provide seamless service.

Salomann et al. (2005) distinguish between three kinds of knowledge flows that play a vital role in the interaction between an organization and its customers: Knowledge for, from and about customers. Knowledge for customers to support customers in their buying cycle, a continuous knowledge flow directed from the company to its customers. Knowledge from customers has to be incorporated by the company for product and service innovation, idea generation as well as for the continuous improvement of its products and services. Knowledge about customers is collected in CRM service and support processes and analyzed in CRM analysis processes.

2.3. The Task of Customer Knowledge Process in Achieving Customer Knowledge Expansion

The CRM research draw attention to the importance of KM, culture change to develop a customer-oriented organization, and technological readiness essentially CRM is about customer interaction and about learning about customers' needs and preferences in order to provide more suitable products and services to customers in the future. The importance of technology in enabling CRM is confirmed by the attempts at defining the concept. One view of CRM is the utilization of customer related information or knowledge to deliver relevant products or services to customers (Levine, 2000). Furthermore, Newell (2000) discusses a range of CRM case studies that used customer knowledge to deliver relevant products and services. CRM has been also defined as the alignment of business strategies and processes to create customer loyalty and ultimately corporate profitability enabled by technology (Rigby et al., 2002). In a similar vain, Ryals (2001) defines it as the lifetime management of customer relationships using IT.

Kumar and Ramani (2004) viewed CRM as the process of getting and maintaining an ongoing relationship with customers across multiple customer touch points through differential and tailored treatment of individual customers based on their likely responses to alternative marketing programs, such that the contribution of each customer to the overall profitability of the firm is maximized. Therefore, to realize CRM success, business and IT executives should implement CRM processes and technologies and foster employee behavior that supports coordinated and more effective customer expansion throughout all customer channels.

A high degree of CRM process implementation is characterized as where firms are able to adjust their customer interactions based on the life-cycle stages of their customers and their capacity to

influence or shape the stages (i.e., extending relationships, (Reinartz et al., 2004). E-CRM is defined as the application of CRM processes utilizing IT and relies on technology such as relational databases, data warehouses, data mining, computer telephony integration, the Internet, and multi-channel communication platforms in order to get closer to customers (Chen & Chen, 2004). Interestingly, the level of technological sophistication of CRM technology makes no contribution to economic performance and supports the view that CRM is more than just software (Reinartz et al., 2004). CRM can be conceptualized at three levels:

1. Company wide,
2. Functional, and
3. Customer facing (Buttle, 2004).

Bhaskar and Zhang (2005) confirm that the most significant changes in the practice of marketing during the last decade is the shift in emphasis from a transaction orientation customer interaction to the CRM, However, in large organizations, it is not very easy to collect and to transform the customer data necessary for creating systems to support it as the basis of the organizations wide customer relationship strategy, In terms of marketing strategies, CRM systems allow organizations to manage customer data, analyze customer relationships to keep existing customers and attract potential new customers. Therefore, the goal of every organization is to get new customers and keep customers involved in organization Also, retention existing Customer within the organization, and enhancing the relationship with customers to develop the expansion of customer relationship.

The enhancement of existing relationships is important to organizations, since attracting new customers is known to be more expensive. Therefore, as part of their CRM strategy, the need to understand and react to changes of customer behavior is an inevitable aspect of surviving in a competitive and mature market, (Lariviere & Poel, 2004).

2.4. Phases of Customer Knowledge Expansion

In recent years companies have integrated their CRM and KM efforts because they realize that KM plays a key role in CRM process (Dous et al., 2005). Additionally, CRM is a strategy which aims at acquiring customers, retaining and expanding the relationship with the customers (Alryalat & Alhawari 2008). Generally, CRM is defining as an interactive process that achieves an optimum balance between corporate investment and the satisfaction of customer needs to generate the highest profit through customer expansion.

Based on the theoretical background and literature review, a conceptual model was developed to examine the role of Customer Knowledge process (Customer Knowledge Codification, Customer Knowledge Representation, Customer Knowledge Sharing, Customer Knowledge Application, Design of Customer Knowledge, Execution of Knowledge from Customer, and Verify of Knowledge from Customer) on Customer Knowledge Expansion. To achieve the Customer Knowledge Expansion, need to investigate seven phases that can be seen in Table 1.

The first stage deals with "Customer Knowledge Codification." The codification stage involves the conversion of validated customer knowledge into explicit form. It is used to represent customer knowledge in transferable, comprehensible and easily accessible format.

The second stage deals with "Customer Knowledge Representations." It describes the knowledge in familiar terms. The aim of this phase is to represent the customer knowledge in explicit form to make the view simple.

The third stage is concerned with "Customer Knowledge Sharing." It refers to the transfer of the customer knowledge to others by boosting individual's innovativeness and performance.

The fourth stage focus on "Customer Knowledge Application" to organization's products, services and processes aiming in certain ways to

Table 1. Taxonomy of customer knowledge expansion

Main Dimension/Customer Knowledge Expansion	Sub Dimension/Parts of Process	References
Customer Knowledge Expansion	Customer Knowledge Codification	Miltiadis and Pouloudi (2003)
	Customer Knowledge Representation	Stollberg et al (2004)
		Sun and Gang (2006)
	Customer Knowledge Sharing	Lai and Chu (2000)
		Alavi and Leidner (2001)
		Bouthillier and Shearer (2002)
		Sun and Gang (2006)
		Abdullah et al (2005)
	Customer Knowledge Application	Lai and Chu (2000)
		Parikh (2001)
		Alavi and Leidner (2001)
		Stollberg et al (2004)
	Design of Customer Knowledge	Alryalat and alhawari (2008)
	Execution of Knowledge from Customer	Bueren et al (2005)
		Salomann et al (2005)
		Dous et al (2005)
		Gebert et al (2002)
	Verify of Knowledge from Customer	Sunassee and Sewry (2002)

improve them. This stage helps individuals utilize the customer knowledge possessed by other individuals.

The fifth stage is "Design of Customer Knowledge": which is defined as the systematic plan or a guide for extending the relationship with the customers. It is not only concerned with preserving the relationship with the customer. But it also prepares the company for a profound and long-term relationship. It determines the important steps needed to achieve an insightful affiliation between the organization and their customers.

The sixth stage "Execution of Knowledge from Customer": This phase produces knowledge base called knowledge from customer that includes customer knowledge to improve products and services.

The final stage is "Verify of Knowledge from Customer." The main objective of this stage is to verify the knowledge from customers. The main objective of the verification stage is to reveal the reliability of the source by providing evidence, conducting tests and investigating the reference to ensure its accuracy.

3. RESEARCH MODEL

CRM is often described as a strategy or a set of activities the organizations employs to gain a competitive advantage. Also, CRM helps organizations make sense of customer needs and help organizations manage these relationships and helps to predict the future. Therefore, customer knowledge expansion is very important for the survival of organizations to achieve the competitive advantage.

In addition, Customer Knowledge expansion is the process of deepening and sustaining the relationship with the most valuable customers

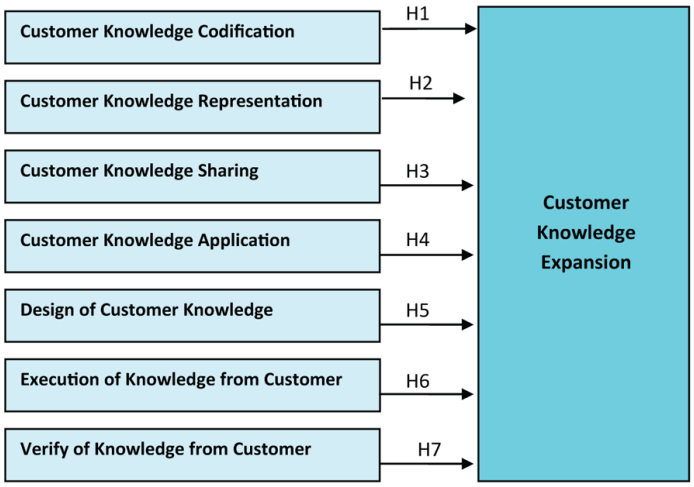
(Alryalat & Alhawari 2008). It is concerned with developing a value proposition relationship management with the customer. This act of sustaining the relationship will automatically results in turning the customers into profitable ones. Also, CRM helps organizations make sense of customer needs and help organizations manage these relationships and helps to predict the future. Therefore, "Customer Knowledge Expansion" is important for the survival of organizations to achieve the competitive advantage.

Based on the theoretical background and literature review, a conceptual model was developed to examine the role of Customer Knowledge process (Customer Knowledge Codification, Customer Knowledge Representation, Customer Knowledge Sharing, Customer Knowledge Application, Design of Customer Knowledge, Execution of Knowledge from Customer, and Verify of Knowledge from Customer) on Customer Knowledge expansion. Figure 1 presents the research model, dependent on Table 1.

Seven hypotheses address the associations between Customer Knowledge process and "Customer Knowledge Expansion." The seven hypotheses which guided this line of inquiry are as follows:

- There is no significant relationship between "Customer Knowledge Codification" and "Customer Knowledge Expansion" at level ($\alpha \leq 0.05$);
- There is no significant relationship between "Customer Knowledge Representation" and Customer "Customer Knowledge Expansion" at level ($\alpha \leq 0.05$);
- There is no significant relationship between "Customer Knowledge Sharing" and "at level ($\alpha \leq 0.05$);
- There is no significant relationship between "Customer Knowledge Application" and "Customer Knowledge Expansion" at level ($\alpha \leq 0.05$);
- There is no significant relationship between "Design of Customer Knowledge" and "Customer Knowledge Expansion" at level ($\alpha \leq 0.05$);
- There is no significant relationship between "Execution of Knowledge from Customer" and "at level ($\alpha \leq 0.05$);
- There is no significant relationship between "Verify of Knowledge from Customer" and "Customer Knowledge Expansion" at level ($\alpha \leq 0.05$).

Figure 1. Research model



4. RESEARCH METHODOLOGY

4.1. Justification of Selecting the Quantitative Research

The quantitative approach supplied a suitable research data collection strategy, allowing the collection of a large amount of data from a size-able population in a highly economical way. The construct was subjected to the scale reliability procedure of SPSS 11.0, using the Cronbach's Alpha Cronbach (1951) criterion to assess the internal consistency of the studied construct. The Cronbach' Alpha coefficient is above 0.75 the value exceeds the accepted cut-off value of 0.75, as suggested by Nunnally (1978). This indicates that each individual item is internally consistent and highly reliable.

4.2. Justification of Selection the Questionnaire

The questionnaire started with a brief description of the meaning of the main concepts, and it gave instructions on how to answer each section of the questionnaire. An initial draft was developed based on an extensive literature review. It includes many questions which are in line with the research aims. For that reason, the research survey could be described as being comprehensive. It is divided into two parts. The first part includes the personal information of the respondents such as gender, area of profession and years of experience. The second part includes the questions related to variables that affect the integrated Customer Knowledge process regarding Customer Knowledge Acquisition.

4.3. Sample

The sample of the survey is divided into four Jordanian Bank which apply the CRM system. A total of 185 questionnaires were sent to six Jordanian banks. A total of 172 questionnaires were returned, 165 of which were completed and 7 were uncompleted. A total of 13 questionnaires were not returned. To increase the return rate, each bank was assigned a contact person to collect and return the questionnaires. Table 2 shows the summary of the sample size.

5. DATA ANALYSIS AND RESULT

This study contains 139 males with a percentage of 84.2% and 26 females with a percentage of 15.8%. The largest group of respondents (54.5%) indicates that their area of specialization was Information Technology (IT). The smallest group area of specialization of respondents indicated Management Information system (4%). Additionally, the

Table 2. Summary of the sample size

Category	Number of Questionnaires Distributed	Number of Questionnaires Returned	Number of Questionnaires Unreturned	Number of Completed Questionnaires Returned	Number of Uncompleted Questionnaires Returned
Bank 1	30	29	1	28	1
Bank 2	40	36	4	34	2
Bank3	45	41	4	40	1
Bank 4	30	28	2	26	2
Bank5	20	20	0	20	0
Bank6	20	18	2	17	1
Total	**185**	**172**	**13**	**165**	**7**

largest group of respondents (36.4%) indicates that their years of experience range from (1-2 years). Finally, the smallest group of respondents (17%) indicates that their years of experience is (Less than 1years). This demographic data are detailed in Table 3.

Based on the objectives and hypotheses of the study, the researchers applied the regression Analysis (ANOVA). The following in Tables 4 through 10 represents the test of the hypotheses by using Analysis of variance (ANOVA), based on the significant level of (0.05).

Referring to Table 4, 5% of the variance in "Customer Knowledge Expansion" accounted by "Customer Knowledge Codification," the significance equal 0.00, which is less than (0.05). For that reason, there is an effect of "Customer Knowledge Codification" on "Customer Knowledge Expansion." Previous research on the use of "Customer Knowledge Codification" is mainly conceptual. The present study is one of the first to use empirical quantitative data to investigate concept of "Customer Knowledge Codification" to improve customer knowledge expansion. The implication of this finding for Jordanian Bank is that they may need to pursue a combined strategy aimed at managing "Customer Knowledge Codification" and "Customer Knowledge Expansion" in order to improve customer satisfaction.

Referring to Table 5, 9% of the variance in "Customer Knowledge Expansion" accounted by "Customer Knowledge Representation," the significance equal 0.00, which is less than (0.05). For that reason, there is an effect of "Customer Knowledge Representation" on "Customer Knowledge Expansion." Previous research on the use of "Customer Knowledge Representation" is mainly conceptual. The present study is one of the first to use empirical quantitative data to investigate concept of "Customer Knowledge Representation" to improve customer knowledge expansion. The implication of this finding for Jordanian Bank is that they may need to pursue a combined strategy aimed at managing "Customer Knowledge Representation" and "Customer Knowledge Expansion" in order to improve customer satisfaction.

Referring to Table 6, 7% of the variance in "Customer Knowledge Expansion" accounted by "Customer Knowledge Sharing," the significance equal 0.00, which is less than (0.05). For that reason, there is an effect of "Customer Knowledge Sharing" on "Customer Knowledge Expansion." Previous research on the use of "Customer

Table 3. Demographic data

Description	Variable	Result	Percentage
Gender	Male	139	84.2%
	Female	26	15.8%
Area of Specialization	Information Technology	90	54.5%
	Management Information system	11	6.7%
	Marketing	22	13.3%
	Customer Relationship Management	42	25.5%
Experience	Less than 1years	28	17%
	1-2 years	60	36.4%
	3-5 years	31	18.8%
	6 years or more	46	27.8%

Table 4. ANOVA test for "customer knowledge codification" and "customer knowledge expansion"

R	R Square	Adjusted R Square	Sig
0.22	0.05	0.046	0.00

Table 5. ANOVA test for "customer knowledge representation" and "customer knowledge expansion"

R	R Square	Adjusted R Square	Sig
0.30	0.09	0.087	0.00

Table 6. ANOVA test for "customer knowledge sharing" and "customer knowledge expansion"

R	R Square	Adjusted R Square	Sig
0.28	0.07	0.07	0.00

Knowledge Sharing" is mainly conceptual. The present study is one of the first to use empirical quantitative data to investigate concept of "Customer Knowledge Sharing" to improve customer knowledge expansion. The implication of this finding for Jordanian Bank is that they may need to pursue a combined strategy aimed at managing "Customer Knowledge Sharing" and "Customer Knowledge Expansion" in order to improve customer satisfaction.

Referring to Table 7, 8% of the variance in "Customer Knowledge Expansion" accounted by "Design of Customer Knowledge," the significance equal 0.00, which is less than (0.05). For that reason, there is an effect of "Design of Customer Knowledge" on "Customer Knowledge Expansion." Previous research on the use of "Design of Customer Knowledge" is mainly conceptual. The present study is one of the first to use empirical quantitative data to investigate concept of "Design of Customer Knowledge" to improve customer knowledge expansion. The implication of this finding for Jordanian Bank is that they may need to pursue a combined strategy aimed at managing "Design of Customer Knowledge" and "Customer Knowledge Expansion" in order to improve customer satisfaction.

Referring to Table 8, 6% of the variance in "Customer Knowledge Expansion" accounted by "Customer Knowledge Application," the significance equal 0.00, which is less than (0.05). For that reason, there is an effect of "Customer Knowledge Application" on "Customer Knowledge Expansion." Previous research on the use of "Customer Knowledge Application" is mainly conceptual. The present study is one of the first to use empirical quantitative data to investigate concept of "Customer Knowledge Application" to improve customer knowledge expansion. The implication of this finding for Jordanian Bank is that they may need to pursue a combined strategy aimed at managing "Customer Knowledge Application" and "Customer Knowledge Expansion" in order to improve customer satisfaction.

Referring to Table 9, 14% of the variance in "Customer Knowledge Expansion" accounted by "Execution of Knowledge from Customer," the significance equal 0.00, which is less than (0.05). For that reason, there is an effect of "Execution of Knowledge from Customer" on "Customer Knowledge Expansion." Previous research on the use of "Execution of Knowledge from Customer" is mainly conceptual. The present study is one of the first to use empirical quantitative data to investigate concept of "Execution of Knowledge from Customer" to improve customer knowledge expansion. The implication of this finding for

Table 7. ANOVA test for "design of customer knowledge" and "customer knowledge expansion"

R	R Square	Adjusted R Square	Sig
0.29	0.08	0.08	0.00

Table 8. ANOVA test for "customer knowledge application" and "customer knowledge expansion"

R	R Square	Adjusted R Square	Sig
0.25	0.06	0.06	0.00

Table 9. ANOVA test for "execution of knowledge from customer" and "customer knowledge expansion"

R	R Square	Adjusted R Square	Sig
0.38	0.14	0.139	0.00

Jordanian Bank is that they may need to pursue a combined strategy aimed at managing "Execution of Knowledge from Customer" and "Customer Knowledge Expansion" in order to improve customer satisfaction.

Referring to Table 10, 4% of the variance in "Customer Knowledge Expansion" accounted by "Verify of Knowledge from Customer," the significance equal 0.00, which is less than (0.05). For that reason, there is an effect of "Verify of Knowledge from Customer" on "Customer Knowledge Expansion." Previous research on the use of "Verify of Knowledge from Customer" is mainly conceptual. The present study is one of the first to use empirical quantitative data to investigate concept of "Verify of Knowledge from Customer" to improve customer knowledge expansion. The implication of this finding for Jordanian Bank is that they may need to pursue a combined strategy aimed at managing "Verify of Knowledge from Customer" and "Customer Knowledge Expansion" in order to improve customer satisfaction.

The relation between the Customer Knowledge process (Customer Knowledge Codification, Customer Knowledge Representation, Customer Knowledge Sharing, Customer Knowledge Application, Design of Customer Knowledge, Execution of Knowledge from Customer, and Verify of Knowledge from Customer) and Customer Knowledge Expansion was confirmed in this study. The findings are summarized as follows:

1. "Customer Knowledge Codification" had a positive impact on "Customer Knowledge Expansion."
2. "Customer Knowledge Representation" had a positive impact on "Customer Knowledge Expansion."
3. "Customer Knowledge Sharing" had a positive impact on "Customer Knowledge Expansion."
4. "Customer Knowledge Application" had a positive impact on "Customer Knowledge Expansion."

Table 10. ANOVA test for "verify of knowledge from customer" and "customer knowledge expansion"

R	R Square	Adjusted R Square	Sig
0.22	0.04	0.04	0.00

5. "Design of Customer Knowledge" had a positive impact on "Customer Knowledge Expansion."
6. "Execution of Knowledge from Customer" had a positive impact on "Customer Knowledge Expansion."
7. "Verify of Knowledge from Customer" had a positive impact on "Customer Knowledge Expansion."

Moreover, although the importance of terms of Customer Knowledge Processing such as the (Customer Knowledge Codification, Customer Knowledge Representation, Customer Knowledge Sharing, Customer Knowledge Application, Design of Customer Knowledge, Execution of Knowledge from Customer, and Verify of Knowledge from Customer) is often acknowledged in the literature, this study enhances understanding of these relationships in providing empirical results based on quantitative data. Further, the findings are based on data that was gathered from the perspective of employee of Jordanian banks. In our view this is an important contribution because Customer Knowledge Processing related Customer Knowledge Expansion may vary significantly.

6. CONCLUSION

The article attempts to build a more complete framework of the factors that influence Customer Knowledge Expansion. The results of this study clearly show that seven of the selected factors (Customer Knowledge Codification, Customer Knowledge Representation, Customer Knowl-

edge Sharing, Customer Knowledge Application, Design of Customer Knowledge, Execution of Knowledge from Customer, and Verify of Knowledge from Customer) have a significant impact on Customer Knowledge Expansion in Jordanian banks. Consequently, the paper illustrated the role Customer Knowledge process achieves Customer Knowledge Expansion. These processes help to acquire more customers by providing the members of the organization with real information enabling correct reaction in making the right decisions in order to gain the competitive advantage. This research contributes to the understanding of the Customer Knowledge process and Customer Knowledge Expansion. The research has succeeded in proposing a model that enriches current research by offering specification, justification, and empirical validation of a set of interrelationships between important factors.

This research describes an integration of Customer Knowledge process and Customer Knowledge Expansion. Hopefully these findings will shed some light for policy makers allowing them to integrate Customer Knowledge process and Customer Knowledge Expansion to improve customer satisfaction in Jordanian banks. To the best of our knowledge, no existing studies have empirically tested for an interaction effect on expand of customer knowledge and Customer Knowledge process. Similarly, while the interaction effect between Customer Knowledge processes has been suggested as phases, empirical support has been scant. Our study fills these two major gaps in the literature.

Due to lack of Customer Knowledge process in Jordanian bank, the banks are not aware of Customer Knowledge Expansion facilities. This is also the reason for a lack of trust in Customer Knowledge process. Therefore, the vital contribution of values based recruitment and selection, innovative and need-based training and development, comprehensive, and reasonable performance evaluation, foster satisfaction, and quality of work life are essential dimensions that have positive effects on superior performance for sustained competitive advantage that need to be capitalized by executive "Customer Knowledge Expansion" at all level by using (Customer Knowledge Codification, Customer Knowledge Representation, Customer Knowledge Sharing, Customer Knowledge Application, Design of Customer Knowledge, Execution of Knowledge from Customer, and Verify of Knowledge from Customer).

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Chapter 51
The Role of Relational Mediators in the CRM–Performance Link:
Evidence from Indian Retail Banks

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ABSTRACT

CRM literature has considered the role of relationship quality (satisfaction, trust and commitment), but its respective effects on relationship maintenance (retention) and relationship development (cross-buying) are unnoticed. This research proposes an integrated model of CRM and investigates its impact on relationship quality, relationship maintenance, and relationship development. Specifically, it examines the effect of CRM on satisfaction, trust, retention and cross-buying. The results indicate significant and positive effect of CRM on satisfaction; satisfaction has a positive effect on trust, retention and cross-buying, and trust positively influences retention. Satisfaction plays a mediating role in the relationship between CRM and its outcomes. The results imply bank managers to focus on satisfying customers primarily to maintain and develop customer relationships.

INTRODUCTION

Marketing has witnessed a paradigm shift towards relationship approach a decade ago (Gronroos, 1994). Hence, the concept of customer relationship management (CRM) is a constant theme in marketing. Today, many firms adopt CRM strategies with the aim of understanding customers better and building better relationships (Fitzgibbon and White, 2004). It provides number of benefits including increased customer satisfaction, trust, loyalty, sales effectiveness, cross selling opportunities, and profitability. Concisely, CRM efforts increase length, depth and breadth of a relationship (Bolton, Lemon, & Verhoef, 2004).

CRM is applicable more in banking industry as it is known to be highly human intensive and customer interactive industry (Dowling, 2002) and banks represent the economic stability and prosperity of a country (Rootman, Tait, & Bosch,

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2008). But, global banking environment has been changed due to regulatory, structural and technological factors (Rao, 2008). Consequently, without exception, Indian banking sector has also been transformed to a greater extent following deregulation, liberalization and globalization of the economy. These challenges together with increasing demanding customers compel banks to maintain customer relationship for improving business performance. Accordingly, most of the Indian banks are investing heavily in CRM technology (Khare, 2010) with a view to maintain and develop relationship with customers (Roy & Shekhar, 2010). On the contrary, the importance of developing such relationships and the outcomes of the relationships are largely ignored by Indian banks (Khare, 2010).

Theoretically, numerous empirical studies have reported positive effect of CRM on customer behavioral outcomes such as customer satisfaction (Mithas, Krishnan, & Fornell, 2005), customer trust (Sin, Tse, & Yim, 2005), and customer retention (Yim, Anderson, & Swaminathan, 2004); and financial performance outcomes such as return on assets (ROA) (Sin, Tse, & Yim, 2005), profitability (Reimann, Schilke, & Thomas, 2010), and return on equity (ROE) (Minami & Dawson, 2008). However, firstly, previous research has tested only partial impact of CRM either on satisfaction or retention and failed to address sequential effect of CRM, which is expected from customer satisfaction to firm financial benefit (Minami & Dawson, 2008). Secondly, CRM model tends to combine the effect of CRM on both customer metrics and financial metrics, and often used financial measures such as ROA and profitability to measure financial performance. But, it is argued that customer metrics like cross-buying or cross sell ratio is an important outcome of CRM efforts (Bohling et al., 2006) and it contributes to firm profits (Blattberg, Getz, & Thomas, 2001; Liang, Wang, & Farquhar, 2009). Thirdly, Aurier and N'Goala (2010) articulate that CRM theory has considered the role of relationship quality perceptions (satisfaction, trust and commitment), but ignored to examine their respective effects on relationship maintenance (customer retention) and relationship development (cross-buying). Moreover, in relationship efforts model, it is stated that the roles of relational mediators (satisfaction, trust and commitment) vary according to different relational perspectives (Palmatier, 2006). Fourthly, it is believed that perception of relationship and behavior is context specific (Dimitriadis, 2010; Palmatier et al., 2006) and therefore CRM performance has to be studied in Indian context (Jham & Khan, 2008). And finally, studies on CRM have considered firm perception, leaving open the issue of how customers perceive CRM efforts (Chan, 2005; Sin, Tse, & Yim, 2005). To the best of our knowledge, till date, none of the empirical studies on CRM have examined its impact on relationship quality, relationship maintenance and relationship development.

These gaps necessitate a rationale for developing and testing a more integrative conceptual framework containing the relationship between CRM, relationship quality; maintenance; and development in Indian retail bank setting from customer perception. The framework allows us to simultaneously investigate the respective impacts of relational mediators on both relationship maintenance and development. Specifically, we examine the impact of CRM on customer satisfaction, customer trust, customer retention and customer cross-buying. We believe that our study findings would shed light and add substantive theory to the body of knowledge on CRM. To realize this, we first review previous research on CRM followed by the proposed model and hypothesis construction. Second, we present the research methodology, including the instruments used for hypothesis testing. Finally, the empirical results are examined, key managerial and research implications are provided.

LITERATURE REVIEW

Concept of CRM

CRM is an integral part of relationship marketing (RM) and many of the scholars use the term RM and CRM interchangeably (Parvatiyar & Sheth, 2001). But RM becomes CRM when it is targeted towards customer market especially (Lindgreen & Antioco, 2005). CRM means different thing to different people, for sales community, it means sales-force automation; for marketing people, it signifies customer selection, and for information technology group, it may suggest database management (Sharma & Iyer, 2007). Nonetheless, the basic premise of CRM is to maintain a mutually beneficial relationship (Soper, 2002).

CRM research can be divided into two streams. One is process approach and the other is relationship approach (Lin, Chen, & Chiu, 2010). Process approach contains initiating, maintaining and terminating relationship with customers (Reinartz, Krafft, & Hoyer, 2004). Relationship approach refers to activities such as understanding customers, giving privilege to key customers and delivering superior services from the use of available information technology (Sin, Tse, & Yim, 2005). Our study follows the tradition of relationship approach.

CRM and its Outcomes

Empirical studies report positive influence of CRM on its performance measures under various perspectives. For instance, in *process related perspective*, Reinartz, Krafft, and Hoyer (2004) conceptualize CRM as a process that contains three different stages including relationship initiation; maintenance; and termination. It is found that initiating the relationship and maintaining it improve firm's economic performance. In this context, Becker et al. (2009) report that technological and organizational implementation positively influences CRM performance at each of the three stages. Reimann, Schilke, and Thomas (2010) conclude that three stage CRM process has an indirect impact on customer satisfaction and profitability through differentiation and cost leadership. In a process oriented framework of CRM effectiveness, Chen et al. (2009) discover that elements of CRM effectiveness like RM, information technology and organizational climate increase customer loyalty.

In *relational activities perspective*, the study by Yim, Anderson, and Swaminathan (2004) reveal that CRM dimensions such as focusing on customers and managing knowledge influence customer satisfaction; and managing knowledge and organizing around CRM increase customer retention levels. The results also support that CRM dimensions have an indirect relationship to sales growth through satisfaction and retention. On the similar note, Sin, Tse, and Yim (2005) find that CRM positively influences customer satisfaction, customer trust, return on investment and ROA. Jayachandran et al. (2005) report that relational information process increases customer relationship performance. Minami and Dawson (2008) identify that integration of customer data and loyalty scheme with the use of IT (relationship orientation) increase CRM implementation, which is found to have an indirect impact on ROE.

In the *perspective of technology*, CRM system implementation containing BPR and organizational learning increase the level of relationship quality (satisfaction, trust and commitment) and organizational performance (Chang and Ku, 2009). In B-to-B context, Richard, Thirkell, and Huff (2007) find that CRM technology adoption increases relationship strength (trust and commitment) and relationship performance (satisfaction, retention and loyalty). CRM system investment and CRM capability is positively significant to customer satisfaction in a retail context (Srinivasan and Moorman, 2005). CRM contains legacy and new application that increases customer satisfaction levels (Mithas, Krishnan, & Fornell, 2005).

In sum, review of CRM and its outcomes reveal that the majority of the studies have concentrated on customer satisfaction, customer trust and customer retention, leaving other expected outcomes of CRM. Moreover, studies with two or more outcome variables combine both financial as well as non-financial measures.

CRM in Financial Services Context

Effective implementation of CRM reduces cost, complexity and waiting time; increase performance and service levels; and increase bank customer relationships (Blery & Michalakopoulos, 2006). It also helps in increasing firms' profit efficiency but unhelpful in improving cost efficiency (Krasnikov, Jayachandran, & Kumar, 2009). Use of CRM software improves productivity and performance quality (McNally, 2007) and the adoption of right technology will result in enhanced customer management of relationships (Ellis-Chadwick, McHardy, & Wiesehofer, 2002).

CRM enablers are found to affect CRM success. For example, firms engaged in effective project management, realistic time scheduling and perfect programming will reap the benefits of CRM success such as customer satisfaction and retention (Blery & Michalakopoulos, 2006). Similarly, critical enablers such as realistic CRM implementation schedule, personalization, customer orientation and clear CRM strategy contribute to increased customer retention (Eid, 2007).

Bank employees' knowledgeability and attitude are the crucial factors in improving effectiveness of CRM strategy (Rootman, Tait, & Bosch, 2008) when combined with IT infrastructure, and business architecture (Coltman, 2007). Affective commitment and loyalty programs enhance customer retention and customer share development (Verhoef, 2003). Furthermore, assertiveness and affiliation of the service provider increase customer retention and share of wallet.

Adoption of mobile banking as a CRM tool assists banks in acquiring and retaining customers (Riivari, 2005). Existence of online banking, virtual banking and non-banking may make the bank to lose customers and yet it is useful to identify high net worth customers from the usage of e-banking (Sciglimpaglia & Ely, 2006). In Indian financial services context, recently, Khare (2010) explores that Indian customers are skeptical to use online banking. Support of bank employees in educating the importance and value of online banking will change customer perception and improve CRM strategy.

In conclusion, CRM in financial services context reveal that it is devoid of a complete conceptual model reflecting the impact of CRM on possible non-financial outcomes. So, we try to examine the influence of CRM on its expected customer outcome variables.

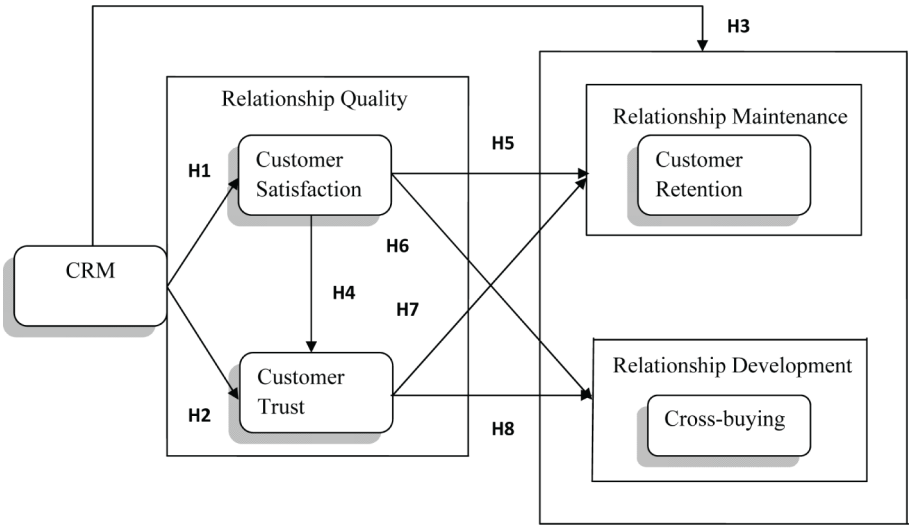
CONCEPTUAL MODEL AND RESEARCH HYPOTHESIS

Figure 1 represents our extended and advanced CRM model. The causal model depicts the relationships between CRM and relationship quality, relationship maintenance and relationship development. We now discuss the theoretical underpinnings for our hypothesis.

Relationship Quality

Relationship quality (RQ) has been used frequently in buyer-seller relationship literature (Athanasopoulou, 2008) and it is considered as relationship strength (Garbarino & Johnson, 1999). Earlier, it has been conceptualized mainly of trust and satisfaction (Crosby et al., 1990). Later, commitment has been added as one more indicator of RQ (Beatson, Lings, & Gudergan, 2008). We assume RQ as satisfaction and trust of customers with the bank since they are widely used in financial services context (Bejou, Wray, & Ingram, 1996; Wray, Palmer, & Bejou, 1994).

Figure 1. Conceptual model



Relationship Maintenance

Banks try to maintain and expand relationship for achieving long-term profitability of a customer (Jarrar & Neely, 2002). Aurier and N'Goala (2010) conceptualize customer retention as one of the patronage behaviors in relationship maintenance phase. McNally (2007) considers customer retention as one of the maintenance phase activities. In line with above studies, we consider customer retention as an indicator of relationship maintenance.

Relationship Development

Retaining existing customers is not sufficient for developing relationship and enhancing profitability. Making retained customers to buy additional products (cross-buying) helps in relationship development and it will generate financial benefit to the firm (Bolton, Lemon, & Verhoef, 2004). Cross-buying is considered as relationship development or extension (Verhoef & Donkers, 2005). Ngobo (2004) conceptualizes it as expansion of the relationship and Bolton, Lemon, and Verhoef (2004) consider it as breadth of the relationship. Similar to Verhoef and Donkers (2005), we conceptualize cross-buying as relationship development.

Effect of CRM on Customer Satisfaction

Customer satisfaction has been considered as an important goal of CRM activity (Yim, Anderson, and Swaminathan, 2004) and it is a focal outcome in buyer-seller relationship (Smith & Barclay, 1997). In banking context, relationship efforts made by a retailer would have an effect on customer satisfaction (Liang & Wang, 2007) and several studies have reported positive impact of CRM on customer satisfaction (e.g., Mithas, Krishnan, & Fornell, 2005; Sin, Tse, & Yim, 2005; Srinivasan & Moorman, 2005). Therefore, we hypothesize:

H1: There is a positive relationship between CRM and customer satisfaction.

Effect of CRM on Customer Trust

Trust plays a major role in the success and benefit of developing customer relationships (Hulten, 2007; Morgan & Hunt, 1994) and it is the single most powerful RM tool available to the service providers (Berry, 1995). Furthermore, empirical studies on CRM find positive association between CRM and

customer trust (e.g. Richard, Thirkell, & Huff, 2007; Sin, Tse, & Yim, 2005). Therefore, we hypothesize:

H2: There is a positive relationship between CRM and customer trust.

Effect of CRM on Customer Retention

Every relationship management activities are focused at increasing customer retention. Menon and O' Connor (2007) argue that CRM efforts such as assertiveness and affiliation will generate retention of customers. Empirical studies in the context of banking have also reported positive relationship between CRM and retention. For instance, Yim, Anderson, and Swaminathan (2004) find positive effect of CRM dimensions on retention. Eid (2007) find positive impact of CRM effectiveness on customer retention. Based on these arguments and findings, we hypothesize:

H3: There is a positive relationship between CRM and customer retention.

Effect of Customer Satisfaction on Trust, Retention and Cross-Buying

Satisfied customers tend to develop their affiliation with the service provider and their association in the service relationship (Bolton, 1998). In a banking context, overall satisfaction arrived from service quality influences trust (Aurier & N'Goala, 2010). In the study of Liang and Wang (2007), it is found that satisfaction arrives out of relationship benefits have positive effect on customer trust.

In satisfaction literature, it has been explored that a key determinant to customers' decisions to continue or terminate a business relationship arrives from satisfaction (e.g., Bolton, 1998). Greater customer satisfaction is generally believed to increase customer retention levels (Yim, Anderson, & Swaminathan, 2004). Number of empirical studies finds positive influence of satisfaction on retention (e.g. Hennig-Thurau, 2004; Mohd Kassim & Souiden, 2007).

When customers are satisfied in the initial stages, they build necessary trust and expand their relationship through cross-buying behavior (Bendapudi & Berry, 1997; Reinartz, Thomas, & Bascoul, 2008). In a recent study, Dimitriadis (2010) finds that satisfaction with a bank influences cross-buying. Some studies have reported direct or indirect relationship between satisfaction and cross-buying (Bloemer et al., 2002; Ngobo, 2004). On the other hand, insignificant relationship between satisfaction and cross-buying is also reported (Liu & Wu, 2007; Soureli et al., 2008). However, based on the argument that satisfied customers tend to buy additional products (Liu & Wu, 2007), we expect the relationship between customer satisfaction and cross-buying to be positive. Therefore, we hypothesize the following:

H4: Customer satisfaction will have a positive influence on customer trust.
H5: Customer satisfaction will have a positive influence on customer retention.
H6: Customer satisfaction will have a positive influence on cross-buying.

Effect of Trust on Retention and Cross-Buying

Trust is generally considered as a fundamental requirement for successful relationship maintenance and enhancement (Gronroos, 1999). Several studies in RM consider trust as a determinant of customer retention (Doney & Cannon, 1997; Johnson & Grayson, 2005). The positive effect of trust on customer retention has been examined in literature (e.g. Liu & Wu, 2007).

Many studies have reported that trust influences cross-buying intention (Crosby et al., 1990; Liang, Chen, & Wang, 2008; Liu & Wu, 2007; Soureli et al., 2007). Whereas Verhoef, Franses, and Hoekstra (2002) report insignificant relationship

between trust and cross-buying and argued that trust is important for clients only in choosing a new service provider. Nevertheless, trust is regarded as a scope for extending relationship (Selnes, 1998). Therefore, we hypothesize the following:

H7: Customer trust will have a positive influence on customer retention.

H8: Customer trust will have a positive influence on cross-buying.

METHODOLOGY

Sample and Data Collection Procedure

To empirically test the model proposed in Figure 1, we collected survey data on CRM, customer satisfaction, customer trust, customer retention and cross-buying. The study sample consisted of retail bank customers. A self-completion web questionnaire was mailed to a convenience sample of 1100 respondents. Due to lack of population information or sample frame, convenience sampling was used to improve the precision of the estimates as suggested by Cooper and Schindler (1998). Web survey resulted in usable 426 responses, yielding a response rate of 38.7 per cent. Table 1 describes the demographic profile of the respondents.

Measurements

Measurements for all constructs were taken from existing literature. To measure CRM, 9 items were adopted from Sin, Tse, and Yim (2005). 3 items were adapted from Singh (1990) and Verhoef, Franses, and Hoekstra (2001) to measure customer satisfaction. Based on Crosby et al. (1990) and Morgan and Hunt (1994), we adopted 3 items for measuring customer trust. 3 customer retention items were based on Zeithaml, Berry, and Parasuraman (1996) and finally for measuring cross-buying, 2 items were adopted from Foster and Cadogan (2000). All the statements were measured on a five-point Likert scale ranging from 1 'strongly disagree to 5 'strongly agree'.

Pretest

Items and definitions were given to three marketing professors and two bank managers to assess item wordings and applicability of measures to suit the banking context. Word changes were carried

Table 1. Demographic profile

Demographic Information n = 426		N	%
Gender	Male	286	67.1
	Female	140	32.9
Age	Less than 20 years	3	0.70
	21-30 years	322	75.6
	31-40 years	57	13.4
	41-50 years	26	6.1
	More than 50 years	18	4.2
Education	Undergraduate	83	19.5
	Post-graduate	264	62
	Professional Degree	64	15
	Others	15	3.5
Employment	Private sector	202	47.4
	Public sector	54	12.7
	Self-employed	30	7
	Student	92	21.6
	Others	48	11.3
Primary Bank	SBI	103	24.2
	HDFC	82	19.2
	ICICI	64	15
	Punjab National Bank	25	5.9
	Karur Vysya Bank	18	4.2
	Others	134	31.5
Duration with primary Bank	Less than 1 year	48	11.3
	Between 1-4 years	218	51.2
	Between 4-7 years	98	23
	Between 7-10 years	33	7.7
	More than 10 years	29	6.8

out based on the comments received. Instrument containing all 20 items were pretested by 210 MBA students. 3 items from the initial battery of 9 items of CRM were deleted based on item-to-total correlation criterion (< 0.4), factor loading of less than 0.4, cross-loading of less than 0.4 (Hair et al., 1998) and Cronbach's alpha less than 0.7. EFA using principal component extraction and varimax rotation performed on the remaining 6 items of CRM resulted in one single factor.

ANALYSIS AND RESULTS

Measurement Model

In order to test the validity of measures used in the study, we conducted confirmatory factor analysis using AMOS 16.0 and by employing maximum likelihood method. The model fit the data well with a (chi-square value (103) = 260.08, p = 0.000, GFI = 0.94, AGFI = 0.91, CFI = 0.96, TLI = 0.94 and RMR = 0.027). Measurement reliability was confirmed by assessing Cronbach's alpha values. All the alphas exceeded the threshold limit of.70 (Table 2). All the items were loaded on their respective factors, thus validating the unidimensionality of the constructs (Anderson & Gerbing, 1988). The t-values for the loadings were high, demonstrating adequate convergent validity. All measures of composite reliability and all average variance-extracted (AVE) estimate were exceeded the threshold limit of 0.6 and 0.5 respectively (Hair et al., 1998; Fornell & Larcker, 1981) (Table 2). Moreover, AVE for each dimension was higher than the squared correlation among the five factors, confirming discriminant validity (Fornell & Larcker, 1981) (Table 3).

Structural Model and Hypothesis Results

Given a valid and reliable scale to measure, we tested the overall model. The model fit the data well with a (chi-square value (106) = 315.85, p = 0.000, GFI = 0.93, AGFI = 0.90, CFI = 0.94, TLI = 0.92 and RMR = 0.03).

Structural model evaluation shows that as hypothesized, CRM was found to positively affect customer satisfaction (p= 0.000, t-value = 10.98), thus supporting H1. As predicted, satisfaction positively influences customer trust (p= 0.000, t-value = 6.77), customer retention (p= 0.003, t-value = 4.52) and cross-buying (p= 0.000, t-value = 8.53), supporting H4, H5 and H6. In case of customer trust, it did influence customer retention (p= 0.002, t-value = 3.05), supporting H7.

However, we find no direct relationship between CRM and customer trust (p= 0. 585, t-value = -0.55), customer retention (p= 0.679, t-value = -0.414). Therefore, H2 and H3 are rejected. Trust did not have relationship with cross-buying (p= 0.584, t-value = 0.548), rejecting H8. Moreover, the indirect effect of CRM on trust was 0.539 (0.77 * 0.70). CRM also had an indirect effect on retention through satisfaction and trust (0.42 * 0.12 = 0.54).

DISCUSSION

Although previous research has extensively studied relationships between CRM and customer satisfaction, customer trust and customer retention, they were incomplete by considering partial impact of CRM on its performance outcomes. Moreover, only few studies have addressed the impact of CRM purely on customer outcome variables and provided empirical evidence. The primary contribution of this study is in the development of an extended conceptual model for CRM with its expected customer outcomes. The model included five variables such as CRM, customer satisfaction, customer trust, customer retention and cross-buying. As one step further, besides replicating CRM model in Indian context, we expanded the model by considering all the possible non-financial indicators. Empirical

Table 2. Measurement model

Item	Standardized Loadings	t-Value	Cronbach's Alpha	AVE	CR
CRM			**0.87**	**0.64**	**0.70**
My bank employees are committed in providing prompt service to me	0.88				
My bank carefully evaluates my evolving needs	0.86	11.353			
My bank offers customized products/services to me	0.80	11.304			
My bank employees are willing to help me in a responsive manner	0.78	12.889			
My bank employees effectively communicate with me	0.76	12.180			
My bank makes effective use of information technology for fast and quality service.	0.75	12.442			
Customer Satisfaction			**0.83**	**0.70**	**0.73**
I am satisfied with my relationship with the bank	0.86				
I am satisfied with the willingness of my bank to explain procedures	0.88	17.734			
I am satisfied with the personal attention of my bank towards me	0.76	15.485			
Customer Trust			**0.81**	**0.67**	**0.72**
My bank has high integrity.	0.76				
My bank is trustworthy.	0.85	14.982			
My bank puts my interest first.	0.85	15.062			
Customer Retention			**0.73**	**0.65**	**0.70**
I say positive things about my bank	0.78				
I encourage friends and relatives to invest with my bank	0.84	11.976			
I consider my bank as my first choice when comes to banking products	0.80	10.896			
Cross-buying			**0.73**	**0.75**	**0.78**
I have intention to increase the volume of business with my bank	0.89				
I have intention to buy more products from my bank	0.84	13.174			

Table 3. Discriminant validity and descriptive statistics

Constructs	CRM	Customer Satisfaction	Customer Trust	Customer Retention	Cross-buying
CRM	**0.64**	0.35	0.16	0.16	0.23
Customer Satisfaction	.59*	**0.70**	0.29	0.23	0.30
Customer Trust	.40*	0.54*	**0.67**	0.20	0.15
Customer Retention	.40*	0.48*	0.45*	**0.65**	0.29
Cross-buying	.48*	0.55*	0.39*	0.54*	**0.75**
Mean	21.75	11.58	11.78	10.58	7.15
SD	3.76	1.93	1.88	2.18	1.46

* Correlation is significant at the 0.01 level

Diagonal elements indicates AVEs

Lower half of the table represents the phi correlation coefficient and the upper half of the table refers to the squared phi correlation.

evidence examining CRM effect on relationship development (cross-buying) has been very modest, but cross-buying behavior is specifically indispensable to banks where establishing, maintaining and developing relationship is important (Sin, Tse, & Yim, 2005). Therefore, to the best of our knowledge, this is the first empirical study to investigate relational mediators sequentially in the CRM-performance link as well as to examine CRM from the perception of customers in Indian retail bank setting.

Empirical results of this study show that CRM positively influences customer satisfaction and this is consistent with previous research (Sin, Tse, & Yim, 2005; Yim, Anderson, & Swaminathan, 2004). The negative and insignificant effect of CRM on trust and retention is offset by its indirect effect through customer satisfaction and this indicates that satisfaction mediates the relationship between CRM and its outcomes. This finding support the views of Morgan and Hunt, 1994 that impact of RM strategies on outcomes are fully mediated by one or more of the relational constructs such as satisfaction, trust and commitment. Moreover, Chan (2005) and Chen and Popovich (2003) suggest that the mere use of CRM does not automatically lead to customer retention. Aurier and N'Goala (2010) and Bolton (1998) suggest that satisfaction is a basic and necessary condition in developing affiliation and reinforcing trust with the service provider.

This study also provides support for the link between satisfaction, trust, retention and cross-buying. Satisfaction positively predicts trust and it is in line with prior studies (Aurier & Gilles N'Goala, 2010; Liang & Wang, 2007). Satisfaction and trust have direct positive association with retention, exhibiting similar results of Liu and Wu (2007). Influence of satisfaction on cross-buying is supported by Bloemer et al. (2002) and Ngobo (2004). Somewhat surprisingly, we found insignificant impact of trust on cross-buying. This is in contrast with the results of Liu and Wu (2007). Yet, this can be explained by the fact that relationship between trust and cross-buying varies to different contexts of the studies (Verhoef, Franses, & Hoekstra, 2002).

MANAGERIAL IMPLICATIONS

Results of the study show that CRM aids in the improvement and development of relationship through customer satisfaction. This hints the bank marketers that the fore most goal of CRM is to satisfy the customer, which in turn, provides financial benefit to them. Our results indicate that managers who focus on building, maintaining and developing relationship with customers should note that delivery of prompt services; effective communication; customized products/services; and efficient use of information technology are the most vital CRM strategies. Precisely, bank marketers can concentrate on the orchestration of people, process and technology in implementing CRM activities (Chen & Popovich, 2003; Sin, Tse, & Yim, 2005). By focusing on higher levels of customer satisfaction, managers can develop trust with customer, retain existing customers, convince customers for repeat business and thereby, cutting cost by keeping current customers than acquiring a new.

This study also provides evidence for the impact of satisfaction and trust on retention. Notably, satisfaction dominantly increases retention levels, while trust is the secondary one. This means that satisfaction should be the primary aim of the service provider, since customer develops trust only for the first time they involve in the relationship (Verhoef, Franses, & Hoekstra, 2002). In the later stages of relationship, satisfaction plays an important role in developing relationship as satisfied customers will evaluate the risk associated with the service provider and decide to maintain or develop relationship (Aurier & N'Goala, 2010). Our study results have shown that satisfaction

also affects cross-buying behavior. This implies that for persuading existing customers to buy additional products, satisfying customers should be the mantra for bank mangers. Altogether, managers can achieve customer profitability through retention and cross-buying (Liang, Chen, & Wang, 2008). In conclusion, the study proved the long held belief that CRM increases business performance. And customer satisfaction appears as a pivotal concept and remains as an important basis for building trust; maintaining and developing customer relationship.

LIMITATIONS AND FUTURE RESEARCH DIRECTIONS

Our study has included only 6 items for measuring customer perception towards CRM activities. Future research can develop a standardized scale for measuring CRM in Indian retail banking context and investigate it impacts on both objective and subjective outcomes. The chosen set of factors in our framework is not exhaustive nor a list of the most important factors. For example, customer loyalty and customer commitment could also be added in the CRM-performance link. Convenience sampling warrant caution before generalizing the results beyond the population studied. This study is limited to banking context and warrant caution before generalizing to other industries and nations. The study is cross sectional and future research can consider longitudinal observations.

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Chapter 52
Computing Skills in Forecasting for Liquidity Risk Management in the Indian Banking Industry

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ABSTRACT

Liquidity Risk Management (LRM) in the banking industry happens at two levels: (1) the Central Bank (i.e. the regulator) and (2) the commercial banks. The term "liquidity" for the Central Bank means the monetary base consisting of the currency and the reserves in the banking system. These are the supply side of the interest rate market. The Central Bank being the only supplier of the same can target the interest rates by varying supply of monetary base and vice versa. There are several ways including auctioning and redeeming the government securities for squeezing and pumping liquidity into the system. However, before such recourse, the Central Bank needs an assessment of the liquidity requirement of the system and applies the forecasting techniques, which are mostly econometric by nature involving the time series data. This chapter explores this process.

1. INTRODUCTION

1.1 Concept of 'Liquidity' for a Bank

The term 'liquidity' is defined for a bank as "the ability of a bank to fund increases in assets and meet obligations as they come due, without incurring unacceptable losses" by the Basel Committee on Banking Supervision (2008). In the above definition, the term "without incurring unacceptable losses" tallies with the term "at a reasonable cost" in the definition of 'liquidity' provided by the Reserve Bank of India (2012). With the above ability a bank manages the mismatches in the volumes between the maturing liabilities and the maturing assets at the end of different common terms to maturity. If such mismatch affects the cash availability in a bank for the depositors at any point of time it would lead to bank-run. In this context Sethuraman (2008) distinguished between liquidity and solvency as follows. Solvency means a non-zero net worth. Even on the day of the bank-run it is possible for a bank to be highly solvent without having any cash or liquidity. In the day to day business of a bank, liquidity is an index of how fast it can convert the assets into

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cash without any loss and/or how fast it can raise the wholesale funds from the unsecured interbank market without facing any hike in the payable interest for any reason unique to itself.

1.2 Concept of 'Liquidity' for the Central Bank

For the Central Bank, the term 'liquidity' is signified by Mitra and Abhilasha (2012) as "financial flows of various kinds, ranging from that originating from the Central Bank to the overall existent financing available in the banking system" or more simply by the term 'macroeconomic liquidity'. Here 'liquidity' is described to be determined by the net change in the bank reserves through the interaction among the various autonomous factors that drive liquidity and its management by the RBI through the impacts of the RBI actions and the autonomous factors such as the government financial flows, the foreign capital flows and the demand for currency on the reserves of the banks with the RBI as a result of the central banking functions of the RBI in the Indian Rupee market as well as the foreign currency markets apart from its functions as the monetary authority of the country and the daily outstanding figure of liquidity adjustment facility though repo and reverse repo (LAF) is officially considered to be a measure of available funding in the system. The LAF is a process whereby the banks borrow from the RBI against the government security collateral, called 'repo' process. Thus the LAF, introduced in the middle of 2000, is a monetary policy tool as per tquantity based monetary targeting described by the Reserve Bank of India (2003), in the hand of the RBI to pump liquidity into the system.

The aforesaid monetary policy tools include the cash reserve ratio (CRR) and the open market operations (OMO). Higher the CRR, higher are the bank deposits with the RBI and vice versa. Liquidity in the system increases when OMO takes place in the form of the outright purchase of government securities and the repo operations, and vice versa when the OMO takes place in the form of the outright sale of the government securities and the reverse repo operations. With the ongoing LAF operations the RBI may ease the CRR for the banks.

2. BACKGROUND

Econometrics emerged as a distinct discipline in 1930s and gradually crossing the border of the social sciences entered the realm of computational finance and risk management in 1990s, where it churns laser generated data as also computer generated data apart from time series data like currency-exchange data. There are three broad categories of econometric analysis – (a) linear regression models, (b) time series models and (c) dynamic econometric methods. The time series models like the GARCH are widely used by the practitioners in the modeling of volatility. Practitioners also use analytical statistics, e.g. the probability distributions are used in computing the limits. In addition, a range of softwares based on Excel is used in constructing the yield curve.

Liquidity for a commercial bank means cash in hand, gold reserve, marketable securities and unencumbered government securities which are by large covered by the statutory liquidity ratio (SLR) requirement. In the forecasting of its liquidity requirement a bank needs computing skill in the case of the following components of the forecasting process: (i) forecasting the volumes of the liquid assets, the liquidity coverage ratio, the net stable funding ratio, the borrowing needs, the volumes of collateral, the premature deposit withdrawals, the variance analysis and (ii) the stress testing for the purpose of calculating the internal limits and developing a contingency funding plan. This is an exercise of analytical statistics involving fitting the field data with the appropriate probability distribution functions and then generating samples. These samples include the values of the variables during both the periods of stability and

stress. Alternative scenarios are formulated by putting these samples into analysis under a set of assumptions. In forecasting or designing the alternative scenarios, data mining is also used as a powerful tool. The results thereof are to be submitted to the regulator along with action plan in the case of any anticipated crisis.

Academics expressed the fear of superficial advices from the applied research and consultancy born out of blind application of software with an intention to quickly resolve the risk management issues in the banks.

Against the backdrop of intense liquidity crisis, wild volatility in the interest rates and spiraling inflation following one after another in the Indian financial system during the post-crisis period, this chapter would revisit the econometric models with the causality analysis used by the practitioners in the Central Bank and the commercial banks and also the way they are used.

3. MAIN FOCUS OF THE CHAPTER

3.1 Link between the RBI's Liquidity Adjustment and the Call Money Market

For controlling the demand for liquidity the RBI has introduced marginal standing facility (MSF) whereby a bank may borrow from the RBI at a rate 100 basis points higher than the repo rate although sometimes the RBI accommodates the excess demand for liquidity by allowing a second LAF, e.g. at the financial year 2011-12 ending on 31st March 2012 the second LAF was scheduled after the time of the normal LAF on the same day. With the LAF the RBI maintains stability in the overnight call money market. Thus the LAF helps the RBI to replace the reserve targeting with the interest rate targeting. The LAF is also considered to be a narrow measure of money supply and subject to some autonomous drivers of liquidity like the volume of currency with the public, the cash balance with the government and the foreign exchange operations by the private businesses, which are normally constrained by various monetary policy tool parameters of the RBI. There is enough room in the post crisis period for hypothesizing a positive feedback from the overnight call rate to the repo volume, i.e. when the former is down the LAF window remains in absorption mode and vice versa as per the Reserve Bank of India (2008). An observation of the daily/overnight call rates and daily net LAF, i.e. injection (+) or absorption (-) shows that towards the end of the financial year, the end of the month of March, call rates look up steeply and the amounts of liquidity injection are also at high levels. A sample of the same has been demonstrated in Figure 1 here for the period from June 1, 2011 to May 19, 2012.

On March 30, 2012 the call rate shot up by 324 basis points. In the last quarter of the financial year the liquidity-injection by the RBI goes up. For example during the entire second week of February 2012, the RBI injected daily four digit figures of liquidity in billion INR. Pairwise Granger causality test as described by Hamilton (1994) with 1 day lag shows that these variables Granger cause each other. The result is given in Table 1.

If we assume that on the one hand the Central Bank responds to the call rate of the previous night by manoeuvring the LAF and on the other hand a participant in the overnight call market responds to the tenor of LAF of the previous day, i.e. if LAF

Table 1. Pairwise Granger causality tests

Date: 11/01/12
Time: 19:42
Sample: 01-06-11 to 19-05-12
Lags: 1

Null Hypothesis:	Obs	F-Statistic	Probability
DCR does not Granger Cause NLAF	251	9.91277	0.00184
NLAF does not Granger Cause DCR		9.24816	0.00261

has injection mood it will report multiple positive figures on a particular day or positive figures for a number of days successively. In terms of Hamilton (1994) if a particular observed series of daily call rate (DCR) Granger-causes net LAF (NLAF) one should use auto-regressive specification and test the null hypothesis H0: DCR does not Granger cause NLAF. With this view in end, here the lag period (p) is specified to be one. This period may be extended to two, three and so on depending upon the circumstances. For $p = 1$, the auto regressive relationship from the Central Bank view point may look like DCRt = a + b NLAFt-1 + g DCRt-1 ut, where u is the residual, *'a'* is intercept and *'b'* and 'g' are slope coefficients. After estimating above proposed relationship with OLS (ordinary least square technique), one need to calculate the residual sum of squares RSSfor p=1 = $\sum$t=1, 2,…...,T-1 ut2, when sample size is T and compare the result with a univariate auto-regression of DCR using F-Test at the recommended 5% level of significance. If the computed F value exceeds the table value of F, H0 is rejected. Similarly from an overnight call money market participant's view point one can test the null hypothesis H0: NLAF does not Granger cause DCR. If both of the above null hypotheses are rejected for the same sample one may be sure about existence of bidirectional causality between NLAF and DCR. To see the status of causality between DCR and NLAF for a period which does not contain the financial year end like from May 29, 2012 to October 30, 2012, the 5% F-Test is conducted and the result comes up to be little different. H0: DCR does not Granger cause NLAF is rejected at 5% F-Test here. The result is given at Table 2.

Table 2. Pairwise Granger causality tests

Date: 11/29/12
Time: 12:33
Sample: 29-05-12 to 30-10-12
Lags: 1

Null Hypothesis:	Obs	F-Statistic	Probability
DCR does not Granger Cause NLAF	102	1.07035	0.30339
NLAF does not Granger Cause DCR		8.67137	0.00403

This means the RBI was not much concerned about the systemic liquidity conditions when financial year end is not nearing.

Comparison between the level graphs Figure 1 and Figure 2 of NLAF and DCR for the periods from June 1, 2011 to May 19, 2011 and from May 29, 2011 to October 30, 2012 respectively here reveals that in the vicinity of financial year end the peak is by and large higher than the preceding one but when the financial year end is a distant future, every peak is by and large lower than the preceding.

Table 3 furnished the result of cointegration exercise between NLAF and DCR during the sample period including the financial year end.

Table 3 demonstrates long term equilibrium and non-spurious relationship between above variables in line with Granger (1986) quoted by Gujarati (2003).

The LAF repo rate is the floor of the delivery of the excess reserves by the RBI to the banks. In presence of a continuing liquidity surplus the LAF causes emanation of a distorted interest rate structure across the economy. Similarly in presence of a continuing liquidity crunch MSF rate works as the ceiling and helps the RBI keep the interest rate structure under its control. This is a part of the RBI's liquidity management operations process of overseeing that the functioning and the flows of the financial as well as real markets are not affected by the systemic liquidity fluctuations.

Ferhani (2005) took note of liquidity management by the Central Banks of the developed countries followed by their emerging economy counterparts with the monetary policy implementation in 1970s as a measure of the direct control and later their shift towards the reserve money management. The direct control was lost because of the distribution of resources by the financial markets and increasing number of non bank intermediaries. In the interest of efficiency

Table 3. Pairwise Granger causality tests

Date: 11/29/12
Time: 12:57
Sample: 6/01/1911 5/19/2012
Included observations: 247
Test assumption: Linear deterministic trend in the data
Series: NLAF CDR
Lags interval: 1 to 4

Eigenvalue	Likelihood Ratio	5 Percent Critical Value	1 Percent Critical Value	Hypothesized No. of CE(s)
0.104134	32.58496	15.41	20.04	None **
0.021719	5.423698	3.76	6.65	At most 1 *

*(**) denotes rejection of the hypothesis at 5%(1%) significance level
L.R. test indicates 2 cointegrating equation(s) at 5% significance level

and growth the market forces were being allowed to allocate resources.

The link between liquidity management for a bank and the same for the Central Bank is the possibility that liquidity problem of one bank can have repercussions on other banks and hence may spread over the system.

3.2 Liquidity Risk Management Process in a Bank

The Central Bank of a country takes care of the interest of the depositors as also the lenders. Because the liquidity risk arises out of the potential asset liability volume mismatches across the maturity structure - as discussed above, the RBI circulates guidelines from time to time about how to manage such mismatches and also warns the banks from time to time whenever it feels such mismatches to be in an alarming magnitude and may lead to systemic liquidity risk, e.g. in the last week of January 2011 the RBI warned banks against the fast shortening deposit maturity vis-à-vis the lending terms especially in the infrastructure lending. This risk is known to be the funding liquidity risk.

The LRM in a bank as per the RBI is the first and foremost component of asset liability management (ALM), for, even the cash equivalent assets held by the banks at the instance of the RBI as SLR like government securities and treasury bills may depreciate in a financial crisis. Hence liquidity risk is another form of market risk, where all market participants are willing to offload their portfolios or the secondary market is lacking requisite depth to absorb them. This is also called market liquidity risk. As guidelines on LRM for the ALM purpose, to begin with within Basel I frame, much before the 2007-08 crisis, the RBI suggested in 1999 the banks to report (a) the statement of structural liquidity having two components – (i) total outflow in eight different time buckets and (ii) total inflows in these buckets and the statement of Gap between the rate sensitive assets (RSA) and the rate sensitive liabilities (RSL). A decrease in the market rates of interest may lead to premature closure of the RSA whereas a hike in the same may lead to the higher interest payments on the RSL. Both these phenomena may cause a surge in the outflows. In 2012, as a part of implementing the Basel III guidelines the RBI asks the banks to measure liquidity with the two approaches – the stock approach and the flow approach. The concept of 'stock' has been explained in contrast with the concept of 'flow' in Bank Management Literature by Vento and Ganga (2009). Balance sheet items like 'Balances with banks and money at call and short notice' and 'advances' are called the stock items in the sense their figures are enumerated for

a particular financial year with a single numerical value for every variable whereas the items in the structural liquidity statement like 'term deposit' within the maturity bracket of 29 days to 3 months and 'tier II bonds' within the maturity bracket of over 1 year and up to 3 years in a format similar to different fund flow statements for different maturity buckets aggregated into a single one are called the flow items. These approaches emerged in the circumstance where the pre-crisis period liquidity risk models were reported by the same to have failed to track the tailed events. Prior to the Basel III, the flow approach calls for the structural liquidity statements as discussed above but bifurcated into two components – one for the domestic operations and another for the offshore operations. But in Basel III, the structural liquidity statements have three more components based on combined onshore and offshore operations, foreign country wise operations and consolidated operations including aforesaid four components.

At the Board level a bank need to declare the liquidity risk appetite of the bank, i.e. the magnitude of liquidity risk the bank is willing to bear. The Federal Reserve Bank of San Francisco has given an example of above magnitude – the proportion of debt obligation not funded yet.

3.3 The Liquidity Issue Regarding Fixed Income Products

In India banks hold in their investment portfolio treasury bills and long term dated government securities (G-sec) within and beyond the SLR requirement stipulated by the RBI. If the fair price (to be denoted by 'price' in this context) of a security is considered to be proxy for liquidity, in a situation where the security is selling at premium, as the security approaches towards maturity, both the maturity and the price have to decrease and duration decreases and vice versa. Duration means the sensitivity of the price of the security towards fluctuation of the benchmark rate (Grandville, 2001). Longer the distance of the security from maturity, the larger is the duration value and vice versa because a larger number of coupons are due and not paying more than yield. As an example is picked up from CCIL (2012) the security 8.33% GOVT.STOCK 2026, traded with the maximum volume on November 30, 2012. Figure 3 here shows that other things remaining the same, as the maturity decreases over time, but price is increasing initially because of the lingering excess demand attributable to the liquidity premium theory and then decreases from January 13, 2013. The reader may herself check that the duration of the above security starts falling after remaining constant till the second week of July 2013 because of the combination of coupon and yield unique to itself other things remaining unchanged.

On the other hand the security 8.15% GOVT. STOCK 2022 experiences a decreasing price with a decreasing maturity because it is paying a less coupon than does the yield or alternative return – then the holders of this security like to dispose it in lieu of incurring interest loss for next nine years of remaining maturity (Figure 4 here). The reader may check that the price starts increasing in the third week of March 2013 other things remaining unchanged.

The former security is more liquid because it will be paying a higher coupon for a longer period. Here the term 'duration' may be interpreted as the period within which the dirty price of the security would be recovered by the buyer.

3.4 Liquidity Risk Management by the Central Bank

In a country like India, where the banks are increasingly involving the international operations, the Central Bank, as a part of the systemic liquidity management, needs to engage in the cross border coordination, interventions in the banks' money market operations and the foreign exchange derivatives dealings by the banks, and adjustment in its liquidity operations. In India the RBI on behalf of the government *de facto* guarantees the

bank debts, but does not buy the distressed assets against the suggestion from the International Monetary Fund (2010). The same also prescribed a systemic view of liquidity management instead of a bank-centric view.

Since some select simple and weighted addition formulae of the diverse components of money supply are considered by academics as measure of liquidity also and liquidity crisis is deemed by the same as another version of monetary instability, the line of distinction between the systemic LRM policy and the monetary policy must be very thin. Though there was reportedly a hot but academically rich debate between the banking economists inside and outside the RBI during the pre-reform period around the applicability of balancesheet approach vis-à-vis multiplier regarding the RBI's arriving at a agreeable measure of the money supply, in the monetary policy operations the RBI stance was chronologically the reserve money targeting because of its perceived limited efficacy of money multiplier, after emergence of the new Keynesian ideas described by Goyal (2011), interest rate targeting and recently call rate targeting. The call rate targeting is keeping in view the systemic LRM also.

3.5 Forecasting Liquidity for a Bank

The literature on liquidity forecasting by a bank from academic perspective is in a nascent stage and yet to appear in public in its full fledged form. Every bank has their economists who perform the job of forecasting. Depending on the technological sophistication and human expertise level of the bank, the nature of forecasting and the softwares used varies from bank to bank because the choice of forecasting methodology is left to the banks in India – there is no guideline or regulation of the same.

To start from the scratch, let us consider the ANNEXURE - I of the first ALM guideline of the RBI circulated in February 1999. Liquidity forecasting for a bank means the forecasting of the variables appearing in the columns with the titles 'INFLOWS' and 'OUTFLOWS'. This requires collection and compilation of daily data on these variables by the concerned bank. Since these data need not be public as per the extant financial disclosure norms, for academics it is not possible to access the same. But periodical aggregate figures of these variables are published by the RBI.

As per the most general academic notion, forecasting methodology is of two types – (i) qualitative and (ii) quantitative. In dire paucity of quants in the bank, qualitative method is used based on the experience and the acumen of the senior executives. The quantitative forecasting of above variables comprises use of one or a combination of the following frameworks:

1. Classical bi-variate or multi-variate regression models involving time series data of policy/independent variables and target/ dependent variables,
2. Time series econometric models built up exclusively for time series data like auto regression, moving average, auto regressive moving average (ARMA), auto regressive integrated moving average (ARIMA), autoregressive conditional heteroskedasticity (ARCH) and generalized autoregressive conditional heteroskedasticity (GARCH),
3. Hendry's General to Specific Method and
4. Bayesian Framework.

These are all for detecting causality between the target variable on the one hand and on the other hand policy variables, own lagged values of the target variable or a combination of the two and then performing simulation to check whether the estimated causality reproduces the past behaviour of the target variable described in Pindyck and Rubinfeld (1998). Above exercises could be performed either in a spreadsheet with Analysis Value Pak or using software like Eviews® version 7 or TSP® version 4.5 with looking glass interface. Automaticity into the functions

in a spreadsheet may be inserted into the above models. Above models have limitation that they do not forecast extreme or stress events. But the bankers need stress testing for different purposes like understanding the daily changes in 10 year government securities yield in the stock dealing desk or in the risk management desk quantifying market risk described in Das (2010).

After J P Morgan popularized value at risk (VaR), practitioners started ascertaining the probability distribution of the target variable and generate samples using the distribution parameters. There are three types of VaR:

1. The normal VaR,
2. The historical VaR, and
3. The simulated VaR.

The normal VaR is computed using the features of normal distribution based on a confidence interval in the daily change of a variable like premature withdrawal during the sample period of, say, 1000 business days, with probability, say, 99%. This gives an estimate of the maximum withdrawal amount during the sample period. The historical VaR is computed by arranging the sample data in an ascending or a descending sequencing, calculating percentile of each figure and then spotting the one with, say, 99% or 99.5%. Suppose there are 1000 sample points. After arranging them in the above mentioned style, we need to locate the fifth largest value of the daily change and then need to multiply it with the exposure value in order to obtain 99% VaR. In order to generate the simulated VaR the first step is to fit the sample in fitting softwares like Easyfit® and run it. Check the probability distribution, note the values of the mean and the moments and using the same run several, say, 100 rounds of simulation in order to generate alternative samples. From each sample compute 99% VaR using both of previous two methods. Then choose the maximum of these. This is to remember that after fitting the data in above software the probability distribution often comes out to be other than the normal distribution like, the lognormal distribution.

Before feeding into any model, the time series data needs filtering from the outliers and the property of non-stationarity. Otherwise regression parameters may not be significant or may be spurious. Non-stationarity most of the times is detected with the unit root tests and removed with the differencing of order 1, 2 etc. Any reliable results from the regression analysis call for both the regressor and the regressand to be non-stationary or stationary of the same order. If regression between two variables of same order of integration, i.e. non-stationarity provides robust adjusted $R2$ and t values, these variables are said to be correlated. All the methods revolve around the least square method or alternatively the maximum likelihood method.

3.6 Forecasting Liquidity for the Central Bank

The Central Bank should be ready to prevent or take an immediate action against the eruption of any liquidity crisis, for, the liquidity crisis may convert into a solvency crisis. In the process, as described by the Money Market Contact Group (2009), the Central Bank needs to oversee the payments system and capture the common liquidity risk factors across banks.

Forecasting the macroeconomic liquidity by the Central Bank follows definition and measure of the same. In India the first hint of the link between the concepts of liquidity vis-à-vis money dates back to Bhole (1987). There was elaboration on the same in the Working Group on Money Supply (1988). Keeping in view the property of 'moneyness' or liquidity of certain instruments which compete with money the Working Group on Money Supply (1998) reduced the difference between the broadest measures of money and liquidity having compiled the liquidity aggregates by including the liabilities of the post office savings banks and the non-bank financial institutions with

the liabilities of a specified number of financial institutions, and excluding certain non-money instruments from the measure of broad money. Since the above liquidity measure is subject to a number of autonomous factors and the repo rate is a policy variable which the RBI cannot change daily, the RBI needs to operationalize the liquidity mismanagement by steering the call rate. At this juncture a number of studies during the period 2009-2011 tried to explore the genesis of liquidity conditions in the factors driving violations of the following four arbitrage relationships –

1. The covered Interest Parity,
2. The CDS-bond basis for non-bank corporations;
3. The on-the-run U.S. Treasuries versus the off-the-run U.S. Treasuries, and
4. The interest rate swap spread and the constructed systemic liquidity risk index (SLRI) based on these violations- described by Severo (2011).

His findings which are applicable to India are the SLRI varies directly with the net stable funding ratio and the SLRI affects inversely the volatility of the bank stocks. In India a study by a group of RBI economists - Mishra, Mohan and Singh (2012) made a similar attempt after a year to construct the systemic liquidity index (SLI).

They reported that (i) the SLI encompassed the major components of the financial markets like the banking sector in the form of a difference between call and repo rates, the corporate sector in the form of a difference between the commercial paper rate and the certificate of deposit rate, the foreign exchange market in the form of the implied deposit rate and the expectations about the liquidity conditions in the form of the steepness of the overnight index swap curve, (ii) the variance-equal method is found to be the most appropriate relative to other methods in the Indian context, (iii) the liquidity condition has impact on return on bank stocks, (iv) the LAF has impact on the SLI and (v) the SLI varies directly with the credit growth vis-à-vis the deposit growth. But DEPR (2012) did not perform contingency claim analysis, the valuation of the implicit liquidity guarantees and the computation of the liquidity insurance premium because these do not apply in India.

Their liquidity indicators were (i) the weighted average call rate (WACR) minus the RBI repo rate, (ii) the three month commercial paper (CP) rate minus the three month certificate of deposit (CD) rate, (iii) the three month CD rate minus the three month implied deposit rate, and (iv) the WACR minus the three month overnight indexed swap (OIS) rate. The RBI in its database on Indian economy stores above data for free distribution to the public.

Following are problems with the data on above variables:

1. The RBI repo rate varies over specified periods, not daily, i.e. since April 18, 2012 it is 8% till the date of submission of this chapter in November 2012. For any sample lying within this period, the variance of above rate is nil and the standard normal method of the SLI computation comes to a halt here.
2. The RBI provides weighted average rates of the CPs, not for the specific three month maturity.
3. Because the volume of the overnight call lending is the maximum on any business day compared to all other maturities the WACR is tilted towards the overnight call rate and hence it is inconsistent to adjust the WACR for the three month OIS rate.

3.7 Forecasting Bond Liquidity

In the context of the securities market the bid-ask spread may be viewed as a proxy for the illiquidity of a security (Chacko, Das, and Fan, 2010). In this study the line of distinction between an investor and a market maker vanishes when the

limit orders by the investors fall within the bid-ask quotes of the market makers. It compares the bid quotes and the ask quotes for buying and selling an exchange traded fund (ETF) of bonds to a call option and a put option respectively with the exercise prices at the net asset value (NAV). So whenever a transaction is taking place, this study proposes that, one of the options has a non-zero value. This value represents the illiquidity. He devised a very handy formula of the illiquidity measure of the above ETFs which is likely to appeal to the Indian bankers, barring a few, the most of which are not quants, once the bond ETF market develops.

3.8 Liquidity Adjusted Value at Risk

Keeping in view that the risks associated with the market illiquidity have not been effectively incorporated into the VaR models the most emerging markets are less than perfectly liquid and many securities cannot be traded with an ease in the markets of the emerging economies like India having been subject to the process of the financial sector reform and deepening *pari passu* with a series of liquidity crises since summer 2004, Roy (2004) attempted to construct a liquidity adjusted value at risk (L-VaR) model that incorporates the liquidity risk in the VaR models. He tested the performance of L-VaR model *vis-à-vis* existing VaR models and finds that in the Indian context the liquidity risk is an important component of the aggregate risks absorbed by the financial institutions. While surveying the academic literature on L-VaR he enumerated following six approaches:

1. Ad-hoc Approach,
2. Optimal Liquidation Approach or Transaction Approach,
3. Liquidation Discount Approach,
4. Exogenous Liquidity Approach,
5. Market Price Response Approach, and
6. Intraday Liquidity Risk Approach.

Having critiqued above models for their implementation problems, he found a modified version of the exogenous approach put forth by Bangia, Diebold, Scheurmann and Stroughair (1999) to be suitable in the Indian context. The following facts raise question of implementation of this approach:

1. Bangia, Diebold, Scheurmann and Stroughair (1999) applied their approach to compute the L-VaR of the foreign exchange.
2. Roy (2004) applied this approach to the coupon paying dated government securities for the period 2003-04.
3. Currently the RBI keeps the information about only treasury bills regarding bids received and bids accepted in the public domain, i.e. the weekly statistical supplement and the RBI Bulletin. The link www.nds.rbi.org.in mentioned at the end of Table 3 in Roy (2004) does not exist now and perhaps is replaced by https://www.ndsind.com/accessible only by member institutions via login with username and password.
4. The RBI does not yet ask the banks and financial institutes to compute L-VaR.

4. RECOMMENDATIONS

1. The banks may form a liquidity policy separately for the period when the financial year end is coming near, e.g. the last quarter of the financial year and other three quarters after ascertaining the nature of the link between the LAF and the call rates.
2. The RBI should make the bid and ask spread available to the public for each dated security traded. This would assist the academia to work on the L-VaR.
3. Though the RBI does not make it mandatory for the banks to compute the L-VaR, but nevertheless they may do it for specific securities as well as for the G-Sec portfolio

with a view to managing the market risk capital charge.

4. The Association of Mutual Funds in India should compute the liquidity risks of the ETFs for the benefit of both the investors and the regulators.

5. FUTURE RESEARCH DIRECTIONS

A behavioural study of the daily volumes of the deposits to and the withdrawals from the commercial banks may be performed by the academia if the banks publish data on these variables in the public domain since the links between the cycles of the deposits and the withdrawals by the different sectors of the industry on the one hand and on the other hand systemic shocks like oil price hike and the rise in non-performing assets may be explored via an econometric modeling with the appropriate dummy variables.[1]

6. CONCLUSION

Against the backdrop of the evolution of the macroeconometric models involving time series data and the compatible softwares used by the official economists as also the independent researchers, this chapter discussed the application of some of above to the liquidity forecasting as a part and parcel of liquidity management by banks, the financial institutions and the regulators. It distinguished between the concepts of liquidity and the practices of liquidity management from the separate angles of the banks and the Central Bank. It picked up the time series samples from the different parts of the financial year and analyzed the relationship between the market liquidity and the Central Bank's monetary operations in India. It examined the important studies on modeling liquidity and the liquidity risk for exploring their applicability in India and accordingly made certain recommendations. Finally it suggests the way to study the behavioral aspects of withdrawals from and deposits into the banks such as to strengthen their liquidity management policy.

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KEY TERMS AND DEFINITIONS

Basel III: Stronger norms than Basel II in terms of liquidity and capital.. Standards and regulations designed by Basel committee on Banking Supervision (BCBS) regarding market risk and capital to be set aside as cushion against market and credit risk. Basel I focused on credit risk.

Basis: Basis means difference between spot rate and forward rate in the derivatives literature. In asset management liability literature it means the intra-bucket spread between asset rate and liability rate.

Call Money: Unsecured short term interbank loan.

Dirty Price: Clean price plus broken period interest. Clean price means present or fair value.

Duration: When interpreted as percentage of price, it means sensitivity of the fair price of a bond towards fluctuations in the benchmark rate like 10 year government securities rate. When interpreted in terms of number of years it means the period of recovery of security price. Duration is more popular for academicians but for practitioners modified duration is more accepted with similar interpretations.

Econometrics: Application of Statistics in Econometrics.

Fair Price: Present value of all the future cash flows from the security discounted with the rate of return or opportunity cost of capital available from an alternative avenue of investment. If market price is different than fair price, arbitrage makes them equal. The concept originated from Marginal Efficiency of Capital (MEC) propounded by Keynes.

***F*-Test:** A test to examine whether any significant regressor is omitted in the regression equation.

Inflation: Rise in prices, normally measured in terms of wholesale price index (WPI).

Null Hypothesis: Normally a statistical relationship under inquiry into its very existence. Null hypothesis assumes the relationship does not exist. Alternative hypothesis assumes the relationship exists.

Liquidity: Ability to procure cash without incurring any premium.

Liquidity Adjustment Facility (LAF): A monetary policy tool of the Central Bank to have reign on systemic liquidity.

Ordinary Least Square (OLS): The most basic but the widestly accepted tool of statically estimating relationship s between variables. Different modified versions of OLS are found in almost all econometric models.

Rate Sensitive Assets (RSA): Floating rate loans, floating rate bonds etc, are examples of RSA. Fixed rate products are non-RSA.

Rate Sensitive Liabilities (RSL): Floating rate deposit is an example of RSL. Fixed rate deposit is an example of non-RSL.

Repo: Repurchase agreement between banks and the Central Bank.

Tail: The left end of the graph of normal probability distribution denoting extreme losses as happened to big US banks during the sub-prime crisis.

Simulation: An exercise of generating samples with pre-specified properties, expected to repeat historical behaviour of the variable under consideration.

Solvency: Excess of assets over liability in the balance sheet.

Structural Liquidity: Maturity wise statement of inflow and outflow of cash to be prepared by banks for reporting to the Central Bank as a part of asset liability management.

Value at Risk (VaR): The amount of the largest loss in the market value of the investment portfolio with a probability of say, 99% or 99.5%. It is a measure of market risk.

ENDNOTES

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Chapter 53
An Investigation into the Risk of Construction Projects Delays in the UAE

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ABSTRACT

The growing rate of delays in project delivery is considered a major criticism of the construction companies in the United Arab Emirates (UAE). This paper aims to investigate the causes and effects behind the delays pertaining to delivery of construction projects in the UAE. The study is exploratory in nature, and incorporates a pilot questionnaire survey and interviews. An extensive literature review indicates potential factors that have possible effects on construction completion delay. The questionnaire forms were sent to 50 construction companies. Thirty-five (70%) completed responses were received. Analysis of the survey data has revealed that about 42 potential causes and effects of delay relate to various groups of stakeholders. The results show the top fifteen factors relate to clients, project managers and finance aspects. It was found that cost and time overruns are the most significant effects. These results are in partial agreement with previous studies. The paper argues that the key determinant in ensuring project control is on-time project delivery. The results of the study can provide moderate support for a suggested hypothesis, through a framework of project success factors. It should be of high concern to knowledge managers in various roles and decision-makers.

INTRODUCTION

Construction delay is ubiquitous in construction business, as well as being one of the most common risks to project success. This phenomenon largely overlaps the roles and interests of various project stakeholders in a multicultural society. Construction delay can be defined as the time overrun either beyond the contract deadline or beyond the date on which the parties agree upon for the delivery (Assaf & Al-Hajji, 2006). Project success is considered to have been achieved when

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it is completed within time, cost, on specification and to stakeholders' satisfaction (Majid, 2006). Delay is considered a frequently recurring problem in many developing countries, especially those that have grown so quickly despite the recent financial crisis, for example, the UAE construction sector (Faridi & El-Sayegh, 2006; Motaleb, 2009).

Many researchers have classified the causes of construction project delay by stakeholders in groups like clients, contractors, consultants, project managers, resources (such as labor, materials, equipment), external and financial/economic factors (Odeh & Battaineh, 2002; Ahmed et al., 2003; Assaf & Al-Hajji, 2006; Faridi & El-Sayegh, 2006; Motaleb, 2009). The literature is extensive on this phenomenon. An investigation into selected global research in Table 1 has supported the way forward and future work for UAE construction projects. They have been classified into public and private sectors according to causes of group/ category. It is reported as full/partial agreements beyond the studies, between 2000 -2010 to identify gaps in knowledge.

Table 1. Summary of global research (2000-2010)

No	Research	Project	Factors (Groups) causing delay	Effects of delay
1	Al-Momani, (2000)	Public buildings, (Jordan), **Public sector**	Designer, External, Finance, Client, Contractor	Time overrun
2	Noulmanee et al., (2000)	Highway construction, (Thailand), Public sector	Resources, Designer	Time overrun
3	Elinwa and Jashwa, (2001)	Public works (Nigeria), **Public sector**	Finance, Resources, Designer, Project Manager, Contractor, Government	Time &cost overrun
4	Aibinu & Jagboro, (2002)	General construction (Nigeria), **Private and Public sectors**	Client	Time & cost overrun
5	Ellis and Thomas, (2002)	Highway (USA), **Public sector**	Project Manager, External, Contractor, Designer	Time overrun
6	Manavazhia & Adhikarib, (2002)	Highway (Nepal), **Public sector**	Resources	Time overrun
7	Odeh & Battaineh, (2002)	General construction (Jordan), **Public and private sectors**	Client, Resources, Project Manager, Contractual, External, Consultant	Time and cost overrun
8	Ahmed et.al., (2003)	Building Project (Florida, US), **Private sector**	External, Client, Designer, Consultant	Time & cost overrun
9	Frimpong & Oluwoye, (2003)	Groundwater Construction(Ghana), **Public sector**	Finance, Contractor, Resources	Cost overrun
10	Choudhury & Phatak, (2004)	Commercial construction projects, US	Client, Contractor, Finance, Design	Time overrun
11	Koukshi et al., (2004)	Residential (Kuwait)	Resources	Time &cost overrun
12	Sun et al. (2004)	Construction projects (UK)	Client	Time &cost overrun
13	Acharya et. al., (2005)	Building project(Nepal)	Resources, External, Contractor	Time overrun
14	Koushki, (2005)	Residential (Kuwait), **private sector**	Client, Finance, Contractor, Resources	Time & cost overrun

continued on following page

Table 1. Continued

No	Research	Project	Factors (Groups) causing delay	Effects of delay
15	Wiguna &Scott,, (2005)	Buildings projects (Indonesia), **Private sector**	Finance, Client, Designer, External, Contractor	Time & cost overrun
16	Abdu-Rahman et. al., (2006)	Construction Project(Malaysia),	Finance, Resources, Client	Time overrun
17	Aibinu & Odeyinka, (2006)	Residential &offices (Nigeria), **Public** and **Private sectors**	External	Time & cost overrun
18	Assaf & Al-Hejji, in (2006)	Construction project(Saudi Arabia),**Public and Private sector**	Client	Time overrun
19	Faridi & El-Sayegh, (2006)	Construction Project (UAE),**Public** and **Private sector**	Consultant, Project manager, Client, Resources	Time overrun
20	Fong et al., (2006)	Building construction, fire installation (Hong Kong), **Private sector**	Project manager, Client, Governmental	Time overrun
21	Othman, (2006)	Public project (Malaysia)	Contractor	Time overrun
22	Zaneldin, (2006)	Different 124 claims of Const. projects, (UAE), **Public and Private sector**	Contractual	Time overrun
23	Alaghbari et al., (2007)	Building Construction Project (Malaysia)	Financial, Project Manager	Cost overrun
24	Sambasivan and Yau (2007)	Construction projects (Malaysia)	Contractor	Time &cost overrun
25	Abdel-Razek et al., (2008)	Building construction (Egypt) – **Private** and **Public**	Contractual, Financial, Client	Time overrun
26	Long L.H., (2008)	Construction project (Vietnam)	Project Manager, Resources, Designer, Financial, Governmental	Time & cost overrun
27	Sweis et al, (2008)	Residential projects(Jordan),**Private sector**	Client, Finance, Contractor, Resources, Project manager	Time &cost overrun
28	World Bank Iraq Trust Fund, (2008)	Schools and Rehabilitation (Iraq), **Public sector**	Governmental, Financial, Contractual, Resources	Time &cost overrun
29	Kaliba et. al., (2009)	Road construction (Zambia)	Financial, Designer, Project manager	Cost & time overrun
30	Motaleb,(2009)	General construction (UAE), **Public and Private sectors**	Client, Project manager, Finance	Time &cost overrun
31	Tumi et. al., (2009)	Construction project (Libya), N/A	Project manager	Time &cost overrun
32	Abdul-Rahman et. al., (2009)	Construction project (global study)	Finance	Time &cost overrun
33	Asnaashari, E. et al., (2009)	Construction Projects (Iran), **Public and Private sectors**	Resource, Governmental, Financial, External	Cost overrun
34	Enshassi et al., (2009)	General Construction,(Palestine), **Public and Private sector**	External, Resources, Financial, Contractor	Time &cost overrun
35	Al-Nuaimi, A., et al.(2010)	Building construction project(Oman), **Public and private sectors**	Client, Contractual	Time, & cost overrun, Disputes
36	Khoshgoftar, et al., (2010)	Construction Projects (Iran), **Public and Private sectors**	Financial, Project Manager, Contractual	Time overrun
37	UN Development, (2010)	Construction projects, schools (Iraq), **Public Sector**	Governmental, External	Time overrun and dispute
38	Yang, J., (2010)	BOT projects in Public Construction (Taiwan)	Contractual, Finance Governmental.	Postponement of BOT projects

Causes of Delay

The causes are grouped into 10 categories, relating to various stakeholders and factors, namely, i consultant, ii contractor, iii client, iv project managers, v financial, vi resources, vii contractual, viii governmental, ix designer, and external factors. This has encouraged the authors to outline the abstract of causes, to build the foundation of the methodology of construction project delay in the UAE and has helped in the development of a questionnaire.

As shown in Table 1, we exposed the most significant causes of delays in different periods of time and defined them geographically. Investigation into project sectors has been considered, as well as public and private sectors. Some interesting observations have been raised in the risks of delay in construction projects, to analyze the outcomes from each category-related delay. Each category has been highlighted with either low or high exposure, and the most significant factor is related to the *Client,* by excessive change orders, lack of experience and slow-decision making (Al-Momani, 2000; Odeh & Battaineh, 2002; Aibinu & Jagboro, 2002; Ahmed et al., 2003; Koushki, 2005). This view is supported by Wiguna and Scott (2005), Abdu-Rahman et al. (2006), Assaf and Al-Hejji (2006), Faridi and El-Sayegh (2006), Fong et al. (2006), Sweis et al. (2008), Motaleb (2009), and Al-Nuaimi et al. (2010). The next significant factor is financial problems, possibly coinciding with the recession, such as poor cash flow and funding programme constraints, payments delays, and debt problems that are related to the economic situation (Alaghbari et al., 2007; Sweis et al., 2008; Long, 2008; World Bank Iraq Trust Fund, 2008; Motaleb, 2009; Abdul-Rahman et al., 2009; Asnaashari et al., 2009; Kaliba et al., 2009; Khoshgoftar et al., 2010; Yang, 2010). Project managers can be the cause of time delays, in terms of poor planning, poor coordination, site management, inadequate time estimation and lack of team communication (Elinwa & Jashwa, 2001; Odeh & Battaineh, 2002; Fong et al., 2006; Faridi & El-Sayegh, 2006; Alaghbari et al., 2007; Sweis et al., 2008; Motaleb, 2009; Tumi et al., 2009; Kaliba et al., 2009; Khoshgoftar et al., 2010).

A research proposal has been developed along the lines of Morris's work (1994), who considered construction as an industry that should be placed in project management methodologies at various life-cycle stages as a *mature user*. The previous research shown in Table1 highlights different projects that have dealt with different views, such as the cases of socially related effects of construction delays on the investors/developers, or any other stakeholders. The perspectives have been built up depending on the nature of each country. Therefore, differences in factors involved in the delays would explain the reason why the same projects could be considered successful by one factor and unsuccessful by another one. The criteria of project success should be considered according to different cultures and environments. For example, causes of delays in the USA were due to improper project management in relocations, procedures and fund programmes (Ellis & Thomas, 2002). In the UK, it is reported that the changes due to excessive changed orders by the client, add to delays (Sun et al., 2004).

In Ghana, monthly payments, poor contract management, material procurement, poor technical performances, and escalation of building material prices have been identified as the most important factors responsible for time and cost overrun (Frimpong, 2003). Long et al. (2008) reported that incompetent project teams, poor designers and estimations, and management problems related to site and procedural techniques have all been identified as major causes of delay in Vietnam. Koushki et al. (2005) found that the financial difficulties, changing orders, insufficient experience of clients and contractors are the main delay factors in Kuwait. Assaf and Al-Hejji, (2006) identified similar causes in Saudi Arabia. Fong et al. (2006) identified the factors of delay in Hong Kong as being due to project managers (site-co-

ordination) and clients, slow decision making and government inspection, this is in partial agreement with causes of delay in Malaysia (Sambasivan & Yau, 2007). Sweis et al. (2008) concluded that inadequate planning, scheduling and financing by contractors, and changing orders by clients, were found to be the main factors causing delay in Jordan. Therefore, similarities and differences in the causes of delay can be seen, and this paves the way for more advanced research.

Effects of Delay

Construction delay has an adverse impact on the project's ultimate success in terms of time, cost, quality and safety (APM, 2006; Arditi & Pattanakitchamroon, 2006). In addition, the most important effect that should be observed on the success criteria of the project, are the degree of influential variables that are related to the decision-making and variations/change orders made by the client, causing time and cost overrun, as well as other related factors (see Table 1).

Empowerment of stakeholders' decision making has been encouraged previously in different environments in project management, but it is limited under project management authority. It is more valuable for stakeholders to set their goals and keep inventories, as such managerial functions and effective plans can be born from motivated stakeholders. Moreover, project completion on time and budget within specification (Barber & Warn, 2005) are other measures of success criteria.

Effect of Knowledge Management

Significant historical information and knowledge has been used to improve decision-making and the outcomes of project control (Albino et al., 2002).

Variations/change orders by clients increase projects delays, as do those by contractors or other stakeholders, due to a number of reasons, as identified in the literature. Therefore, the construction stakeholders have to think about the nature of these problems, using analytical approaches and case studies. Some efforts have, more recently, stated the importance of a project delay analysis approach, for example, analysis of particular time periods during the project (Theodore et al., 2009). Project managers can benefit from the outcomes of such analysis by more effective multiple baselines and resource allocation in project delay analysis (Menesi, 2007).

In fact, there is a moderating effect on the relation between knowledge management of IT and project success (Yang et al., 2011). Arain (2005) secured the base of knowledge management during the earlier stages of a project life cycle, which means the greatest requirement for effective management of variations/change orders. Therefore, having the right technology can help the project manager to get a better project life-cycle and effective decision-making to consider whether investors are willing to proceed on the business. Furthermore, due to any responding changes the organizations' methodologies and procedures have to be supported by experts in how to manage the project rather than what has gone wrong (PMBOK, 2004).

Effects of the Financial Crisis

With reference to the construction projects situation in the UAE, and particularly in Dubai, it was published that many stakeholders have been affected by the state of project delays, the contractors and clients, the majority of them being affected by the current financial crisis (Elweshahy, 2008). As a result, clients are not able to deal with the due payments and many projects have been cancelled or postponed (Brendel et al., 2010). The effects of construction delays; however, are not confined to clients, contractors and construction companies, but could influence the overall economy of a country such as the UAE, where the construction industry plays a major role in its national development and contributes 14% to gross domestic product (GDP). This is a common

occurrence worldwide, compared with the UK which contributes about 10%, and Singapore, Malaysia, Korea, New Zealand, Australia, and India contributing 3-8% (Low et al., 2009).

In the UAE, both the national and foreign investors persist to encourage people with attractive incentives to invest in their respective properties. This investment trend has generated a bubble in the construction sector, which was then severely affected by the global financial problems of 2008-2009. Moreover, the expansion in construction and infrastructure resulted in an increase in the number of the immigrant workers and expatriate population in a very short time (Abu Dhabi Chamber of Commerce and Industry, 2009).

Faridi and El-Sayegh (2006) revealed that about half of construction projects in the UAE had encountered delays. Motaleb (2009) found that the number of construction projects encountering delays increased by about one fifth in 2009. Despite the time and cost overruns there are still a huge number of construction activities in the country. According to a recent investigation into the current and future state of the construction industry in Dubai, more than half of the construction projects in real estate, infrastructure, leisure and entertainment, worth $582 billion, are now on hold (Global Real Estate News Centre, 2009).

However, there are still construction projects going ahead that are worth about US$700 billion. Therefore, it is crucial to identify the significant causes and effects of delays of construction projects in the UAE since the construction industry represents a dynamic growth-oriented sector. It is also important to critically review the methodology and validation of the measures of control delays and project success factors, according to causes and effects of projects delays. The objective of the research work that underpins this paper is to identify the significant causes and effects of construction project delays in the UAE. This is part of a PhD study aiming to develop a framework for the effective management and control of construction delays in the UAE. In the next section, the research methodology is outlined. Then, results are discussed, before conclusions are drawn and future research work is proposed.

RESEARCH METHODOLOGY

This is an exploratory study and as such a pilot questionnaire survey has been designed with reference to previous research studies in Table1, on various causes of project delays in groups, and limited personal interviews have been conducted. The questionnaire form consists of three sections. The first section is intended to gather information about the respondents' profile. The second and third sections are enquiring about the causes and effects of construction projects delays, respectively. In this study, the pilot questionnaire is used as a convenient and cost-effective tool to gather information from the target companies, which are geographically scattered in various parts of the UAE. The purpose of the pilot questionnaire was to assess the feasibility of a full-scale survey research. The questionnaire was emailed to two contractors and two consultants, whose feedback was used to modify the questionnaire contents, where appropriate, for the next stage.

Questionnaire Administration

The questionnaire was distributed to a random sample of fifty experts and project managers working in the UAE-based, consulting and contracting, private companies. Thirty five (70%) responded and returned complete and usable questionnaires. The participants were 15 consultants, 12 project managers, and 8 contractors (see Table 2).

Method of Data Analysis

The data analysis was carried out in two parts using SPSS for Windows and Microsoft Excel (version 17). The survey data was manipulated in SPSS to generate the frequency (f_i) of the response

Table 2. Questionnaire distribution and respondents

Description	Number of Distributed	Number of Respondents	Percentage of Respondents%
Consultants	20	15	75%
Project managers	17	12	70%
Contractors	13	8	61%
Total	**50**	**35**	**70%**

category index for the cause and effect factors. The relative importance index (RII) for each factor was calculated using the frequency data for each response category generated from SPSS. The RII is the calculation of the mean frequency of each response category index for the probability and impact. It can be calculated

$$RII = \frac{\sum_{i=1}^{n} w_i f_i}{\sum_{i=1}^{n} f_i} \quad (1)$$

where f_i is the frequency of the i^{th} response, and w_i is the weight assigned to the i^{th} response.

Spearman rank correlation coefficient r_s was also used to determine the strength of the relationship between the consultants and project managers' ranking for various factors. It is a measure of correlation between two series using the ranks rather than the actual values (Kottegoda, 1997; Coakes et al., 2009). It can be calculated as:

$$r_s = 1 - \frac{6\sum_{i=1}^{n} d_i^2}{n^3 - n}, \quad (2)$$

where d_i is the difference in ranking between consultants and project managers i^{th}. The higher the value of r_s approaching 1 or -1, the stronger the association between the two sets of ranking (Odeh & Battaineh, 2002).

RESULTS AND DISCUSSION

Causes of Delay

Forty two causes of delay were identified and grouped into 5 sets, namely,

1. Contractors,
2. Consultants,
3. Project managers,
4. Clients, and
5. Financial and other external factors respectively.

The top fifteen factors are summarized in Table 3.

Table 3. Top fifteen factors based on all responses

Factor Description	RII	Rank
Change orders	4.265	1
Lack of capability of client representative	4.191	2
Slow decision making by client	4.182	3
Lack of experience of client in construction	4.135	4
Poor site management & supervision	4.130	5
Incompetent project team	4.110	6
Inflation/prices fluctuation	4.075	7
Inaccurate time estimating	4.042	8
Late delivery of materials	4.025	9
Improper project planning/scheduling	4.022	10
Inaccurate cost estimating	4.020	11
High interest rate	3.995	12
Client's financial difficulties	3.987	13
Unreasonable constraint to client	3.982	14
Inappropriate construction methods	3.950	15

Contractors' Factors

Sixteen contractor-related, frequent causes of delay were identified; two of these causes are among the top fifteen factors included in Table 3. Late delivery of materials was ranked ninth, and inappropriate construction methods was ranked fifteenth. Contractors have to ensure that all resources such as materials are available throughout the project, whenever needed. Accurate time estimations of materials delivery require accurate project information, in terms of quality of information, and information flow, availability and supply of resources.

Consultants and Project Managers' Factors

The consultant and project Manager factors were not included among the list of the top fifteen factors as shown in the Table 3. On the other hand, it is worth noting that the consultants and the project managers put special emphasis on the time and cost estimation, which appeared in the top list to occupy the 11th and 15th rank, respectively. In addition, both the consultants and project managers contribute, to some extent, to other factors including poor site management and supervision, improper project planning and scheduling, incompetent project teams, and inappropriate construction methods.

Clients' Factors

The most important client-related causes of delay are change orders, lack of capability of client representative, slow decision making by the client, and lack of experience of the client in construction. These causes are assuming the 1st to 4th ranks among the top list as shown in Table 3. Excessive change orders can cause significant disruption to project completion, as changes consequently causes changes in schedules, increase costs through rework and decrease labor efficiency. Accurate time and estimations of materials delivery require accurate project information in terms of information quality and flow, availability and supply of resources. Although contractors are perceived to cause some inaccurate estimates, as discussed earlier, they are the ultimate party who produce estimates. It can be argued that the clients are largely responsible as the party that issues excessive change orders. Poor estimation and change management reflect a lack of efficient and effective project management.

Financial Factors

Five financial-related causes of delay were identified. Three of these factors, namely inflation and price fluctuations, high interest rates and client financial difficulties are in the list of the top fifteen as shown in Table 3. These results are expected, given the recent high escalation of prices of steel and cement, the current credit crunch and the related economic crisis in Dubai.

External Factors

This group of causes is ranked low by consultants and project managers, and. none of these factors are among the top fifteen factors (Table 3). Problems with neighbors are not considered a serious cause of delay as it seems that affected people near sites are usually well informed about projects and satisfactory compensation is offered for their properties. Besides, environmental and social impact assessments are carried out fairly, when necessary, in the UAE. These will ensure that projects run smoothly without interruptions during the construction phases.

Conformity between Consultants and Project Managers' Rankings

A further analysis has been done to find out the conformity between consultants and project managers, by using the Spearman rank correla-

tion coefficient (Equation 2). This coefficient was found to be 0.918, indicating a strong conformity between consultants and project managers for the ranking of the causes of delays.

Effects of Delays

Six potential effects of delay have been identified as shown in Table 4. Time and cost overrun are the two most important effects of delays, ranked first and second respectively, by both consultants and project managers (see Figure 2). These results are in strong agreement with the results of important causes of delay. Out of the top causes of delay (see Figure 1), there are at least five factors that cause the effects of time overrun, including change orders, slow decision making by the client, and lack of capability of the client representative, construction financial difficulties and late delivery of materials. There are at least five factors that can result in cost overrun, including inaccurate cost and time estimations, poor site management, an incompetent project team, and improper project planning and scheduling. These results are also consistent with other published work related to other developing countries, e.g. Aibinu and Jagboro (2002) in Nigeria, and Wiguna and Scott (2005) in Indonesia.

A Comparative Study

A similar study has been carried out for the construction industry in the UAE (Faridi & El-Sayegh, 2006). We have summarized, in Table 5, the rank order of the top 15 causes of delay in both the current work and their 2006 study. Ten of the top 15 factors were also reported in the 2006 study. Apart from lack of capability of the client representative, ranked 2nd in both studies, the ranking order of all other common factors changed.

Table 4. Ranking order of Effects of delay

Rank	Effect Description	RII		
		Consultants	Project Manager	Overall
1	Time Overrun	4.160	3.750	3.960
2	Cost Overrun	3.830	3.370	3.600
3	Dispute	2.420	2.750	2.585
4	Arbitration	2.200	2.500	2.350
5	Litigation	1.900	2.000	1.950
6	Total Abandonment	2.250	0.917	1.584

Figure 1. Top fifteen causes of construction project delay in the UAE

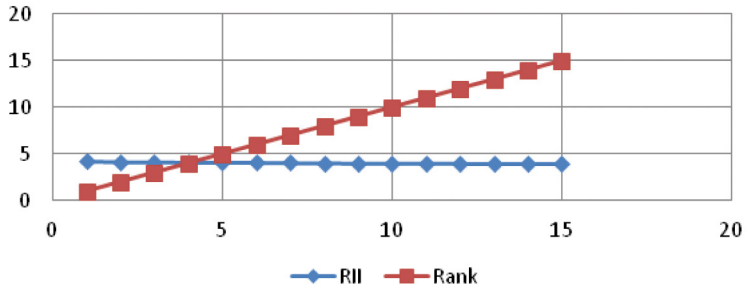


Figure 2. Effects of delay

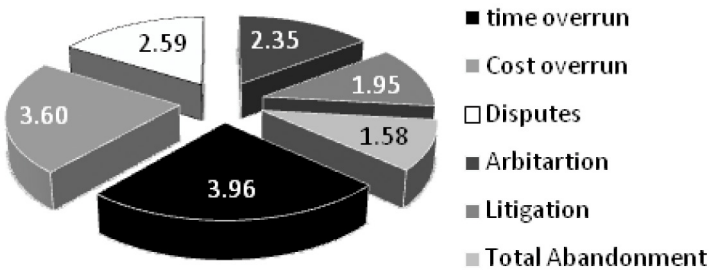


Table 5. Ranking comparison between 2011 and 2006 of top causes of delay in UAE

Factor Description	2010 Rank	2006 Rank	Rank Change
Change orders	1	27	-26
Lack of capability of client representative	2	2	0
Slow decision making by client	3	---	Not applicable
Lack of experience of client in construction	4	---	Not applicable
Poor site management & supervision	5	19	-14
Incompetent project team	6	12	-6
Inflation/prices fluctuation	7	---	Not applicable
Inaccurate time estimating	8	---	Not applicable
Late delivery of materials	9	6	+3
Improper project planning/scheduling	10	23	-13
Inaccurate cost estimating	11	8	+3
High interest rate	12	---	---
Client's financial difficulties	13	10	+3
Unreasonable constraint to client	14	17	-3
Inappropriate construction methods	15	7	+8

The 'change orders' factor has moved considerably, from 27th place to become the most important factor. This is followed by poor site management & supervision, and improper project planning/scheduling which moved up 14 and 13 places to be the top 5th and 10th, respectively. An incompetent project team moved up six places to be the top 6th factor. Inappropriate construction methods, however, moved down the list 8 places. The remaining 4 factors moved up/down by 3 places.

Interviews

In addition, typical interview results have shown that:

1. Two governmental consultants, with more than 30 years experience, explored the importance of proper classifications and categorizations of consultants based on past learning knowledge. However, they have initiated some research ideas to recover managerial defects, but validation is required

for UAE construction project performance. They added. Moreover, this will assist public sector projects to evaluate the knowledge, experience, efficiency and past performance of other stakeholders (consultants, contractors and developers etc.).

2. Two consultants, from the private sector, agreed on the significant forecasting budget considering the excessive change orders/ variations by clients, as well as its effect on time and cost. It is argued that the insufficient monthly payments have affected the flexibility of the project progress recently.
3. One project manager criticized the lack of co-related technical financial details. He added, full stakeholder's knowledge can prevent the unexpected delay and help clients in faster decision making.
4. Another consultant, with 25 years experience, criticized the pre-matured project culture that disturbs any scientific pattern searching of risk control approaches; he said "a very important point is that a positive percentage of prequalified or interested users, who apply the same approach, does not exceed 5%."
5. Two consultants from the architecture and value chain built environment sections agreed on the project complexity due to pre-bidding analysis, so the critical mission appears in the contract management.
6. Another project manager criticized the recent client attitude towards project slow down completion by getting rid of some of the workforce and this left few posts in the recent financial crisis.
7. All interviewees agreed that proper knowledge tools and financial methods to face a crisis could lead to improvement of project performance, to be noticed that 20% of them did not recognize the difference between financial risk management and procurement.

CONCLUSION AND THE WAY FORWARD

The objective of the research work that underpins this paper was to investigate the causes and effects of construct project delays in the UAE. Data has been collected through interviews and a pilot questionnaire distributed to a group of experts working in local consulting, project management and contracting companies operating in the UAE.

Forty two potential causes of construction project delays have been identified and categorized into contractor, consultant, project managers, client, financial, and external categories. The significance of these factors has been investigated using the relative importance index method. Fifteen top causes include six client-related factors, four project manager-related factors, three financial factors, and two contractor-related factors. Client-related, project managers and financial factors seem to be the most significant causes of delay. These results are in general agreement with published previous studies in the UAE.

This exploratory study has highlighted a view of the many distress projects in the UAE and particularly in Dubai, in the financial crisis, the trade press have recently detailed how the UAE has been severely affected by the global economic downturn with reports of many project delays, and this may add the factor of the risk of financial crisis to the list of factors, although it has not yet been fully investigated.

The effects of construction delay have also been investigated. Time and cost overrun have been found to be the two most important effects. This is in strong agreement with the identified significant causes of delay. So, it is only a matter of time before the stakeholders begin to avail themselves of the phenomenon described above. However, some of the results are surprising and have implications regarding additional measures of project success, the need for knowledge manage-

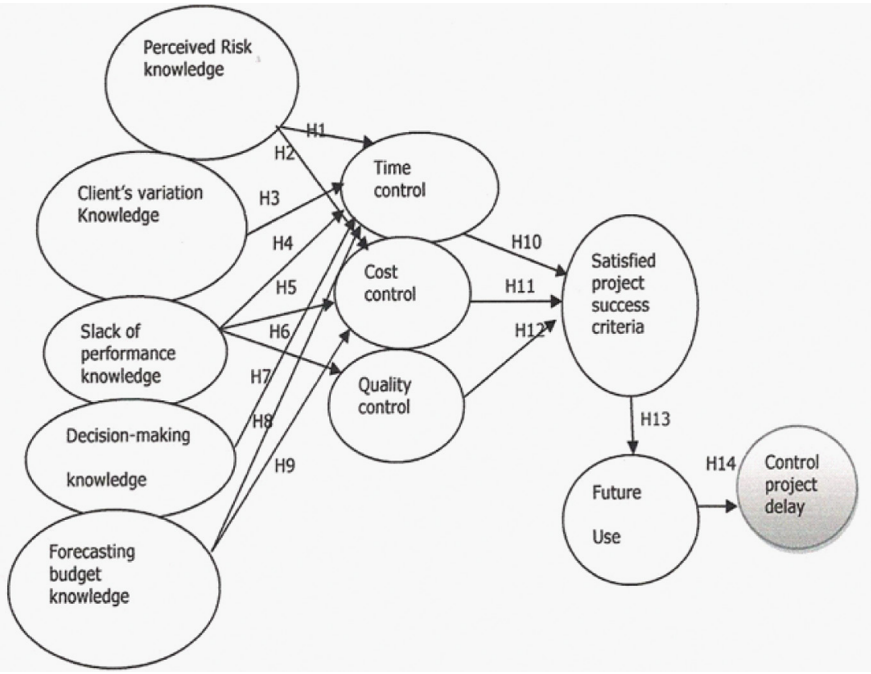
ment training for clients, and their representatives, but also project managers and their teams in risk management innovation.

Further future work could include conducting a well-grounded survey of construction delays analysis in the UAE to triangulate the initial approach adopted in these research findings and provide direction for IT project managers to adopt advanced techniques for project delay control. In addition, the effects of information flow between the organization levels, the importance of professional project management programmes and skills development. Accuracy of procedures and record keeping will also become indispensable, by the next decade, for IT project managers.

The problem of project control can be summarized as controlling additional measures to prevent delay, such as developing stakeholder knowledge management, as this may formulate good dependencies of relationship and interaction, rather than depending on the traditional success criteria; and predicting changes in the early stages can minimize the disruptive/risk effects. Moreover, to save time and help the project team in decision making, developing the project performance and confirming stakeholders' expectations.

In a way of validating variables/measures in a proposed conceptual framework to control the delays, hypotheses are set in Figure 3 to resolve the great percentage of a problem related to poor knowledge of stakeholders in the preconstruction

Figure 3. Determinant of control construction project delay in terms of specific Hypotheses (H)
*There is a positive relationship between: perceived knowledge of risk in the earlier stage of construction and time (***H1***), perceived knowledge of risk in the earlier stage of construction and cost control (***H2***), appropriate client's knowledge in variations and time control at early stage (***H3***), there is a negative relationship between: slack of performance and time control (***H4***), slack of performance and cost control (***H5***), slack of performance and quality control (***H6***). There is a positive relationship between: stakeholders' decision-making (Client, contractor, developers, and governmental processor) and time control (***H7***). There is a negative relationship between: lack of forecasting budget knowledge and time control (***H8***), lack of forecasting budget knowledge and cost control (***H9***). There is a positive relationship between: the time control and project success criteria (***H10***), the time control and project success criteria (***H11***), the time control and project success criteria (***H12***), the satisfied project success criteria and time future use (***H13***), the future use of the success criteria and control delay (***H14***).*



stage. Noticeably, the majority of the interviewees insisted on significant and proper knowledge management to control the risk of delay, rather than depending on local management tools only.

Limitations of the study are the sample size and the methodology adopted. Therefore, due to the small number of responses, further, more extensive studies are required to support the above findings.

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Chapter 54
Enabling Factors for Knowledge Sharing among Employees in the Workplace

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ABSTRACT

This chapter investigates enabling factors that promote knowledge sharing among employees in the workplace. The study was conducted on employees of Commercial Bank of Ethiopia (CBE) as a research case. Banks in particular and financial institutions in general are now becoming knowledge intensive organizations where knowledge is used as a key strategic resource to achieve their business goals as well as competitive advantage. This study uses an exploratory case study research method that allows deeper understanding and interpretation. Although there is plenty of literature on knowledge sharing, existing findings are not consistent due to the influence of contextual factors on knowledge sharing. This study identifies organizational, individual, task characteristics, and technological factors as main enabling factors that promote knowledge sharing in the workplace. Although organizations put much emphasis on technology to promote knowledge sharing in the workplace, non-technological factors (organizational and individual factors) appear more significant. As the study was conducted on a commercial bank within developing economies context, it contributes additional perspectives to confirm or extend existing findings on knowledge sharing.

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1. INTRODUCTION

Knowledge is an important tool to accomplish tasks in the work place. Knowledge sharing is the daily routine activities of employees in the work place whether the organization have clear procedure on knowledge sharing or not (Award and Ghaziri, 2007). Bartol and Srivastava (2002) defined knowledge sharing as individuals sharing of organizational relevant information, ideas, suggestions, and expertise with one another. Through knowledge sharing, individual knowledge is converted into organizational knowledge so that it is used to create value for the organization. Knowledge is used to create new products and services and increase organizational profitability (see Award and Ghaziri, 2007; Kubo, Saka and Pam, 2001; Bock et al., 2005; Alhammad et at, 2009).

Knowledge is not a tangible product which can be easily transferred from knowledge owners to knowledge seekers (Hendriks, 1999; Lin et al., 2012). Most of the organization´s knowledge resides in the mind and body of employees who create, recognize, archive, access, and apply knowledge to carry out their tasks (Bock et al., 2005). Knowledge is a resource for employees through which they get power and other benefits in the organizations. Supervisors cannot oblige employees to share their knowledge (Lin et al., 2012). Organizations installed different IT systems so as to promote knowledge sharing among their employees (see Yang, 2008; Al-Ma'aitah, 2008; Gupta et al, 2008). However, such effort was not successful to achieve the expected result in knowledge sharing (see Yang, 2008; Jeon et al., 2011). Effective knowledge sharing mostly depends on the positive attitude of employees who possess the knowledge. However what factors best motivate employees to share knowledge are not well known issue despite the presence of ample literature on the topic (Alhammad et at, 2009, Burgess, 2005). We found also paradoxical findings among researchers (see Jones et al, 2006; Donate and Guadamillas, 2010; Ismail et al, 2007; Alizadeh et al., 2011). This implies that further research is required to increase our understanding about enabling factors that promote knowledge sharing in the work place. The main purpose of this research is to increase our understanding about motivational factors for knowledge sharing in the workplace. Specifically the research has addressed the following research questions

- Why employees seek knowledge from other sources?
- What factors motivate employees to share knowledge in the workplace?

The result of the research will help practitioners what interventions to undertake in their organization to create a knowledge sharing culture and develop a successful knowledge management system. Such local research will have also a theoretical contribution to extend existing knowledge sharing theory across different socio-economic contexts.

2. LITERATURE REVIEW

Knowledge as a resource has a variety of benefits for the organization. It is one of the main inputs in the production process as well as in the service delivery (Grant, 1996; Lin, 2007). It helps organizations to improve the quality of services, innovate new products, reduce operational costs, improve relationships with customers and suppliers and easily adapt to the changing environments (Kharabsheh, 2007; Saenz, Aramburu and Rivera, 2009; Gold et al., 2001). Organizations can create value from knowledge when they can integrate knowledge held by individuals (Grant, 1996). Unused stock of knowledge is not considered as a resource (Grant, 1996; Blair, 2002). Organizations which can create, capture, organize, share and use knowledge have increased capability to survive in the market. They have also a better chance to excel beyond their competitors in the long term (De Long and Fahey, 2000; Curadoand

Bontis, 2011). Generally the resource based view of knowledge implies that increasing existing stocks of knowledge and employees capability to share and use knowledge will create business value (Yang, 2010; Saenz et al., 2009).

2.1. Knowledge Management (KM)

Knowledge management is defined as an activity that deals with creating, capturing, storing, processing and dissemination of knowledge in the organization (see Alavi and Leidner, 2001; Gupta et al, 2008). Knowledge creation refers to the acquisition of new insights and ideas in the process of problem solving by individuals in the organization (Nonaka et al, 2000). It is created by integrating existing stock of knowledge in the organization or acquiring new knowledge outside the organization (Grant, 1996). Knowledge capturing refers to the identification of new and useful knowledge in the organization. An organization has abundant knowledge held by its members. All knowledge may not be useful for the organization with regard to its objectives. Knowledge capturing includes identification and validation of knowledge that is critical to the business processes. Knowledge storage deals with preservation of existing knowledge in such a way that it can be easily accessible by all members of the organization (Oshri, 2008). Once knowledge is stored in the centralized database, it can be easily accessible by anyone in the organization. This will help the organization to avoid unnecessary efforts to collect and manage redundant information and knowledge (Tseng and Lin, 2008) and increases organizational innovation capability (Gold et al., 2001).

Knowledge dissemination is communication of knowledge in the knowledge repository to potential users (see Lee and Al-Hawamdeh, 2002; Hendriks, 1999; Gold et al., 2001). Unless knowledge is communicated and applied, having an avalanche of knowledge in a knowledge repository is not considered as a resource (Grant, 1996; Bliar, 2002). Organizations promote knowledge dissemination by installing intranet, creating Expert profiles and indexes (Oshri, 2008). The purpose of knowledge storage and dissemination is to encourage knowledge reuse. It has many benefits for the organizations ranging from cost and time saving to minimization of risks in new product development (Oshri, 2008). The last cycle of knowledge is application. It refers to using knowledge to execute tasks. During application, new business value can be generated. At the same time, new knowledge can be created through the process of applying new knowledge; individuals adapt it to their context and include their personal judgments (Oshri, 2008; Nonaka, 1994). Knowledge management activities can be seen as a cyclic process. All knowledge management activities are systematically managed by the organization to exploit the benefit of knowledge to the organization. One activity is not important without the other nor is it substitutable for the other.

2.2. Knowledge Management and Financial Institutions

Banks represent a major component of the country's financial system and play a key role in enhancing the overall economic growth of the country (Allen & Carletti, 2008; Worku, 2010). They mobilize savings from lenders and ensure availability of funds for investment. Banks fill the information gap between lenders and borrowers by developing an efficient information system to run their business. The efficiency of the financial system of a country has a direct impact on the country's economic growth (Allen & Carletti, 2008). The banking industry in Ethiopia is at a lower level even as compared to some other African countries (Kapur & Gualu, 2012; Worku, 2010). There are no international banks operating in the country due to the fear that they will weaken the domestic banks.

Established in 1942, CBE is the oldest bank in Ethiopia (CBE, 2011). It has more than 500 branches stretched across the country. As of June

30th 2011, it had total deposits of birr 86.5 billion, about 2 million account holders and more than 8,000 employees. CBE has been growing at a fast rate since the last two years. For example, the number of branches has increased from 402 in September 10, 2011 to 516 in March 15, 2012 (an 8% growth in branches within six months) (CBE, 2012). This fast growth is due to the Ethiopian government's initiation to extend banking services to all population groups in the county and to speed up the country's economic growth. CBE is larger than all other banks taken together in Ethiopia with service coverage of more than 70% (CBE, 2012).

CBE has a vision to be a world class bank by the year 2025. Since April 30, 2012, the Bank has introduced a core banking system that allows the Bank to provide online banking services throughout all of its branches. The new system allows its customers to get service from any branches in the country. The Bank also started Internet banking that allows customers to check their balances, transaction details, money transfer and view checking details from their desktop computer without having to visit a CBE's branch. The use of the core banking system helps the Bank to capture more digital information and manage more complex systems. This again requires the Bank to use its knowledge resources more extensively than before. KMS has now become an important tool for banking business. The Governor of Bank Negara Malaysia also pointed out during the official launch of "Towards a Knowledge-Based Organization" program in October 2000:

If we are to be a central bank, with farsightedness and an ability to face new challenges, we need to be equipped with the expertise and the means to implement appropriate policies, and have confidence in our actions. An important component of this future is that the Bank must fully embrace and employ the principles of knowledge management. Whilst the principal objectives of the central bank remain unchanged, the new knowledge management strategies refocus the Bank's policies and practices in managing knowledge as a key corporate asset, and in leveraging and exploiting knowledge to better achieve these objectives (cited in Ali & Ahmad, 2006, pp. 2-3).

The reason why knowledge is a strategic resource for financial institutions is that the world economies became more globalized and the use of IT in organizations became ubiquitous. "The velocity and dynamic nature of the new marketplace has created a competitive incentive among many companies to consolidate and reconcile their knowledge assets as a means of creating value that is sustainable over time" (Gold, Malhotra and Segars, 2001, p. 186). Customers' needs frequently changed due to easy access to new services. New technologies come quickly to the market that gives better competitive advantage to adopting organizations. Employee turnover is high due to fast information access for better jobs. Organizations also generate more knowledge than before due to easy access to external knowledge and use of IT tools to capture, store and process information (Ali & Ahmad, 2006). The traditional resources of labour and capital are not adequate to operate competitive in this highly volatile business environment (Chuang, 2004; Lin, Wub and Lu, 2012). Knowledge has become one of the strategic resources to achieve sustainable competitive advantage (Grant, 1996). Every organization has a unique knowledge and the ability to integrate and apply knowledge has become a key factor of differentiation for competition (Gold et al., 2001; Grant, 1996). Furthermore, knowledge is a resource whose value increases as more people use it unlike other physical assets (Cabrera & Cabrera, 2002).

2.3. Knowledge Sharing

Knowledge sharing is a part of any organization's activity whether they have clear procedures on knowledge sharing or not (Award and Ghaziri, 2007). It is also the core activity of KMS. Knowl-

edge sharing is basically the act of making knowledge available to others within the organization (Ipe, 2003, p.341). It is a deliberate act in which knowledge is presented in a way to be understood and absorbed by the recipient through the whole departments and organization (Hendriks, 1999; Lin, 2007). It is an exchange of organizationally relevant information, ideas, suggestions, and expertise with one another (Bartol & Srivastava, 2002). Hendriks (1999) also elaborates knowledge sharing as a process of knowledge externalization and internalization. Externalization refers to making the hidden tacit knowledge visible to others in the form of framed information by way of demonstration, codification and verbalization. Internalization is the process of assimilation of received information into new knowledge by way of rehearsal and practical actions (Nonaka, 1994; Hendriks, 1999).

A key issue in knowledge sharing is the presentation of knowledge in a way absorbable by the recipient (Ipe, 2003) and the recipient's readiness to internalize the new information. Successful knowledge sharing is not a one way process; it is a two way dialog which involves active participation of the source and the recipient during the interaction. People who are willing to share their knowledge do not dump information but they put themselves in the seeker's position to understand the problem and frame their knowledge in a way useful to the problem and assist construction of new knowledge by the recipient (Hendriks, 1999). Knowledge sharing results in joint ownership of the shared knowledge and is different from other material exchanges which results in the transfer of ownership (Ipe, 2003). The more people owned the same knowledge, the more opportunity is created to apply the knowledge (Cabrera & Cabrera, 2002). Knowledge sharing exists at individual as well as at organizational level. Individual level knowledge sharing involves direct sharing of knowledge through face to face interaction while organizational level knowledge sharing involves capturing, storing and making knowledge available to all members of the organization (Lin, 2007). Knowledge sharing is a process through which employees learn to acquire new skills and capability (see Gold et al., 2001; Nonak, 1994; Grant, 1996).

2.4. Enabling Factors for Knowledge Sharing

Knowledge is not a tangible product which can be easily transferred from knowledge owners to knowledge seekers (Hendriks, 1999; Lin et al., 2012). Researchers identified a list of social, organizational and technological factors that promote knowledge sharing (e.g. Ipe, 2003; Bartol & Srivastava, 2002; Lin et al., 2011; Jeon, Kim and Koh, 2011). However, knowledge sharing is still a challenging task for many organizations (see Jeon et al., 2011; Lin et al., 2012; Alizadeh, Miandashti and Fami, 2011; Burgess, 2005). Factors that promote or hinder knowledge sharing are highly dependent on its contextual factors (Jones, Cline and Ryan, 2006; Lin et al., 2012). A factor which is identified as a favorable condition in one context may not be directly replicable. For example, Alizadeh et al., (2011) identified weak association between organizational culture, ICT infrastructure and structure in the one hand and knowledge sharing on the other. However, other researchers found a strong relationship (see Jones et al, 2006; Donate and Guadamillas, 2010; Ismail et al, 2007). These paradoxical findings create confusion among practitioners what strategies to use so as to encourage their employees to effectively share knowledge. King (2008) also mentioned that the issue of identifying the best motivational factors for knowledge sharing is not yet resolved agenda even worldwide. This implies we need more empirical case study researches across different contexts to better understand knowledge sharing in the workplace (Bechina and Bommen, 2006). Knowledge sharing is also an important factor that predicts the success of organizational knowledge management system.

Most of the studies conducted on knowledge sharing uses quantitative research method which is not appropriate to understand the complex phenomena of knowledge sharing. This research will also contribute our understanding of knowledge sharing by applying a qualitative research method which is appropriate to understanding complex social constructs.

3. RESEARCH METHOD

An exploratory case study research method was used for this research. Its main intent was to gain new insights, findings and interpretations, in order to extend existing theories (Yin, 2003). Knowledge sharing is a social construct (Nonaka, 1984) which requires deep investigation from multiple perspectives (see Miles and Huberman, 1994; Yin, 2003). Knowledge sharing enabling factors among employees in developing economies (such as Ethiopia) has not been well studied so far, and the case study research method is an appropriate method to study this little known phenomenon. It is also very difficult to make a demarcation between knowledge sharing barriers and other contextual organizational variables. They are highly intertwined. Other researchers have also used the case study research method to address problems in knowledge sharing research (see Jonsson, 2007; Kubo, Saka & Pan, 2001; Azudin, Ismail & Taherali, 2009).

The data collection instrument was developed iteratively over the course of the research process. We began by asking one question: "What are the factors enabling knowledge sharing among employees in CBE?" Based on the responses of the first few respondents' additional questions were included in the interview check lists. The interview questions were open ended and addressed individual, organizational and technological factors that act as knowledge sharing barriers in the work place. Data was collected from March 2011 to September 2011 from employees in CBE using multiple data collection methods including: interview, observation and document review. Later additional data was collected based on the information gap identified during data analysis. Respondents were purposively selected from different directorates of the Bank (see Table 1). All respondents were University graduates with different years of work experience in the Bank.

Although most of respondents are male, female respondents were also included in the interview. All interviews were recorded and the interviews took place in one of Ethiopia's native languages (Amharic). Each interview was transcribed and translated in English by the first author. The translated versions on the interviews were validated by some of the respondents to check if there was any misinterpretation in the translation process. We found positive agreement from our respondents.

Data analysis was carried out using a qualitative data reduction method. The raw data was entered into NVIVO version 9 software. The main use of the software was to organize and store the data. It is a good tool to maintain the case database which increases the trustworthiness of the research findings (Eisenhardt, 1998). We

Table 1. Composition of respondents by department and demographic characteristics

Directorates	Male	Female	Total Respondents
Customer and Accounts Transaction Service (CATS)	7	0	7
Credit Directorate	6	3	9
System Development and Application Customization (SDACD)	4	1	5
Applications Systems and Infrastructure Support (SIS)	2	0	2
Research and Development (R&D)	4	0	4
Corporate Communication	3	1	4
Human Resource Development (HRD)	3	1	4
Total	29	6	35

used open coding methods (Singh & Kant, 2008) to identify concepts, categories and themes. The researchers interactively read the raw data to classify interview chunks into concepts, categories and themes. Relationships between categories were identified by assessing repetition of texts in different categories, causal relationships, and doing cross tabulation using NVIVO software. We also used NVIVO software to count the frequency of respondents for each category. This was used as one method to weigh the relative importance of one factor from other. Analytical generalizations were made by comparing empirical patterns with previous research findings to expand existing knowledge sharing theories (Yin, 2003).

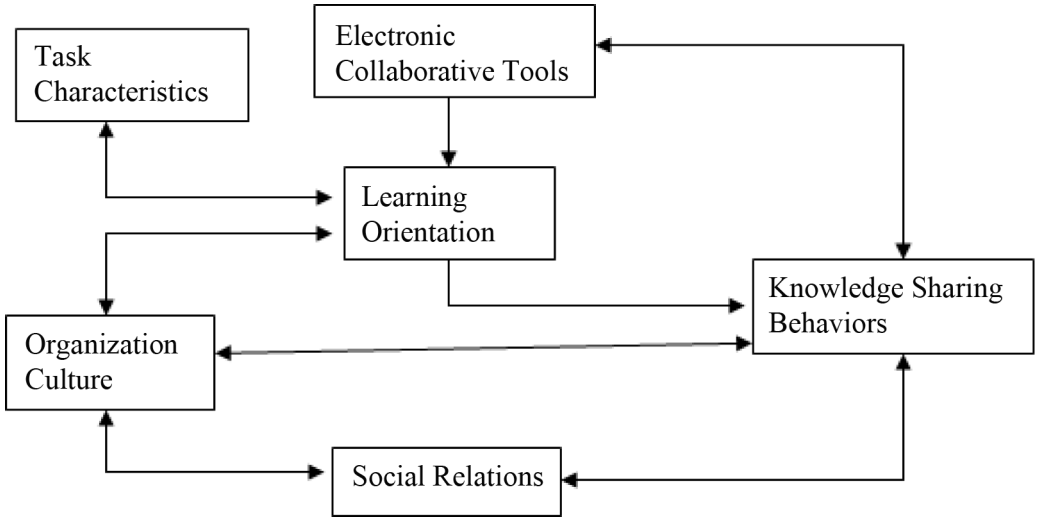
4. RESEARCH RESULTS ON KNOWLEDGE SHARING IN THE WORKPLACE

The empirical data collected through open ended interviews, observation and organization documents were stored in NVIVO Software as case database. After we organized our data into concepts, categories and themes, we found task characteristics, organization culture, social relations, learning orientations and social networking tools as factors that promote knowledge sharing in the workplace (See Figure 1). In the work place context, knowledge is a resource that helps employees to perform tasks and achieve goals (Grant, 1996; Kharabsheh, 2007). In other words, one has to own the required task knowledge to perform a standard job set out by the organization. Knowledge sharing is initiated when there is a knowledge need by one party and willingness to share by the other party. Our theoretical model includes both factors that initiate knowledge seeking and knowledge sharing.

4.1. Learning Orientation

Learning is defined here as an increase or change in knowledge or skill that occurs as a result of some experience (Maurer, 2002, p. 14). Learning orientation refers to employee's intention to acquire new knowledge to increase their capability in the task. Deshon and Gillespie (2005) described learning orientation as employees' intention to learn new skills and increasing their competence and abilities. As knowledge gives a competitive advantage for the organization, it also provides the same benefit for the individual employee. It is an

Figure 1. Enabling factors for knowledge sharing in the workplace



important tool employees should possess to act competitively in the organization. Every organization has a unique knowledge that is acquired from experience and this knowledge is a key resource for employees to achieve its organization business objectives. Knowledge acquired from colleges and universities is not sufficient to do tasks in a specific organization. In fact, education helps to acquire background knowledge that helps to quickly learn on the task. Most of the knowledge required for the task in CBE is acquired by working on the task after employees joined the Bank (Kubo et al., 2001). Employees not only perform organization tasks but also learn organization knowledge as their regular duty. As the System Analyst mentioned with regard to on the job learning:

We learn for our own purpose. It is important for our existence. If I don't know, I will not exist in the Bank.

Lack of experience is the main factor that motivates employees to acquire new knowledge and skills from other employees. CBE also recognized lack of experience as the main knowledge gap creators and organizes different knowledge sharing strategies (like training) to promote knowledge sharing from seniors to junior employees (Kubo et al, 2001).

Learning orientation requires commitment to acquire new knowledge and skills (Kharabsheh, 2007). Employees with high learning orientation do not satisfy by reusing existing knowledge to perform their tasks. They strive to get new knowledge to improve their competency and appear knowledgeable expert in the Bank. As the Credit Analyst explained:

The Bank has a standard guideline how one loan is processed. You do your task by that guideline. However, the Bank is dynamic, some other day, those guidelines have limitations. In order to improve those guidelines, I have to learn from different sources.

Commitment for learning has a benefit not only for the employee himself but also for the Bank. Being knowledgeable expert in the Bank, employees may have a chance to get better position and recognition by other colleagues in the Bank. They also change the image of the Bank to be competitive organization in the market. As most of the organization knowledge is created and used by employees, knowledgeable employees contribute new knowledge that expands existing stock of Bank knowledge (Ipe, 2003). Other researchers also confirmed learning orientation as one of the factors that increases employees' interaction for knowledge sharing (Ipe, 2003; Kharabsheh, 2007; Maurer, 2002; Thompson, 2012).

4.2. Social Relations

Knowledge sharing is affected by the relationship between knowledge owners and knowledge seekers. Unless there is a good social relationship, knowledge owners will not share their valuable knowledge to other colleagues (Chow and Chan, 2008; He, Qiao, and Wei, 2009). Social relationship is very important to share tacit knowledge which is highly sticky with the knowledge owners and require more effort to share knowledge to other colleagues (He et al., 2009). The main social factors identified that affect knowledge sharing are helping others, reciprocity, interpersonal trust and social recognition. These factors are conceptualized as social relations in this literature. Social relation is defined as the level of trust, reciprocity, openness and shared norms among interacting actors (see Chow & Chan, 2008; Nahapiet & Ghoshal, 1998).

4.2.1. Reciprocity

Reciprocity is the main external driving force for knowledge sharing. When people share their knowledge, they also expect reciprocal benefit since knowledge sharing requires time and loss of exclusive ownership of the knowledge. Reciprocal

benefit offsets this cost. One of frequently cited reciprocity in the CBE for sharing knowledge is to distribute task responsibility. As the Customer Service Manager mentioned:

You are working in one home. Unless you share your knowledge, everybody comes to you and you cannot work.

The Bank is risk averse organizations. Employees also do not do tasks by trial and error methods unless they are confident enough to handle the task. This implies that employees who are knowledgeable and hoard knowledge are expected to do more work in order to avoid errors by less capable employees. Therefore employees are encouraged to share their knowledge due to the immediate reciprocal benefit of sharing their task burden.

Knowledge sharing has also a reciprocal benefit of deepening one's personal knowledge. When employees are asked, they think critically to present their knowledge in a way understandable to other colleagues. Even they do not know the response, they are motivated to further read or ask other colleague to know the requested knowledge and learn more from the interaction. As a Junior Customer Officer explained:

When I answer my colleagues' questions, it helps me to know that knowledge deeper. If I don't know it, I ask other person and I update my knowledge.

Sharing knowledge in the workplace also helps to get social recognition by other employees and promotion by the Bank. As the Credit Analyst confirmed:

If you share knowledge, you can be seen as reference and recognized in the Bank. You may also get promotion.

When you share knowledge, it also creates a good work environment. Employees mentioned that if you share today, you will also get similar support when you face problem. This finding is also supported by other empirical researches (see Cropanzano and Mitchell, 2005; Ipe, 2003; Jeon et al., 2011; Bock et al, 2005)

4.2.2. Helping Others

Intrinsic motivation is stronger than extrinsic motivation as it is not contingent with external factors (Gagne, 2009). Extrinsic motivation creates a competitive environment and people may develop a knowledge hoarding habit to get more rewards. With regard to intrinsic motivation, it is the internal desire and satisfaction that motivates people to share their knowledge. The presence of shared vision among employees is one of the factors that create intrinsic motivation. As a Customer Service Manager explained:

I have to brief my junior employees how to do their task in detail. - What is to be debited and credited? I tell them step by step. We are working in one home.

The HRD Officer also mentioned similar view:

Sharing your knowledge is generally the human characteristics. You get internal satisfaction.

Other researchers also found similar finding with regard to the positive association between helping others and knowledge sharing (Chow & Chan, 2008; Nahapiet & Ghoshal, 1998).

4.2.3. Interpersonal Trust

Trust is an important factor for knowledge sharing (He et al., 2009; Kubo et al., 2001). Trust is the extent to which you believe in the good intent, competence, and reliability of others (He et al., 2009, p. 177). It also includes psychological and emotional bonds (Kubo et al., 2001). Trust also creates a favorable work environment where

employees freely express their ideas and share their experiences. As Credit Manager explained:

There is a check and balance in the Bank. There are supervisor and auditor who check your work. On top of that, supporting each other makes our relationship stronger.

A Customer Service Manager also confirmed similar view:

There is an existing culture that we inherit from our seniors. It is not a simple thing. We transact such huge amount of money and we trust each other. That trust strengthens our relationship. We are working together. We drink together.

Although the Bank has good standard procedure manual, it is through interpersonal interaction employees get most of the knowledge they need from their colleagues.

Frequent interaction is the base for development of trust through which one party knows the intention of other actor. CBE organizes different forums that promotes interaction among employees and consequently builds interpersonal trust. Fluid task description within the department, training, mentoring and open office architecture are the main practices that build interpersonal trust among employees (see Kubo et al 2001; Chee-Yang Fong2011; Cabrera & Cabrera, 2005). The Bank task is risky. If one of the colleagues makes a mistake, others are also responsible for the mistake. This encourages employees to work collaboratively and openly share their knowledge. One cannot hoard knowledge to be exclusive person in the Bank. The Bank wants generalist professionals who have broader knowledge base and can handle different cases to assist customers in one contact point. Knowledge is not used as a criterion in performance appraisal to get promotion or other incentives. Other empirical research also found similar finding (see Kubo et al 2001; He et al., 2009; Chen and Cheng, 2011).

4.3. Organizational Culture

Organizational culture is the shared understanding that guides and shapes employees interpretation of events and actions (Donate and Guadamillas, 2010; Ali & Brooks, 2009; De Long & Fahey, 2000; Ipe, 2003). Employees do not act outside the overall organization framework. If the organization promotes learning, employees will also have a positive attitude to learn from their task and other colleagues and develop their capability. Organization culture is complex construct, which exists at different layers (McDermott & O'Dell, 2001). The frequently mentioned dimensions of culture are basic assumptions, norms and practices (see De Long & Fahey, 2000; Ali & Brooks, 2009). Basic assumptions are core values which are taken for granted ideas (De Long & Fahey, 2000). They are unconsciously executed by members of the organization (Ali & Brooks, 2009). They are invisible attributes of culture. Norms are social standards that specify what is right and wrong actions in the organization (Donate and Guadamillas, 2010). Practices are the most visible expression of culture (Ali & Brooks, 2009; De Long & Fahey, 2000). It includes organizational artifacts like databases, office layout, pattern of interactions, dressing styles and the likes. They are emanated from basic assumptions of the organization. If knowledge sharing is given importance in the organization culture, we observe knowledge sharing activities exercised by employees.

Human Resource Development (HRD) has core values in the Bank's culture. The Bank undertakes different human resource development practices to promote knowledge sharing from senior to junior employees. HRD practices create conducive work environment that fosters knowledge sharing among employees in the workplace (Fong et al., 2011; Cabrera & Cabrera, 2005). HRD practices that promote knowledge sharing in the Bank are training, mentoring and job rotation.

4.3.1. Training

The Bank organizes different training programs to promote knowledge sharing from seniors to juniors so that junior employees will acquire the necessary knowledge and skills that are specifically required for the task. Training is a form of education that is designed to fill a knowledge gap on the task. Bank trainings are designed to deliver specific knowledge required to do bank tasks such as customer service and trade service. Senior staffs serve as trainers in the on job training programs. Seniors share the tacit knowledge of the Bank which is not available anywhere in the bank documents. As the Credit Manager explained

Here I am a Credit Appraisal head. I am expected to provide training to other employees, especially training on internal operations.

Training is also used as a forum to share experiential knowledge among employees at the same position. Most of the trainings are organized among employees who are at the same positions; they have many common problems that facilitate knowledge sharing. Although they have similar problems, they solve in different ways. Training helps trainees to crystallize those different ideas and develop best solutions for future actions. As HRD Officer mentioned

Instead of the trainer, we get a lot of idea from peer discussion during the training. That brings more knowledge for us.

A Loan Recover Officer also confirmed similar view:

It may not be the same. In training you discuss the problem you encountered. Others also mention their case. So we discuss and deicide which one will be best solution for the bank.

Training also creates a forum to share knowledge among employees who are at the same position. Knowledge is not always flowing from seniors to juniors but also among juniors who are at the same positions. Such knowledge is more up-to-date to solve current problems.

It was repeatedly mentioned by respondents that employees in the Bank do not have good practice to codify their knowledge. Training creates an opportunity to share knowledge through face-to-face interactions. But codification requires deeper thinking to organize one's knowledge and present it in a way understandable by other colleagues. It also requires time organize and present to other colleagues while the Bank does not allocate time for such activities. Knowledge sharing through training does not require much effort as compared to codification and encourages knowledge sharing. It is also a two way interaction so that any ambiguity will be clarified during the interaction.

Employees are busy with their task and do not have time to interact with each other. Training gives a slack time for employees to focus on social interaction and share ideas and experiences. CBE is a large organization with many branches scattered throughout the country. Training also gives an opportunity to bring employees in one room from different locations and encourage formation of social network that serve as channel for future knowledge sharing. As the Customer Relationship Manager explained:

When we take training, we know each other. We also exchange our telephone address. Later when we have problem, we call to our training participants. The training is usually organized for employees who are working at the same position.

The Bank can also measure the contribution of knowledge donation by trainers and provide appropriate incentive mechanism. Of course it

is difficult to measure the amount of knowledge shared through training but Bank uses training time as a measure to provide incentives for trainers. One of the main challenges to provide incentives for knowledge donation is the lack of metrics. It can be inferred that informal knowledge sharing can be rewarded by the amount of time spent for knowledge interactions.

Employees also mentioned that when they are assigned as trainer, they learn more when they prepare for the lecture and try to answer questions raised by trainees. Training also helps trainers to develop knowledge sharing self efficacy which is one of the antecedent factor for effective knowledge sharing. Fong et al (2011) also explained that training provides a platform for employees to gather and share new knowledge.

Although the Bank undertakes intensive on job training programs, it is very difficult to claim that training is an effective means of knowledge sharing. It is just used to introduce employees to new work practices. Employees get most of the knowledge by interacting with their colleagues on the task. The Bank did not make any assessment how effective its training to share knowledge among its employees.

After training, we did not do evaluation what returns it brings to the Bank. We feel that it necessary, we did do such evaluation due to shortage of knowledge to do the task. We don't have comprehensive HRM strategy that leads us - Where we are, where we reach.

It was also reported by some employees they are assigned to a new position before taking any training and they could manage their task by asking their colleagues. There is an issue that needs to be investigated does the training worth than other means of knowledge sharing channels since the Bank allocates thousands of dollar for training budget.

4.3.2. Mentoring

Mentoring creates a shared mental context for sharing tacit knowledge. Although the Bank provides training and procedure manual to facilitate knowledge sharing, mentoring is also used to share knowledge on the task. Mentoring on the task allows sharing of tacit knowledge through two way dialogs after employees get basic knowledge through training or education. Researchers revealed that most knowledge is shared through informal interaction than formal knowledge sharing mechanisms (Karkoulian, Halawi and McCarthy, 2008). Mentoring is undertaken on the task and facilitates knowledge application and internalization. As Credit Relationship Officer explained:

Coaching and training are two different things. Training is used to provide basic knowledge. But coaching is used to fill a knowledge gap that arises during knowledge application. The mentor follows your work and when he identifies a gap, he fills that knowledge gap.

Some knowledge like process knowledge is very difficult to share outside task context. In the bank context, mentoring is used to reduce risks on the task that may arise due to trial and error learning process. Karkoulian et al. (2008) also confirmed mentoring as one of the factors that promote knowledge sharing in the work place. They also remarked that informal mentoring is a better predictor of knowledge sharing than formal mentoring.

However there is a norm in the Bank that seniors know everything and juniors are expected to listen to their seniors. This has an influence in one way flow of knowledge like the traditional teaching learning method. Seniors don't have the intention to learn from their juniors. As HRM officer confirmed:

The Bank has a culture of mentoring. A new employee learns from seniors through mentoring. Training is just to make things formalized. You learn a lot of things from other employees. The bank could not grow quickly as we see now.

Junior employees also mentioned seniors' unwillingness to learn from their juniors. This practice does not support knowledge sharing which is a two way interaction. It is only through two way interactions knowledge is amplified and new knowledge is created that is instrumental for innovation and new product development (Nonaka, 1994). CBE is expected to change this practice to maximize the benefit of its knowledge resources.

4.3.3. Job Rotation

Other researchers also revealed similar findings (see Cabrera & Cabrera, 2005; Kubo et al, 2001; Hsu, 2006). CBE's tasks are highly interrelated and employees need to have a general knowledge about all operational activities of the Bank. Employees with general bank knowledge can be rotated to any position where the Bank faces a manpower shortage. When employees transferred to a new position, they face a knowledge gap and are encouraged to acquire new knowledge to fill their knowledge gap. As Credit Advisor explained:

Job rotation may serve you in different ways. If you work longer time in one position, you don't add new knowledge. You have to be rotated to a new position. When you are assigned to different positions, you learn new things to perform your new task. The Bank also trains you.

Job rotation is an effective means for tacit knowledge acquisition (Kubo et al, 2001). It supports both demonstration and observation methods of knowledge sharing. Employees acquire the knowledge by directly working on the task and interacting with seniors who have the experience on the task. People centered knowledge management is more effective to share knowledge than technology centered approach (Hsu, 2006).

Job rotation also creates opportunity to create social network and relationship through interaction on the task (Cabrera & Cabrera, 2005; Kubo et al., 2001). This relationship will also serve as channel for future knowledge sharing if employees rotate to other positions in other branches. Most of the employees in CBE are accounting, management and economics graduates who share a common educational background. When an employee rotates to a new position, he/she will not face challenge to interact with seniors. People who share common background can easily share knowledge than people with different backgrounds (Nahapiet & Ghoshal, 1998).

4.3.4. Organizational Innovativeness

CBE is characterized as innovative organization that strives to satisfy its customers. The existence of CBE depends on the service fee paid by its customers. CBE regularly introduces new products to its customers. It also develops new procedures to provide the new products. This product and process innovation creates a knowledge gap among employees and motivates them to acquire knowledge from other colleagues as well as from external sources. As a Customer Service Manager mentioned:

When a new service is introduced, it creates confusion among us. Recently we start to sell bond. That creates a knowledge gap how to sell it. We learned about bond in the University. But we did not do since we joined the bank. This knowledge gap motivates us to acquire new knowledge.

Moreover, CBE is one of the largest organizations with many branches in the country. CBE also shows innovation by branches. When CBE opens a new branch, employees in the branch face challenges to perform operational bank tasks. In addition all branches may not provide the same

service. Branches in the small towns start with small services. As the town grows, the Bank also expands its services. The new service is considered as innovation for the branch and creates a knowledge gap for the employees working there. As the Customer Relationship Manager explained:

Our District provides loans for limited requests. Now we started to provide loan for agricultural projects and export. Handling such requests is new to us and it creates knowledge gap.

Although the service is new to the branch, it is not new to the Bank. The Bank supports the new branch by providing on job training. However, training is not adequate to solve all problems that arise while delivering the new service. Employees frequently interact with senior employees in other branches by making telephone calls and exchanging e-mails.

CBE uses latest technologies to improve the efficiency of its services. The Bank introduces different technologies at different times to increase its internal efficiency. The Bank undertook two big automation projects which are called Bank Master and Core Banking Projects. Core Banking Project was just implemented in April 2012. Although the Bank provides training when it introduces new technology, training may not adequate to get all knowledge required to use the new technology. Employees frequently interact with colleagues and other knowledge sources to acquire the necessary knowledge to use the new technology. Introduction of new technology is one of the organizational factors that motivate employees to seek new knowledge from other colleagues.

Therefore organizations which have innovative culture expect their employees to learn and acquire new knowledge so as to effectively execute the new task. Employees also develop intrinsic motivation to engage in knowledge sharing and develop their knowledge and skills to act according to their organization expectation. Organizational innovativeness creates a challenging work environment that promotes employees to engage in knowledge sharing and continues learning. This finding is also supported by other researchers (see McDermontt & O'Dell, 2001). Employees think critically, reflect on new knowledge and frequently interact with each other. Interaction is the main source of knowledge creation (Nonaka, 1994).

4.3.5. Monetary Incentives

Monetary incentive is considered as one of cultural practices that are targeted to promote knowledge sharing in the workplace (Al-Alawi et al., 2007). The Bank provides incentives for those employees who participated as trainer on job training programs. Monetary reward is one of the factors that influence employees' behavior to share their valuable knowledge to other colleagues (Cabrera & Cabrera, 2002; Bartol & Srivastava, 2002). The Bank also provides incentives for those who published to Bank's Mudaye Nuwaye Magazine. Although employees complain the lack of incentive for knowledge sharing, the Bank is willing to provide incentives for measurable knowledge contributions.

Although the Bank provides incentives for article contributes to Bank's publications, employees' contribution is not encouraging. There are different reasons why employees are not willing to donate knowledge despite the presence of monetary incentives. First, most of the employees lack the necessary skills to share their knowledge through codification. Second, the amount of monetary incentive is not sufficient to compensate the effort required to contribute knowledge through publishing articles. Unless reward is proportional to the knowledge contribution effort, employees may not be encouraged to contribute their knowledge just to get a monetary reward (Cabrera & Cabrera, 2002; Yang and Wu, 2008).

4.3.6. Open Office Architecture

The physical location of employees is an important factor for knowledge sharing. Closed office does not promote knowledge sharing. On the other hand open office architecture encourages knowledge sharing. It allows employees meet accidentally on the corridor and share ideas and experiences. Most of the tacit knowledge is shared through informal interaction than formal interactions. Open architecture is an alternative means to encourage knowledge sharing in the same building where there is no good technological support to share knowledge. The Bank does not encourage blocked offices. We have also observed when employees encounter problem on the task; they easily interact to nearby colleagues without leaving their chairs. Other researchers confirmed that the role of open office layout to promote knowledge sharing in the work place (Bechina and Bommenm, 2006; Riege, 2005). Bechina and Bommenm (2006) further remarked the negative impact of open office layout for employees who need concentration to create new knowledge. We also observed the problem of open office layout to create disturbances through noisy telephone calls and conversation where telephone is the main means of office communication tools in Ethiopia. Employees in R&D and system development department are not happy with open layout office.

Open office architecture also encourages supervisor and subordinate interaction. Although we repeatedly heard that managers work as coachers to their subordinates, the closed office for managers indicates that managers are not easily accessible for subordinates. However we have seen open offices for managers in service delivery departments where supervisors are required to provide immediate solutions when subordinates face problem. We can claim that organizations who are customer oriented should adapt open office layout architecture to quickly share knowledge and solve problems.

4.4. Task Characteristics

Task is one of the contextual factors that affect employee's knowledge sharing behavior (Kim, 2008). It is a challenge that encountered on the task that motivate employees to acquire new knowledge from other colleagues. Task has different dimensions which have different impact on employee's knowledge sharing behavior. More frequently cited task dimensions that have direct impact on employees' knowledge sharing are task variety, task uncertainty and task interdependence (Kim, 2008; Bin, 2009).

Task uncertainty implies a lack of specificity in task structure, inputs and processes. Tasks with high uncertainty are solved using personal experiences than explicit knowledge of the organization. They are very dynamic whose inputs and process changes depending on the situations. Although CBE develops standard procedure manual for all tasks, employees mostly use their experience based tacit knowledge to accomplish tasks with high uncertainty characteristics. Tasks like managerial positions, customer promotion and research on new product development are mentioned as tasks with high uncertainty characteristics. On the other hand, structured tasks have definite inputs, processes and outputs. The required knowledge can be codified as explicit knowledge for later retrieval. Employees working on tasks with low uncertainty frequently interact with colleagues until they internalize the standard procedures manuals. Once employees internalize the task knowledge, the task becomes boring as it does not initiate employees to seek new knowledge and learn new skills. We find such tasks in the service delivery area like CATS and Trade Service Directorates. The Bank normally assigns new graduates and unqualified employees in these areas. As employees get more experience, they are promoted to senior level positions that require personal creativity and judgment. Therefore, tasks which have high uncertainty creates a challenge for employees and promote employees

frequently interact with each other to acquire new knowledge and solve task related problems.

Task variety refers to the number of components included within the task. The more components the task has, the broader knowledge base it requires to accomplish the task. Employees are normally trained in one specialization and face a knowledge gap when they are assigned on such tasks. Task variety is the main knowledge gap creators and directly influences employees to seek knowledge from other sources so as to accomplish their task within the deadline and accepted quality.

Task interdependence refers to the extent of input and output exchange between or among different task components. Organization is a system, which contains interacting tasks or components through exchange of inputs and outputs. Employees who work on interdependent tasks have many opportunities to interact with each other and share knowledge. As the Credit Analyst mentioned:

I studied biological science in the University. I am hired for agriculture loan position. But I work on manufacturing, agriculture and export. Most of my task also involves financial matters. I also work as accountant. I do everything.

Task interdependency also exists among supervisors and subordinates. When subordinates encounter some challenge on their task, they ask their supervisors for solutions. Interdependent tasks create a context for knowledge sharing among employees. As employees interact to exchange task inputs and outputs, they develop close social relationship. Interaction is the main process that leads for the formation of social relationship among people. Through the interaction they are able to know the expertise level of other colleagues and can quickly locate when they need new knowledge from other colleagues.

4.5. Electronic Collaborative Tools

Electronic collaborative tools appear as one of enabling factors for knowledge sharing in our open coding data analysis. Electronic collaborative tools are software products that support collaboration over IT networks among groups of people or employees who share a common task or goal (Al-Ma'aitah, 2008).

Knowledge sharing involves an effort, which is usually expressed in terms of time. Electronic collaborative tools promote knowledge sharing by reducing knowledge sharing efforts. In CBE, employees don't have slack time to share knowledge unless they are assigned as trainer. Under such pressure of time constraint, it is less likely employees are motivated to share their knowledge. Likewise, knowledge seekers may not be promoted to acquire new knowledge if the process takes long time rather they complete their task with easily available knowledge. In this regard, technologies will have great role in reducing knowledge sharing efforts and encourage employees to engage in knowledge sharing activities. The three important dimensions of electronic communication media that facilitate knowledge sharing are usefulness, ease of use and access.

Employees in the Bank mentioned different cases how Internet is useful to acquire new knowledge their task. As System Analyst explained:

Our main source of knowledge is Internet. There are different services on Internet like discussion forums, online help and latest documents. When we encounter new problem, we check on Internet.

A Manager from R&D Directorate also reflected similar view

Without Internet, we cannot do anything. We get most of information for our work from Internet. Especially information about other organizations.

Business environments are very dynamic and organizations can cope up with this change by integrating internal and external knowledge sources. In this regard, Internet reduces efforts to acquire new knowledge by clicking a button on their desktop computer. It also creates new opportunity to access new knowledge which would not be possible without the presence of Internet. Knowledge acquired from Internet is also used to extend existing knowledge of the Bank by integrating with its internal knowledge.

Internet is more important for employees who engaged in tasks with high uncertainty. Those tasks are very dynamic from time to time depending on the external environmental factors. For example, employees in Promotion Directorate want to learn from other banks and competitors how they promote their customers. Such knowledge can be easily acquired from Internet and adapt to revise their promotion strategy. In the absence of technology, getting external source of knowledge is difficult and expensive. Therefore Internet has a contribution for on job learning.

The Bank also appreciates the role of technology to promote information exchange even within the organization. Electronic communication tools offer an easy way to share knowledge. The Bank installed Intranet in all branches of the Head office. IT Directorates properly utilized the Intranet services to share information. As Officer in the IT Vise President explained:

Now we started a new service on Open Ticket Request System. It is new service for our Bank. When system administrators have problem, they post their problem. Someone in the network responds to the request. They also use it to exchange message.

Employees in Credit Directorate also use Intranet to share files. As the Credit Analyst explained:

We use local Intranet to share files and exchange messages. Our supervisors also send message through Intranet. This practice comes as a result of BPR study recommendation. It has a lot of benefit like saving cost to print papers.

However Intranet is not used in all offices to share files. In most offices, there is no Intranet system. The existing Intranet is not connected to offices in other buildings. The role of communication technologies is to overcome distance and time barriers. For employees who work in the same building, communication technologies may not appear as important as face to face interaction and paper based document exchange. The Bank does not have also any explicit procedure what should be the mode of document exchange. Normally the Bank is very sensitive to risks. Every employee of the Bank wants to keep hardcopy document as witness for any risks.

In addition, employees use e-mail to send documents to colleagues in remote branches. Although telephone is the traditional type of communication, it is the most frequently used technology to share knowledge in the Bank. Telephone is easy to use technology and it is not frequently interrupted due to power interruption and technical failure. Employees also get immediate feedback to solve their problems up on request. The implication is that more adaptable technology is the one that is more dependable, easy to use and provides immediate feedback. E-mail and other online chatting services are not as popular as the telephone service. Other researchers also mentioned the importance of technology to enhance knowledge sharing practice among employees (Al-Ma'aitah, 2008; McDermott and O'Dell, 2001; Riege, A. 2005).

5. SOLUTIONS AND RECOMMENDATIONS

Knowledge sharing is a complex phenomenon which is composed of knowledge seeking and knowledge sharing. In order for an effective knowledge sharing to take place, there must be willingness to use and share knowledge. This study identified individual, organizational, task characteristics and technological factors that influence knowledge sharing behavior in the workplace. With regard to individual factors, we found learning orientation and social relation as immediate predictors of knowledge sharing. Knowledge is used to increase employees' capability to accomplish a task and achieve goals. This implies that organizations should create a work environment that facilitate on job learning.

Although employees acquire knowledge by working on the task, some tasks are very dynamic and complex which cannot be mastered through experience. They are always changing quickly to respond to the changing external environment. Tasks like customer promotion, research and development and IT systems are challenging tasks that require employees to regularly update their knowledge. Of course organization innovativeness has also an impact on employees learning behavior. Unless the organizations are ready for changes, employees may not be encouraged to learn and create new ideas that support organizational level innovation.

On the other hand, organization culture is the most important contextual factor that influence employees attitude towards knowledge sharing. With regard to organizational culture, human resource development practice that encourages on job learning, monetary incentives and open office layout structure are identified as elements of organization culture that promote knowledge sharing in CBE. CBE organizes different on job training, mentoring and different level meetings to promote knowledge sharing from seniors to juniors as well as employees at the same level. In the absence of organizational support, knowledge sharing remains an individual responsibility. Organizational level knowledge sharing promotes conversion of individual level knowledge into organization knowledge where it create value to the organization.

Although technological factor is important for knowledge sharing, it is not as important as organizational and individual factors. The Bank adapts people centered knowledge management approach. Such approach is important to share tacit knowledge of the organization but not effective to share explicit knowledge. Employees usually tend to share their knowledge in personal communication. They may not see codification as alternative way of knowledge sharing. The Bank has valuable explicit knowledge that is accumulated through its long year banking experience. This knowledge is not properly organized and stored in such a way that it can easily facilitate knowledge retrieval and integration. Access to existing knowledge resources is important to avoid reinventing and speed up new innovation when it is integrated with the tacit knowledge of employees.

The current effort of knowledge sharing in the Bank is to develop individual employee competency. Most of the knowledge sharing is designed to promote one way flow of knowledge from seniors to juniors. Although individuals are the main knowledge creators and users of knowledge in the organization, the Bank can benefit more by creating a collective shared knowledge among employees. Collective knowledge is a synergy to quickly create new ideas and products and services.

Although the Bank devises different knowledge sharing strategies, the Bank does not know which knowledge sharing strategy is more effective to share its experiential knowledge. For example the Bank invests more than half a million dollar for training. The Bank does not know the contribution of training to achieve its business objectives. Employees mentioned that they get most knowl-

edge through informal personal interaction than training. Organization should reassess the different knowledge sharing strategies and pay attention on a strategy that brings more benefit. Although the Bank pays much emphasis on the traditional means of knowledge sharing channels, there is a need to support the current practice with the state of the art knowledge sharing tools such as case based reasoning system and e-learning.

6. FUTURE RESEARCH DIRECTIONS

This research is conducted on single case study. The study proposed a theoretical framework that is used as lens to investigate knowledge sharing in the workplace. It is necessary to undertake similar study in other organizations to come up with a formal knowledge sharing theory. Qualitative research is good to build new theories grounded on empirical data but it lacks standard instrument to measure the explanatory power of the new theory. We recommend undertaking similar study with quantitative research method to quantify the amount of variation explained by variables that are identified as knowledge sharing behavior predictors. Knowledge Management Systems (KMS) are mentioned as one of the tools organizations use to promote on job learning by facilitating knowledge sharing among employees. However, the Bank does not have a knowledge management system. It supports on job learning by organizing different training programs. Training cost is one of the significant expenses of the Bank but the Bank does not measure the relevance of training to achieve its business objectives. We recommend researchers to undertake research that develop instrument to measure the effectiveness of different knowledge sharing strategies and recommend the best one for future practice. In our research we found that individual and organizational factors are mentioned as important factor that promote knowledge sharing. We argue that technology is not mentioned by our respondent because there is no KMS in the Bank. We also recommend other researchers to prove our research finding by doing similar research on organization which have a well developed KMS.

7. CONCLUSION

Knowledge sharing is a complex phenomenon which is composed of knowledge seeking and knowledge sharing. In order for an effective knowledge sharing to take place, there must be willingness to apply knowledge and share knowledge. The study identified individual, organizational, technological factors and task characteristics as the main factors that influence knowledge sharing in the work place. With regard to individual factor, learning orientation is a driving force to seek knowledge from other colleagues. Job rotation and task characteristics influence employees' attitude to have high learning orientation and engage in knowledge sharing activities. Tasks with high uncertainty and complex components create a knowledge gap which is an indicator of high learning orientation. Employees with high learning orientation are those employees who identified their knowledge gap and willing to engage in knowledge sharing to fill their knowledge gap. Internet is also found as one of the factors that form a high learning orientation behavior. It creates new opportunities to access knowledge which would not be possible without it. In the absence of Internet, employees may not be motivated to think out of the box and try new things.

Knowledge sharing is a social interaction. Employee's relationship with other colleagues has strong influence to share their knowledge to their colleagues or not. Employees who have closer relationship share knowledge freely and openly. When the social relationship is low, employees tend to use other source of knowledge rather than asking other colleagues. Organizational culture has

also strong influence on knowledge sharing in the workplace. It creates an opportunity for employees to interact with others and share valuable task knowledge. It has also an impact on development of social relationship and social network among employees which is found one of the antecedent factors for knowledge sharing.

Although there is unresolved issue with regard to monetary incentives on knowledge sharing, this research found that monetary incentive has an influence on employees' attitude to engage in knowledge sharing. Employees are willing to participate in the on job training programs mainly because of the presence of monetary incentive. However, monetary incentive should be proportional or better than the effort one puts on knowledge sharing. Open office layout also encourages development of social relationship and frequent interaction among employees to solve problems. Most of knowledge in the workplace is shared through informal interaction than formal interaction. Our research also found similar result. Although the Bank has a standard procedure manual for each task, employees acquired most of the knowledge through informal interaction with their colleagues.

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KEY TERMS AND DEFINITIONS

Bank: A financial institutions that handles financial transactions among and between organizations and people.

Data Mining: Is a software tool that is used to extract hidden knowledge in the database.

Electronic Collaborative Tools: Is a set of technological tools that includes online databases, Intranet, wikis, blogs and Internet that facilitate knowledge sharing across distance and time.

Explicit Knowledge: Is knowledge that is that is stored in documents and databases. It is more structured than tacit knowledge.

Information: Is data that is organized in a way to be meaningful for its end users.

Knowledge: Is information integrated with experience. It is a capability to apply information to solve problems and make decisions.

Knowledge Management System: A system that is designed and implemented to capture, organize, store, disseminate knowledge to facilitate value creation.

Knowledge Sharing: Is a process of two-way interactions to share ideas and experiences. It results in joint ownership of knowledge by the knowledge owners and knowledge seeker.

Knowledge-Based Society: Is a society whose main source of income comes from knowledge creation, dissemination, and use.

Organization Culture: Is a shared understanding or shared knowledge that is acquired from problem solving experiences and that shapes future interpretation and actions by the members of the organization.

Social Capital: Is a shared resource that exists among members of a group that share common goals. It is usually expressed through social relationship, social network and shared language.

Tacit Knowledge: Is knowledge that acquired from experience. It is sticky with the knowledge owner and difficult to share through codification.

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Chapter 55
Establishing the Linkage between Internal Market Orientation and Service Innovation

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ABSTRACT

This chapter proposes that internal intelligence generation and dissemination are significantly correlated and have substantial impact on responsiveness. In addition, responsiveness determines the success of internal market orientation and its effect on various employee-related outcomes. The study examines the extent of internal market orientation in Indian banking and its consequences as perceived by the employees of a highly successful private bank that has a wide network of branches in a northern city of India. Structural model was proposed and structural equation modelling was used to test the research hypotheses. The findings reveal that internal intelligence generation and dissemination are correlated to the extent of 0.89 and have significant impact on a bank's responsiveness to employees' needs and wants. Results of the study reveal that internal market orientation ought to be considered as an important strategy for retaining internal customers. Internal market orientation has an indirect significant impact on service innovations in terms of new product/service development, technology advancement, and process innovation through greater staff compliance, strong team work, and greater moral responsibility.

INTRODUCTION

As developed nations emerge from the financial turmoil and economic retrenchment of recent years, they are relying more on the developing economies to serve as the engine of global growth. Emerging economies, despite the turbulence, have managed stronger and more sustained economic expansion. These economies have been bolstered by a record of improved financial and fiscal sta-

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bility. The main driver of accelerated success by financial organizations in emerging markets is product and service innovation. Innovation is critical to accelerate progress and expand the market for financial services, through lower barriers to entry, increased productivity, and transformed economics of service delivery. Many economies are characterized as service economies, yet little attention is devoted to analyze service innovation and value creation (Ostrom et al., 2010). In this regard, Burgess and Steenkamp (2006) argued that the current knowledge of marketing phenomena derives almost exclusively from research conducted in western developed economies (industrialized nations such as the US or UK), and it is critical for marketing scholars to pay greater attention to emerging economies. While considering the views of Burgess and Steenkamp (2006) and Ostrom et al. (2010) about the gaps in the services research and the lack of research in emerging economies, O'Cass and Sok (2013) explored innovation driven value creation in B2B service firms in Cambodia. Many studies in the area of service innovation demonstrate a primary focus on single country analysis with the focus on developed economies, including North America (e.g., Scheuing & Johnson, 1989), Europe (e.g., Edvardsson, Haglund, & Mattson, 1995) and Australia (e.g., Alam & Perry, 2002). Aside from two studies (viz., Alam, 2007; Song et al., 2000), comparative research of service innovation concepts between developed and emerging economies is lacking. The emerging-market financial institutions rising into the top ranks of global market capitalization (ranking came mostly from China). More recently, institutions from Brazil, Chile, Indonesia, Thailand, Malaysia, Turkey, India, and South Africa have made their way up the rank. With increasing consumer awareness and global connectedness, the competitive picture has changed and thus today new emerging-market and service innovation strategies are required. Research on service innovation is regarded as being of significant importance by marketing practitioners and scholars due to the large proportion of wealth created by the service sector in both developed (e.g., U.S., Canada, & UK among others) and emerging (India, Brazil & others) economies (Chapman et al., 2003; Tidd & Hull, 2003) especially in financial sector. Previously Indian firms had little need or incentive for innovation, before the period of economic liberalization particularly in the service industry, because India was a protected and inward-looking economy lacking intense competition (Krishnan, 2003). Also Dutz (2007) posited that stronger competition among enterprises unleashes innovation in emerging economies like India. Dutz's study also indicates that businesses in India should focus on increasing competition that will drive innovation. Deregulation and heightened competition in India force companies to innovate (Alam, 2007). As a result, innovation becomes a key activity in the service industry in India.

Employees, constituting an internal market of an organisation, play a very significant role in bringing service innovations. They are the ones who bring forward new ideas, concepts, and successful innovations. Facing the intensive competition, service firms in almost all industries need not only deliver superior service quality but also create new approaches to service (Lovelock & Wirtz, 2004). The key to the well-implemented new service lies in the attitude and competence of the employees (Varey, 1995). In this regard, internal marketing is used to develop and maintain a service culture and to introduce new products and new marketing activities (Tansuhaj et al., 1988). While many other factors could determine the success of a new service (e.g., de Brentani, 1989; Edvardsson, Haglund, & Mattsson, 1995; Martin & Horne, 1995), internal marketing is expected to help the employees gain awareness and acceptance of new services being developed and offered to the market (Gronroos, 2000). Thus, the two concepts, viz., internal market orientation

and innovation are of utmost importance. The present study is an effort towards establishing the linkage between these two concepts in the area of financial services.

REVIEW OF LITERATURE

The concept of internal customers emerged in the literature on services marketing (Sasser & Arbeit, 1976; Berry, 1981) and subsequently in the services management literature (Gronroos, 1981). The term internal marketing (IM) has been first used by Berry et al. (1976) and later by George (1977), Thompson et al. (1978, p. 243) and Murray (1979). However, it was not until the publication of Berry's (1981, p. 25) article in which the term entered popular discourse, where he defined internal marketing as "viewing employees as internal customers, viewing jobs as internal products that satisfy the needs and wants of these internal customers while addressing the objectives of the organization." Internal marketing uses a marketing perspective for managing an organization's human resources (George & Grönroos, 1991). It is based on the philosophy of viewing organization's jobs as internal products and employees as internal customers (Sasser & Arbeit, 1976) as also indicated by Berry (1981). Internal marketing (IM) becomes important because it has a role in ensuring that everyone in the organization embraces appropriate marketing principles. It has been defined variedly in the marketing and the organizational behaviour literature. Gronroos (1981) defined internal marketing as "selling the firm to its employee." George and Gronross (1991) suggested that "internal marketing of employee is best motivated for service-mindedness and customer-oriented behavior by an active, marketing like approach, where marketing like activities are used internally."

Arndt (1979) identified three major tasks for IM;

1. The dissemination of information to and from all internal groups involved in or affected by the marketing activities, for the efficient implementation of marketing decisions;
2. The development of competence, especially important where "the organization is the product" (i.e., in service business); and
3. The development and maintenance of incentive and motivation system which reward marketing performance.

Three components have been conferred on IM (Foreman & Money, 1995), viz.,

1. Development (items having to do with developing employees),
2. Rewards (items having to do with rewarding employees), and
3. Vision (giving employees something to believe in).

These factors closely mirror three of the essential aspects of IM practice identified by Berry and Parasuraman (1991), viz., participation in decision making, empowerment and open communication. Lings (2004) has normatively referred to internal market orientation (IMO) as suggesting three core dimensions comprising the notion of internal market intelligence generation, internal-market communications and internal-market response. Specifically, Lings and Greenley (2005) took as reference the market orientation (MO) of Kohli and Jaworski (1990), thus identifying five components of IMO (being implementation of internal marketing) in their scale:

1. The informal generation of internal information not previously planned by the managers;
2. The formal generation of internal written information, through questionnaires, surveys, etc.;
3. The formal face to face generation of internal information, through interviews and meetings planned in advance by managers;

4. The dissemination or communication by managers to their employees of the internal information generated; and
5. The design and implementation of the managers' response in accordance with the internal information generated and communicated.

The first dimension, viz., internal-market intelligence generation, relates to such activities as the identification of exchanges of value for the employees, the comprehension of the labor market conditions, the recognition of specific internal segments of employees with different characteristics and needs, and the designing of strategies for the internal market. Information generation within the internal market appears to have three main foci:

1. To identify employees' perceptions of their inputs to their jobs;
2. To identify employees perceptions of outputs (i.e., what that they receive); and
3. To identify employees' perceptions of the equity of this exchange (Huseman & Hatfield, 1990).

According to Lings and Greenley (2005), there are three modes of information generation, based on different types of interactions between managers and front-line staff. These are formal written information generation, formal face-to-face information generation, and informal face-to-face information generation. Formal approaches to information generation are manifested in two modes; the use of written media, e.g., questionnaires and job satisfaction surveys and formal face-to-face interactions, e.g., interviews, appraisals and meetings (Cobb et al., 1998). Further, the close physical proximity of managers and their front-line staff provides scope for informal day-to-day, face-to-face interactions. This offers additional opportunities for information generation. Thus, IMO contains elements that help in the collection of information from employees with regard to knowledge about exchange items, internal market segment and competitors' activities (Lings, 2004).

Information dissemination is a second important pre-requisite to align employees' attitudes and behaviours with the organization's goals (Boswell & Boudreau, 2001; Guest & Conway, 2002). Internal communications is a key in this process by which an organization transfers information from one entity to another, i.e., disseminate information throughout the organization (Johlke & Dale, 2000). The close physical proximity between managers and employees increases opportunities for such communication, providing the chance to disseminate information. Elements of IMO including information generation, information dissemination and responsiveness to information are centred around communication or dissemination (Lings & Greenley, 2005; Gounaris, 2006, 2008) and assist in the creation of a workplace culture (climate) in which bi-directional communication is valued and encouraged. This process fosters communication between employees not only within their own departments, but also on an interdepartmental and cross-functional level.

The last dimension of IMO involves responding to the information generated about the wants and needs of employees. Responding to information about the internal market may take several forms and appropriate responses have been suggested as the design of jobs (Sasser & Arbeit, 1976; Berry & Parasuraman, 1991), the manipulation of financial rewards (incentives) (Sasser & Arbeit, 1976); and the administration of nonfinancial rewards and desirable outcomes (Varey, 1995), including management consideration (Johnston et al., 1990), and training (Van Haastrecht & Bekkers, 1995). The HRM literature also identifies several responses to internal market research information. Gomez-Mejia (1988) suggested that this information should be used to develop appropriate reward systems for employees. Briscoe (1980) suggested that there are four main responses that organizations may adopt, viz., change the people, change

the organization, change the interface between the people and the organization, and individualize the organization.

Consequently, it is assumed that successful internal marketing programmes can lead to important payoffs for an organization (Arnett et al., 2002), such as customer satisfaction. Literature empirically supports the IMO link with the end customers' satisfaction (Tansuhaj et al., 1988). It enables managers to demonstrate a caring attitude and also a sense of responsibility and pride in belonging to an organisation in which all departments and employees work as a team and provide consistent services. IMO is thought to influence employee attitudes and behaviours, in particular employee motivation to provide good customer service (Tansuhaj et al., 1988).

As service industry becomes more and more important in the economic life, innovation plays a critical role in the increasingly competitive business environment in which firms operate. The service innovation happens frequently in the service delivery process as the process of service production is often synchronized with the process of service delivery. The service innovation is a new service or a renewal of existing service, which is put into practice and provides benefit to the organization; the benefits usually derived from the added value that the renewal provides to the customers (Toivonen & Tuominmen, 2006). Defined broadly, innovation is an idea, practice, or object that is perceived as new by an individual or organization (Rogers, 2003). While the definition set forth by Rogers can be applied to the service context, a distinct definition for service innovation is warranted to recognize its unique nature. Service innovation is the development of a new service that is perceived as new and helpful to a particular focal audience (Flint et al., 2005).

Despite the long-standing recognition of the importance of satisfying employees to create successful service outcomes for customers (e.g., Bitner, Booms, & Mohr, 1994; George, 1990), limited empirical research in IMO has examined employee-level outcomes in the form of service innovation. While relating IMO with innovations, Gupta and Rogers (1991) suggested that internal marketing is a mechanism to overcome the difficulties of getting new ideas and new ways adopted. The association between innovation and the market-orientation of a firm has been examined to be both positive and significant (Agarwal et al., 2003). In other words, a more market-oriented firm is more likely to consider innovation, which ultimately leads to superior firm performance (Agarwal et al., 2003; Han et al., 1998). But, the research question is- whether internal market orientation of a firm leads to service innovation or not? As limited work has been done in this area, the present study attempts to systematically integrate two related concepts of internal market orientation and service innovation. Thus, the study aims to conceptualize the relationship between an organization's level of IMO and the success of its service innovations.

The study has been carried out in the Indian banking context, which is still in its developing stage. It shall provide useful insights to other emerging economies as well, particularly those sharing similar characteristics with India. This work is quite relevant for Indian banking industry primarily due to two reasons, viz., banking sector in India is confronting acute competition from national as well as foreign banks; and there is high level of employee switching from one bank to another, more specifically among private banks. In order to retain the intellectual capital and lock their employees, banks have to properly understand employees' wants and needs from respective organization and respond to them most efficiently and effectively. Proper implementation of market orientation can also be made possible only through serious endeavours for initiating IMO efforts. Market orientation coupled with IMO can ensure better pay offs to any organization (Sanchez-Hernandez & Miranda, 2011). Indian banks can face competition both at national and international upfront only if they update their

strategies according to the changes in internal as well as external markets. IMO inculcates a sense of commitment and identification, which would help a bank in introducing new services/schemes. Banking environment encouraging participation of employees in decision making, open/free flow of communication both horizontally and vertically and empowering employees, shall guarantee lower level of employee switching (Asif & Sargeant, 2000). Moreover, customers shall also give their maximum business to that bank, which shall be able to provide additional value. Thus, service innovations shall help retain the market share.

The rest of the paper is organized as follows. First, we present an overview of the literature on IMO and service innovation. Second, we explain our research method and data collection process. Next, we finalize IMO scale using confirmatory factor analysis. Finally, we discuss managerial implications of the study, its limitations and future research directions.

HYPOTHESES FORMULATION

Organisations that have developed or in the process of developing an IMO are generally interested in the views of their employees, as IMO involves the generation and dissemination of intelligence pertaining to the wants and needs of employees. Information generation is relevant to the internal market as it relates to employees' perceptions of the inputs to their jobs, the outputs (what they receive) and the equity of this exchange; information dissemination between management and employees and among managers relates to information generated internally about the needs of employees and their requirements, which is shared and communicated across departments (Rodrigues & Pinho, 2012). Consequently, one would anticipate that the more the information is generated about employees' wants and needs, the more likely the organisation is to communicate this information to appropriate decision makers (Lings & Greenley, 2009). In context to external market orientation, Kohli and Jaworski (1990) note that for an organization to adapt to market needs, market intelligence must be communicated, disseminated and perhaps even sold to relevant departments and individuals in the organization. Similarly, with regard to IMO, information pertinent to the internal market must be communicated and disseminated by an organization to adapt to the needs of the internal market. One of the future lines of research enunciated by Lings and Greenley (2005) centres on the need to corroborate the possible causal order of the dimensions of internal market orientation. On the lines of the several studies on market orientation, in which the dimensions of MO (generation and dissemination of the information) have been found to be related to each other, following a causal order (Diamantopoulos & Hart, 1993; Kohli & Jaworski, 1990; Slater & Narver, 1995), Lings and Greenley (2005) proposed that such a causal link can also be established for the dimensions of IMO. In order to examine the causal relationships between internal information generation and dissemination, we offer the following hypothesis-

H1: There is a positive association between internal intelligence generation and internal intelligence dissemination.

Stauss and Schulze (1990) suggest that internal marketing refers to the management of exchange processes with internal members and assert that one of the challenges of internal marketing is to generate information about things of value that are exchanged, specifically what the employee seeks from the job, what they are prepared to give up to get it and what competitors are offering in terms of employment. They further recognized that generating and understanding information about the internal exchange will allow employers to formulate appropriate responses to the internal market. Lings and Greenley (2005) report five managerial activities associated with IMO: three

related to generating information about the internal market (i.e. employees' wants and needs, using informal methods, formal face to face methods and formal written methods), one related to disseminating information, and one to implementing the response to this information (i.e. the development of job products to satisfy the wants and needs of employees). This conceptualisation of IMO as internal market sensing and responding activities was later confirmed by Gounaris (2006). Following the logic of Jaworski and Kohli (1993), it appears probable that these internal market sensing and responding dimensions are causally related. Generating information about the internal market (no matter which mechanism is utilised to obtain it) is likely to precede dissemination of this information. Both information generation and dissemination are likely to precede value creating responses to the internal market. This makes both logical and intuitive sense that information is required to be collected prior to any dissemination effort and consequently, the collection of information must precede its dissemination in the process of IMO. Thus, above discussion led to the following hypothesis-

H2: Both internal intelligence generation and dissemination leads to internal responsiveness.

Developing and enacting appropriate internal market responses to enhance the value of employment for employees has been reported to have several important consequences for the organisation. The adoption of effective response mechanism within the organisation results in employees being better informed and motivated to carry out the strategic responses of the firm to its market (Wasmer & Brunner, 1991). Elements of the internal marketing, which have been identified by several studies include: selecting right personnel (Berry, 1984; Tansuhaj et al., 1988; Grönroos, 2000), effects of training (Harrell & Fors, 1992; Cahill, 1995; Grönroos 2000), considerations of empowerment (Shostack, 1987; Brown et al., 1994; Grönroos, 2000), and effects of teamwork. Motivating employees to deliver exception service is thought to be a key determinant of customer satisfaction. From an internal marketing perspective, many researchers have argued that by responding to the needs of their internal customers, firms enhance their ability to satisfy the needs of their external customers. However, both customers and employees need to be seen as part of a virtuous circle in which attention given to one reinforces attention given to the other. Thus, satisfaction of the internal customer is of critical importance as satisfaction will ultimately affect the satisfaction of the external market (Ballantyne, 1997; Heskett et al., 2008). The internal market of a business encompasses its employees, so this market is continuously being influenced by the ability of employees to work together as a unit to reach and maintain the objectives of the business. The internal marketing concept emphasises that teamwork amongst the employees of the business is a key factor in the development and retention of a successful business strategy (Kale, 2006). Previously, Davis (2001) suggested that internal marketing can bridge the gap between the different internal constituencies and establish cooperation among them. Thus, successful implementation of internal marketing can lead to better teamwork. The rationale for the adoption of IMO is to ensure that employees feel that management cares about them and their needs are met. It empowers employees and gives them accountability and responsibility. It can be concluded that IMO is a tool that harnesses the employee power and creates an environment where every member acts as both a client and customer in order to create responsibility (Mishra, 2010). It is sometimes difficult for an organization to maintain consistency in performance and keep the motivation levels high especially when the work is monotonous, thus IMO breaks the monotony and brings consistency both in employee decision making and performance. Employees are the `strength of any business success since their value to the organization is essentially intangible and not easily

replicated (Meaghan & Bontis, 2002); therefore managers in various organizations must ensure that there is employee continuity (consistency) in their organization to enhance organizational competitiveness.

Thus, quitting intentions and staff retention are the consequences of IMO, as happy and motivated employees are less likely to seek alternative employment (Ozment & Keller, 1999; Taylor & Cosenza, 1998). Employees are also likely to have positive attitude and comply with organizational strategies aiming at creating customer satisfaction (Piercy & Morgan, 1990). Through employee satisfaction and commitment, IMO constitutes a core competency and capability of the organization, creating a sustainable competitive advantage through more satisfied and loyal customers, which in turn amount to increased profitability (Greene, Walls, & Schrest, 1994; Lings & Greenley, 2005).

H3: Internal responsiveness leads to increased customer satisfaction, esprit-de-corps, sense of responsibility, staff attitude and staff compliance.

Though the basic processes for developing new products or services depend mostly on technology, but there are other aspects also which are equally important as technology (Tidd et al., 2001; Nijssen et al., 2006). In particular, IMO is especially relevant for innovation in services, since success depends on how the employees deal with it. According to Edvarsson and Olsson (1996), the main task in service innovation is to create the prerequisites for services, which the customer perceives as having an attractive added value. In this sense, IMO creates co-operative and enthusiastic employees (Ballantyne, 2000); Ahmed et al., 2003), commitment (Hogg, 1996), coordination and cooperation among employees and departments (Ahmed & Rafiq, 2003) and participative management (Davis, 2001). Johnston et al. (1990) highlighted the important part managers can play in IMO by developing a working climate of psychological support, mutual trust and respect, thus improving customer satisfaction. IMO is considered to be a critical factor for success in all three stages of the service innovation process. In the planning stage, employees have long been identified as an important source of winning ideas (McGuire, 1973) and better the IMO, the more successful ideas one may expect. The active involvement of frontline personnel in particular is essential for the success of the innovation since they possess invaluable information about the needs of the targeted customers (Lievens et al., 1999). In the development stage, communication flow among project team members must be suitably managed throughout the project's life-cycle (Lievens et al., 1999) to enable them to reduce uncertainty (Souder & Moenaert, 1992). And in the market launch stage, it is well known that the efforts put in by the team are linked to success (Calantone & Di Benedetto, 1988) and that the training and in-house selling of the new service (de Brentani & Cooper, 1992) during the launch help to validate the internal customers approval of the innovation (Abramovici & Bancel-Charensol, 2004). Blazevic et al. (2003) established a dependence relationship between the speed in developing a service innovation project and the knowledge generated by the interactions of the team members. In this context, Foote et al. (2005) found that employees' attitudes (affect and cognition) toward self directed work teams were positively related to their commitment to implement a team concept. Innovation in services typically results from increased customer satisfaction, i.e., if customer is satisfied with the present services, the service provider would definitely introduce service innovation in order to increase its satisfied customer base. Within the strategic model, employee-driven innovation appears particularly important for services (Sundbo, 1998, 2008). In a sense, employees are equivalent to technology in manufacturing; they carry out the acts that constitute the service "product" and they have the knowledge needed to perform those actions. In

executing an innovative strategy, firms can identify the ideal process blueprint for the organization and secure the best technology money can buy, but it takes people to make it all work (McKnight & Hawkrigg, 2005). From this review, it is clear that organizations that do not focus on employee commitment, understanding, and capabilities at the beginning of a strategic change run the risk of wasting time and money trying to resolve internal problems later (Averett, 2001). In case of a service innovation, the role of frontline employees in successful implementation can be especially important because employees often "are the service" in services context (Zeithaml et al. 2009, p. 352). As such, service innovations will succeed only if the employees embrace, execute, and promote them. However, task autonomy also may change employees' feelings toward and beliefs about the task. Service firms classify the innovation with customer satisfaction, quality improvement and so on (Liu & Lu, 2006). The implications of IMO for service innovation are clear; in addition to training for consistent service quality, managers need to make employees responsible and flexible enough to handle heterogeneous customers and to keep the end goal of customer satisfaction in mind. Firms have innovation resources in the form of employee competencies (creativity, involvement, customer insight, project work discipline etc.) and the employees' knowledge about customers and their interpretation of this knowledge and managers' abilities to organise and lead innovation processes based on their experiences. According to Zhou and Wu (2010) existing organizational people, processes and routines influence innovations that constitute new ideas and practices.

This discussion has led to formation of the following hypothesis:

H4: IMO resulting into perceived customer satisfaction, esprit-de-corps, sense of pride and responsibility, staff attitude and staff compliance, finally leads to service innovation through these outcomes.

RESEARCH METHODS

The items under three dimensions of internal market orientation, its consequences and service innovation, were generated from different sources, like discussion with managers and employees of the bank, experts in the area of marketing and a perusal of relevant literature like Jaworski and Kohli (1993); Kohli and Jaworski (1990); Lings (2004); Lings and Greenley (2005); Narver and Slater (1990); Russell and Russell (1999); Singh (2000); Singh (2003); etc, on the basis of which an instrument was framed for the collection of requisite data. Some items were kept in negative form so as to have internal cross checking and to ensure the active involvement of respondents. The negatively worded items were reversed before data processing.

Items pertaining to the variables of three sub-constructs of IMO, staff compliance, staff attitude and perceived customer satisfaction, have been extracted from Lings and Greenley (2005). Items relating to sense of pride, responsibility and esprit-de-corps have been adapted from Kohli and Jaworski (1990). Intelligence generation contained items pertain to formal intelligence generation in the form of formal written information generation and formal face-to-face information generation, informal information generation and segmentation of internal market. Intelligence dissemination comprised of items focusing on the relationship between management and employees, attitude of managers, organisation climate, relationship among employees and wants and needs of employees. Responsiveness contained items relating to strategies for each segment, job design to meet wants and needs of employees, incentives in the form of bonus, salary, loan and other allowances, management considerations and training and social element (Refer Annexure-1).

A successful Private Bank located in the northern India (hereafter referred to as PvtBank for brevity) was selected to achieve the objective of the present study. Rationale for the selection of

this bank lies in the fact that only profit making firms can employ internal market orientation as their strategic endeavour. In fact, this bank is the oldest profit making private bank amongst other private banks. It has a wider coverage through branch network all over Jammu and Kashmir State of India and the entire country. Also according to an unpublished report of Reserve Bank of India (2008), this bank ranks among the largest and strongly profitable private sector bank, with strong retail presence in the northern region of India (i.e., with large and diverse branches) when compared with other banks. The rational for selecting this bank was the long-run profitability of the bank. Being the most successful bank, it is in a position to adopt and implement IMO in an effective manner. Pre-testing was performed in three discernible stages, viz., self administered instrument to the employees of bank branches located in a northern city of India, vetting of the instrument and further, qualitative assessment of instrument items by the consultative panel. An initial instrument was pre-tested with 30 internal customers of 10 PvtBank branches, selecting three from each branch A prior consent was obtained from 30 internal customers of these branches before they were approached for pilot testing the instrument. The instrument was also pre-tested for qualitative assessment by the consultative panel formed, i.e., marketing executives of Zonal office and other practitioners, in order to make it more reliable. The final instrument comprised of three dimensions of IMO, staff compliance, staff attitude, sense of pride and responsibility, esprit-de-corps, and perceived customer satisfaction. Coefficient alpha values ranged from 0.578 to 0.919 (Table 1), implying higher internal consistency in the data for the constructs under consideration. A five-point Likert scale was used for the instrument ranging from 'highly satisfied' (5) to 'highly dissatisfied' (1). In all there were 37 branches of PvtBank in Jammu city of Jammu and Kashmir state and there were 194 internal customers working in these 37 branches, who were finally approached for the collection of requisite data. Respondents were middle level employees of the bank in different branches. Out of 194 instruments distributed among these internal customers, 162 instruments respectively were completely filled in by the respondents, thereby constituting 84% response rate.

ANALYSIS AND DISCUSSION

The study used structural equation modelling (SEM) as a technique for maximum likelihood estimation in examining the proposed hypotheses using AMOS (16.0). Most commonly used method of analysis for SEM is a two-step approach suggested by Anderson and Gerbing (1988). Confirmatory factor analysis (CFA) was performed for all the major constructs, viz., internal intelligence generation, internal intelligence dissemination, responsiveness, staff compliance, staff attitude, sense of pride and responsibility, esprit-de-corps, perceived customer satisfaction and service innovation. Composite reliability, Cronbach's alpha and construct validity were checked to judge the consistency and authenticity of the data.

We performed CFAs on all the scales used in the study to determine whether the items actually reflected the underlying latent constructs. All the scales exhibited adequate fit with the data, coefficient alpha value more than 0.7 for most of the scales, average variance extracted (AVE) exceeding 0.5. All the items loaded high on their respective constructs, suggesting convergent validity (Table 1). To find evidence of discriminant validity, we compared the constrained model (covariance between two measurement models was constrained to one) with the unconstrained model (covariance was freely estimated) for every pair of the constructs used in the study. Using the chi-square difference test, we found that all the unconstrained models significantly reduced the chi-square value over the constrained models (Anderson & Gerbing, 1988).

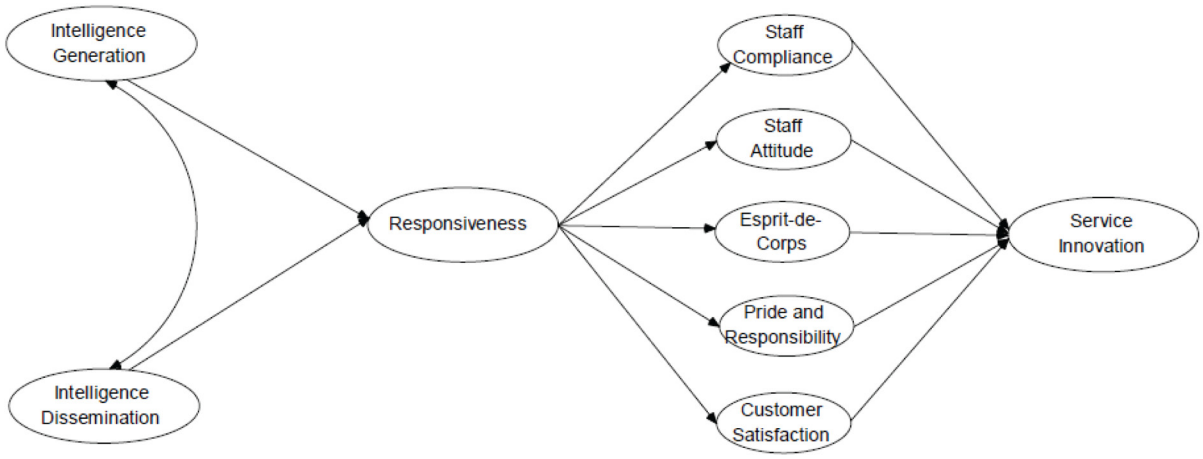
Table 1. Descriptive statistics: mean, standard deviation, average factor loading, cronbach alpha, average variance extracted and composite reliability

Construct	Mean	SD	AFL	Alpha	AVE	CR
IG-FIG	2.139	.764	.618	.847	.533	.967
IG-IIG	3.932	.717	.733	.671	.548	.947
IG-SEG	3.887	.493	.628	.729	.570	.975
ID-BME	2.532	.577	.624	.759	.511	.961
ID-AM	3.850	.680	.679	.807	.602	.976
ID-OC	3.834	.968	.583	.696	.486	.906
ID-EE	4.282	.336	.640	.772	.504	.988
R-INC	4.207	.469	.594	.782	.492	.970
R-MC	3.953	.557	.706	.842	.540	.988
R-TRAN	3.981	.678	.763	.909	.602	.991
R-JD	3.748	.597	.724	.789	.563	.974
Staff Attitude	4.271	.688	.813	.888	.669	.989
Staff Compliance	3.621	.586	.599	.618	.541	.940
Esprit-de-Corps	3.096	.499	.572	.578	.466	.979
Perceived Customer Satisfaction	4.485	.509	.714	.810	.539	.987
Pride and Responsibility	4.162	1.009	.726	.738	.543	.962
Service Innovation	3.129	.821	.923	.919	.853	.964

Abbreviations used: IG- intelligence generation; ID- intelligence dissemination; R- responsiveness; FIG- formal intelligence generation; IIG- informal intelligence generation; SEG- segmentation of internal market; BME- relationship between management and employees; AM- attitude of management; OC- organization climate; EE- relationship among employees; INC- incentives; MC- management consideration; TRAN- training; JD- job design; SD- standard deviation; AFL- average factor loading; AVE- average variance extracted; CR- composite reliability.

Proposed hypotheses were tested through structural model (Figure 1). SEM results reveal that internal intelligence generation is best represented by formal intelligence generation, informal intelligence generation and segmentation of internal market. These results are consistent with the study of Lings and Greenley (2005). Internal intelligence dissemination comprises of attitude of management toward employees' needs, organizational climate, relationship between managers and employees, and among employees. Responsiveness consists of management consideration, incentives, training and effective job design. Internal intelligence generation and dissemination are highly correlated (b=.89), which signifies their interdependency. Hence, first hypothesis (H1) stands accepted, i.e., the quality of information generation shall determine the extent to which this information has to be disseminated effectively. Both intelligence generation (b=.61) and dissemination (b=.42) are significantly influencing the response design and implementation of the information so generated and disseminated, therefore accepting H2. Effective response design and implementation result into sense of pride and responsibility (b=.51), esprit-de-corps (b=.61), staff compliance (b=.51), staff attitude (b=.75) and perceived customer satisfaction (b=.52). This leads to the acceptance of H3. Thus, responsiveness toward the needs and wants of employees consequents into more responsible and committed work force, who can ultimately contribute significantly toward

Figure 1. Conceptual model of internal market orientation and service innovation



generating new ideas. These outcomes of IMO bring innovations, as employees feel motivated and satisfied toward assuming greater responsibilities and exerting extra for the overall growth of an organization. In context to banking sector, three outcomes of IMO, viz., sense of pride and responsibility (b=.63), esprit-de-corps (b=.13) and staff compliance (b=.14) seem predicting service innovation, where sense of pride and responsibility has greater prediction for service innovation. Hence, H4 is partially accepted. Thus, inculcating a sense of pride and responsibility and generating team efforts among employees is the crux of innovation.

Besides chi-square, additional fit indices, such as the Goodness of Fit Index (GFI), the Comparative Fit Index (CFI), the Normed Fit Index (NFI), the Tucker-Lewis Index (TLI), the Root Mean Square Residual (RMSR) and the Root Mean Square Error of Approximation (RMSEA) have been used to determine the fit of the tested model. These fit indices proved to be robust to sample size effects. Model fitness reveals that CMIN/df (1.172) is non-significant (p=.123); RMSR (.020) and RMSEA (.033) are below 0.08; GFI (.928), CFI (.986), TLI (.980) and NFI (.915) respectively are above the threshold of.90. Hence, the data fit the model very well.

CONCLUSION

The study finds that IMO is represented by internal intelligence generation, internal intelligence dissemination and responsiveness, where intelligence generation and dissemination are positively correlated and significantly predict responsiveness. Thus, the greater the degree of intelligence generation and dissemination, the greater shall be the response toward its implementation. Internal marketing programmes aim at empowering employees, ensuring open communication and effective participation in decision making, ultimately consequent into motivated and committed work force. IMO through its three components has positive outcomes in the form of sense of pride and responsibility, caring attitude, teamwork spirit, compliance and perceived customer satisfaction. Hence, market-oriented attitudes and behaviours of management toward internal market is the bottom line of the market orientation of employees. Satisfied and motivated staff tends to think favourably toward the success and long-term growth of their organization. IMO results into employees' commitment for and identification with the organization. They feel encouraged to efficiently perform both in-role and extra-role behaviours so as to help an organization achieve its objective.

IMO finally ensures employees' lesser intentions to quit their job, therefore they think seriously about the growth of their organization. Such a growth can be guaranteed if these employees introduce new products, process, technology etc. Thus, novel ideas can be expected from the employees' if their wants and needs are taken care of by the management. IMO encourages employees' to perform beyond the task assigned to them. They feel responsible and accountable toward the success and survival of their company. The study also reveals that the outcomes of IMO lead to innovation, particularly for banking services. More specifically, sense of responsibility, esprit-de-corps and staff compliance amount to innovations in the service sector. Hence, attitudes and behaviours of management have significant impact on the attitudes and behaviours of the employees. If management feels responsible toward meeting internal market's expectations, then employees shall deliver quality services to achieve success in the external market.

MANAGERIAL IMPLICATIONS

The study has important implications for managerial practice. The model provides a framework within which a clear relationship between IMO and service innovation gets established. More particularly, the bank in question has a long history of new product/service development, novel process ideas and technology breakthrough resulting from employee participation, empowerment and free communication. Bank managers need to recognize the critical roles that employees play during the innovation process. To bring innovation in services, managers must work to gain and maintain internal aspects of performance – employee satisfaction, retention and commitment. Thus, management should focus on internal market research by conducting surveys at least once a year to gather information about the job requirements of internal customers. Managers need to enhance their listening skills and learn to generate information about the wants and needs of employees using both formal and informal techniques. The process of designing jobs to meet the needs of employees (i.e. by adopting an IMO) involves gaining a better understanding of the things that employees' value in their employment. Such information can be acquired through formal internal market research, but due to the close physical and psychological proximity of service managers and their employees, information about wants and needs may be obtained through informal routes as well such as conversations and 'hall talk' (Lings, 2004). Service organisations also need to facilitate the dissemination of this information throughout the organisation and to encourage debate regarding the most appropriate response design to employees' wants and needs and how best to balance these with the objectives of the firm. Management has to understand that internal responsiveness depends upon the internal marketing intelligence and dissemination activities. Management must use internal market information in designing the jobs that can better meet the needs of employees, satisfy and motivate them to perform better service encounter with the external customers. The surveys relating to internal customer orientation need to focus more on creating awareness about internal service quality, the identification of internal customers' expectations in terms of financial and non-financial incentives, generating and understanding the information for formulating an appropriate response to the internal marketing in terms of job products etc. (Lings & Greenley, 2005).

Employees share the need to be trusted and empowered to take a greater level of responsibility and autonomy in their service roles. Customer satisfaction (internal and external) should be more important than adhering to rigid rules and policies. Since banks implement internal marketing in order to develop and maintain a workforce that is customer oriented and focus on delivering quality, they need to accept the proposition that employee

empowerment can significantly contribute to the creation of a "climate for service." The emphasis placed on training and development contributes to developing service-oriented employees, improves their competencies and leads to employee satisfaction and hence, enhances the motivational level of employees, which ultimately lead to new service development.

The findings of the present study indicate that internal marketing practices aim at enabling banks to bring innovation in services through the 'people' element of their marketing mix. To achieve good service innovation, it is paramount that internal service providers have the freedom and flexibility to adapt the service delivery to meet the needs of their internal customers. A formalised strategy for implementing internal marketing procedure needs to be drawn up by head office staff. This includes both training programmes and a system of post-training feedback to ensure that the lessons of training are actually being transferred to the workplace. The adoption of a supportive management style is required, which shall encourage the development and motivation of staff. Managers need to pay significantly more attention to the communication of marketing (and other organizational) strategies and objectives to employees so that they understand their role and importance in the implementation of the strategies and achievement of marketing and organizational objectives (Gronroos, 1981). Service innovation requires managerial guidance, which demands a firm strategy or business model as a guideline, as long as it is based on the customer encounter and customer values. The results also support the value of providing employees choice and independence regarding implementation of new strategy innovations so that they believe they have autonomy, which in turn leads to greater motivation to participate. Training and incentives that give employees a sense that they have choices in innovation implementation are likely to result in more positive feelings, beliefs, and behaviours related to the innovation. The leadership at all levels is responsible for steering the organization's attitude toward innovation, creativity and new ideas. If the directors of a company fail to recognize new ideas, recognize and reward both incremental and radical innovations and to provide support, the possibilities for innovation to occur are limited. Encouraging front-line employee involvement in the new service development increases the likelihood of positive implementation of innovative services. The service firms should introduce innovation centres for different service innovation function teams according to the degree they possess information of innovation. For employees, the firms should adopt the incentive mechanism of authority distribution, encouragement plan of service innovation and so on. Briefly, management requires understanding of the variables that can affect aspects such as levels of internal marketing orientation, a managerial issue that goes beyond the traditional functional approach because banks today face the challenge not only of designing innovative customer-focused service strategies to compete and grow but also of translating such strategies into results through successful execution. Thus, IMO can convert internal customers into brand ambassadors for promoting banking services and introducing new service developments. Employees shall sell the brand of their organization only if they feel motivated and satisfied with the internal market environment. Hence, banks have to formulate market-oriented strategies, which require proper understanding of the wants and needs of its employees so that the ultimate objective of achieving success in the external market can be accomplished.

Particularly in context to emerging economies the concept of being market-oriented is not so forthcoming. Hence, it becomes imperative for firms to first become market oriented so that implementation of internal marketing concept is more effective. An organization should have broader objective of serving the external market so that proper understanding of the needs and wants of internal customers from organizational offer-

ings becomes essential. Service innovations in the emerging economies can be made possible only when a firm has satisfied and motivated employees who can contribute whole-heartedly and exhibit citizenship behaviour toward accomplishing the goal of superior profitability through introducing new ideas and successfully implementing them. Thus, an organization has to ensure a team of satisfied, committed and motivated staff who can take the responsibility of bringing innovations in the existing processes and developing new products/services.

LIMITATIONS AND FUTURE RESEARCH AGENDA

India, being an emerging economy, possesses peculiar features, resources and capabilities, which may not be prevalent in other developing nations in the same proportion. India itself is a nation with diversity of cultures among different states and cities. Hence, before generalizing the findings of the present study, a proper thought is highly solicited toward drawing comparisons between two nations/two country states. In addition, certain IMO activities are institutional-specific. Few services demand continuous updating of the latest information, like telecommunications whereas others may not require intensive training programmes like railways and postal services. Thus, the competitive intensity, nature of the service, labor market conditions, market dynamism, technological turbulence etc shall also determine the level of IMO required. Extent of IMO needed may differ for different services as well as settings, which would ultimately determine the innovations required.

Future studies can draw significant differences in the present level of IMO in public as well as private banks, so as to determine the extent of innovations desired by these banks. Similar study can also be replicated for other services like telecommunication, insurance, education etc. Further research work can be carried out to examine the mediating role of IMO in the market orientation-innovation link. Same relationship can be analyzed for entrepreneurial orientation and innovation link.

Also a comparative analysis of the role of IMO in generating service innovations can also be initiated between two competing private sector banks or a successful private and public sector bank. In India competitive intensity, market turbulence and technological advancement in the area of financial services have been introduced by private sector banks and thus, it makes sense to examine the extent of IMO in these banks and its impact on bring innovations, may it be in terms of new products/services, new processes, improved technology, etc.

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KEY TERMS AND DEFINITIONS

Indian Banking: Indian banking industry is presently confronting a very healthy and intense competition between government-owned, private sector banks and foreign banks. Indian banking is passing through a fast moving and competitive environment where changes are taking place at a much faster speed than ever in the history of Indian banking sector. Today Indian banking industry is one of the largest in the world. It is characterised by a large number of banks with mixed ownership. The commercial banking segment comprises 27 public sector banks in which government has a

majority ownership of over 51%, 40 private sectors banks and 33 foreign banks.

Intelligence Dissemination: The extent to which information is communicated, distributed, shared, and discussed among marketing department and other departments through formal and informal tools.

Intelligence Generation: It is the extent to which a firm gathers primary and secondary data from every obtainable source, mainly from the organizations stakeholders such as customers, competitors, suppliers, and intermediaries in addition to market forces like social, cultural, economical, political, legal, technological and many other forces.

Internal Market Orientation:-: It may be defined as treating employees as internal customers, viewing jobs as internal products that satisfy the needs and wants of these internal customers while addressing the objectives of the organization.

Responsiveness: It is the behaviours and activities taken as a reaction to generated and disseminated intelligence, there are two phases, viz., response design and response implementation.

Service Innovation: Service innovation comprises new or significantly improved service concepts and offerings. Irrespective of whether they are introduced by service companies or manufacturing companies, innovation can be in the service process, service infrastructure, customer processing, business models, commercialisation (sales, marketing, delivery), service productivity and hybrid forms of innovation serving several user groups in different ways simultaneously. It can be considered as an organizational value, which includes both innovation in organization for existing service products as customers request or to fulfill organization's goals and innovation in processes.

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APPENDIX

Table 2. Survey instrument for measuring internal market orientation and service innovation

INTELLIGENCE GENERATION	
FIG	**Formal Intelligence Generation**
FWIG	**Formal Written Information Generation**
1.	Management conducts survey to identify major influence on employees' behaviour.
2.	Management frames questionnaires to identify your wants and needs.
3.	Bank conducts survey with employees at least once a year to assess the quality of employment.
4.	Regular staff appraisal is conducted by the management.
FFIG	**Formal Face-to-Face Information Generation**
1.	Management conducts regular staff appraisal to discuss what employees want.
2.	Management meets employees at least once a year to find out what expectations they have for future jobs.
3.	Management interacts directly with employees to find out how to make them more satisfied.
4.	*Several departments together plan work periodically.*
5.	*Focus group discussions are held regularly to identify your wants and needs.*
IIG	**Informal Information Generation**
1.	Managers frequently talk with the staff about their work.
2.	Manager tries to solve the problems causing change in the behaviour of employees.
3.	*Information regarding employee needs is generated independently through various sources.*
SEG	**Segmentation of Internal Market**
1.	*Bank has sound working relationship between departments.*
2.	Departments look after different segments.
3.	Staff welfare is looked after satisfactorily by Human Resource Development department.
4.	*Goals of respective department are in harmony.*
5.	*Protecting one's own department is a prime concern.*
6.	*One department generally dislikes interacting with other.*
7.	Ample opportunities are available for informal talks among different departments.
8.	Employees are accessible to those in other departments.
INTELLIGENCE DISSEMINATION	
BME	**Between Management and Employees**
1.	Management regularly meets employees and discusses issue relating to the organisation.
2.	Management shares your work progress.
3.	Bank consults employees on managerial issues.
4.	Data on employees' satisfaction is disseminated at all levels on regular basis.
5.	*Group interaction between management and employees is satisfactory.*
6.	Management trusts employees to exercise good judgement.
7.	Management allows a high degree of initiative.
8.	Management permits you to use own judgement in solving problems.

continued on following page

Table 2. Continued

9.	Management regularly reports back to you about issues that affect working environment.
10.	Regular staff appraisal and meetings are conducted at all levels.
11.	*Top executives are easily accessible.*
12.	*Communication from manager to employees is routed through proper channel.*
AM	**Attitude of Managers**
1.	Managers make sure that employees are happy with their jobs.
2.	Bank considers employees as important resource for service delivery.
3.	Keeping employees satisfied is as important as keeping customers satisfied.
4.	Managers understand all factors that affect employees' satisfaction.
5.	Managers help employees in official problems.
OC	**Organisation Climate**: The organization for which I work
1.	Is genuinely concerned with the welfare of all its employees.
2.	Tries to accommodate different personal needs of all its employees.
3.	*Does not recognise the importance of its employees.*
4.	Treats all employees in a way that they are valued.
BEE	**Between Employees and Employees**
1.	You are friendly with other employees in bank.
2.	You get respect from them.
3.	Employees develop friendly relationship with each other.
4.	Employees are co-operative.
5.	*Your colleagues feel jealous when you get appreciation letter.*
6.	*You financially help each other.*
7.	You prevent your colleagues from doing wrong things.
8.	You help each other at the time of need without being prejudiced by caste or religion etc.
9.	There is mutual trust and understanding between employees.
10.	You help your colleagues in improving themselves.
11.	Your colleagues feel happy when you get appreciation letter.
12.	Employees communicate out of concern for one another.
RESPONSIVENESS	
JD	**Job Design**
1.	You are satisfied with your job.
2.	Your work is both interesting and challenging.
3.	*You work as much in the bank as is expected from you.*
4.	You are satisfied with rules and conditions of the job.
5.	*You are asked to work more than fixed hours.*
6.	Corrective action is ensured when employees express unhappiness with supervisors.
7.	*Activities of different departments are well coordinated to modify the conditions of employment.*
8.	Management makes changes in job when employees feel dissatisfied.
9.	Employees have enough opportunities for advancement.

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Table 2. Continued

10.	Bank regularly plans for career development of its employees.
11.	Employees are provided with adequate job security.
12.	Bank provides sound working conditions to its employees.
INC	**Incentives**
1.	Your bank is giving best salary.
2.	Your salary commensurate with work.
3.	Salary is revised from time to time.
4.	Salary is an important element in job design.
5.	Bank charges minimum interest rates on loans.
6.	You get housing loans at nominal rate of interest.
7.	You get loans for purchasing new consumer durable items.
8.	*You get medical aid in case of serious ailment.*
9.	*Bank provides attractive retirement benefits to its employees.*
10.	*Organisation has a mechanism to reward for good work done by employees.*
11.	Promotion policy is logical and fair.
12.	Management sanctions leave when needed.
13.	Bank provides remuneration compensation.
14.	The interest rate structure differs from one bank to other.
MC	**Management Consideration**
1.	Manager develops a work climate of psychological support.
2.	Supervisors recognise employees as an individual and treat them with respect and dignity.
3.	Manager develops a work climate of helpfulness.
4.	Management respects your individuality.
5.	Manager develops mutual trust and respect with employees.
6.	*Management uses restriction and threat to control employee behaviour.*
7.	*Management allows employees complete freedom in their work.*
8.	*Management permits you to do the work the way you think the best.*
TR	**Training**
1.	Bank arranges regular training both on and off the job.
2.	Training meets the needs of both employees and bank.
3.	Training helps increase your efficiency in job.
4.	*Financial assistance is provided during the period of training.*
5.	*Training is required for satisfactory performance.*
6.	*Personal biases of a manager influence the selection of employee for training.*
7.	Training methods are tailored through your development.
8.	Bank arranges adequate training facilities for its employees.
9.	Employees are regularly sponsored for various need-based training courses and conferences.
10.	Employees are constantly acquainted with the changing procedure and regulation through refresher courses.
11.	Development of employees is given due recognition in this bank.

continued on following page

Table 2. Continued

SA	**Staff Attitude**
1.	Staff members are generally happy working here.
2.	Staff members are happy to put extra efforts when needed.
3.	Employees are well motivated.
4.	Employees have positive thoughts towards management.
5.	Employees are happy to take more responsibility.
SC	**Staff Compliance**
1.	Employees act in a way that is consistent with the image the bank wishes to develop.
2.	Management checks employees' work regularly.
3.	*Employees are smart and well presented.*
4.	Manager often tells employees how to improve their performance.
CS	**Customer Satisfaction**
1.	Customers are satisfied with bank services.
2.	Customers receive a very friendly service from bank staff.
3.	Bank prides on friendliness attitude of staff.
4.	Customer service is the key factor to differentiate from competitors.
RES	**Responsibility**
1.	Employees are well paid for assuming greater responsibilities.
2.	Employees are treated well for inducing a sense of responsibility.
3.	Growth opportunities are open to every employee, which motivate them for higher responsibility.
TW	**Team Work**
1.	Management-employees relations are cordial.
2.	Management takes appropriate steps to ensure that employees cooperate with each other.
3.	Employees have developed good understanding.
4.	There is a fair compatibility among employees.
SI	**Service Innovation**
1.	Employees feel motivated in introducing new schemes and services.
2.	There is a continuous improvement in the technology.
3.	Employees try to bring changes in the existing processes and procedures.

Note: Items in italics got deleted during CFA.

Chapter 56
The Royal Credit Bank Strategy and Transformation Program:
The Gulf Management Strategic Planning

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ABSTRACT

This case discusses a strategic planning issue related to unplanned radical change. The Royal Credit Bank is the leading and largest lending bank in the Middle East. The bank suffered for a long time from bureaucracy, inefficiency, lack of productivity and misalignment with customers' needs for added value services. The Royal Credit Bank was approaching a change program of a scale and depth that occurs once in most employees' lifetime. It would transform the bank's business and operating models, culture, and leadership, impacting virtually every part of the organization. This had profound implications across strategy, leadership, people, and systems. This case highlights the impact of implementing large programs in an outdated banking environment where the challenge is beyond finding the solution. The real challenge was to make the solution work given the environmental issues and challenges faced by the leadership team to make things happen.

ORGANIZATION BACKGROUND

The Royal Credit Bank (RCB) is considered to be the largest bank in the Middle East in cash assets. Located in a GCC country, RCB is a government lending institution that provides interest-free loans to citizens. The target audience of the public who are eligible to apply for loans falls into two categories:

- Small enterprises, employers, and emerging trades; to encourage them to run their own businesses independently.
- Citizens with limited incomes, in order to help them overcome their financial difficulties. This category benefited from loans for social purposes like marriage, family support and renovation, in addition to vocational loans for micro project enterprises.

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The bank aimed to encourage entrepreneurship for individuals and institutions in the country, support the small and medium enterprises to pass the startup phase and grow into an economy contributing organization. The bank also aims to promote savings and thrift by individuals and institutions in the country through creating the capabilities to enable achieving this purpose.

With the capacity of 800 employees, the RCB operated a capital topping $10 billion in cash assets. The bank operations were governed by the Prime Minister's cabinet. A council of ministers headed by the Minister of Finance set the governing policies of the bank; nevertheless the Royal Monetary Agency was responsible for monitoring the bank's operations and activities in accordance to the law and the governing and guiding principles.

Since the bank is a government institution, the aim of the bank was not for profit as much as it was to offer economic and social help to citizens and SME's. The bank had several funds and financing sources which consisted of the following:

- The bank's capital.
- Government deposits.
- Fees for expenses incurred by the bank in performing its functions as determined by its Board of Directors; loans for social purposes to low-income individuals shall be exempted from such fees.
- The income resulting from investing bank's funds, balances and assets.
- Allocations or funds granted or loaned to the bank by the government.
- Loans and deposits provided by the Royal Monetary Agency and other public and private institutions and charities.
- Deposits made by the public and guaranteed by the government.
- Saving bonds.
- Securities and collaterals of various types.
- Funds or allocations offered by others as a gives or endowment.

The bank operated through a structure that typically speaks to a government agency, rather than to a commercial bank. Most of the employees are not an exact job fit; some of them have not passed high school. Some others reached a director level only because they were on the job long enough, but not because they had what it takes to do the job. Lack of governance, proper reporting, and guiding principles meant that the day to day work was painted with inefficiency, lack of productivity, bottlenecking, long trace work processes, and untraceable files.

A Board of Directors is assigned by the council of ministers, the BoD should have representative members from several different agencies that assume the regulatory role (i.e. The Royal Monetary Agency), a sponsoring role (i.e. the ministry of finance), or a supervisory role such as the ministry of economy and commerce. The BoD is the supreme authority overseeing the bank's activities and the achievement of its goals.

The bank has a Director-General, who is appointed recently pursuant to a resolution by the council of ministers upon a recommendation by the Minister of Finance. The Director-General had the following responsibilities:

- Achieve the bank's objectives.
- Oversee the bank's management and implement the policies and decisions adopted by the Board of Directors.
- Represent the bank before third parties.
- Collect receivables due to the bank or transferred thereto.
- Develop strategies that address strategic, tactical and operational direction of the bank.
- Sponsor development programs that enhance the bank operations and align with the strategic direction.
- Report quarterly on the bank's performance and adherence to regulations, compliance to governance and laws.

The organization structure resembled a typical government agency structure. The existing organizational structure of a government agency in an Arab country is rooted earlier to decades back in time, a time when massive, multilayered bureaucracies were seen as the most effective and efficient approach to managing government organizations. According to Islam and El Araby (2007) some of the characteristics that define governmental organizations in the Arab countries are the closed culture, the modest education levels within the workforce, and the limited technical ability to collect, display, and transmit information. These were some of the factors that led to the creation of an opinionated, centralized management system where managers did the thinking and workers were expected to do the assigned work without contribution or question.

As far as this case is concerned, some aspects of the organizational culture may be present within individuals of an organization in the Arab countries. The following are some of those cultural aspects and how they affect directly the change that can be implemented within an organization:

- Power distance will hinder any attempt for effective change, as it contradicts with the enablers of change (Oakland and Tanner, 2006), as well as neglecting an important element of change which is people in case of mal-management (Haridimos, 2005; Islam and El Araby, 2007; Oakland and Tanner, 2006).
- Self-praise; makes it difficult for an organization to agree upon the need of a change unless there is a severe driver for change (Islam and El Araby, 2007).
- Stereotypes may delay change as an idea taken about a supplier or a raw material, may stop using it although it can help in the process of change, unless a vital change is needed (Islam and El Araby, 2007).

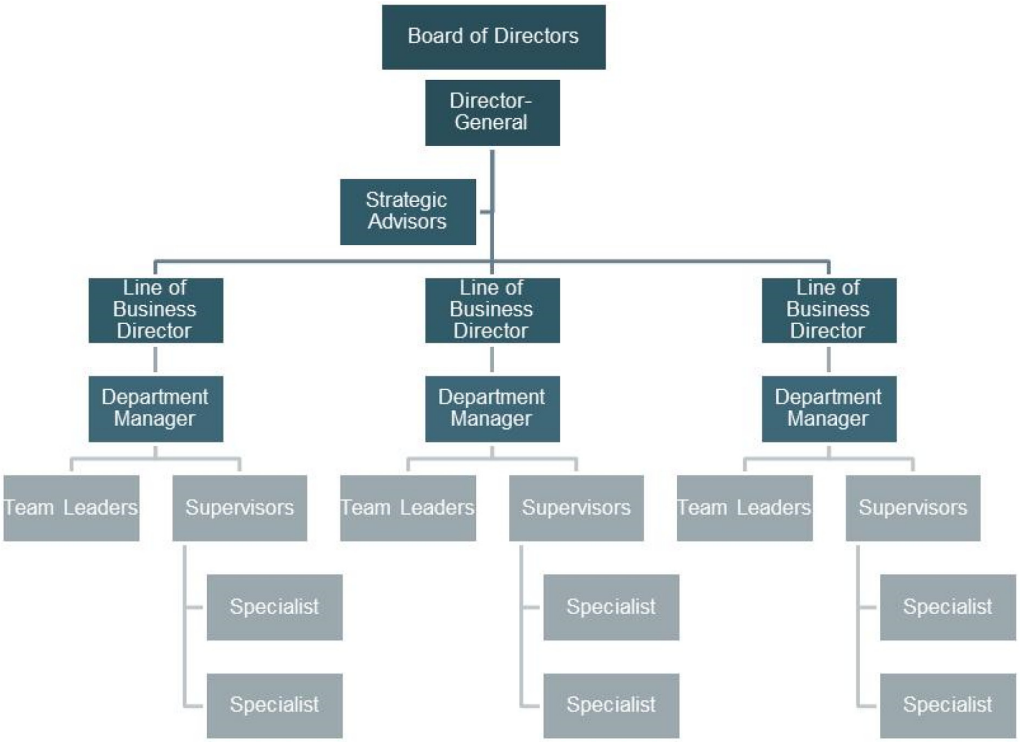
Reporting to the Director General (DG); each business line was headed by a director who is accountable and responsible for overseeing the business operations. Within each business line, there were several departments which were headed by managers. Department managers are supported by team leaders, supervisors and specialists.

The recently assigned DG was the main driver of any strategic advancement of the bank. He was in pursuit of enhancing the performance of the bank's operations by all means, yet there were certain limitations that he faced and had to deal with constantly. Under the supervision of the BoD, he established a program that addresses the bank's need for development at many levels. The aim of the program was to present the bank to the public through an internationally recognized business model that achieves the target objectives of the bank and serves the public according to the expectations of stakeholders.

When the new DG came on board, he found that the culture of the bank was dominated by a bureaucratic approach to conducting day to day business; the directorates operated in silos in separation of each other and kept boundaries held to maintain power and authority in the director's hands. Directors demonstrated the power of authority that they had by narrowing the process progress into their signature of approval on every loan application across the bank. This resulted in many undesired bottlenecks that affected the bank's operations and created delays in response to public demand. Lack of commitment to the bank's success due to lack of proper controls, tools, committed management and audit authorities resulted in $200 million of untraceable loans. The bank featured on the first page of the newspaper [which newspaper?] due to poor services and response to loan applicants.

When the financial crisis resonated around the world, the effects started to be felt on the ground in the country. More citizens started to knock on the doors of the bank for loans to assist them during

Figure 1. RCB's organization structure



the difficult times. It didn't take long before the government took immediate action to remedy the situation by announcing that the bank was granted an additional $3 billion to support a wider range of target citizens and business.

The moment this announcement made it to the media, the bank went through a life-changing experience that resulted in the series of consequences no one anticipated or expected.

SETTING THE STAGE

Arab countries in general suffer from different cultural aspects that act as obstacles to their progress. These cultural aspects are as follows:

1. Resists change (El Araby, Labib and Islam, 2006).
2. Rejects initiatives that are not Arab originated (El Araby et. al., 2006).
3. Self-praise (Heggy, 1998a; Islam and Labib, 2007).
4. Stereotypes and Conspiracy Theory (Heggy, 1998a; Heggy, 1998b; Islam and Labib, 2007).
5. High Power Distance and High Uncertainty Avoidance (Anjard, 1998; Hofstede, 2003a; Hofstede, 2003b; Islam and Labib, 2007; Macleod and Baxter, 2001).

Organizational change mostly intends to change the organizational state from the undesirable "before" to an improved or desirable future state (Ragsdell, 2000). In spite of the importance and costs of reaching the desirable state, many change programs fall back from meeting set targets (Oakland and Tanner, 2006).

Change is a way of telling people to adopt new ideas in dealing with different aspects of their lives. One of these aspects is introducing new ways of doing things, new ways of seeing themselves, their roles and their interactions with others inside and outside the organization (Sinclair, 1994).

The change that might occur in an organization affects individuals from top managers down through the organization's hierarchy (Almaraz, 1994). Managers have to understand the influence of change on their employees and try to solve problems that may occur as a result to this change (Sinclair, 1994). These problems may happen because change is relative and differs from one person to the other, which makes it important to analyze problems that may occur from implementing change from different points of views (Sinclaire, 1994; Ragsdell, 2000).

The effectiveness of companies operations is associated with the extent of implementation of aims, objectives, or targets or precisely with the working effects or results and usually is defined as the degree to which the companies achieve the objectives or the ability to produce desired effects or results. The effects or results in one company are expressed through the organizational performance (Al-Shammari and Hussein, 2008).

The studies and practice show that many changes that have occurred in developing and emerging countries have led to the faster diffusion of strategic planning (Al-Shammari and Hussein, 2008). On account of the problem of the implementation of strategic planning, the main focus of strategic planning literature has shifted to strategic planning effectiveness.

Many authors in their definitions of strategic planning refer to objectives and results and thus to effectiveness of strategic planning. Armstrong (1982, p.198) defines strategic planning as "an explicit process for determining the firm's long-range objectives, procedures for generating and evaluating alternative strategies, and a system for monitoring the results of the plan when implemented." Strategic planning consists of planning processes that are undertaken in firms to develop strategies that might contribute to performance (Tapinos, Dyson and Meadows, 2005).

Sherman, Rowley and Armandi (2006, p.10) define strategic planning as "a process that any organization engages in to critically analyze its external and internal environment; formulate a plan of action based on creating the best fit between the firm's resources and environment opportunities; establish acceptable methods of reducing its own weaknesses and mitigating external threats; identify appropriate tactics for implementing the plan; and then establish methods of measurement that the organization will apply over time to see whether or not the tenets of the strategic plan are leading to the desired results."

Strategic change needs initiatives and elements for this change to take place; according to (Haridimos, 2005; Islam and El Araby, 2007; Oakland and Tanner, 2006) the most important initiatives are:

- Leadership
- Define Change
- Learning

In an organizational strategic development context, culture and cultural gaps will have a great role in the issue of leadership and learning concerning change and resistance to change, as leaders deal with people and people are affected by culture.

After a difficult period during the credit collapse when economizing was the most desirable strategy, financial services firms focused on sustainability and growth. The key to growing again would often be to build a coherent and reinforcing system of differentiated capabilities – including people, knowledge, tools, and processes – throughout the value chain. The experiences of the banking unit within a large global financial services firm illustrate well the systematic effort required to succeed with a business and IT strategy and transformation program context.

The level of change has now been unprecedented in the financial industry. Delivering once-in-a-lifetime change on a large scale demands many elements such as new leadership attributes, strong governance, and superior people management to help embed a new culture. A bank without these attributes may find that the journey to the new normal is a step too far. But those that make the transition successfully will be well positioned to be among the industry's high performers of the future.

The performance and role of banks are in the spotlight. More than ever in living memory, banks are under the close scrutiny of politicians, regulators and markets, who are all looking to the banks to deliver on their economic and social roles of enabling commerce, and providing a safe haven to channel savings into productive investment.

Fifteen years back, the bank equipped the business with a banking system that included a proprietary tailor developed banking software, mainframe, thin client user stations, connectivity network that connects the main branches to the headquarters. At that time, that was one of the advanced systems that any bank could possess.

Years passed before the bank started to look into the aging banking system and the overhead that it imposes on the bank to fund the support and maintenance of the system. Since the application was tailored and built on a proprietary code, there was not any vendor out there that could support it except for the company that developed it in the first place. After several years the application was no longer supported in the market, so the bank had to sign a support contract with the vendor to establish a special unit to support this system specifically with a cost of millions of dollars.

The bank did not care to establish an internal capacity for the IT and kept relying solely on the vendor support to manage the IT needs of the bank. The bank leadership didn't pay attention to this situation for years, although the situation was complicated yet it did not impact the slow pace, low productivity nature of the daily work that the bank employees enjoyed. The silos structure helped in feeding this situation with more complexity due to the fact that the process was a mix of automated and human processed which resulted in the inability to trace a certain loan application file across the process end to end.

The IT department was a small department consisting of sixteen government employees, most of whom were not IT related in specialization. Many had an educational background related to social studies such as history, arts, and basic high school, secretarial diplomas and even religious studies. The policy of the government for hiring employees did not dictate the alignment of specialization of the employee to the target job; many jobs were filled with incompetent and unqualified employees. This resulted in a very weak ability of the department to come any close to reality with advancing the IT systems in the bank, and total reliability on the support vendor which in return placed two employees (50 years and above) in the bank on a full time basis, to support the system and keep the lights on.

The department did not have a director. The leadership of the department consisted of a manager and an experienced independent consultant who helped in leading the day-to-day activities of the team. Neither of them were in a position to drive a strategic development direction or establish added value projects that could collectively put the department back on the right track.

An outdated system, an incompetent team, lack of organizational structure, motivation, direction, leadership and capabilities to do the job properly, were the characteristics of the IT department at RCB. The RCB leadership did not pay attention to the fact that the IT situation of the bank had turned into a time bomb. Despite the fact that there were untraceable files, loans, cases, data in the system and on paper files as well, it did not matter much since the overall mission of the bank was not for profit, given a government driven bureaucratic culture, with absence of the proper audit authority that looks into regulatory compliance in a proper

manner. The bank did not realize how serious the situation was until the media announcement of the additional funds that the government provided.

CASE DESCRIPTION

Although the bank was a government institution, it had a huge impact on the private banking and financial services sector. Private banks lost millions in loan business due to what RCB offered in the market, the ceiling reached to supporting businesses up to $3 million, and individuals up to $20 thousand with a 0% interest rate.

The government announcement drew the attention of those who did not think of RCB as a source of financing, considering the financial crisis impact. Everyone started to think of RCB as a gold mine. Shortly after the announcement, the lineup was double the length since the day before and it kept increasing, the bank had to temporarily close its doors and organize the crowds to be able to accommodate them.

The DG was on vacation out of the country at that time, the directors tried their best to contain the situation and keep their calm. That was an unprecedented situation that they experienced. Yet they knew that there will be consequences if they were not up to the level of public expectation of bank's overall performance.

The Blackout

Right in the middle of all of this chaos, the time had come for something that no one thought would happen. The bank's network was hacked. The system was brought down, and no one was able to access any information or manage any system files. It was a big hit right in the middle of a crucial time, when the bank was put in front of the public as a source of help. The bank failed to deal with the situation completely.

The hit was very hard; the network penetration was deep and carefully crafted. The department manager at that time and the independent consultant took charge, and tried to fix the issue by calling in all possible sources of help to resolve the situation. However, it took two business days to bring the system up and running again. The two full time support subject matter experts who were planted in the IT department by the banking system vendor; were completely useless because all they knew was related to the code of the system but not comprehensive enough to help in resolving a situation like this, especially that what they know about the system was already outdated considering the new emerging technologies that come out every day.

On the Hot Plate

The DG interrupted his vacation and flew back into the country to manage the situation closely. But it was too late. Right upon his arrival, the bank made it to the front page of all the newspapers. The tension was high and the situation was very sensitive. The bank's doors remained closed to the public, but other doors were open by other agencies that paid attention to the situation and started to take precautionary action towards getting involved at the right level.

The DG called for an emergency meeting of the BoD, preceded by a meeting with the bank directors for a briefing on the situation and readiness to business continuity action plan. To the DG's disappointment, nothing was in place to sustain the business continuity and operations. Stepping in the boardroom, the DG was trying to put together something that can save face and could be reasonably discussed as an emergency resolution of the situation.

The discussion in the boardroom was heated and lacked rational thinking in the beginning. However the DG managed to drive the meeting by presenting facts and concluding impacts and remedial actions.Then he presented a recommended fast track approach to address the situation with high level steps that should put things

back on the right track. Despite the vulnerability of the situation which would continue to threaten the bank, the accelerated approach that the DG adopted should have helped in fast tracking the solution of the problem. Finally the BoD agreed that it was time to resume operations and face reality with their current situation that they had to handle, trying to avoid getting into the same situation as much as possible.

Defining the Problem

The DG realized that the problem was not only the technology issues at hand; it was mainly the reason why the situation deteriorated to a level where this problem surfaced. The culture of the bank was driving the whole situation, not realizing the importance of the bank's mission and its impact on the beneficiaries, resulted in an unacceptable organizational behavior.

Some of the problems that were on the surface were due to the aging workforce employed at the bank. In addition to the impact of the isolated unorganized directorates that created bottlenecks, and caused loss of value, due to the employees' incompetence, and lack of sense of responsibility. Some of that was inherited by the government system; some other was created by the bank's employees.

The failure to introduce proper banking business systems in the bank years ago was a major issue that the DG was trying to resolve by immediately addressing and eliminating out of the picture. The DG's understanding of the importance of the revitalization of the IT systems in the bank was unquestionable yet he needed to make sure that he was adopting the right direction to address this part of the problem.

The DG realized that in order for him to create a significant impact on the culture of the bank, he had to make some difficult decisions and introduce some hard changes that help in reshaping the bank's behavior towards business and clients as well. He was also determined to address this problem through adopting a top down approach, optimistically hoping that the new adopted direction should help in presenting solutions and help further in carrying the change forward.

The Advisors

The DG called for a meeting with the IT leadership to discuss the situation and set immediate next steps towards situation resolution. The IT manager and the experienced consultant were not sure how to handle the situation; consequently they agreed that they needed experienced professional help to assist leading the efforts to address the problem. The DG assigned the experienced independent consultant as an acting department director and assigned the manager as a deputy director. At that meeting they agreed that they will bring an experienced consulting firm to help in putting together a plan and implement a solution that saves the bank from the current situation.

The DG did not stop at that point; he also managed to assign one of the highly experienced directors in charge of an initiative that should address the bank's operating model as a whole. The DG's vision was to introduce a completely new business and IT operating model that addresses all the issues and puts the bank on the right track in providing excellent services to the public and acts as a main player in the market.

The highly qualified director assumed the role of program manager, collaborating closely with the acting IT director and his deputy to act on the matter, and immediately invited several advisory firms to qualify and bid for this engagement. It didn't take long before the right firm was selected to partner with the bank towards planning, designing, validating and executing the selected solution in the bank.

Highly qualified subject matter advisors were injected into the bank to support several aspects, but mainly to conduct a current state assessment and help defining the situation as it exists before and after the incident. IT advisors, deep banking

industry advisors and experienced project and program managers were plugged to put together an overall approach to create a transformational program that should save the business and enable IT to become a service center.

The Program

Between the program leadership from the bank side and the advisors side, they were able to define a program that addressed three immediate needs:

Phase 1: Immediate projects (quick wins) to resolve the critical IT and business issues.

Phase 2: Short term initiatives (realized in one year) to introduce major change in certain pain areas that impact customer service and operations performance.

Phase 3: Mid to long term initiatives (realized in 3 – 5 years) to address transformational aspects and build capabilities needed to introduce new business and IT functions.

Phase 1 was set to target issues related to process effectiveness and efficiency performance issues. The initiative identified the need to acquire IT systems, banking solutions, and technology infrastructure required to support the overlaying architecture of IT solution stack. On the business side, it targeted designing IT enabled processes that set the direction for the business through a fully automated customer service end-to-end. Another stream was set to address the bank organization structure. This stream aimed to define business functions, governance structure, performance measures and roles and responsibilities in accordance to the target set of capabilities that the bank was planning to operate.

Phase 2 was designed to start as soon as phase I began. It targeted developing aligned business and IT strategic plans that addressed the tactical and operational aspects of the bank. The objective of phase II was to resolve the issues of the day to day operations, and implement an integrated framework for the business that would be enabled by the IT capabilities. Implementing the right tools, processes, and technology solutions, the bank should be able to overcome the issues facing business such as the untraceable loans, poor service offering at the front desk, human dependent processes, and vulnerable technology environment.

Phase 3 was an end to the transformation program, starting midway of phase II, and continuing until the end of the program. It was designed to address the human skills and capabilities, business and technology integration, human capital training and education. The other aspect of this phase was addressing the long term strategic planning, without being under the stress of firefighting mode that the bank was operating through at that time.

CURRENT CHALLENGES FACING THE ORGANIZATION

The program aimed to immediately present solutions to existing problems that kept the bank behind for so long. The organization culture, group dynamics affected by the existing silos, interaction with change management, organizational structure change and its impact on the new direction; finally the leadership and communication style that the bank chose to adopt and continue to practice along the way.

When the Rubber Hits the Road

The program leadership team consisting of the BoD, the director general, the program director, the IT acting director and his deputy, selected members of the business directors and the team of experienced advisors were all focusing on kicking off the program as soon as possible.

In a matter of a couple of weeks, the program plans, structure, scope, targets, milestones, projects outcomes and phase alignment were set. The DG wanted to show immediate progress on the

ground internally to the stakeholders, externally to the government agencies involved and to the public who was closely watching for improved results on a daily basis. The program kick-off was announced in the media and had a lot of attention and comments from those who were anticipating this critical move to be either the end or the start of a new era in the bank's business life.

The program leadership team knew that they are under the microscope and that they had no room for delayed results or unacceptable program outcomes. The pressure was high, yet it was a source of motivation to everyone on the program. Most of the bank directors and leadership team were invited to the kick-off meeting. The anticipation filled the room with tension, and many questions were in most of the attendees' minds, questioning how things will come around. It was not long before the DG started the introductory speech to announce the program objectives, scope and timelines. In addition to explaining the benefits expected to be delivered out of the program,the DG explained the role of directors in this new process and how cooperative they should be to help the bank advance to the next level and become recognized for its high standards of banking services.

On the Way

The program started with full steam pressure. Everyone was racing against time to show some difference in the shortest time possible. The IT department team was so excited about the journey, however some of them were not that excited to cooperate. This was an expected reaction from employees who are incompetent to cope with the fast pace of the projects, and the daily work that they had to handle. On the business side, the situation was not as promising as the IT side. Most of the employees were close to retirement. They were used to using conventional ways of doing business, totally dependent on manual work. They had the least clue of how to use technology to conduct business. This symptom extended to the department managers and business line directors as well, which created a situation that was not accounted for at all. Those who suffered these symptoms created a wave of aggressive resistance to the program as a whole.

Three months into the program, the program team was working hard on gathering requirements, designing future state, designing technology and business architecture, establishing new functions and capabilities. The overall progress was going well and according to the plan, especially that the team was working in the background in separation from the operational layer of the bank. As soon as the interaction reached to the operational layer, the resistance surfaced, and the progress slowed down. The DG was not surprised to learn what was going on. He understood the bank culture very well, and he was anticipating that issues will come along the way. But, he was mainly focusing on showing progress in early stages of the program, which he achieved and was able to mobilize a successful program plan with the involvement of a highly experienced consulting firm.

The program leadership team met to discuss the issues that they were facing, and recommend effective corrective actions and remedial reaction. The advisors team suggested several risk mitigating actions. They also promoted a couple of side streams that focused on immediate response to the issues they were facing. The DG thought that more should be done to help save the effort that was invested and yet to be devoted to complete the program down the road.

The Exit Criteria

The DG worked closely with selected directors and experienced consultants on offering a workable solution that met the interest of the bank leadership direction as well as the employees who were fearing the unknown and what was going to happen to them.

The DG prepared an exit criteria package for those who chose to opt out of the transformation

program. The DG's team designed a lucrative early retirement package that applied to all employees of forty-five years and above. Another option was also offered to employees between forty-five and fifty-five years old to encourage employees to choose for themselves. The second option was to be reassigned to another government agency based on their qualifications and fit in a six month window from accepting the offer.

The two options had to be approved by the BoD and the council of ministers, which was not an easy mission. But the DG used the right cards to facilitate a very successful meeting with the Board of Directors and gain their agreement to move ahead with the approval from the council of ministers. Approximately two weeks later, the two options were presented to the council of ministers. Following a very long discussion and debate about the critical situation the bank is going through, both options were whole heartedly approved. This provided the program leadership team a huge motivational factor to advance further in confidence and achieve more success in meeting the program objectives.

The Transformation

The IT department dug deep into the ground to lay a very solid foundation for a strong future of technology enabled banking services. The direction was to make the IT arm of the bank an enabler of the business at all levels, and promote continuous technology advancement and development. The architectural foundations of the new enterprise banking system were laid down and the selection of a new banking solution started. A fully fledged service oriented organization structure was established to support the new direction, as well as an internationally adopted and recognized set of best practices which were implemented to enable the IT team to operate efficiently and serve the business productively.

The advisors formulated a five year IT and business strategic direction and plan that was aligned with the overall direction of the bank. The strategic plan addressed most of the pain points that the bank was suffering from; it targeted getting rid of the legacy systems, processes, and organizational negative behavior in the shortest time possible (1 to 3 years down the road). A Project Management Office (PMO) department was established to drive and supervise all the projects that would be implemented. An HR training facility was out-sourced to offer continuous training to employees. This initiative targeted enhancing the employees' soft and hard skills, core business knowledge, business capabilities and work ethics as well.

The ship was sailing in the right direction, and milestones were met with tolerance to time slippage considering the issues that the program leadership team had to handle and navigate. Nearly one year down the road, one hundred-fifty employees opted for one of the options for the exit criteria; two hundred-fifty fresh blood competent employees were hired to support and operate the new capabilities that the bank established around the business and IT. It was about time to announce the outcomes of the strategic planning project and the organizational restructuring project as well.

No Turning Back

A date was set for the first year milestones announcement. The anticipation was mounting and the anxiety was overwhelming the bank employees. They did not know how their future would be shaped and what to expect from that change. Although the program management was closely managing the change through regular announcements, newsletters, integration workshops, team building and intensive training programs targeting the immediately affected employees, the new structure and direction of the bank carried many unrevealed details that would affect everyone's life.

On the day of the announcement, the leadership of the bank was flown to the headquarters from around the country. The boardroom was stacked with nearly sixty-five management team

members of different levels and business lines. The DG directed the advisors to lead the session and announce the changes, while he commented on the results and provided some direction on the next steps. The Board of Directors agreed to attend later in the session, anticipating that there might be some discussion that they did not want to be part of. Last but not least, the program leadership sat among the audience and facilitated some positive comments and questions, enabling the announcements to be given smoothly. The advisors started the session with a summary of achievements, current status of the program and future targets. The advisors diligently explained the strategy components, opportunities, initiatives, business case and roadmap. Then they turned to the new organization structure announcement. They attentively explained the new structure of business lines, shared services, lines of integration across the bank, governance structure, methods of application, target performance measures and finally the organizational structure that would take effect within thirty days.

All eyes turned to the group of managers and directors – totaling 10 – who immediately knew that the value of their signature on file was blown away. It was clear to the attendees that the new structure directly affected their roles, and set them for elimination from the new organization structure. They denounced the new direction accusing the team of being unfair and unappreciative of their dedicated service to the bank. Apparently a leak happened before the session, and they came prepared to set the meeting on fire. However, the program leadership team was also very well prepared, supported by the DG and the BoD, and the DG immediately took charge of the situation. He explained to the audience the impact on the business if the current course of business as usual continued to evolve. The bureaucratic behavior of the directors, managers and others would put the bank in a worse situation than before. If someone chose not to cooperate, they would still be maintained as employees of the bank, yet they would be placed in a position newly created to accommodate those who needed time to adapt. The position was called "business process advisor," a role that was completely stripped from any authority or power; and the employee was to be informed on a need to know basis.

The DG came with a ready-made list of employees who would be moved into that position. He announced the names in the meeting and offered the two exit criteria options for those who chose to object and refused to move as directed. Such a life changing stand! It was more of a Mexican standoff with big business decision guns being pulled in a crowded room. Silence suddenly filled the room before the DG said: "We are all gathered here to move ahead, we don't have the choice of going back, and there is no turning back. Either you accept to sail ahead with us or you make the choice to stay on the safe shore that I just offered."

SOLUTIONS AND RECOMMENDATIONS

As of that day, nothing has stayed the same. The bank advanced with the transformation program as planned and managed to achieve most of the sought after benefits. The bank certainly continued to serve the public with the highest degree of dedication and commitment to quality banking services. It was the bank's mission to make people's life easier, which the leadership translated into reality with their assurance of advancing and serving the public as expected of them, considering the acts presented about the bank, the industry dynamics, the economic situation and the internal challenges. The overall situation could have been mitigated years ago if the management of the bank paid attention to staying on course with the advancement of the business services offering and technology driving forces that shape the business behavior in a certain industry.

The impact of a business and IT strategy with transformation programs is huge when it targets a highly visible bank in the financial industry. The leadership of the institution should always be aware of the consequences if they make it to the front page with a scandal or an undesired situation.

A better rigorous approach should be brought into the process of establishing transformational programs, intensive planning, impact assessment, organizational dynamics, politics, business performance, scope of change, timelines and peoples readiness to produce results, interaction with external parties, and last but not least working as one unit to achieve a defined target.

Change is a permanent phenomenon. It is necessary due to external forces like technology, systems, and social changes interacting with the internal variables of the organization. According to Hovemeyer (1993), to implement change, Kurt Lewin's model of unfreezing the situation, implementing a change and refreezing could have been put into action. Individual, group and organizational changes take place continuously. Individual change refers to change in attitude, perception and also acquiring new skills to cope up with external environment (Hovemeyer, 1993).

Watson (2002) argued that change is structured when it is planned, and it is unstructured when change is implemented as a reaction to a particular situation. There is great resistance to change because of the fear of the unknown. Therefore, the bank employees must be educated, trained, made party to change and the benefits of change must be divided between the employees and the organization. It is the sensitive handling of employees' emotions making them psychologically ready to implement change that will ultimately work for better success.

Fear must be removed from people's minds. Change must be taken in the positive manner for the growth of the organization. It is difficult to predict which strategy will succeed in implementing the change. Efficient communication, educating the people about impending change, participation, and active involvement and last but not the least sharing the benefits of change with people is the essential requirement for overcoming resistance to change (Coch and French, 1948).

Barney and Griffin (1992) discussed that the growth oriented organizations have to study the internal and external environment while making suitable changes. Introduction of information technology, knowledge revolution, technology advancement, competition due to global market scenario, high expectations of customers due to social revolution, and last but not least, the work pressure an employee is facing has made it necessary to carry out organizational development in a planned way.

It is imperative to improve organizational culture, redesign and redefine jobs and accord full freedom of action and autonomy to workers so that the organization is always a learning organization. Organization development therefore is a planned process of change in an organization's culture through utilization of behavioral science technologies (Watson, 2002).

However, as much as it may sound as a cliché, it is still an inescapable fact that people are the main resource of any organization. Without its members, an organization is nothing. An organization is only as good as the people who work within the group. In today's increasingly global and competitive environment the effective management of people is even more important for organizational survival and success. Accordingly, the underlying theme of this case has been the impact of implementing business and IT strategy with transformation programs and the importance of the role of management as an integrating activity. It has been concerned with interactions among the structure and operation of organizations, the process of management and the behavior of people at work.

The nature of organizational behavior and the practice of management should not be considered in a vacuum but within an organizational context and environment. In this case we discussed that other external factors could also affect the inter-

nal behavior and cause change of direction of business. It is imperative to understand that not seeing the future could be a main source of fear of the present.

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KEY TERMS AND DEFINITIONS

BoD: Board of Directors.

Change Management: Is an approach to managing the transition to a target future state of individuals, teams, and organizations.

DG: Director-General.

GCC: Gulf Cooperating Council.

RCB: Royal Credit Bank.

Strategic Planning: Is a structured process of defining an organization strategy, or direction, and making informed decisions on managing its resources to pursue this strategy and achieve the desired goals.

Transformation Strategy: Is about adopting the organizational strategic programs and change culture, to formulate fundamental improvements in how business is conducted in order to industry and market evolution.

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Chapter 57
Business Intelligence Enterprise Solution at Abu Dhabi Finance: Issues and Challenges

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ABSTRACT

The challenge of transforming data and information in enterprise information systems into knowledge that can be rolled up and presented to management as key performance indicators is business-critical. The implementation of a business intelligence layer on top of the transaction processing systems and management information systems is viewed as an opportunity to move up a level to promote knowledge-based decision-making and strategic planning. This chapter attempts to examine the issues and challenges associated with the initiative by Abu Dhabi Finance to implement business intelligence solutions that extract information from the enterprise information systems, present them as KPIs for senior management, and produce knowledge that can be used to support decision-making and strategic planning.

ORGANIZATION HISTORY AND BACKGROUND

Abu-Dhabi Finance Trust (AFT) is Semi-government Company opened its doors in November 2008 with the goal to be the leading source of mortgages in UAE and then expand its services throughout the MENA province. It was built by four leading organizations in UAE.

AFT main strategy is to make clients expect more, as they are willing to dedicate their efforts to maintain a high quality standards and customer satisfaction.

The vision of Abu Dhabi Finance is stated as: "Our inspiration is to be the leading real estate mortgage company in the UAE and over time in the MENA region."

The mission of Abu Dhabi Finance is indicated as the purpose:

- To become a leading innovator in mortgage solutions and services with a specific focus on delivering superior client service.
- To enable real estate investment through offering financial solutions to individuals

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in pursuit of home ownership and wealth creation.
- To become an employer of choice, attracting and developing top talent.
- To promote and support the formation of the real estate sector in Abu Dhabi.
- To create value for our stakeholders.

The values of Abu Dhabi Finance include the following:

- Each of our clients is one of a kind.
- More than a supplier, we are a companion.
- The Abu Dhabi Finance experience is always memorable.
- We create value equally to our clients, our stakeholders, and our employees.
- We make a difference in our community.

The above vision, mission, and values configure that AFT devotes their services with high quality, as they care about their stakeholders and most of all their clients. They believe that organization success comes by dedicating strong rooted standards with superior customer satisfaction; as they are the drive towards achieving their goal to be the leading mortgage company and to sustain and grow more in the market.

SETTING THE STAGE/ CASE DESCRIPTION

Business Perspective

AFT is a mortgage financer; therefore, they need to adopt software that will deliver effectiveness to their business activities. As they are financing their business activities lies between calculating the down payment, the interest rate as it varies between 5.75 and 8.5 depending on the market, method of repayment either a interest only mortgage loans, a part from the repayment and part of the interest, or a interest roll-up loans, and developing financial reports. Therefore, the required software must perform these calculations and every client data must have a separate report that presents their due payments, method of payment, requested product. The requested software must alert the mortgage advisor if any due payment were not placed and when is the next payment will be needed upon the client plan of repayment process.

Technology Perspective

By the above description of the company activities and work processes here comes the description of processes and systems they use to maintain the superior customer satisfaction and internal integrated company. Abu-Dhabi Finance Trust uses the SLAs; Sales Level Agreements software which is an Oracle Business Intelligence Enterprise Edition (OBIEE) that is primarily a business intelligence tool to report key performance indicators information and other relevant departmental and management reports. AFT chose this software as they need to have each client account information separately formatted in reports, as it has to do with finance; payments should be well organised and the interest rates adjusted to the amount remaining. Also, they chose this software as it integrates all company departments together and enable them to share documents and reports along together, to make sure that everything is moving on the right loop.

In addition to the above, it also allows the users to create and share ad-hoc reports to use them without requiring any technical assistance. The ad-hoc reports is a visualization approach it allows users to interact with the system easily and efficiently, as the reports goals is to seek out the answers to different questions and adjust the resources available according to current business requirements. The ad-hoc reports are easy to

navigate and search through them, they are built easily through self-service; it demonstrates how each department in the company is functioning and what their activity level of business is. The ad-hoc reports as mentioned above are all about visualization as "a picture is worth a thousand words" it organizes the information in a clear concise form, it allows the users to view the required information in a powerful yet managed environment, the uniqueness of the ad-hoc reports is that you can filter out the data to the exact required field to measure and compare easily. In addition, it allows the users to build out hypothesis from what if scenario functions to visualize and analyse how changes will bring on growth and development to the organization. The ad-hoc reporting is a win-win process as it is a self-service both users and IT department are benefiting from it; it offers a strong robust enterprise to assemble all the present and future challenges and requirements.

Moreover, the dashboards in OBIEE are the overview of the information and pages; it is an interface that allows several reports to be viewed at the same time. The dashboards are like the warehouse, it is a container for reports that allows them to be interactive and retrieval; also, it can view data and reports in a summarized way and in graphical method if applicable.

The SLAs helped in managing the organization and the tasks required as the software allows the company to increase efficiency and accuracy by automating daily ad-hoc reports which provides effective communication tool and it also saves a lot of time and effort as they do not have to create those reports manually. In addition, it helped in getting the required information instantly by assessing the user definable fields. The hypothesis option id the SLAs helped the organization by improving their budgets and time spent on projects. The tools that are built within the system for financial plans helped a lot in managing the future plan for consumer's repayment process efficiently, as mistakes were minimized and ensure that everything is being handled accurately.

Issues and Problems before Implementation

The company had more than 30 legacy systems running at the same time on different databases including, Oracle, MS Access and SQL Server and were also running on different platforms. These legacy systems were used by nearly 2000 employees from different business areas, such as; Maintenance, Inspection, Inventory, Purchasing, Contracts, Finance, Human Resources, and Payroll.

New technology implementation and installation is compatibly easy as there is expert people who can implement it, but when it comes to staff and workers issues and problems starts to emerge. Changing people means and techniques in conducting work and behavior is the most challenging part. The human element is the essential to activate and work out the effectiveness of the new software, but it can lead to high costs with less productivity, hence leading to more mistakes, inefficiency, and longer time to implement the software. As the system was relatively new to the IT resources in Abu-Dhabi Finance, therefore there was a very steep learning curve involved, along with some teething problems during the initial setup. Workers at the initial stage lack the required and proper skills to adopt with the software. If the workers fail to communicate effectively with the new software, then this whole project and implementation process will be jeopardized. So, AFT realized those problems from the beginning and started to devote their efforts to ensure that each member attitude must be influenced to accept the new software; as well as, adapting the new necessary skills to guarantee a successful implementation. They started by conducting a systematic diagnostic approach, as they analyzed the areas of inadequate performance, then overcoming issues that emerged by the implementation the system. They had a prior training session to reduce errors and facilitate the process of adapting to the new software skills; however, prior

training is not enough; they used the e-learning sessions for post implementation; the e-learning sessions and modules costs less and requires less effort from the IT resources, as this technique will be self service learning and engaging with the system. This type is better as its available always at any time with unlimited number of access, so each member can keep on learning and practicing by looking into the online sessions and modules until they become mastery in it.

ERP PROCESSES

Software Selection Process

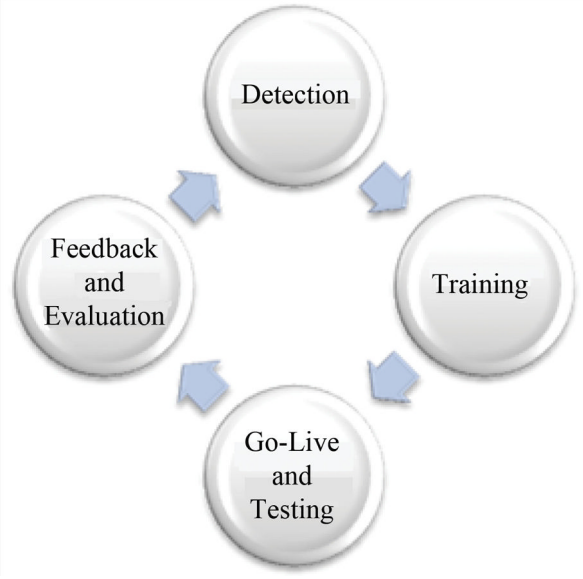
AFT chose the SLAs after a Proof of Concept process (POC), which they first build the expectations by inviting various business intelligence software vendors to conduct on site workshops, the purpose of the invitation was is to determine if the software scope meets with the organizational goal and mission. After building the expectations, they started to filter out and weigh the presented software to locate the best suited one, this process was held by controlling the expectations; here comes the cancellation and incorporation of the presented software's. The proof of concept process will minimize the ambiguity of the software requirements and provide an understanding of the new software resources, potentials, and limitations. Also, it's a tool that helps in defining the design decisions at an early stage in the process, and it reduce the possibility of project failure as it minimize the uncertainty of adapting new software. However, the proof of concept does not provide the final deliverable as it only view and demonstrate the methods and functionality of the software, but not the requirements of the implementation process as it require specialised resources. AFT faced some issues that are mainly related to overlapping or missing features in the various options provided and considered.

Software Implementation Process

Abu-Dhabi Finance Trust went through four different phases to implement the SLAs software, the implementation phases were built to provide a faultless transformation; from a paper-based procedure to an electronic procedure, that ensure all the client information and operation has been inserted into the system; to supply and deliver superior high level of performance, support, and managing relations. The four phases are discussed below (also see Figure 1):

1. **Detecting the Software:** This phase is done after the proof-of concept process; that determines the organization needs and match to the right software. At this phase, a demonstration has been done to ensure that the SLAs applications and services are assessing in delivering the organization goals. It defines the software structure and explores the policy of operating the software, it also provides more clear understanding about the

Figure 1. Four implementation phases



software weaknesses and strengths, and it helps in collaborating the conversion process and software configuration.

2. **Training:** At this phase, a training session is done for the staff in form of a demonstration or by doing the daily activities, to learn how to enter data and interpret it. The training session is done before the Go-live phase to make sure that the staffs has been trained to optimize the system and get the best out of it, and ensure that they are being able to perform their tasks and activities effectively. AFT has used a tailored training session, which has been developed to deliver the requirements of the organization and the tasks that should be performed by their staff. After finishing the training, they made sure that each member of the organization has been trained properly to Go-live and use it with the clients, this way they will minimize faults and ambiguity while using the new software.
3. **Go-Live and Testing:** After performing the training session and system configuration and analysis for readiness, that gave the organization the green light to Go-live and initiate and the system. Here the system has been initiated and used actively by the staff, and then comes the testing phase to detect if the system has delivered the requested goals or not. Testing is very important to make sure that the company has invested their money in a worthy valuable project, rather than keeping moving on it and at last turns to be a catastrophe.
4. **Feedback and Evaluation:** Following the testing a feedback and evaluating must be performed to demonstrate the effectiveness of the software on the organization and how it made the organization deliverables be performed in a better effective way. SLAs have taken the organization into a journey of continuous improvements and leveraging the organization into a new enhanced edge.

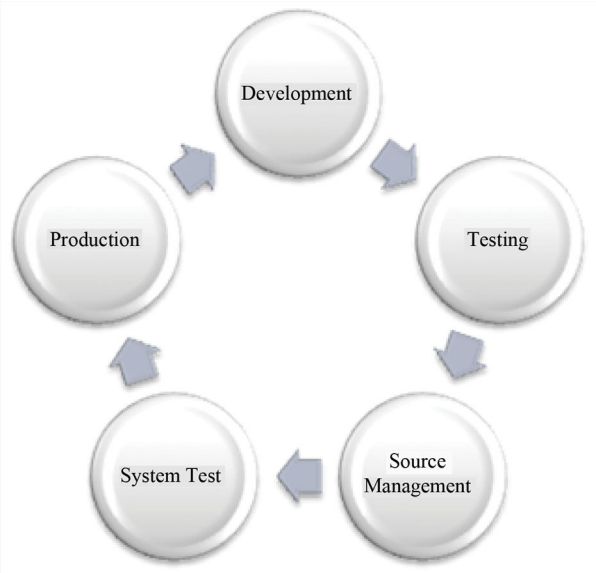
The SLAs is not just software, it is a business strategy that has been adopted after an advanced planning and research, to promote effectiveness and efficiency through better integration channels and effective report development process.

Report Development Process

Figure 2 illustrates the summarization of report development process and how it moves through the organization to start the production phase. It views how the client information and operations are being inserted into the SLAs software and how it runs through several levels to be operated and optimized to reach high productivity level, and provide high level of performance in a manageable and convenient process.

The Cycle shows how the report being transferred in the management level and start producing, developing reports is which requires several phases in which some reports needs to be passed through departments to be build. Then reports must enter into a testing phase to make sure

Figure 2. Development process



that data that have been entered are correct and reduce errors and redundancy. The third phase is to manage the resources that have been reported and interpret them to test them if they work with both client and business requirements, and then start the production phase.

BENEFITS AND CONCERNS

Software Benefits

Abu-Dhabi Finance Trust reveals the benefits that they have attained from the software. The software provided a full automation of the business critical; Key Performance Indicators (KPIs), by allowing the management to view how each department is growing and performing, as it automated the process of seeing how the organization is performing toward the goals and strategic objective, it also helped in making decisions in quicker time with less effort as there is an available accurate measures that can be looked into at anytime.

In addition to the above, it didn't automated the KPIs only but also the MI (Management Information) reports, by using the business information to build a measurement plans and forecasts. Also, it had a significant reduction on man-hours spent on developing manual reports, as the SLAs is all about having a formalized reports that can be also be changed easily into graphs if applicable. The SLAs has a connectivity with Smartphone's, so the time of sharing reports has minimized through auto notifications and auto alerts features that the SLAs send to the Smartphone once the reports has been sent and the user can check it directly, this feature helped in having a fast rich interaction process. Moreover, the SLAs is the single source of truth for all data reported in the organization.

The software has changed the process of customer care, as there is enhanced auditing and monitoring by understanding how the users interact with the software and provide the feedback for the customers. The SLAs software is built on a unified infrastructure, so it has reduced costs and improved productivity by having a system that delivers several services. Users' knowledge and expertise has increased; it is a task-oriented software and encourage users on self-learning by engaging themselves and interacting actively with the system features, reports, and innovative rich graphics. The SLAs software that provides a well integration between all organization departments and minimizes redundancy, also it avails a measurement and feasibility to reach organization goals; it is a reliable system that provides scalability and optimizes performance.

Technology Concerns

Abu-Dhabi Finance Trust had one technology concern; it was around running the software on a Microsoft Windows Server Platform, since the product is more stable on Linux Platform, they implement it on Microsoft windows Server due to the lack of the in-house expertise in Linux Administration, they have decided to deploy the software on a Windows Server. This is a challenging step to take as it may cause lots of problems and failures due to the failure to the system to function properly on the Windows Server, as it designed to be on a Linux Platform. The Platform is the framework for operating any system; it supports and limits its functionality. This may lead to having a poor investment, if the platform turns to be a failure; however, Abu-Dhabi finance have studied the challenges that can be raised by implementing the system, and till now no major problems has accord.

Management and Organization Concerns

The management was concerned about the steep learning curve involved, especially for the non-technical users, as they require lots of training and auditing process. They were aware if the no proper training is available, it will cause the system to

fail, and the new investment will just collapse at once. In addition, they were concerned about the accuracy and data presented in the system database; even they have studied their choice precisely the concern was still there until they started to use it and optimize it.

TECHNOLOGY COMPONENTS

The SLAs implementation process required five different technology components to implement and initiate it.

1. Microsoft Windows Server 2003

Windows Server 2003 is a reliable and flexible server for the SLAs software, its features, visualization tools, resources, and management tools integrates with the SLAs to accelerate and enhance its functionality. The server saves time as its efficient and dynamic, and it delivers high quality features, valuable functions, and a powerful operating system. It provides with a solid infrastructure for the SLAs software system, it enables the system to operate on highly dependable, consistent, and scalable platform. Windows server has provided the organization with better solutions, as management concerns in deploying a platform that is compatible with both management goals and the changing environment is solved.

In addition, the server has benefited the organization by reducing power consumption, as it is one server the initiates and supports organization computers. As well as, reducing power consumption it has improved management tasks as well, by enhancing command-line tasks and improving remote management by having better visualization and graphical integration process. Windows server has the ability to extend features and utility by integrating it with other software. In short, windows server 2003 increases productivity, efficiency, and provides rich experiences for users and management.

2. Oracle Business Intelligence Enterprise Edition Answers

As the business environment is always changing, an OBIEE Answers is a solution for all the operational and business intelligence tactics it has been developed by Siebel but provided as a part of OBIEE. This application allows users to find answers and build their own customized queries and reports without having any IT technical assistance. It is also the tool that business developers use it to build the reports and dashboards; it is a warehouse of retrieving information that answers business questions.

3. Business Intelligence Publisher

This is formerly called XML Publisher; it provides a powerful design and building structure for delivering information securely and in the correct format. Business Intelligence Publisher has new features that works perfectly with the SLAs software to leverage dashboards, data, calculations, and allows requesting for business intelligent services.

In addition, it allows collecting data from multiple records and reports to display it in one single document, and it allows having fast communication and performing business tasks quicker by connecting to smart phones. It helps having a faster report interaction; it highly optimizes reports with using less memory space as it uses a compatible version of reports. So, BI Publisher results in better integration process and allows its reports to be designed in Microsoft word; as well as, Adobe Acrobat, this means it is easy, efficient, and most of all an intelligent technology component.

4. Oracle Database 10g

Oracle Database is a relational database that it's main goal to calculate resources and present the relation between them, its system architecture for the SLAs software. Oracle Database Features:

- Creating tables and views, to display sequences and consistent data modeling.
- Specifies attributes, relationships, and entities.
- Building Web-based applications.
- Flashback features, to undo the mistakes that users perform.
- Creates database backups to prevent massive failures.
- Information management and managing its lifecycle.
- Managing the unstructured data and it acts as a warehouse for reports and databases.

It enables to bring a change into the organization environment with a very low risk, as it has many features that benefit the organization in having great performance scalability, secured and centralized communication, and it helps to move from single to clustered open communications.

5. MS SQL Server 2005

SQL server developer is exclusively supported with graphical tool developing databases; it has many features that enhance business activities.

- **Data Mining:** This is an option in the SQL server, it helps users to extract their required data, describe, save, and share it. In addition, it provide data in visualize and transforming data to graphics. It automates knowledge by allowing users to build and discover information and databases (Anonymous, 2011).
- **Data Modeler:** SQL server allows users to design and build data models; it provides instructions for designing and building data models.
- **DBMS Scheduler:** This feature provides the users to form a schedules, chains, jobs allocation, jobs authenticated, and databases targeted.
- **DBA Functionality:** It enables users to review database arrangement and construction, and edit it to initialize their activity. It mange resource plans and prioritize them, and it identifies inspection settings and maintains users roles and profiles secured.
- **Exporting and Importing Data:** It acts as an interface to have a dynamic secured data exchange.
- **Menus:** It allows recompiling plans by connections, and generating API tables; which are tables builds based on user ID, it helps in having a dynamic and easy configuration process.
- **Migrations:** All migrated tasks are managed by the project navigator; it delivers the tasks to right persons in the company as the users profiles are being captured, so it redistribute and migrate tasks by targeting the appropriate person for the task.
- **PDF:** It generates PDF documents for the databases, to have a faster sharing process and maintain secured documents transfer as it is authorized to have different levels of document encryptions and a password-PDF document.
- **Query Builder:** SQL worksheet is tightly integrated with the query builder; it allows automatic determination of connected and joint data, helps in grouping and sorting procedures of databases.
- **Schema Browser:** This feature allows having easier navigation process between databases and objects, and it supports a filtering and narrowing information to display the précised requested information.
- **Times Ten:** It supports the memory storage of the databases; it compresses databases to avail more storing space.

Therefore, the SQL Server helps in having accelerated database development, faster communication and productivity, and easier database designing process.

MAIN CHALLENGES

Current Challenges

Abu-Dhabi Finance Trust faced some problems regarding the SLAs software; the software is a combination of XML Publisher by Oracle Corporation and Seibel Analytics, it's marketed by Oracle as a single product; however, there are some integration and user management issues due to the coupling of these two corporations.

Future Challenges

Managing the various backend database connections, and report repository is becoming a bit tedious as the number of reports and the available data gradually increase. Therefore, upgrading to the newer version is a future concern, since it will involve a minor learning curve for the new features and system changes.

RECOMMENDATIONS

The software should be deployed and installed only after a thorough analysis of business requirement and after consulting the deployment guides provided in order to avoid issues arising post deployment. Also, finding the right software for the organization guarantee a successful investment, as it will help in achieving organizational goals.

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KEY TERMS AND DEFINITIONS

Ad-Hoc Reporting: Tools to allow end users to easily build their own reports and modify existing ones with little technical skills.

Business Intelligence (BI): A set of applications and technologies for gathering, storing, analyzing data to make better business decisions.

CRM: Customer Relationship Management.

Dashboards: A set of tools to allow business users to define, monitor and analyze business performance via Key Performance Indicators (KPIs).

DBA: Database Administrator.

ERP: Enterprise Resource Planning.

Key Performance Indicators (KPI): Quantifiable measurements to help an organization define and measure progress toward organizational goals.

MENA: Middle East and North Africa.

MI: Management Information.

OBIEE: Business Intelligence Enterprise Edition.

Proof of Concept (POC): The demonstration that a product is technically and financially viable.

SLA: Service Level Agreement.

SQL: Structure Query Language.

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Chapter 58
Identifying the Business Value of Information Security

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ABSTRACT

Management may see information security as an inhibitor to daily operations if the investment is not well aligned with current business activities or is presented in financial terms not relevant to their agenda. While this chapter shows that information security improvements create bottom-line business benefits, there is still a need for security managers to focus on quantifying those benefits in relevant financial terms. The purpose is to demystify the principles of general investment processes and criteria for calculating the benefits and costs of investments while accentuating alignment to the imperatives of the organization that makes the investment. As information security investments are assessed alongside other investment projects, it helps to consider them on an equal footing, implying the use of similar, and ideally the same, methods of financial cost projection. It is equally important to position and present the proposed investment in a relevant business context.

INTRODUCTION

When top level management makes investment decisions it strives to find a balance between risk and reward for the company to meet the overall goals and ambitions. These goals could be defined as single year financial targets combined with annual budgets and rolling forecasts or they could be related to more long-term metrics used to drive a change.

Since 2008 we have witnessed unprecedented changes in the global economic environment that has presented new risks and challenges combined with new technologies, where some have helped improve information security and some have brought new risks and concerns.

Many security professionals struggle with the fact that costs associated with information security incidents can have large components which are difficult to quantify. Information security decisions still need not be taken with a complete lack of quantified value. Quite to the contrary, in the manner of any investment request, there are often numerous opportunities to collect data and trend information in order to measure the effectiveness of the investment.

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If investments in information security are assessed alongside other investment projects it helps to consider them on an equal footing, implying the use of similar (and ideally the same) methods of financial cost projection. Benefits that cannot be measured with quantitative values may mean less to senior management. They may see information security as an inhibitor to their daily operations if the investment is not well aligned with current business activities or is presented in financial terms that seem not relevant to their agenda (Tsiakis and Pekos, 2008).

This chapter is aimed at providing information security professionals with a brief introduction to performing cost benefit analyses of information security investments and presenting them to management in order to bridge the gap between security professionals and business leaders.

It is based on recent reports and previous research on the topic, and should be considered as a summary only. For a deeper analysis and broader perspectives on obtaining support and funding from senior management, please refer to the full reports.

The Need for Alignment to Business Needs

Over the past several years, we have witnessed unprecedented changes in the global economic environment. Increased pressure to improve profitability, coupled with increased government and industry regulations and austerity measures have presented new risks and challenges – challenges that many organisations are now struggling to address. We also witnessed new technologies introduced and adopted, some that helped improve information security and some that brought new risks and concerns.

The professional services firm Ernst & Young (2012) has conducted research on the impact of the downturn in the market by conducting more than 50 000 direct meetings with senior executives since 2008 as well as performing annual benchmark studies, the latest published in December 2012, run by the Economist Intelligence Unit (EIU) surveying 1,500 C-suite, board directors and senior managers from around the world.

As with earlier studies, Ernst & Young have factored out the impact of sector and distinguished between the highest and the lowest quartile of performers, in both revenue and EBITDA growth, to identify specific patterns of action that might explain the difference in performance. Top level management could use this study, and others, to help define priorities for investments to meet the overall goals and ambitions of the company.

Four key areas have been identified where high performers are significantly ahead of their competitors: customer reach, operational agility, cost competitiveness and stakeholder confidence (see Table 1).

Companies researched share that information is a fundamental asset to them. Information security is therefore critically important to protect data against a wide variety of threats, such as unauthorized disclosure, data errors or loss of information.

Table 1. Identified key areas of high performing companies 2008-2012. Source: Ernst & Young.

Key Performance Area	Identified Common Priorities in Key Area
Customer reach	• Focus on key segments • Broaden product/service offer • Prioritize markets • Reinforce brand
Operational agility	• Accelerate speed of response • Create flexible work/delivery platforms • Master innovation • Improve collaboration
Cost competitiveness	• Inform pricing process • Sustain cost reduction • Pass on cost pressure • Optimize capital
Stakeholder confidence	• Identify and explain risks • Enhance reporting • Anticipate regulatory compliance • Re-engage with internal talent

The annual Global State of Information Security® run by the professional services firm PwC (2012) shows that from 2008 to 2009 there was a significant drop in respondents expecting increased information security budgets, reflecting the initial impact of the financial crisis. For the following years barely more than half of the respondents expected increases in budget spend, while 45 percent of the 9,300 respondents see a tightening of information security budgets for 2013 which will forestall updates to their security programs, and economic conditions ranks first among the multiple factors shaping security budgets.

According to the PwC study shown in Figure 1, organisations that consider themselves leaders in the field of information security are much more likely than other companies to employ integrated approaches and frameworks that combine compliance, privacy and data usage, security, and identity theft. They are less likely to cut security spending and more likely to increase it. They measure financial losses more thoroughly, and are much better aligned with overall business strategy than non-leaders. Finally, leaders are far more aware of what's going on in their organisations than the average respondent. On question after question, either none – or a very small fraction of the leading companies – said they did not know the answer, while "do not know" responses among the general respondent population routinely registered 15% or more.

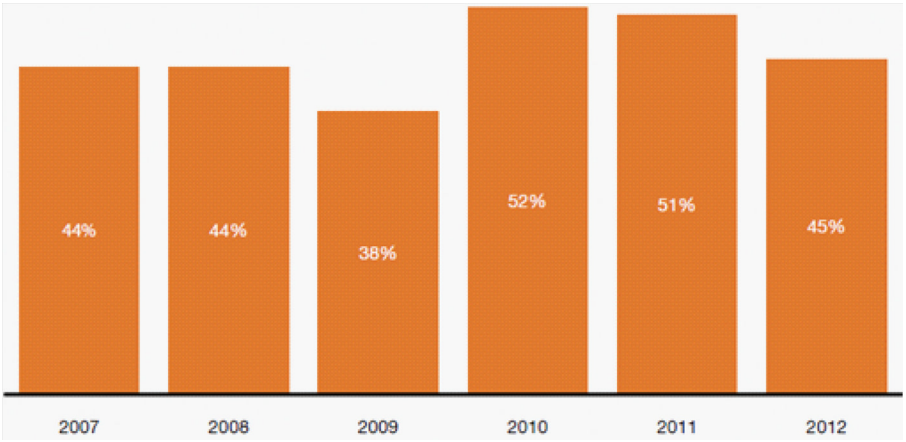
Similar findings are made in other surveys as well, where the number of respondents who indicate that their information security strategy is aligned to their IT strategy and to their business strategy has risen dramatically since 2008 (Ernst & Young, 2012)).

In short, information security improvements increase compliance and reduce risks, making security breaches less likely or less costly – creating bottom-line business benefits, as shown by ENISA - the European Network and Information Security Agency, working for the EU Institutions and Member States (ENISA, 2008).

MAIN ACTIVITIES TO ENSURE ALIGNMENT TO BUSINESS NEEDS

When planning for an information security investment it is essential to know what areas of improvement are prioritised in the organisation. All investments should be aligned to the business objectives and the executive agenda. There are

Figure 1. Percentage of respondents who believe that information security spending will increase over the next 12 months, 2007-2012
Source: PWC



multiple stakeholders in a company whose needs should be taken into account.

Take a look at the four key areas again – how will the proposed investment contribute to the improvement in any of the areas identified by management as critical? Does the organisation use any other set of business goals or priorities to be aligned to?

The typical investment approval process includes the following aspects to consider (Weill and Ross 2004):

- How much to spend.
- What to spend it on.
- How to reconcile the needs of different stakeholders.

There is a need to ensure that the governance model of the organisation is understood properly. Depending on what key performance area that is being supported by the information security investment, there will be different stakeholders who need to take appropriate actions. Stakeholder aspects to consider:

- Who makes investment decisions?
- How are investment decisions measured in terms of effective management?
- How will these decisions be captured and monitored in financial terms?

Many information security initiatives provide value to the company by managing identified risks through reduced incident costs. Other security programs aim at improving governance effectiveness or meeting compliance requirements. Regardless of which, they need to be clearly aligned to one or several business objectives that guide the leadership team making the investment decisions.

If the information security professional is not fully aware of the agenda of the organisation the proposed investment may not be realised, not because the investment in itself would be a poor investment, but simply because the needs it addresses are not relevant to the management agenda that has developed since the financial crisis started.

In 2004 the Massachusetts Institute of Technology's Sloan School of Management research presented three alternative financial performance models being most relevant for IT governance: asset utilisation, profit and growth (Weill & Ross, 2004). These models can still be found reflected in the financial calculations used for investment requests, as will be shown later in this chapter.

The structure of this chapter is in line with general principles for investment processes and presents the five key steps to take for improving chances of approval to investment requests (see Table 2).

IDENTIFYING MAIN RATIONALE AND STAKEHOLDERS

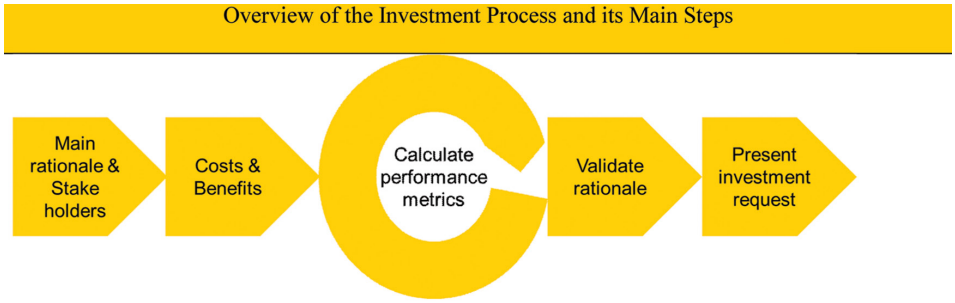
The investment process starts when there are identified needs for risk mitigation (see Figure 2). The main rationale for these needs vary and have different implications on what methods to apply for a useful cost benefit analysis.

There may be a risk that the proposed information security investment could be seen as driving costs or a source for productivity loss in operations. Therefore it is useful to ensure that the investment comes out as a positive investment that enables or supports business targets (Tsiakis and Pekos, 2008).

Main aspects to consider are:

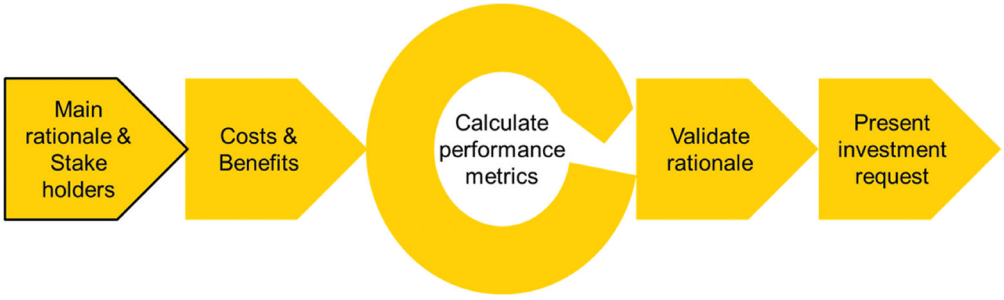
- Why should we, as an organisation, invest in this security initiative?
- What is the precise effort in question?
- Who in the organisation will be impacted by this effort?
- Who do we need support and participation from?
- What is the value of that effort to the organisation?

Table 2. Approach for information security investments



Step		Key Question to Address
Main rationale & Stake holders	Identifying main rationale and stakeholders	Understand the main rationale and identify stakeholders for the information security investment
Costs & Benefits	Capturing costs and benefits	Document the value to the organisation, using quantitative data whenever possible. This entails both non-financial security metrics and financial costs and benefits.
Calculate performance metrics	Calculating performance metrics	The non-financial and financial parts of the cost benefit analysis are made iteratively and in parallel to better identify and capture relevant values for the investment request, so that the security investment can be compared on equal footing to other investment requests.
Validate rationale	Validating investment rationale	Validate that the results match the main rationale and are relevant to the stakeholders and their goals
Present investment request	Presenting investment request	Prepare how to communicate the value of the investment to management

Figure 2. Identifying main rationale and stakeholders



- How are we going to substantiate or measure that value?

Business drivers create the main rationale for information security investments. One driver is due to someone within or outside the company identifying risks or gaps in the current control environment that inhibits profitability or growth. Another business driver is when security mechanisms can enable cost reductions in operations through increased efficiency or effectiveness. A third business driver is when there are opportunities to improve the company's asset utilization (see Table 3).

Case Example: Privacy Compliance Benefits for Data Centre Provider

This case shows how a risk analysis regarding the management of privacy was developed to present benefits aligned to business goals as part of the investment request.

The objective with the engagement was to support the data centre outsourcing company with IT legal skills regarding management of end-customer data within the area of outsourced services. It was also to match those to the business objectives of operational cost reduction, growth and lowered liability risks. This was a moving target which required change readiness for the outsourcing organisation taking over accountability for lowering liability risks while meeting contractual obligations at a set price. The past 40 years have shown that privacy and data protection have never been static (Gutwirth et al., 2011).

In this case there were four main phases in the process of winning and managing a customer contract that were analysed. During all these phases the outsourcing provider handled issues related to the processing of end-customer personal data.

Outsourcing phases that were analysed:

1. Negotiation and win of contracts
2. Transition of customer operations to IT outsourcing provider
3. Contract fulfilment
4. Standardisation and centralisation of operations to global data centres

The main risk areas in Table 4 were identified:

A set of mitigating actions were proposed to management and as all of the risk areas were addressed in terms of alignment to business objectives, these mitigating actions were easily discussed and accepted by the relevant stakeholders.

This example shows that the commonly used risk analysis can be used to produce business aligned investment requests in the area of privacy management, which othwerwise often is seen as a topic related mainly to regulatory compliance and a cost driver.

CAPTURING COSTS AND BENEFITS

By measuring information security metrics, both non-financial and financial, the security professional can improve the security organisation's visibility and standing within the company as well as indicate the value of information security

Table 3. Business drivers and information security initiatives

Business Driver	Examples of Information Security Initiatives
profitability or growth	Mitigating unacceptable risks in control environment for new services, products or when entering new markets.
cost reduction in operations (reduced opex)	Improvements in process efficiency or effectiveness, e.g. increased automation of preventive controls
improved use of assets (reduced capex)	Divestment of assets with increased use of outsourced services in a secure way

Table 4. Privacy risk areas, IT outsourcing provider

Risk Area	Description
Missed opportunities for cost reduction	When the data centre provider operates services for its customers the aim is to reduce operating costs thanks to standardisation and centralisation. Wrongful presumptions that privacy regulations inhibit such actions will block cost reduction opportunities in operations.
Over-delivery without proper remuneration	The data centre outsourcing provider agrees to a certain level of privacy controls in the outsourcing contracts. If the transitioned operations are not meeting those requirements before they are taken over, the provider will have to improve the privacy management compared to original operations without proper compensation from the customer company. The same applies when the IT operations are centralised to global data centres that meet higher privacy compliance levels than those originally in place.
Contract penalties, negative publicity and legal actions	When existing IT operations are transitioned to be managed by the data centre outsourcing provider they are received 'as is'. If these operations are not validated to meet the contract from the time they are taken over, there may be data leakage with liabilities for the provider. In several jurisdictions there is also a legal requirement to disclose data breaches, opening up for legal actions from the end-users (Anderson and Böhme, 2009).

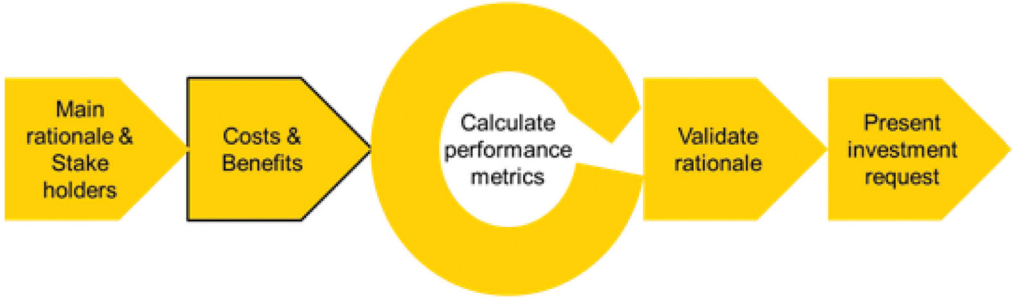
investments (see Figure 3). Despite the clear demands and advantages, security metrics are too often poorly developed or based on data that is ineffective to provide measurement of financial benefits, or costs, to the company.

Many security professionals struggle with the fact that costs associated with information security incidents can have large components which are difficult to quantify as security design is based on quantitative or qualitative analysis where especially qualitative analysis can be difficult to transform into financial consequences (Tsiakis, 2010). This is not to say that organisations have to make their information security decisions with a complete lack of quantified financial value. Quite to the contrary, in the manner of any investment request, there are opportunities to collect data and trend information in order to measure the effectiveness of information security investments, as for any investment request (Gordon and Loeb, 2006).

The baseline requirement on metrics used is that they should be quantifiable indicators which can be obtained objectively and are repeatable. The repeatability is important if there is a need to make comparisons of earlier and later values or to find trends. This first requirement is often the reason for security professionals to flinch from measuring security. But information security is not a feeling or a notion. If risks are real, countermeasures must also be substantial which should be possible to demonstrate (von Faber, 2009).

Another important aspect is that the change in measured metrics must be possible to connect to specific information security controls improvements. As a result improvements in controls will show changes in the outcome of measurements.

Figure 3. Capturing costs and benefits



The metrics must also provide enough information to enable the security professionals to add or modify actions in a systematic manner. Specifically, the measurement should directly be aligned with the company's goals.

Still, as with any other investment made in a company, the value propositions for security investments need to be dependent on assumptions and simplifications, as the cost for measuring anticipated effects would otherwise run the risk of outweighing the potential value gained in an improved control environment (Xie and Mead, 2004).

Metrics used for measuring risk mitigation cannot be regarded as purely technical issues as they involve different stakeholders with different needs (Tsiakis, Kargidis and Chatzipoulidis, 2013). Typical metrics with financial impact can be related to the probability, frequency, character, and magnitude of future events, e.g. threats and attacks. In the case of compliance it could be related to employee-time spent on non-productive corrections of information security breaches or the cost of fines and penalties for compliance breaches.

Using metrics to measure improvements based on taken mitigating actions should not be confused with methods for identifying potential benefits of security investments. Security metrics are used to measure what has already happened while potential benefits, if the investment is made, are identified using other methods, where risk analysis and business case analysis are two common approaches.

Risk Analysis

The Information Technology Governance Institute states that a key goal of information security is to reduce adverse impacts on the organisation to an acceptable level of risk. Therefore, an effective security programme will show a trend of impact reduction and quantitative measures can include trend analysis of impacts over time (Information Technology Governance Institute, 2003).

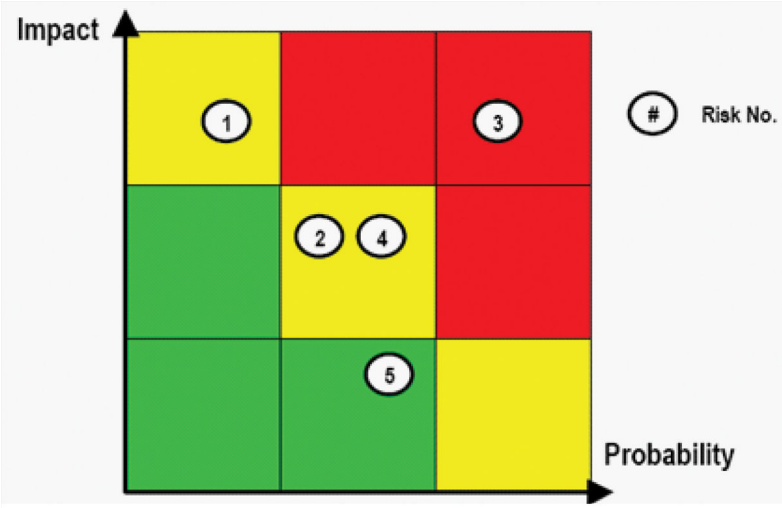
The fundamental purpose of internal control measures is to prevent or detect security breaches. If the solution prevents most incidents before they materialise, it could be deemed superfluous by management unless it is made transparent that the specific investment made an impact. On the other hand, if the implemented solution detect numerous of incidents that were not previously identified, there is a risk that stakeholders see this as a sign of ineffective information security governance, believing the number of incidents have risen.

Risk analysis is the most complex method of estimating profits (Kotler and Keller, 2006). Due to the uncertainties involved in risk measurement and the concept of benefits being based on lowered "value-at-risk," the risks are often assessed in qualitative non-financial terms, e.g. "High, Medium, Low" or 1-10. These estimates are then presented in heat maps, with an example shown below in Figure 4. Evaluating risks in this manner enables participants the opportunity to have a focused discussion, disclose opinions, review facts and arrive at a clearer definition and understanding of the risks – shared by all.

The risk assessment process is a method of determining what kind of controls are needed to protect an organisation's information systems and other assets and resources not just adequately, but cost-effectively. The terms risk analysis, risk assessment, business impact analysis (BIA), criticality analysis, and threat- or vulnerability assessment are all used in this context (Tsiakis, 2010). Experience has shown that the business impact analysis is often seen as clearly connected to business managers' areas of interest, where loss cost calculations may be easier to quantify in financial terms than general probabilities for incidents to occur.

The risk analysis is useful for giving appropriate data input to the financial analysis and effectiveness measurement of information security management. The risk analysis is performed best as top-down scenario oriented, e.g. business units quantify costs of unavailability based on the dura-

Figure 4. Sample risk analysis heatmap



tion and costs due to loss of confidentiality while the IT department quantify costs of loss of integrity and the probability of these security issues. This results in the business impact of security risks and allows determining the influence of security on the necessary capital charge and the expected losses (Locher, 2005).

Business Case Analysis

A common approach used for strategic investment decisions in financial terms is the business case analysis, or BCA. The purpose of business case analysis is to make systematically sound strategic decisions under uncertainty. One of the risks with using business case analysis is that it can often underestimate uncertainty in order to create a vision of a future state precise enough to be captured in financial terms. Another risk is if managers are unable to find a strategy that works under traditional analysis, they may abandon the analytical rigor altogether and base their decisions on gut instinct (Hugh, Kirkland and Viguerie, 2000).

Rarely do managers know absolutely nothing of strategic importance, even in the most uncertain environments. It is often possible to identify trends, such as market demographics or risk exposure. There will always be an amount of uncertainty even after the best possible analysis has been made, but still quite a bit can be known despite this.

If the future is predictable enough, the manager can develop a single forecast that is a precise for the investment and be ready for financial calculations. If there is too much uncertainty, the future can be described as one of several scenarios. The analysis will not identify which outcome will actually come to pass, but it may help establish a general sense of outcome. Here the security professional must develop a set of scenarios based on their understanding of how the uncertainties might play out and each alternative may require different financial models.

Some aspects to consider with regards to development of business cases:

- Develop only a limited number of scenarios as the complexity of managing more than four or five tend to slow down decision-making.
- Avoid developing redundant scenarios that have no unique implications for strategic decision making.

- Develop the scenarios to collectively account for the probable range of future outcomes and not necessarily the entire possible range.
- Typically a set of "base case," "worst case," "best case" and "do nothing case" should cover the needs for assessing an information security investment.

When the future scenarios are being developed to a suitable level of detail, the financial implications of costs and benefits need to be considered as there may be a need to iterate between scenario design and the application of financial calculations to find a useful cost benefit analysis.

Case Example: Business Case for Mobile Security Data Centre

This case, provided by Coromatic Group, shows how business case modelling helped the Business Continuity Program unit of a government agency to invest in mobile security data centres for use in crises management situations.

The objective with the investment was to have access to several fully equipped 20 feet containers with eight 19" server rack capacity, self-sustained with built-in cooling and power generation. The intended purpose of the data centres was to operate field crises management command centres in case of emergency.

When making the stakeholder assessment of needs to be met, there was a clear understanding of the operational benefits for the proposed equipment as this was needed to meet the government expectations of the agency's capacity in business continuity. However, the investment had not been budgeted for in full and at senior executive level there was a general ambition to reduce the amount of assets owned by the agency.

In the business case scenarios that were prepared, one of them was to pay for the mobile data centres as a service instead of acquiring them to be owned as assets. Table 5 summarizes the financial opportunities and risks identified in that specific scenario.

After assessing the different scenarios, including other aspects than purely financial opportunities and risks, the BCP function decided to present the investment case as a service contract to the executive management. The request was approved.

Business Benefits

The benefits expected from an investment need to be collected and quantified so that management may weigh pros and cons of the proposed investment.

As we have seen, market situations and the strategies of a company change over time. By identifying the relative importance of different value disciplines, the information security professional is able to understand what the information

Table 5. Financial opportunities and risks in business case scenario, government agency. Scenario: Mobile security data centres as-a-service - financial aspects

Opportunities	Risks
Meet needs for reducing, or at least not increasing, amount of assets owned	The length of the service contract extends beyond the annual budget horizon to enable an adequate annual cost level
Operating costs can be adjusted per annum based on length of the service contract and amount of data centre containers	If the service contract runs longer than four years the total cost is estimated to be higher than acquiring the equipment up-front
Paying for a continuous service level and functionality instead of technical equipment covered only by a two year warranty removes need for additional maintenance contract	Potential penalties if withdrawing prematurely from the service contract

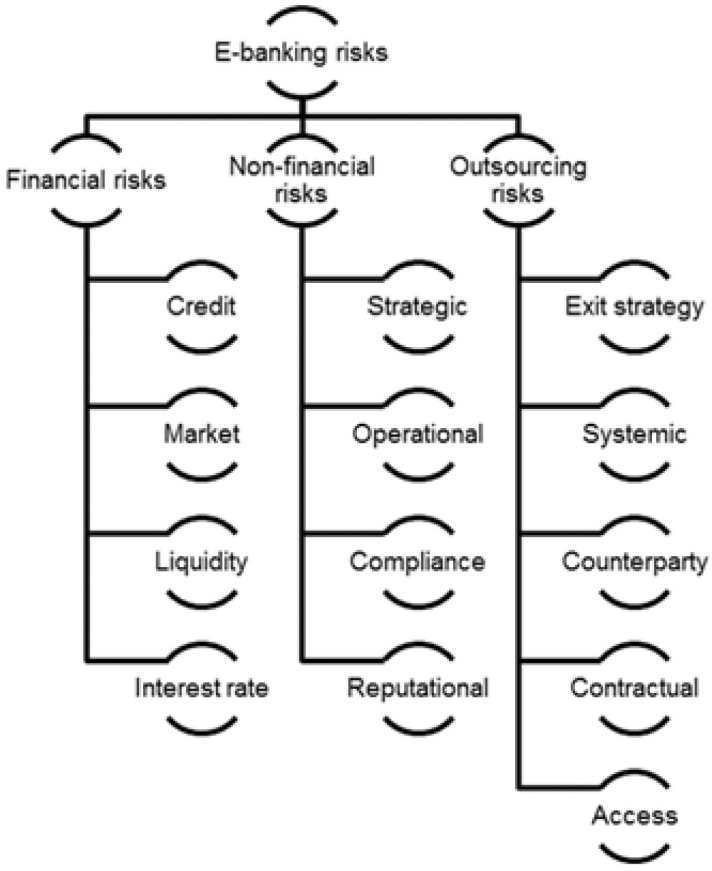
security investment needs to support. In general terms these fall into different categories (Weill and Ross, 2004):

- Cost-effectiveness in operations, i.e. operating expenditures (opex)
- Effective use of assets, i.e. capital expenditures (capex)
- Business flexibility
- Growth

These value disciplines are not taken into account by security professionals often enough. From a business manager's perspective any security investments may seem counterintuitive to the business needs, no matter which of the four disciplines may be driving their agenda. This is why it is essential to ensure a business alignment of the proposed information security investment.

Different industry sectors hold different levels of maturity with regards to appreciating information security as an enabler to business operations. The banking industry is a clear-cut example where both legislators and industry actors concur that risk mitigation in specific areas are required to be a fully licensed operator. It is also an industry where numerous different security governance frameworks are applied to meet business benefits by covering one or several of those risk areas. An example of how to adopt these in the e-banking area, in order to meet the specific requirements stipulated by that business model has been presented by Tsiakis, Chatzipoulidis and Kargidis (2013), shown in Figure 5.

Figure 5. E-banking risks from an IT Security Governance (ITSG) framework perspective



If the organisation is relying on more direct strategies for information security to benefit the overall business agenda, security investments could be assessed using the categories presented by Ernst & Young (2012):

- Customer reach
- Operational agility
- Cost competitiveness
- Stakeholder confidence

Benefits that are identified but cannot be measured with quantitative values may mean less to senior management. Therefore, when analysing information security investments that may seem less tangible, e.g. improvement of internal controls in a security framework or information security awareness trainings, the principles for effective governance can be applied (Weill and Ross, 2004).

Case Example: Measuring Governance Effectiveness

The following example was provided by ENISA (2008) to show the measurement of governance effectiveness at a manufacturer of consumer goods. There was a need for the security professional to present the relevance of a proposed information security program which was to run for 3 months, involving approximately 100 employees working in the financial controlling functions throughout the business units. The purpose of the training was to strengthen the commitment to manual internal controls within the financial reporting processes.

The Chief Financial Officer, CFO, and six other senior managers were interviewed on how the initiative could fit with the corporate agenda. The results of the interviews are presented in Table 6.

By using the respondent data the security professional was able to calculate the governance effectiveness of the proposed initiative as shown in Box 1.

In order to complete the investment request the result of 63 needs to be set in relation to other competing investment requests using the same model for governance effectiveness, or be measured against a baseline of a minimum threshold to be met.

If this threshold is below 63 the investment could be positively assessed from a benefits perspective. However, the cost elements also need to be taken into consideration before a formal investment decision is taken.

Table 6. Example of results from a consumer products manufacturer

Importance of Information Security Investment	
How important are the following outcomes of your information security governance, on a scale from 1 (not important) to 5 (very important)	
Importance	**Outcome**
4.2	Cost-effective use of information security
2.2	Effective use of information security for asset utilisation
4.6	Effective use of information security for business flexibility
3.2	Effective use of information security for growth
Importance of Information Security Investment	
What is the anticipated influence of the proposed information security investment in your business on the following measures of success, on a scale from 1 (not successful) to 5 (very successful)	
Importance	**Outcome**
4.0	Cost-effective use of information security
1.1	Effective use of information security for asset utilisation
3.5	Effective use of information security for business flexibility
3.0	Effective use of information security for growth

Box 1.

$$Governance\ effectiveness = \frac{(4,2\times 4+2,2\times 1,1+4,6\times 3,5+3,2\times 3,0)\times 100}{5\times(4,2+2,2+4,6+3,2)} = 63$$

Investment Costs

The information security investment cost elements need to be put into the proper financial context of the organisation.

The costs will vary greatly from one organisation to another depending on their structure, availability of supporting assets, e.g. automatic monitoring tools, and past experience from running previous security projects. Despite this, assessing the costs for a security investment is seldom the most challenging part of the cost benefit analysis, as these can entail proposals from vendors and be combined with estimated labour costs for executing an initiative. If investment costs for information security are assessed alongside other investment projects it helps to consider them on an equal footing, implying the use of similar, ideally the same, methods of financial cost projection, as the principles of investment requests do not need to differ between very diverse areas of investments. The U.S. Department of Housing and Urban Development (2002) has developed a cost benefit model that could serve as an illustrative example.

A more comprehensive list of commonly used formulas is found in the Appendix to this chapter.

Case Example: Total Cost of Ownership for an Airline Company

The following example was provided by ENISA (2008) to show the investment aspects at an Airline company. It shows common cost elements that can be collected by an information security professional without prior financial experience.

The airline company was planning to run an information security awareness programme. In order to get approval for the plans a budget was produced that showed the major cost elements, as seen in Table 7.

Despite not having identified any benefits, it is possible to perform a TCO calculation (Total Cost of Ownership).

The only variables to be added is how many training sessions were planned (in this case 20 training sessions were run at a cost of € 100 each) and for how long the awareness initiative was to be run as a structured programme. The running

Table 7. Information security awareness costs: Airline Corporation

Cost	Description		€ Estimate
Personnel	Personnel working on the information security awareness initiative. Whether they are full or part-time depends largely on the size of the organisation and the importance of information security relative to other priorities.		60 000
Operational Costs	The operation costs include rent, website maintenance – extranet and intranet -, information security awareness materials – posters, briefing papers, office miscellaneous costs.		25 000
Advertisement and Promotion	Branded coasters, pens, prizes for information security tests, quizzes and competitions, coffee for brown-bag meetings and so on.	Promo: material cost	2 000
		Promo: distribution cost	
		Advertisement: creative cost	
		Advertisement: media cost	
Training	In case an organisation organises awareness training sessions.	Individual materials cost	
		Training rooms, cost per session	100
Contingency	Further funds may be needed to purchase additional security awareness materials, external training courses and so on.		20% on total
Total budget			TOTAL

time is used to normalize all investments across a portfolio of investments. In this case the time frame was 2 years.

The TCO formula would look like Equation 1 in Box 2. In the case of the Airline Corporation, the results of the TCO formula looked like Equation 2 in Box 2.

As can be seen from the equations in Box 2, the normalized TCO for this information security awareness programme was € 53 400, ready to be compared with competing investments.

CALCULATING PERFORMANCE METRICS

When a combination of quantifiable financial metrics to satisfy stakeholder needs have been identified, the security professional should consider what the aim of the investment is to ensure the selection of proper financial models (see Figure 6). Security investments rarely exist for their own sakes; they are enablers of other investments (Tsiakis and Pekos, 2008).

A security investment could support profitability or growth for the company by mitigating unacceptable risks in new services, products or when entering new markets. It could even drive these aspects if security is a critical component of making the product or service relevant to the market at all. Another purpose for the investment could be to drive cost reduction in operations (lowering opex) or improving the use of assets owned by the company (lowering capex). If the aim is to lower opex this is often achieved through process improvements and increased automation, while reduced capex could be achieved through divestment of assets and increasing the use of outsourced services, e.g. cloud based security services.

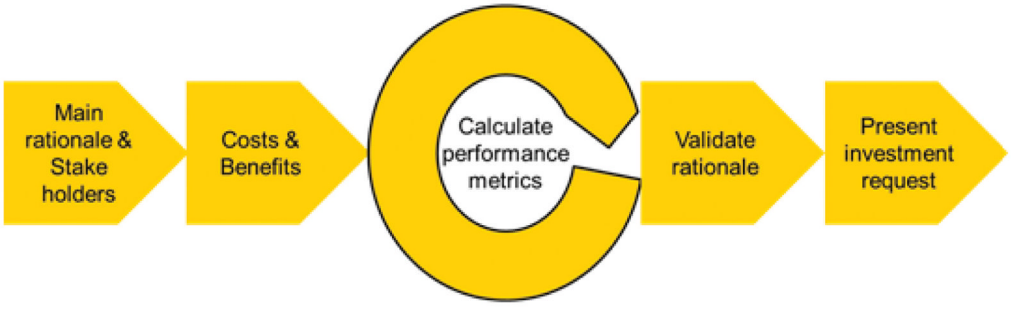
Business managers tend to see information security as an inhibitor to their daily operations if the investment is not well aligned with their current business activities or is presented in financial terms

Box 2.

$$TCO = \frac{\sum_{t=1}^{t=\text{end of awareness initiative}} \text{one time costs} + \text{recurring costs (t)}}{\text{awareness initiative duration}} \quad (1)$$

$$TCO = \frac{60000 + 25000 + 2000 + (100 \times 20) + (0{,}2 \times 89000)}{2} = 53400 \quad (2)$$

Figure 6. Calculating performance metrics



that seem irrelevant to their agenda. With regards to the financial metrics of a cost benefit analysis, some formulas are clearly focused on one aim or the other. For example Total Cost of Ownership does not consider profits, as shown previously in this chapter, while Economic Value Added, reflects growth as a pure measure of value-add to shareholders. The more commonly used Net Present Value or Internal Rate of Return would consider both aspects. Despite this, there are no clear-cut lines for when to use which of all the different calculations available (Cardholm, 2006).

Iteration is Essential

The financial aspects need to be considered not only during the financial calculation, since the collection of non-financial data helps identify and quantify key performance indicators and variables used in the financial part of the cost benefit analysis. Iteration also helps gaining buy-in along the way from stakeholders in operations and the business units. As a consequence the security professional needs to perform the non-financial and financial parts of the cost benefit analysis iteratively to be able to identify and capture relevant values for the investment request (Hyde, Regelman, and Kanagasabai, 2008).

- The iterative process of using financial calculations and non-financial metrics is critical to success.
- Once the financial metrics have been identified, the final calculations are seldom challenging to a professional with a financial background.

VALIDATING INVESTMENT RATIONALE

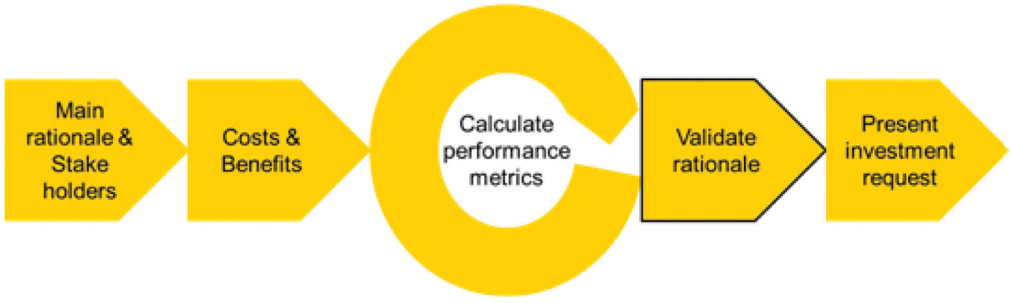
Before presenting the investment request to the decision makers, the security manager should ensure to validate how the proposed investment will fit with the decision makers' key strategies and goals (Figure 7).

To minimise risks that the proposed information security investment could be seen as driving costs or be a source for productivity loss in operations it is useful to re-assess that the investment comes out as a positive investment that enables or supports business (ENISA, 2008).

The main aspects to consider were presented earlier in this chapter:

- Why should we, as an organisation, invest in this security initiative?
- What is the precise effort in question?
- Who in the organisation will be impacted by this effort?
- Who do we need support and participation from?
- What is the value of that effort to the organisation?

Figure 7. Validating investment rationale



- How are we going to substantiate or measure that value?

At this stage of the investment request preparation these questions should be possible to respond to in a transparent way to ensure that no major perspectives have been left out of the cost benefit analysis.

PRESENTING INVESTMENT REQUEST

Management at every level and in every organisation takes decisions every day about how to focus and balance company resources, i.e. people, time and money (Figure 8). Every day, almost every one of those managers will be asked to change something about that focus and balance. The general result of all of this is that many people naturally develop a habit of rejecting ideas almost as a reflex. Even if some requests are approved, others are bounced, and the rest are asked to "redo the business case" or "provide more information."

To avoid such situations the security manager should meet the culture of preferred format for presenting information to management in the company. Some organisations thrive on structured memorandums, while others expect bound reports with colour-coded covers. The approach in Table 8 for preparing and presenting the information security investment is provided with the "slide presentation" style in mind, but can be adapted to fit your organisations preferences (ENISA, 2008).

Figure 8. Presenting investment request

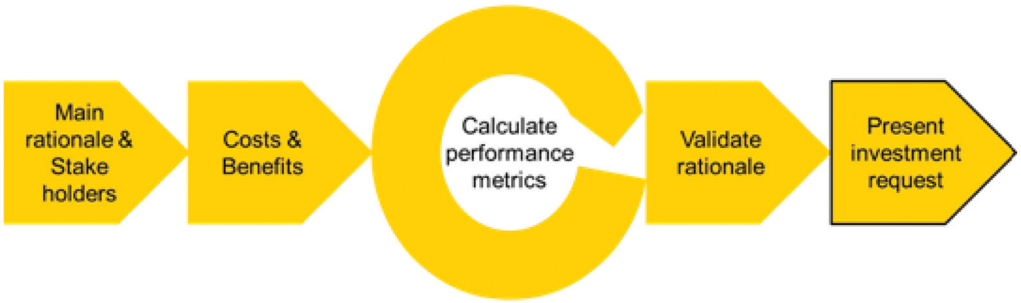


Table 8. Approach for presenting to management

Section or Slide	Key Topics or Speaker Points
Set the stage	• Brief statement to focus and frame the discussion • "In support of the business decision to…"
Document your understanding	• Management should conceptually agree to the threat or problem • Understand the threat in relevant terms, e.g. unnecessary costs • Show this is properly understood by you
Document the opportunity	General value proposition, e.g. "lowered risks of…" or "improved management of…" or "every day that we keep going without addressing this need will cost us the amount of…"
Share the vision	High level description of proposed security initiative and activities
Identify the business value	• Restate the value proposition in positive terms • Tangible outcomes related to business goals, (e.g., cost reduction or increased profit)
Determine next steps	• Clarify why this presentation was given to senior management • Identify any final steps that are needed, or determine what is missing • Now is the time to ask for senior management support

CONCLUSION

While this chapter has shown that information security improvements increase compliance and reduce risks, making security breaches less likely or less costly – which means creating bottom-line business benefits – there is still a need for security managers to focus on quantifying those benefits in financial terms.

In a study performed by Gordon and Loeb (2006) it was presented that senior information security professionals do use some form of financial analysis in budgeting for information security. Some of the participants approached information security expenditures with a formal Net Present Value (NPV) analysis, commonly used for many types of investments in companies. Other respondents used modified financial analyses with less emphasis on formally quantifying the business benefits.

An important aspect to consider is that security professionals should keep using the tools and methods developed by security researchers and industry actors, as this provides the foundation for actually managing security. However, by applying relatively simple financial calculations, the security professional can also make the investment case more clearly understood for senior management that may be less capable in security matters.

A point that should not get lost is that the cost benefit analysis is not an isolated tool for turning security metrics into financial values for its own sake. It should be built on the fundamental understanding of stakeholder needs so that it is useful as a tool to present the investment request in ways that meet those needs as well as the overall business drivers of the organisation.

Categories of business drivers to consider:

- Profitability or growth
- Cost reduction in operations
- Improved asset utilisation

If investments in information security are assessed alongside other investment projects, and they usually are, it helps to consider them on an equal financial footing. This implies using similar, or ideally the same, financial cost projection methods to make sure security gets no less opportunities of funding.

It may be worthwhile considering that business benefits that are identified but cannot be measured with quantitative values may mean less to senior management. This makes the challenge of capturing and measuring the intangible benefits of information security all the more important. Management may see information security as an inhibitor to the daily operations if the investment is not well aligned with current business activities or is presented in financial terms not relevant to their agenda (ENISA, 2008).

Presentation should not be overlooked, but before presenting the investment request, the security manager should validate that the proposed investment will fit with the decision makers' key strategies and goals – just one more time.

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KEY TERMS AND DEFINITIONS

Business Case Analysis (BCA): Captures the reasoning for making an investment. The underlying logic is that the total sum of resources used should be in support of a specific business need that provides a higher value if realised. A business case analysis typically captures both quantifiable and unquantifiable characteristics of a proposed investment.

Business Impact Analysis (BIA): Systematic approach aimed at identifying and quantifying consequences of sudden loss of functions or supporting resources.

Cost Benefit Analysis (CBA): Systematic process for calculating and comparing benefits and costs of an investment by comparing the total expected cost of each alternative against the total expected benefits. It has at least one of two purposes: (a) assess if it is a sound investment in absolute terms or (b) provide a basis for comparing investments in relative terms.

Data Centre: A facility used to house IT equipment and related communications devices. The supply systems are typically designed in a redundant way to ensure power, cooling and environmental controls meet agreed service levels. Data centres range from small units built as secure rooms within existing buildings to mobile container modules and industrial scale facilities that requires several megawatts of power to be run.

Performance Metric: A measure of results based on activities taken. Performance metrics support different stakeholder needs depending on context, which means they can be financed based, aimed on the internal performance of the organisation or be comparative metrics against set criteria, e.g. customer satisfaction or drive continuous improvement.

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APPENDIX

Sample Performance Metrics

The collection of performance metrics collected below covers well-known financial and non-financial examples used to justify investments. The security manager could look at which of these best suits the value and investment disciplines of the organisation and the nature of the information security initiative.

ROI (Return on Investment)

There are several variations of the ROI equation, given multiple interpretations and applications in different industries. This lack of consistency in the definition of ROI complicates the comparison of ROI values of several projects unless they are calculated on the same basis.

$$\text{ROI} = \frac{\textit{net benefits}}{\text{costs}} \times 100\,\%$$

Definition of Terms:

- **Net Benefits:** Benefits minus costs.
- **Costs:** Initial and recurring (or on-going) costs.
- **Time Period:** The standard ROI equation is usually calculated for the first year of the investment. A one-year time period has become an industry standard since companies seek to recover their investment on the first year of operations of the project. This rule of thumb may not be applicable across organisations but it can give a first estimate of the benefits of a project.

$$\text{ROIC} = \frac{\textit{NOPAT}}{\text{invested capital}} \times 100\,\%$$

Definition of Terms:

- **NOPAT:** Net operating profit after taxes.
- **Invested Capital:** Initial and recurring (or on-going) costs.

NPV (Net Present Value)

The NPV of a project or investment is defined as the sum of the present values of the annual cash flows minus the initial and subsequent investments. Future values are discounted according to the organisation's cost of capital and the risk inherent in the investment. NPV is one of the most robust financial evaluation tools to estimate the value of an investment.

$$\text{NPV} = \textit{initial investment} + \sum_{t=1}^{t=\textit{end of project}} \frac{(\textit{Cash Flows at Year } t)}{(1+r)^t}$$

Definition of Terms:

- **Initial Investment:** This is the investment made at the beginning of the project. The value is usually negative, since most projects involve an initial cash outflow. The initial investment can include hardware, software licensing fees, and start-up costs.
- **Cash Flow:** The net cash flow for each year of the project: Benefits minus Costs.
- **Rate of Return (r):** The rate of return is calculated by looking at comparable investment alternatives having similar risks. The rate of return is often referred to as the discount, interest, hurdle rate, or company cost of capital. Companies frequently use a standard rate for the project, as they approximate the risk of the project to be on average the risk of the company as a whole.
- **Time (t):** This is the number of years representing the lifetime of the project.

IRR (Internal Rate of Return)

IRR is defined as the discount rate that makes the project have a zero Net Present Value (NPV). IRR is an alternative method of evaluating investments without estimating the discount rate.

The IRR uses the NPV equation as its starting point, but calculating the IRR is done through a trial-and-error process that looks for the Discount Rate that yields an NPV equal to zero, typically accomplished by using the IRR function in a spreadsheet program:

$$\text{NPV} = 0 = \textit{initial investment} + \sum_{t=1}^{t=\textit{end of project}} \frac{(\textit{Cash Flows at Year } t)}{(1+\textit{IRR})^t}$$

Definition of Terms:

- **Initial Investment:** The investment at the beginning of the project.
- **Cash Flow:** Measure of the actual cash generated by a company or the amount of cash earned after paying all expenses and taxes.
- **IRR:** Internal Rate of Return.
- **N:** Last year of the lifetime of the project.

FCF (Free Cash Flow)

FCF represents the cash that a company is able to generate after laying out the money required to maintain/expand the company's asset base. Creative accounting can cloud earnings, but it's tougher to fake cash flow. For this reason, some investors believe that FCF gives a much clearer view of the ability to generate cash (and presumably profits).

There is a risk with focusing on short-sightedly earnings while ignoring the "real" cash that a firm generates. That is why free cash flow is important, because it allows a company to pursue opportunities that enhance shareholder value. Without cash, it's tough to pursue new opportunities, make acquisitions, pay dividends, and reduce debt and so forth

It is important to note that negative free cash flow is not bad in itself. If free cash flow is negative, it could be a sign that a company is making large investments. If these investments earn a high return, the strategy has the potential to pay off in the long run.

DCF (Discounted Cash Flow)

DCF analysis uses future free cash flow projections and discounts them to arrive at a present value, which is used to evaluate the potential for investment. If the value arrived at through DCF analysis is lower than the current cost of the investment, the opportunity may be good.

$$\mathrm{DCF} = \sum_{t=1}^{t=end\ of\ project} \frac{CF_t}{(1+r)^t}$$

Definition of Terms:

- **CF:** Cash flow: net cash flow for each year of the project: Benefits minus Costs
- **r:** Discounted rate (weighted average cost of capital)

Governance Effectiveness (Non-Financial)

This model shows the effectiveness of the investment defined in relative terms to its importance. The maximum score for the investment is 100 and the minimum score is 20, by using the formula below.

The approach is based on asking the senior management team – at least ten managers is recommended as sample population – to answer questions by giving them a score between 1 and 5. Then average the results and look at variation by business units and level of management to meet the stakeholder composition for the investment decision.

$$\text{Governance Effectiveness} = \frac{\left(\sum_{n=1\ \text{to}\ 4}\left(\begin{array}{l}\text{importance of information security governance outcome}\{\text{Q1}\}x \\ \text{influence of proposed information security governance investment}\{\text{Q2}\}\end{array}\right)\right)x100}{\sum_{n=1\ \text{to}\ 4}\left(5x\left(\text{importance of information security governance outcome}\right)\right)}$$

Definition of terms:

Q1: How important are the following outcomes of your information security governance, on a scale from 1 (not important) to 5 (very important).

- Cost-effective use of information security
- Effective use of information security for asset utilisation
- Effective use of information security for business flexibility
- Effective use of information security for growth

Q2: What is the anticipated influence of the proposed information security investment in your business on the following measures of success, on a scale from 1 (not successful) to 5 (very successful).

- Cost-effective use of information security
- Effective use of information security for asset utilisation
- Effective use of information security for business flexibility
- Effective use of information security for growth

The principles for effective governance were originally defined by the Massachusetts Institute of Technology's Sloan School of Management to measure the effectiveness in IT governance.

TCO (Total Cost of Ownership)

The goal of TCO is to determine a figure that reflects the total cost of the investment, including one-time purchases and recurring costs, not just the initial start-up cost. Because benefits are not considered in TCO, the overall financial analysis is simplified.

$$\text{TCO} = \sum_{t=1}^{t=end\ of\ project} \frac{\text{One time costs} + \text{recurring costs(t)}}{\text{project duration}}$$

Definition of Terms:

- **Onetime Costs:** These are the costs that are derived at one stage during the implementation or operation of a project. One-time costs could include personnel training, new processes being introduced that yield one-time cost, or investment in infrastructure assets.
- **Recurring Costs:** These are costs that continue over time or repeat, for example continuous monitoring of performance.
- **Project Duration:** This is the project lifespan or a standard duration that is used to normalize all the TCO calculations across an enterprise.

EVA (Economic Value Added)

In the field of corporate finance, working capital management is useful to improve a company's financial performance metrics. Economic value added is a way to determine the value created, above the required return, for the shareholders of a company.

$$EVA = (r - c) \times K = NOPAT - c \times K$$

Definition of Terms:

- **r:** The return on capital employed (ROCE) defined as $r = \frac{NOPAT}{K}$
- **NOPAT:** The Net Operating Profit After Tax
- **c:** The Weighted Average Cost of Capital (WACC)
- **K:** Capital employed.

ROSI (Return on Security Investment)

The risk mitigation effects show the benefit of a security investment: it is basically a "savings" in Value-at-Risk; it comes by reducing the risk associated with losing some financial value.

Financial performance measures do not consider security-specific data (such as threats, vulnerability, and risk) as a decision variable. As a vehicle, security managers – striving to find variables to judge the need for a particular investment – have developed different models in the field of cost benefit analyses for information security. The effects are the consideration of risk effects and the ability to integrate those in common accounting concepts.

The Return on Security Investments (ROSI) formula was developed by a team at the University of Idaho led by researcher HuaQiang Wei. They used what they found in the research area of information security investments and combined it with some of their own theories, assigning values to everything from tangible assets to intangible assets.

$ROSI = R – (R – E) + T$ or $ROSI = R - ALE$

Definition of Terms:

- **ALE:** What we expect to lose in a year (Annual Loss Expectancy)
- **R:** The cost per year to recover from any number of incidents.
- **E:** These are the financial annual savings gained by mitigating any number of incidents through the introduction of the security solution.
- **T:** The annual cost of the security investment.

ALE-based methodologies are not applicable for every information security investment. This has made security professionals and researchers to develop alternative strategies as no single approach has yet proven to be suitable for all types of information security investments (Demetz and Bachlechner, 2012), (Xie and Mead, 2004).

Section 5
Critical Issues

This section explores and evaluates strategies and tricks-of-the-trade in Banking, Finance, and Accounting for institutions around the world. Because banking takes place in such a high-risk environment, and especially considering the mistakes of the past, managers must take careful consideration of the facts before making any decision. Factors such as region and culture, investor behavior, and the interconnected nature of banking institutions around the world are only some of the concerns decision-makers face on a daily basis. In this section, 12 chapters explore some of the critical issues driving advances in Banking, Finance, and Accounting.

Chapter 59
Impact of Microfinance Bank Credit Scheme

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ABSTRACT

The purpose of this chapter is to examine impact of microfinance bank credit scheme on maize farmers in Gombe State, Nigeria, using data from 90 randomly sampled maize farmers in Gombe State. The study showed that majority of the respondents (53.33%) accessed amount of credit ranging between 30,000 and less than 50,000 Naira. Majority of the farmers (85.56%) used their credit for the purpose of farm production. Majority of respondents (58.89%) recorded in increase in maize output as result of the intervention of the microfinance credit scheme. Majority of the respondents (86.67%) repaid credit collected. The microfinance credit scheme intervention significantly improved the output and income of the respondents. Ineffective organizational structure of the credit institutions constituted the major constraint in accessing microfinance credits. Microfinance credit facilities extended to the farmers should be improved upon in both quantity and quality. The organizational structure of microfinance institutions should be reorganized to reduce bottlenecks in accessing credits.

INTRODUCTION

The goal of this article is to provide empirical evidence that will assist the reader develop a thorough understanding of the impact of microfinance bank credit scheme on maize farmers in Gombe State, Nigeria. To accomplish this objective an attempt has been made to present the subject in a manner that will be useful to the finance houses and policy makers in the microfinance industry and other stakeholders in microcredit in particular and economic development in general.

The broad objective of this study is to examine the impact of Microfinance Bank Credit Scheme on maize farmers in Gombe State, Nigeria. The specific objectives of the study are to:

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1. Analyse the socio-economic characteristics of the maize farmers in Gombe State, Nigeria.
2. Ascertain the volume of credit acquired from the bank by the respondents.
3. Assess the level of utilization of the credit accessed by the respondents.
4. Determine the impact of credit on the output and income of the maize farmers in the study area.
5. Identify constraints to accessing credit from the bank among the respondents.

The following null hypothesis were stated and tested:

1. There is no significant difference between the output of respondents (beneficiaries) before and after the utilization of micro-credit obtained from the Microfinance Bank Credit Scheme.
2. There is no significant difference between the income of respondents (beneficiaries) before and after the utilization of micro-credit obtained from the Microfinance Bank Credit Scheme.

BACKGROUND

Agriculture is a key sector in the Nigerian economy. Its importance is particularly glaring in its contribution to Gross Domestic Product (GDP), provision of food, provision of gainful employment, provision of capital and capital formation, foreign exchange for development and increasing rural welfare (Nwaru, 2005). Agriculture has remained the largest non-oil export earner and has significantly contributed above 30 percent of Gross Domestic Product (GDP) in Nigeria (RMU, 2003).

Despite these contributions, agricultural growth and productivity has been slow compared to other sectors of the economy because of low utilization of modern inputs by farmers, unavailability and inaccessibility of farmlands, non-mechanization of farming operations and insufficient fund inflows into the agricultural sector. An examination of the Nigerian agricultural sector shows that it is not in a position to finance its own development. Nwagbo (1986) reports that emphasis on the financing problem is rightly founded on the belief that agriculture for various reasons is not in a strong competitive position in relation to other sectors to acquire or obtain investment and productive credit from the usual financial institutions. Farm credits are however, important means for improving farm capital investment in Nigeria, without which there may be no progress in the agricultural sector to adequately fulfill its expected Millennium Development Goals (MDGs) (Musa et al., 2010). Akpokodje and Olomola (2000) contend that if credits were made available to small –scale farmers, the slow growth of the agricultural sector would develop more rapidly. Phillip, Ephraim, John, and Omobowale (2008) assert that credit supply to farmers is widely seen as an effective strategy for enhancing the increase in agricultural productivity.

Therefore, in order to improve the national economy, producers who are the farmers should be supported to expand their scale of production through financial resources (Akpokodje and Olomola, 2000). Akpokodje and Olomola (2000) further explained that associated with mechanization and the acquisition of agricultural inputs is the issue of credit, without which the envisaged agricultural production and development will be a mirage. İn addition, the farmers will still persist old one-man hoe and cutlass system with a farm size that can only guarantee subsistence production.

Credit allows the farmers to satisfy their cash needs induced by the production cycle which characterized agriculture. Despite the general acceptance of the important role of credit and a wide appreciation by most governments of the need for credit, credit schemes for agriculture unfortunately have failed at various times and places to yield the expected and significant results. Some of these schemes have ended up prematurely as

a result of high rate of loan default and corrupt practices on the part of the beneficiaries and loan officials. Where the scheme had survived, they hardly made significant effect on the production of the loan beneficiaries. This may be as a result of the fact that the loans are not large enough to make visible impact or too large as to constitute a burden on the beneficiaries (Adelakun, 1998).

The traditional microfinance institution provides access to credit for the rural and urban low income earners which is culturally rooted and dated back to several centuries (CBN, 2005). Haruna (2007) was of the view that the cost of administering large number of very small loans without collateral is considered by commercial bank to be prohibitive. As a result, poor people are being denied access to formal credit, thus the underlying objective for employing micro credits as strategies to assist the economically active poor people who cannot make savings, accumulate assets or invest in any meaningful income generating activity (like agriculture) that would help to break the prevailing cycle of poverty.

The need for microfinance scheme was further stressed by Oluyombo (2010) as he opined that microfinance institutions and banks are fast becoming household name globally due to its acceptance as a means of reaching those that were not served by conventional big banks. İt therefore means that the adoption of microfinance policy in Nigeria and other countries is part of the global financial integration in the provision of tailor-made financial services to those outside the catchments of the big banks either as a result of their income, location, literacy level or descrimination. This may be the reasons for a major increase in the number of microfinance banks in Nigreria with more coverage area (Olawuyi et al., 2010).

The continuous declining status of the maize farmers who face growing levels of reduced farming activities as a result of poverty, illiteracy and subsistence nature of farming among other social and economic challenges have become an issue of concern. The normal practice has been the provision of funds assigned to finance maize farming via numerous programs and institution that have not yielded any tangible impact on the farmers whom such funds hardly get to. Therefore the broad objective of this study is to examine the impact of Microfinance Bank Credit Scheme on maize farmers in Gombe State, Nigeria.

MAIN FOCUS OF THE CHAPTER

Review of Literature

Agricultural credit has been variously defined by authors. According to Nwaru (2004), agricultural credit is the present and temporary transfer of purchasing power from a person who owns it to a person who wants it, allowing the later the opportunity to command another person's capital for agricultural purposes but with confidence in his willingness and ability to repay at a specified future date. It is the monetization of promises and exchanging of cash in the present for a promise to repay in future with or without interest. Without the willingness and ability to repay, the promise to repay at a future date would be futile. Credit is an instrument whose effectiveness depends on the economic and financial policies that go with it (Nwaru, 2004). If well applied, credit should increase the size of farm operations, increase farm income, introduce innovations in farming, encourage capital formation, improve marketing efficiency and enhance farmers' consumption (Nwagbo, 1989; Nwaru, 2004). However, Udoh (2005) reported that the demand for credit tends to be a derived demand, which indicates the borrowers will demand for credit based on the need for it and the satisfaction to be derived.

The demand and supply of credit is influenced by several factors such as personal attributes of the individual, area specific attributes and credit source attributes (Udoh, 2005). These attributes influence individuals differently irrespective of their gender such that what might determine the

demand for credit by a particular female farmer might be different from what determines credit demand by another farmer. For instance, in studying informal lenders and formal credit groups in Madagascar, Zeller (1994) indicated that informal lenders and group members obtain information about the wealth, indebtedness and income potential of loan applicants and hence ration loan demands an in-depth view of total household wealth and leverage of the household. In line with this, Nwaru (2004) examined rural credit markets and resource use in arable crop production in Imo State, Nigeria, using multiple regression analysis by the two stage least squares. The result revealed that credit demand was significantly influenced by interest rate, educational level of farmer, amount borrowed previously, farm size and gross savings, while gross income of lender, total cost of lending, source of loan (whether formal or informal), worth of loan application and previous loan repayment significantly influenced credit supply.

Agricultural credit is considered essential to the process of improving agriculture and the transformation of the rural economy. In their own contribution, Mahmood et al. (2009) posit that delivery of easy and cheap credit is the quickest way for boosting agricultural production. Ijere (1987), in emphasizing the important role credit plays, describes credit facilities for small- scale farmers as the catalyst that activates the engine of growth enabling it to mobilize the forces within it and to advance in the direction expected or planned for it. He maintained that the greater injection of credit, the more propensity of the economy to move in the given path. Conversely, he stated, if the agricultural sector receives less than its due share of the credit inputs, the very forces, which could have been activated, would automatically dry up and become very inactive. In other words, credit to small-scale farmers must not only be adequate but timely and specific.

To attain agricultural policy objective, programmes such as the National Accelerated Food Production Programme (NAFPP), the Agricultural Development Programmes (ADP), River Basin and Rural Development Authorities (RBDA), Operation Feed the Nation (OFN), the Green Revolution (GR), the National Agricultural Land Development Authority (NALDA), Agricultural Credit Guarantee Scheme Fund (ACGSF), etc were launched (ADP, 2005). Mention should also be made of Nigeria Agricultural and Cooperative Bank (NACB) now Nigerian Agricultural, Co-operative and Rural Development Bank (NACRDB). Yet agricultural policy objectives have not been achieved, as evidenced by the general food scarcity in Rivers State and in the whole country (Olawuyi et al., 2010).

Among the factors responsible for this lack of significant effect of credit schemes are insufficient loan amount, poor loan repayment and corrupt practices of loan beneficiaries and loan officials (Okorie, 1986; Balogun, 1986; Mejeha and Nnanna, 2010). Supporting this view, Nwaru (2005) and Omeh (2006) stated that Nigerian small-scale farmers are known to be economically weak with little or no capital investment. Consequently, they use low technology tools and methods in their production activities, which in turn lead to reduced output and productivity. In its own contribution, IFAD (2002) opined that causes of food insecurity and famine were not so much failures in food production, but structural problems relating to poverty and to the fact that the majority of the developing world's poor population are concentrated in the rural areas.

Summing up all these views, Okerenta (2005) and Tasie (2008) identified insufficient extension or delivery of production credit to the poor farmers as the most critical factor responsible for the declining trend in agricultural production. It is therefore an irony of circumstance that the

small-scale farmers who produce about 85% of food consumed in the country and the agricultural exports are perpetually handicapped by lack of production credit and bedeviled with poverty.

According to Nweze (1990), it was to obviate this sordid situation that successive Nigerian governments have attempted to bridge the credit gap in the agricultural sector through the establishment of various credit programmes. Those supply-led rural finance institutions include the Nigerian Agricultural, Cooperative and Rural Development Bank (NACRDB) and Community Banks.

Due to reforms by the Federal Government of Nigeria, the Central Bank of Nigeria (CBN) set up the Microfinance Banks to take over from Community Banks, with a mandate to making credit facilities available to small-scale enterprise operators including farmers. The policy framework establishing microfinance institutions in the country, saddles them with the responsibility of providing easy, cheap and affordable financial services to resource poor farmers, in a timely and competitive manner. This would enable them to undertake and develop long-term, sustainable entrepreneurial skill, mobilizing loans and creating employment opportunities and increase the productivity of these rural farmers, thereby increasing their farm income and output and uplifting their standard of living (Olawuyi et al., 2010).

The role of microfinance bank is the provision of financial services to the poor small and medium enterprises and maize farmers who are traditionally not served by the conventional financial institution in the urban and rural areas (MPRSF, 2007). Increase in production and establishment of new farm is achieved by making credit facilities and extension services available to small crop farmers, which leads to marketable surplus and increased income which enable small crop farmers to expand farming enterprises and become commercial farmers at the long run.

METHODOLOGY

The Study Area

Gombe State is located in the northeastern part of Nigeria. It is one of the country's 36 states and its capital is Gombe. Gombe State shares common borders with Borno State, Yobe State, Taraba State, Adamawa State and Bauchi State. Gombe State has an area of 20,265 km^2 and a population of around 2,353,000 people as of 2006 (NPC, 2007). Gombe has two distinct climates, the dry season (November–March) and the rainy season (April–October). It has an average rainfall of 850mm. Gombe State has 11 Local Government Areas.

Agriculture is the main occupation of the people of Gombe State with more than 60% of the population engaged in agricultural occupation. Gombe State soil is reached for the cultivation of maize, cotton, groundnut, beans and other assorted grains.

Sampling Technique

The population for the study comprised the entire maize farmers who are beneficiaries of the micro-credit scheme of Microfinance Banks in Gombe State, and must have utilised credit obtained in the last five years. A multistage sampling technique was used in selecting the respondents (maize farmers who are beneficiaries of the micro-credit scheme of Microfinance Bank in the area of study) for this study.

The first stage involves purposively selecting Gombe Local Government Area, which has the highest concentration of maize farmers who are beneficiaries of micro-credit scheme of Microfinance Banks in Gombe State. The second stage involves randomly selecting one (1) Microfinance Bank in Gombe Local Government Area of Gombe

State. The third stage involves making use of the list (record) obtained from the selected Microfinance Bank to randomly select five (5) communities where the beneficiaries reside. The fourth stage involves making use of proportionate size technique to select the respondents (beneficiaries) as follows: Dawaki- 20, Bolari- 20, Shamaki- 20, Pantami- 15 and Kumbiya-Kumabiya- 15. Hence a total of 90 respondents (beneficiaries) were used for the study focusing specifically on the maize farmers.

Data Collection

The data for the study were collected mainly from primary sources. The primary data were collected using a structured questionnaire, copies of which were administered to the 90 beneficiaries selected for the study.

Method of Data Analysis

Data collected for this study were analyzed using descriptive statistics such as frequency distribution and percentages as well as inferential statistics such as t-test analysis. Specific objectives i, ii, iii and v were analyzed using frequency distribution and percentages while specific objective iv was analyzed using t-test analysis. The null hypotheses were analysed using t-test.

Test Statistic Specification

$$\text{Paired t - test} : t = \frac{x - y}{\sqrt{\frac{sx^2}{N_x} + \frac{sy^2}{N_y}}}$$

where t = t-statistic, x = mean of output (or income) after microfinance bank credit intervention, y = mean of output (or income) before microfinance bank credit intervention; s_x^2= standard deviation of output (or income) after microfinance bank credit intervention; s_y^2= standard deviation of output (or income) before microfinance bank credit intervention; Nx = number of observation after microfinance bank credit intervention; Ny = number of observation before microfinance bank credit intervention.

RESULTS AND DISCUSSION

Socio-Economic Characteristics of Respondents

The socio-economic characteristics of the respondents include Age, Sex, Marital status, family size and Educational level, farming experience and farm size.

Age

The result in Table 1 shows that majority of the farmers (48.89%) are within the age bracket of 30 years and less than 40 years. This result suggests that majority of the maize farmers in the study area are young farmers who can make meaningful impact in agricultural production when adequately motivated with the needed credit facilities.

Sex

The result in Table 1 shows that majority (66.67%) of the respondents were males while 33.33% were females. Males own and control more farms than females. The reason could be that females are often married to the males and so might not out rightly own their lands. Usually they have a negligible portion compared to their male counterparts. Single females and widows owning and controlling their farms do not have the desired collaterals to satisfy the lending institutions to attract loans as only very few of them have the capacity to influence the institutions with the collaterals to get loans.

Marital Status

The result in Table 1 shows that majority of the respondents (53.33%) were married while 27.78% were unmarried .The high percentage of the married is as a result of the fact that farming communities believes in marriage, since farming occupation requires labour, their wives and families will assist in the farm work.

Family Size

The result in Table 1 shows that majority of the respondents (38.89%) had family size of 10-13. This result suggests that farmers in the studied area have large household sizes. The high household size of the majority of the respondents suggests that there is abundant supply of family labour in the studied area, which can be harnessed for increased farming activities.

Educational Level

The result in Table 1 shows that majority of the respondents (44.44%) had primary education, 21.5% had secondary whereas 15.4% had tertiary education. The implication of this result is that maize farmers in the studied area are literate enough to appreciate the important role credit faclities can play in helping to expand their farm enterprises.

Farm Experience

The result in Table 1 shows that majority of the farmers (36.67%) have been farming for between 35 years and less than 50 years. This result suggests that the farmers have long farming experience which can enhance efficient use of scare resources.

Table 1. Percentage distribution of respondents by socio-economic characteristics

	Index	Frequency	Percentage
Age	20<30	14	15.56
	30<40	44	48.89
	40<50	26	28.89
	≥ 50	6	6.67
	Total	**90**	**100**
Sex	Male	60	67.67
	Female	30	33.33
	Total	**90**	**100**
Marital status	Single	13	14.44
	Married	48	53.33
	Divorced	18	10.67
	Widowed	11	12.22
	Total	**90**	**100**
Family Size	2-5	17	18.89
	6-9	32	35.56
	10-13	35	38.89
	14-17	5	5.56
	Total	**90**	**100**
Education level	No Formal Education	22	24.44
	Primary Education	40	44.44
	Secondary Education	18	20.00
	Tertiary Education	10	11.11
	Total	**90**	**100**
Farming Experience	5<20	31	34.44
	20<35	24	26.67
	35<50	33	36.67
	50<65	2	2.22
	Total	**90**	**100**
Farm size	< 1	25	27.78
	1<3	40	44.44
	3 < 5	15	16.67
	≥ 5	10	11.11
	Total	**90**	**100**

Source: Field Survey, 2012

Farm Size

A large proportion of the farmers (44.44%) had farm size between 1and less than 3 hectares (Table 1). This suggests that most of the respondents are small to medium scale farmers who should be adequately motivated with the necessary credit facilities in order to expand their agricultural productions.

Access to Microfinance Banks Credit

Access to Microfinance Banks Credit Facility

Table 2 shows that all the respondents (100%) interviewed had access to microfinance banks credit facility, suggesting that maize farmers in the study area benefitted in one way or the other from the Micro Finance Bank Credit Scheme.

Amount of Credit Accessed

The result in Table 2 shows that majority of the respondents (53.33%) accessed amount of credit ranging between 30,000 and less than 50,000 Naira while 40% of the respondents accessed between 50,000 and less than 70,000 Naira of credit. This suggests that the credit extended to maize farmers in the study area is mostly small credit facility.

Method of Credit Disbursement

Table 2 shows that majority of the credits accessed by the farmers (88.89%) were disbursed to them at once, suggesting that the farmers were given the credit facility in one disbursement. The implication is the farmers would be able to have the money in bulk and hence an effective investment of the credit in their farm productions.

Credit Utilization

Utilization of Agricultural Credit

The result in Table 3 shows that majority of the farmers (85.56%) used their credit for the purpose of farm production. This implies that majority of the respondents in most cases appropriately utilized acquired credit for the purpose of Agricultural production.

Changes in Farming Activities due to Intervention from Microfinance Banks Credit Scheme

The result in Table 3 shows that majority of respondents (58.89%) recorded in increase in maize output as result of the Microfinance Banks Credit Scheme intervention. This implies that the intervention of the Microfinance Banks Credit Scheme has improved maize production in the study area.

Table 2. Percentage distribution of respondents by access to microfinance banks credit facility

	Variable	Frequency	Percentage
Access to Credit	Access	90	100
	No Access	0	0
	Total	**90**	**100**
Amount of Credit Received	30,000 < 50,000	48	53.33
	50,000 < 70,000	36	40.00
	70,000 < 90,000	5	5.55
	≥ 90,000	1	1.11
	Total	**90**	
Method of Credit Disbursement	Once	80	88.89
	Installment	10	11.11
	Total	**90**	**100**

Source: Field Survey, 2012

Repayment of Credit

Table 3 shows that majority of the respondents (86.67%) repaid credit collected while a few (13.33%) did not repay credit accessed. This suggests the ability to repay credit collected is high among the respondents while recording only a few cases of outright default.

Promptness of Repayment of Credit

The result in Table 3 shows that majority of respondents (60%) did not repay credit collected as at when due while 40% of respondents repaid credit collected in due time. This result implies that credit repayment made by respondents in most cases lagged behind the scheduled time for repayment. This means that though there was low level of outright default in credit repayment among the respondents, the repayment was chatracterised by high level of delay in repayment.

Table 3. Percentage distribution of respondents by credit utilization

	Variable	Frequency	Percentage
Credit Utilization	Farm Production	77	85.56
	Domestic/ Social Purpose	7	7.78
	Combination	6	6.67
	Total	90	100
Change in Farming Activities	Increase in maize output	53	58.89
	Increase in Farm Size	6	6.67
	Establishment of New Farm	9	10.00
	Use of Improved Farm Input	16	17.78
	Processing of Farm Output	6	6.67
	Total	90	100
Repayment of Credit	Repaid	78	86.67
	Not Repaid	12	13.33
	Total	90	100
Promptness of Repayment of Credit	In time	36	40.00
	Not in time	54	60.00
	Total	90	100

Source: Field Survey, 2012

Impact of Microfinance Bank Credit Scheme on the Output and Income of Respondents

Impact of Credit on Output of Farmers

The result of the t-test in Table 4 rejects the null hypothesis that there is no significant difference between the output of respondents (beneficiaries) before and after the utilization of micro-credit obtained from the Microfinance Bank Credit Scheme. This suggests that the agricultural credit accessed by the maize farmers in the study area from the Microfinance Bank Credit Scheme significantly improved their maize output.

Impact of Credit on Income of Farmers

The results of the t-test in Table 5 reject the null hypothesis thatthere is no significant difference between the income of respondents (beneficiaries)

Table 4. The t-test of no significance difference between output of respondents before and after utilization of credit

	Output Before	Output After
Mean	65.21538462	77.43846154
Hypothesized mean	0	
Degree of Freedom	178	
t-stat	3.895946917	
P (T<=t) one -tail	6.2349E-05	
T - critical (one-tail)	1.650781103	
P (T<=t) two -tail	0.000124698	
T - critical (two-tail)	1.969201329	

Source: Field Survey, 2012

before and after the utilization of micro-credit obtained from the Microfinance Bank Credit Scheme. This suggests that the agricultural credit accessed by the maize farmers in the study area from the Microfinance Bank Credit Scheme significantly improved their income and hence their welfare.

Constraints to Accessing Microfinance Bank Credit

Problems Faced in Accessing Credit

The result in Table 6 shows that majority of the respondents (34.44%) faced problem of administrative bottleneck in the course of accessing credits. This implies that an ineffective organizational structure of the credit institutions constitutes the major problem faced by the respondents in accessing credits.

Problems Faced Hindered Access to Credit

The result in Table 6 shows that majority of the respondents (71.11%) agreed that problems encountered in the course of accessing credit hindered access to credits, suggesting that problems encountered made access to credit practically difficult and in some cases impossible.

Problems Faced in Repayment of Credit

The result in Table 6 shows that majority of the respondents (46.67%) refered to inadequate loan as major hindrance in repayment of credits. This implies that inability to access adequate credits that guarantee quality investments and hence quality returns made it difficult for the farmers to repay credits timely or even outright default.

Table 5. The t-test of no significance difference between income of respondents before and after utilization of credit

	Income Before	Income After
Mean	10890.76923	14619.23077
Hypothesized mean	0	
Degree of Freedom	178	
t-stat	5.55912655	
P (T<=t) one -tail	3.3793E-08	
T - critical (one-tail)	1.650781103	
P (T<=t) two -tail	6.758E-08	
T - critical (two-tail)	1.969201329	

Source: Field Survey, 2012

Table 6. Percentage distribution of respondents by constraints to accessing credit

	Variable	Frequency	Percentage
Problems Faced in Accessing Credit	High interest rate	27	30.00
	Administrative bottleneck	31	34.44
	Delay in loan approval	26	28.89
	High collateral rate	1	1.11
	Inadequate fund for loan	5	5.56
	Total	90	100
Problems Faced Hindered Access to Credit	Hindered	64	71.11
	Did not Hinder	26	28.89
	Total	90	100
Reasons for Delay in Repayment of Credit	Untimely disbursement	26	28.89
	Inadequate loan	42	46.67
	Crop and Weather Failure	13	14.44
	Domestic and Family Problem	5	5.56
	Market instability	4	4.44
	Total	90	100

Source: Field Survey, 2012

CONCLUSION AND RECOMMENDATIONS

Conclusion

The study showed that majority of the maize farmers in the study area are young farmers who can make meaningful impact in agricultural production when adequately motivated with the needed credit facilities.

The maize farmers in the study area benefitted from the Micro Finance Bank Credit Scheme in one way or the other. The credit extended to maize farmers in the study area is mostly small credit facility. Majority of the respondents in most cases appropriately utilized acquired credit for the purpose of Agricultural production. The intervention of the Microfinance Banks Credit Scheme improved maize production in the study area. The ability to repay credit collected is high among the respondents. Howver, credit repayment made by respondents in most cases lagged behind the scheduled time for repayment.

The agricultural credit accessed by the maize farmers in the study area significantly improved their productivity. Furthermore, the agricultural credit accessed by the maize farmers in the study area significantly improved their income and hence their welfare. Ineffective organizational structure of the credit institutions constitutes the major problem faced by the respondents in accessing credits. Problems encountered made access to credit practically difficult and in some cases impossible. Inability to access adequate credits that guarantee quality investments and hence quality returns made it difficult for the farmers to repay credits or delay in repayment.

Recommendations

Based on the findings of the study, the following recommendations have been made:

1. The youth should be attracted into agricultural production by motivating them with the needed credit facilities.
2. More credit facilities should be extended to the farmers since the credit would be appropriately utilized for the purpose of Agricultural production thereby improving maize production in the study area.
3. Since the ability to repay credit collected is high among the respondents, credit facilities extended to the farmers should be improved upon in both quantity and quality. This will ensure quality investment and quality returns and hence timely repayment of credits.
4. The organizational structure of the credit institutions should be better reorganized to reduce the bottlenecks encountered by farmers in accessing credits.

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KEY TERMS AND DEFINITIONS

Agricultural Credit: A credit financing vehicle, such as a loan, banker's acceptance or letter of credit, that is designed specifically for agriculture producers.

Beneficiaries: A person who derives advantage from something, especially a trust, will, or life insurance policy.

Credit: The ability to obtain goods or services before payment, based on the trust that payment will be made in the future: "unlimited credit."

Impact: Measure of the tangible and intangible effects (consequences) of one thing's or entity's action or influence upon another.

Maize Farmers: Farmers involved in producing maize.

Maize Production: Conversion or transformation of maize inputs to maize output.

Microcredit: The lending of small amounts of money at low interest to new businesses in the developing world.

Microfinance: Microfinance is usually understood to entail the provision of financial services to micro-entrepreneurs and small businesses, which lack access to banking and related services due to the high transaction costs associated with serving these client categories.

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Chapter 60
Measurement of Service Efficiency in Different Types of Banking Services:
Mass Services, Service Factories, Service Shops, and Professional Services

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ABSTRACT

As the share of services in economies grow globally, the efficiency of service production becomes crucial. Despite the many studies on service efficiency, it has proven difficult to find the right measures. The main reason is wide range of services from simple to complex, and from mass to professional services. Consequently, there are no commonly accepted measurement frameworks for comparing the efficiency of different types of services. The Service process matrix developed by Schmenner is one of the most widespread and has been extended and applied by many other researchers. This paper uses the classification of the Service process matrix and its four basic services types recognized in the analysis of service efficiency measurement. The focus of analysis is on banking services, as the industry has services in all of the main services categories. Each category is analysed separately, literature is reviewed for suitable measures and suitable measures of efficiency for all service types are proposed.

1. INTRODUCTION

It has been maintained that world has turned into one huge service system (Spohrer & Kwan, 2009), as larger share of workforce is engaged in services than in manufacturing. Consequently, the efficiency of services, service processes and service production has become vital in modern economies. Many studies have looked into different types of services and provided tools for classifying them for differences. Similarly, service efficiency and service quality have been studied extensively. Still, it is not straightforward to measure the efficiency or inefficiency of a given service. It is too easy to find counter arguments, that as services are different, the differences in

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efficiency are due to these, and not caused by inefficient operations. Consequently, comparing them is a case of comparing apples and oranges.

Many service industries have now a wide range of services available, requiring different approaches to service production. For example, gourmet restaurants and fast food chains operate in the same market, but with widely distinct approaches. The direction of development has been toward more production-line approach to services (Chase & Apte, 2007) embodied by McDonald's. The wide range of services makes the measurement and comparison of efficiency more challenging. As the question is topical, many approaches for service efficiency measurement have been presented ranging from strategic alignment to operational process measures. Solutions to this challenge can be found from measurement of manufacturing efficiency. The well-known Product-Process matrix (Hayes & Wheelwright, 1979a, 1979b, 1984) provides a tool for measuring the efficiency of manufacturing of different types of products, as well as, finding the right matches of production processes and products. Accordingly, it has been widely used to recognise efficient manufacturing structures and processes. Also, efficiency metrics and measurement schemes have been proposed (for a review, see e.g. Kemppainen, Vepsäläinen, & Tinnilä, 2008).

Superficially efficiency measurement in manufacturing or service operations seems to be straightforward. Simple measures of output compared to use of resources used should accordingly be adequate. However, it is easy to confuse effectiveness and efficiency, i.e. ability to produce something, and efficiency in doing the right things. In a study of hotel services Yu and Lee (2009), divide efficiency and effectiveness into productive efficiency, as well as, service and productive effectiveness. Productive efficiency measures the amount of inputs required for a given service output, where service effectiveness measures the relationship between services produced and consumer output, whereas, productive effectiveness measures the ratio between number of customers and input resources. Hence, there is a need for multiple measures for efficiency and effectiveness, particularly when looking at the extensive range of services. For example, mass services tend to be far more efficient according to resource-output measurement than the more customised and labour-intensive professional services. Consequently, we can observe that forthright measurement of effectiveness does not always give a relevant result, and there is a need for more multidimensional measurement of efficiency by using several measures. Efficiency measures can also be descriptive, i.e. describe and classify the type of services.

Also in manufacturing operations the strategic fit, i.e. the ability to produce efficiently the right products is a challenge. This challenge is even greater in services, as by nature services are intangible, heterogeneous, inseparable and perishable (IHIP). This reduces the tools for achieving efficiency. Also the very wide range of services poses a challenge, making it even more difficult to analyze efficiency. For example, measuring efficiency in a fast food restaurant is more straightforward than determining the efficiency of a financial advisor. In the latter the quality, i.e. value created, of the service, should be taken into account when determining the efficiency. This is not to claim that the quality in a McDonalds is not of importance. Given this challenge, it is no wonder that it has been approached from different viewpoints. For example, strategic service positioning studies look into finding the right position for services by combining resources in the right way. Manufacturing-related approaches to measurement use measure similar to manufacturing operations, while financial measurement uses financial tools to analyze the performance.

Banking services are no exception to the difficulty of measuring service efficiency. Despite studies showing that inefficient service production

may be in order of 20% of total banking sector costs, the sources of efficiency and inefficiency are somewhat of a black box (Berger & Mester, 1997). One reason for this may be that, while efforts have been made to analyse the banking industry efficiency at firm level, or the efficiency of individual branch offices (Portela & Thanassoulis, 2007), no such effort has been made into opening up the black box by looking into the different types of banking services and the principles of efficiency in them. In the future it is expected that many services, including banking, will see polarisation of services to two extremes (Tinnilä, 2012), i.e. customised services with focus on service level and professionalism, as well as, mass services with scale economies.

This paper analyses the measurement of efficiency in different types of services and the different approaches used in analyses of service efficiency measurement. Many frameworks have been presented to analyse efficiency and to provide classification of services. Several of these studies propose different ways to classify services, banking services included. One of the most applied is the one suggested by Schmenner (Schmenner, 1986, 2004), where a matrix, called Service process matrix, consisting of four quadrants is proposed. The quadrants present the four basic types of services, called Mass service, Service factory, Service shop and Professional service. This paper uses the classification of Schmenner as basis and analyses the efficiency measures that have been proposed to measure and characterise each quadrant. The focus of analysis is on banking services with its wide service range from internet banking and ATMs to professional investment counselling.

The paper is structured as follows: First, the different approaches to measuring service efficiency are introduced. Secondly, the literature of service efficiency measurement is reviewed. Thirdly, the Service process matrix is analysed, followed by in-depth analysis of the four quadrants of the matrix. Fourthly, the different measures used in describing and measuring service efficiency in different services types are reviewed and summarised. Finally, discussion and conclusions are presented.

2. LITERATURE REVIEW OF APPROACHES TO SERVICE EFFICIENCY MEASUREMENT

In this section we will review the main approaches to determining the efficiency of different types of services, focusing particularly on measures connected to efficiency and performance. In addition measures describing and classifying services are reviewed and analyzed.

There are several approaches to measurement of service efficiency and performance ranging from strategic level typologies to straightforward measurement of service processes. From strategic viewpoint many classifications of service types have been proposed (for reviews see Cook, Goh, & Chung, 1999; Liu, Wang, & Lee, 2008; Shafti, Van Der Meer, & Williams, 2007; Tinnilä, 2011). However, classifications typically only indirectly analyse measurement of service efficiency. One approach is to look at *service process efficiency* by analysing the inputs and outputs, as well as, resources and financial performance. *Service quality* and its impacts on efficiency and performance has been the topic of many empirical studies. Some of them also look at the impact of *innovations* on service efficiency. Furthermore, as services aim at *creating value* to customers, there have been attempts to measure the value created. Finally, *service positioning and efficient service structures* have been analysed, as basis for service efficiency.

Table 1 provides review of measurement schemes and approaches, as well as, the measures and metrics used. Table 1 omits the service process matrix of Schmenner and frameworks based on it, as they will be analysed separately.

Table 1. Measurement approaches and schemes for services

Author(s)	Measurement Approach	Measures	
		Efficiency and Performance	Descriptive
Silvestro, 1999; Silvestro, Fitzgerald, Johnston, & Voss, 1992	Service process model for positioning different types of services, e.g. professional and mass services and service shops	Number of customers/service unit/time	Measures of variety: Focus on equipment/people, contact time, customization, discretion, product/ process focus
Kellogg & Nie, 1995	Framework for strategic service management for positioning	Efficient combination of service process and service package structures	Process types: e.g. expert service or service factory, and service package type; e.g. unique, selective or generic
Tinnilä & Vepsäläinen, 1995	Service process analysis matrix for service positioning	Efficient combination of service and delivery channel	Service type and access channel type to services, e.g. network, personnel, agent
Collier & Meyer, 1998, 2000	Service positioning matrix	Combination of service encounter activity sequence and number of pathways to service	Customers service encounter activity sequence, e.g. unique or repeatable and number of pathways into service system, e.g. limited, or many
Verma, 2000	Empirical analysis of challenges in different service types	Combination of customer contact, customization and labour intensity	large number of measures, such as physical surroundings, capital decisions, technological advances
Mayer, Bowen, & Moulton, 2003	Model of descriptors of service processes	Customer encounter satisfaction	Processes of service assembly and service delivery
Grönroos & Ojasalo, 2004	Service productivity model	Service productivity	Total service productivity is a sum of internal and external and capacity efficiencies
Karwan & Markland, 2006	Government services matrix	Match of efficiency/productivity and equity	Importance of equity, i.e. asset specific investments
Matoušek & Taci, 2004	Efficiency in banking services	Cost efficiency and production efficiency measurement by distribution free approach (DFA) method	Focus on efficiency measures
Johansson & Olhager, 2004	Industrial service profiling framework for positioning	Efficient fit between service offering and service process	Customisation, customer contact, range, variability, facilities
Johansson & Olhager, 2006	Industrial service matrix	Match of product-process matrixes for manufacturing and services	Service volumes, manufacturing volumes, flow orientation,
Bergendahl & Lindblom, 2008	Service efficiency and performance in banks	Financial performance connected to service orientation	Loan and deposit volumes, number of bank branches, expenses, margins, losses
Olorunniwo, Hsu, & Udo, 2006	Operationalization of service quality in service factory	Combination of dimensions	Six service quality dimensions, such as tangibles, responsiveness, reliability
Olorunniwo & Hsu, 2006	Operationalization of service measurement in mass services	Service quality, customer satisfaction, behavioural intentions	Six service quality dimensions, such as tangibles, responsiveness, reliability
Shafti et al., 2007	Testing of service dimensions of different classifications to recognize productivity challenges	Testing of productivity-related management themes, e.g. productivity-quality trade-off, improvement policies, quality costs	Labour intensity, customer contact, interaction, customization, judgement, process focus
Portela & Thanassoulis, 2007	Efficiency of bank branch offices	Number of transactions in a branch office.	Production perspective to efficiency i.e. bank branch offices are service production units using resources to produce various services.

continued on following page

Table 1. Continued

Author(s)	Measurement Approach	Measures	
		Efficiency and Performance	**Descriptive**
Gliatis & Minis, 2007	Service Attribute-Process matrix	Analyses the impacts of service attributes and service processes and their relationship	Large number of measures, such as type of customer, customer commitment, delivery channel, personnel judgement
Stratman, 2008	Offshoring service system design matrix	Match of degree of customer contact and several descriptive measures	Production efficiency, offshore potential, strategic value, coordination cost, asset specificity
Yu & Lee, 2009	Efficiency and effectiveness of service business	Productive efficiency and service effectiveness are separate measures	Empirical analysis of services in hotel services
Meepadung, Tang, & Khang, 2009	Model combining operating and profit efficiency in banking	Operating efficiency and profit efficiency	Labour, expenses, service quality
Fjeldstad & Sasson, 2010; Stabell & Fjeldstad, 1998	Value creation in banking and financial services	Cost of debt capital	Customer set density, triadic closure (mutual contact), relational embeddedness
Climent, Mula, & Hernández, 2009	Business process view in banks	Identifies the main service processes in different bank services and suggests performance improvements, e.g. in cycle time	Descriptive and visual tool for analyzing business and service processes
Wang, 2011	Application of Schmenner's matrix in service shops	Capital intensity vs. labour costs	Customization, contact time, authorization
Calabrese, 2011	Service performance matrix	Service performance is an outcome of perceived service quality and service productivity	Technical and internal efficiency, service quality capacity efficiency, human and organizational resources,
Mackelprang, Jayaram, & Xu, 2012	service system performance influenced by employee capabilities and training	Service time, waiting time, productivity and overall performance	Job training, quality training, employee capability

Next, we will analyse the measurement approaches reviewed in Table 1 by dividing them according to their focus. The *first* group of approaches focuses on process efficiency, use and management of resources, as well as, financial performance. The application areas are wide, but there are also examples of their use in banking services. The *second* group of approaches look at service quality and its role in creating and particularly guaranteeing service efficiency. Service innovations are often connected to quality improvements. *Thirdly*, the value creation of services and its impact on service efficiency is discussed. *Fourthly*, frameworks and models for strategic service positioning and recognition of efficient service structures with connected measurement schemes are examined.

2.1. Process Efficiency, Resources, and Financial Performance

There are multiple studies focusing on service process efficiency, efficient use of resources and financial performance. We concentrate on approaches and studies with particular relevance on banking services. McAllister and McManus (1993) analyse scale efficiencies in banking, where increasing returns to scale have been found in small banks, while decreasing scale economies in larger banks. This can be compared to manufacturing operations, where generally scale economies are found in larger production units, at least until the optimal manufacturing volumes are found. Mukherjee et al. (2003) measure the efficiency of banking services by a framework consisting

of physical and human resources, service quality and performance. Their two-stage framework for measuring service efficiency has as dimensions quality and profitability efficiencies, with measures such as resources, service quality features, and performance. The combined, or overall, efficiency is the financial performance of a bank. Along similar lines, Matousek and Taci (2004) measure cost efficiency and production efficiency in banking services, as do also Bergendahl and Lindblom (2008) with measures such as service efficiency and performance in banks. Portela and Thanassoulis (2007) analyse the efficiency of bank branch offices and note that most studies have been made from production perspective, i.e. bank branch offices are service production units using resources to produce various services. The measure used for efficiency is typically number of transactions in a branch office. Mayer et al. (2003) propose a model for descriptors of service processes consisting of customer encounter satisfaction, including measures such as customisation, amount of interaction, accessibility, and duration. Gliatis and Minis (2007) propose a Service Attribute-Process matrix for classifying services according to attributes and different dimensions of services. The goal is understand better the different types of services and connect them to life cycle of services, and consequently to improve efficiency. They list some 30 different attribute measures including type of customer, nature of service delivery, value adding focus in front- or back office, single service or service bundle.

Meepadung et al (2009) use a model combining operating and profit efficiency in banking, while Yu and Lee (2009) analyse the efficiency and effectiveness as separate measures in services. Climent et al (2009) take business process view on bank services by identifying key service processes for process improvement and consequent improvements in efficiency.

2.2. Service Quality and Innovations

Service quality is regarded as important both from customer satisfaction and efficiency viewpoints. Consequently, the impact of quality on service efficiency and performance has been analysed. It is maintained that in service operations quality is more dependent on production efficiency than in manufacturing operations. Also, measurement of service efficiency is regarded as more complicated than efficiency measurement in manufacturing industries. Some researchers see it as a balance between service productivity and service quality (Grönroos & Ojasalo, 2004). They analyse productivity at general level, where process productivity is the relation of input resources transformed to value for customers. This approach emphasizes customer value creation aspects, as opposed to more traditional output of the process. They maintain that manufacturing productivity assumes that changes in input resources do not change the quality of the output (constant quality assumption), whereas, in the context of services, production resources (such as personnel) and systems affect the perceived quality of services. Accordingly they propose a service productivity framework where both service providers and customer's inputs affect the internal efficiency. Customers of the service perceive the quality of the output, which is measured as external efficiency. The demand of the service affects capacity utilisation and capacity efficiency. Finally service productivity is the sum of internal, external and capacity efficiencies. Along similar lines, Calabrese (2011) presents a more complex measurement scheme where service productivity is dependent on technical efficiency focusing on internal efficiency and service quality, which presents the external efficiency dimension. In addition, the capacity efficiency, i.e. the capability to adapt production to market demands, is seen as important. The service performance matrix proposed has service productivity (internal) and

perceived service quality (external) as dimensions. The four quadrants include the high productivity service provider having high service productivity and low service quality, and the failing service provider with low values in both axes, and the high quality service provider with high service quality and low productivity. The fourth quadrant, called efficient service provider, is the optimal position with both high efficiency and quality. Calabrese also recognised the impacts of human and organizational resources to the quadrants. Olorunnivo et al (2006) operationalize measurement of service quality in a service factory, while Olorunniwo and Hsu (2006) does the same in mass services. Both studies are of particular interest as they connect the service type and service efficiency measurement. Service innovation researchers look into the performance of new services, i.e. the factors that affect the failure of introduction of new services (Alam, 2006). The connection to efficiency is that innovations can be connected to e.g. repositioning the service e.g. to lower cost position, new processes or delivery channels, which are closely connected to service efficiency, and use similar or same measures.

2.3. Value Creation in Services

As the goal of services is to create value to customer, one potential measure for efficiency is the amount of value created. As Grönroos (2008) points out, service as business logic facilitates and supports value creation at service customers. However, there are not many studies focusing on the efficiency viewpoint of value creation, and consequently few measures are proposed to evaluate the efficiency of value creations by different service types. Different value configurations, i.e. ways and structures, to create value connected to different types of services have been presented. Particularly the approach of Stabell and Fjeldstad (1998) have been applied to services. Fjeldstad and Sasson (2010) apply this approach when looking into value creation in financial and banking networks.

2.4. Strategic Service Positioning and Efficient Service Structures

Strategic service positioning and the impact of different types of service structures on efficiency have been analysed. In this area there are multiple typologies for positioning services, many of them based on Product-Process matrix of Hayes and Wheelwright (Hayes & Wheelwright, 1979a, 1979b) which provides a way to find the right match between different types of products and manufacturing processes. Along similar lines many frameworks, typically matrices, have been presented to match service types and service production in an efficient way. A service process model (Silvestro, 1999; Silvestro et al., 1992) for positioning services, ranging from professional to mass, uses number of customers per service unit as efficiency measure, combined with variety measures such as contact time and customization. The matrix framework for strategic service management (Kellogg & Nie, 1995) recognizes efficient combinations of service processes and package structures, where e.g. expert services are connected to unique service packages. The service process analysis (Tinnilä & Vepsäläinen, 1995) matches service types with service access and delivery channels with resulting efficient service processes. The service positioning matrix (Collier & Meyer, 1998, 2000) combines service encounter activity sequences and the number of different pathways to service in a way, that e.g. expert services have a unique encounter activity sequence combined with many pathways to the service. The industrial service profiling (Johansson & Olhager, 2004) is a framework for positioning. It emphasizes the match between service offering and service process, while they also propose a further development of the same approach (Johansson & Olhager, 2006) in linking product and process matrices for analysing both manufacturing and industrial service operations.

All these positioning frameworks see service efficiency as a result of the right position of a

service, and as a combination of different key service elements. As such they do not propose any single measure, or combination of measures, as the correct measure of service efficiency or performance.

3. SERVICE EFFICIENCY IN DIFFERENT SERVICE TYPES

3.1. Service Process Matrix in the Analysis of Basic Service Types

In this section, the classification of the Service Process Matrix by Schmenner is first presented, followed by review of studies applying and extending it. Finally, the matrix is used to analyse different types of services and their pertinent descriptive and efficiency measures are recognised.

The Service Process Matrix consists of four quadrants called Mass service, Service factory, Service shop and Professional service, representing the basic service types. The dimensions of the two axes of the matrix are degree of variation, which include customisation and interaction with customers, as well as, relative throughput time. The throughput time is compared within one industry, and starts with customer entering the service process and ends when the customer is leaving it with a fulfilled service. The throughput time is compared to other companies within the same industry, making it a relative measure. Low throughput time means that the service process takes longer time and high throughput time is faster in throughput.

These dimensions describe the crucial differences between service types. As examples in this paper, we use banking and financial services, restaurant services, professional and expert services, as well as, budget priced services. Apparently, these classes overlap, as there are professional banking services, as well as, budget priced restaurants. It should be noted that inconsistent names have been given to the basic service classes by different researchers. However, in this paper we use mainly the terminology of Schmenner to describe these classes.

The four quadrants of the Service Process Matrix differ in terms of service variation and service throughput time. Consequently they can be shortly portrayed in the following way:

Mass services have high relative throughput time (i.e. fast service process) and low degree of variation. These are the typical over-the-counter branch-office services in banking and other office-based services. The volumes are high, but due to labour intensive service production, also the operating costs are significant. Consequently, on most developed nations, this service type is in descendent. This class includes most of the more traditional services, such as branch-office-based banking services, wholesalers, and transport services.

Service factory has a low relative throughput time, i.e. fast service process connected to low degree of variation. The examples include the equivalents of similar large scale manufacturing operations with large number of customers and consequent large service volumes. The typical examples are airlines, transportation services, and hotels.

Service shops are low in relative throughput time associated with high degree of variation. The manufacturing equivalent is job shop manufacturing with jumbled production flows. The high degree of variation demands typically more manual labour in service production, and also in some cases, higher level in employee know-how. Examples include hospitals, traditional restaurants and repair services. Comparing these with service factories, hospitals require highly skilled personnel of various kinds from surgeons to physiotherapists, while traditional restaurants focus on making the food from ingredients by skilled cooks, as opposed to fast food with prepared ingredients.

Professional service has a high relative throughput time and high degree of variation. The customer contact times are typically long,

consisting typically more than one visit to service premises. Also the customer relations are of longer in duration, as professionals, such as medical doctors, lawyers, accountants, architects and similar, have their own long-term customers. Often the relations are person-related, i.e. the customer is more connected to an individual professional, than the company. Despite high labour costs and need for knowledgeable personnel, this type of service is not diminishing. Some of the more straightforward professional services may move toward service shops, but customers demanding individual customised services, based on large amount of interaction, cannot be satisfied in any other of the four basic service types.

3.2. Studies Applying and Extending the Service Process Matrix

As the most applied service positioning matrix, the service process matrix by Schmenner (1986, 2004), has been the given impetus for several theoretical and empirical applications. These include the application by Verma (2000) recognising the management challenges in all of the four quadrants of the service process matrix. The study tests a large number of measures empirically ranging from physical surroundings, capital decisions, scheduling, quality management, employee loyalty to managing growth. Other applications include connection of the matrix with service quality measurements in different service types, i.e. service factories (Olorunniwo et al., 2006) and mass services (Olorunniwo & Hsu, 2006). These studies operationalize the matrix by using a set of service quality dimensions, and also combine some behavioural measures.

The content continuum of Polito and Watson (2004) combines the product-process and service process matrices to facilitate positioning of product-service bundles, i.e. combinations of product and services which have become typical in business-to-business transactions. The continuum provides measures for classifying bundles, e.g. based on service percentage, customisation, labour intensity, and commodity-like attributes. However, it does not specifically address efficiency of product or service production. Stratman (2008) looks at disaggregation of service production in different service types, particularly back-office functions, which can be off-shored. Based on service process matrix, standardised processes of mass services and service factories are easiest to decouple and transfer offshore. Similarly, Metters (2008) provides a typology of offshoring and outsourcing services, particularly electronic services. The matrix is based on Schmenner's quadrants and for each quadrant a strategy for outsourcing is proposed.

An application in public sector services for productivity measurement is the government services matrix of Karwan and Markland (2006), which points out that public organisations are not likely to benefit from automation as much as companies. However, some services with high level of customer interaction are close to service factories, and benefit from similar scale economies. Shafti et al. (2007) base their empirical testing of service dimensions and classification framework on the format of service process matrix, and use customer contact and front value added as dimensions. They also test empirically a large number of descriptive service dimensions and productivity management themes to recognize the most relevant for different types of service industries, ranging from airlines and banks to legal services and universities.

An application in service shops (Wang, 2011) analyses the staff management challenges, particularly in capital intensive services. The considerable investments in facilities and equipment in service shops like hospitals, repair shops, fitness centres, etc., pose new types of challenges for service companies. Mackelprang et al. (2012) analyse impact of training in the mass services and service shops quadrants. They recognise the impacts of job specific training and skills, quality training (including total quality concept and quality tools), as well as, employee capabilities in understand-

ing the organisational strategies, performance in required jobs, and interaction capabilities. These differ considerably in the quadrants.

Next we will analyse each quadrant of the matrix separately with examples in different services.

3.3. Mass Services

Mass services are characterised by relatively slow processes and low variation in services. The class includes most of the traditional over-the-counter services. Service volumes are high, sometimes even very high, but as they are labour intensive, also the costs of operation remain at a high level. Typical examples include most of volume services, such as back-of-the-house operations and traditional commercial banking. Besides Schmenner other researchers have looked into mass services. E.g. Tinnilä and Vepsäläinen (1995) position retail and corporate bank services with branch offices into mass services. These are offered as labour intensive traditional services with a relatively slow process. The personal service in branch offices is often regarded as customised, but although each service encounter is unique, the service process is standardised and consequently belong to mass services.

There has been discussion about the future of mass services, and Schmenner and many other researchers argument that this type of service is less important in the future, as it can be to a large extent replaced with service factories. The high personnel costs drive these services also to digital channels. In banking, branch office services have typically been regarded as mass services. As pointed out by Portela and Thanassoulis (2007), the role of branch offices has been changing from service production toward marketing, i.e. bank offices exist to provide the necessary customer touch points for information, advisory services, while the actual service processes are moved over to service factories. Olorunnivo et al. (2006) analyse the role of service quality in different quadrants of the Service process matrix, and find that mass services face challenges in turning services more customer responsive, develop new attractive marketing practices, and develop the physical service facilities adequately. The high labour intensity of mass services makes them inflexible to respond to changes in volume, necessitating a large permanent workforce. This also brings along hierarchical organisational structures in service processes for maintaining quality. Climent et al (2009) model the business processes of banks, and among the key processes are private customer service, new customer acceptance, telephone answering, affluent customer treatment, etc. These processes are mostly mass processes, and are estimated to occupy 80% of the operative work in banks. Consequently, process improvements include call centres reducing the load to office personnel. In new customer acceptance, the process throughput time has been reduced by 33% in a more service factory-type operation. In mass services the personnel need skills in quality management techniques (Mackelprang et al., 2012) for better measurability and consistency of operations. Also job specific training improves both the performance and quality. Typical measures used in mass services include process time, throughput time, repeatability of service encounter sequence, as well as, number of customers and transactions, contact time, customisation, orientation of service offering (product/process) product, focus in service production, i.e. value creation, such as front- or back-office.

To sum up, mass services aim at offering volume services with little variation and with high standardisation level. The reliance on labour-intensive production mode emphasizes the importance of labour costs and streamlined service processes. Consequently, appropriate efficiency measures are contact time, i.e. time spent in service customers, and number of customers, and transactions in a time unit. The metrics further describing the nature of mass services include standardisation and customisation levels, repeatability of services encounters and service personnel discretion.

3.4. Service Factory

Service factory is a streamlined service process connected to highly standardised services. As the name implies, it is the equivalent of factory operations for best possible efficiency in service production. Schmenner strongly argues that this is the dominant direction of development for many services, particularly high volume services. Examples include services with highly standardised service offering. The proliferation of budget priced services, such as "no frills" or budget-priced airlines, seems to support the argumentation for the growth of service factories. The term service factory has also been used to describe industrial services (Chase, 1991).

Celebrated examples of service factories include McDonalds, Ryan Air and Virgin Airlines. All are prominent in their fields for introducing cut-priced services with very limited service range. Typical is also a well streamlined service production process. McDonalds is well-known for its efficiency research, and development of detailed manuals how its main product, hamburgers, should be produced. The service system is tightly designed for service scripts, and documentation is by e.g. video training program and own hamburger university (Collier & Meyer, 1998). Along similar lines, Ryan Air and Virgin Airlines have changed the business model of airlines by offering basic-only service as standard, and charging extra for everything else. Consequently, a higher degree of self-service is expected from customers, who need to buy the tickets in the internet, pay them, do the check-in themselves, etc. Many traditional airlines have been forced to follow the lead by offering their own versions of budget services. Similar budget versions of services can be found in abundance, e.g. Ikea can be regarded as a budget priced version of furniture store, with streamlined production, supply chain, and warehousing processes.

Can it be maintained that service factory is a prerequisite for creating this new type of budget services? These are exemplified typically with limited product or service range, as compared to more traditional ones. We find this correct in restaurant services, where fast food chains have proliferated. The very name "fast food" reflects the idea of service factory with fast throughput time for customers. The design of service facility, also called servicescape (Bitner, Brown, & Meuter, 2000), reflects this by providing less comfortable seating for fast consumption. The range of offering, i.e. variation, is limited and standardised. Consequently, Buzacott (2000) describes fast food as "take it or leave it"-service with very little customisation for individual customers. Collier and Meyer (1998) look into customer's service encounter activity sequences and point out that gourmet restaurants are unique, while McDonalds has a very repetitive activity sequence, i.e. service processes, and highly repeatable and standardised service offering. Kellogg and Nie (1995), as well as Collier and Meyer (2000), place fast-food restaurants, such as McDonalds, as service factories, as they have generic service package, with customers influencing the service structure at low level. Similarly, service shops, such as education and healthcare clinics have medium influence and restricted or selective service package.

Typical representative examples of service factories in banking include ATMs and check book services as highly repeatable services and with few pathways, or access channels (Collier & Meyer, 1998, 2000). Tinnilä and Vepsäläinen (1995) classify also home banking and terminal connections to banks as volume transactions. Within banking services also machine room operations are regarded as service factories (Silvestro, 1999). Measures used in service factories are similar to those in mass services, but also reflect the higher use of organisational resources (Calabrese, 2011) and investments in infrastructure, equipment and service systems. Other measures include standardisation degree of service packages with little discretion in service delivery in service factories (Kellogg & Nie, 1995).

To summarise, service factories provide a standard service range with maximum efficiency, relying largely on infrastructure systems providing automation and streamlined processes. This facilitates novel service types, such as budget-priced versions of many standard services. The metrics reflect the aims of service factories by focusing on e.g. the ratio of output with time and personnel. The describing measures include automation and self-service levels, range of services, and standardisation of service processes.

3.5. Service Shop

Service shops have higher variation in service range than mass services or service factories. The service process is slower, and typically has higher labour intensity than in service factory. The personnel demands in terms of knowledge and skills are higher, as is understandable in services such as hospitals and higher class restaurants. The division between service factory and service shop is not quite clear cut, as Schmenner (1986) positions restaurants, and to some extent also fast foods, as service shops, although in the later version of the matrix (2004) the latter are positioned in service factory. Although Schmenner proposes similar throughput times for service shops and factories, this is debatable. Typically the larger variety, i.e. larger range of services and more customisation, also require longer customer contact phases and more interaction. In terms of customisation and interaction service shops can be claimed to be "budget" versions of professional services, in the sense that the degree of professionalism, personalisation and customisation is not as high. Typically the personnel do not consist of quite as specialised experts as in truly professional services. The professionalism is more akin to general expertise within the service area. The service range typically has a degree of standardisation and consequently, services are offered in packages or service bundles.

Wang and Xu (2011) have looked into the challenges of managing different types of services based on Schmenner's quadrants, focusing particularly on service shops. They pointed out, that service shops with high interaction needs are more for providing personalized services than standardised ones. The second observation is related to high capital intensity of some service shops with reliance on equipment and facilities to provide the services. This is typical for e.g. hospitals, repair shops and similar. In service shops personnel requires increased level of specific skills related to their tasks (Mackelprang et al., 2012), as the customer requirements have high variation. However, quality management is off lesser importance for efficiency.

In banking, branch offices offer a menu of services by a specialised service system structure, offering e.g. different service points for customers different services, depending on complexity and throughput time of services (Buzacott, 2000). Silvestro et al. (1992) place in the service shop class retail banks and some corporate bank services, as well as, personal banking and small business lending (Silvestro, 1999). Typical measures include those reflecting the degree of customisation and standardisation, such as those used by Kellogg and Nie (1995) measuring limited or considerable customisation of the service. Most or considerable part of service is standardised, and customers can select from predetermined choices, such as selecting from service modules.

To sum up, service shops meet the customer demands for more customised and personalised services. Reflecting this, the range of services is typically wider, and relies on service personnel knowledge. The measurement of service shops is less straightforward than in mass services and service factories, as many of the measures used a given the value "medium."Service shops balance labour intensity and requirements of the wide service range and interaction needs. Therefore, direct metrics of the type, output per person, do

not give adequate information. The more descriptive measures include customisation and standardisation, as well as, service range, discretion and customer interaction.

3.6. Professional Service

Professional services have, according to the definition, a high relative throughput time connected with high degree of service variation. Professional services are characterized by slow service processes, e.g. a legal "service process" may take months, as compared to minutes of a typical service factory process. Consequently, also the customer relationships are longer, sometimes continuous. The services are very labour intensive, and fulfilled with highly knowledgeable personnel, as exemplified by medical doctors and investment consultants.

The measurement of efficiency in this quadrant is more complicated than in others. Stabell and Fjeldstad (1998) call this service type value shop, where the value creation is not dependent on typical measures of efficiency, but depends on the customer value created by an expert. Fjeldstad and Sasson (2010) look into bank services, where value created is largely due to large networks of banks, and being embedded in networks increases the value of banking services for customers. In professional services the value creation is based on information asymmetry, i.e. the professional has more expertise than the customer, and this creates value by solving the customers' problems.

Examples of professional services typically include management consultants, lawyers, medical doctors and similar experts. Also gourmet restaurants are included, as Collier and Meyer (1998) include the celebrated Ritz as having non-repeatable and unique customer encounter. Similarly positioned is Merrill Lynch, as one of the leading financial management and investment advice companies. Other banking and financial examples include corporate banking, investment counselling, notary services and tax accountants. Kellogg and Nie (1995) call this quadrant as expert service, placing accounting and consulting here with high degree of customer influence on services and unique service package.

Measures for professional services include uniqueness of customer encounter and number of pathways built into system, i.e. different ways to access the service. Other similar measures are e.g. customisation of service packages with considerable discretion in defining the service. Silvestro et al. (1992) point out that professional services have few transactions, are highly customised, have long contact times, have value added at front-office by skilled personnel, and have high level of judgement in meetings the customer needs. The complexity of diagnosing customer problem is used by Buzacott (2000) as a measure, using law firms as examples with top-down service system structure. Typically it is regarded that professional services are more focused on creating value in back-offices, rather than in front-offices (Metters & Vargas, 2000). Calabrese (2011) finds that in professional services, it is mainly the individual human resources that create the value, while in service shops organisational systems and modules are the central sources.

Professional services are at the other end of the service scale as service factories. These provide the most personalised services with highly skilled and professional personnel. The expertise of the staff plays an important role in the value creation to customers. Consequently, measures looking at number of customers per expert are not suitable. In this quadrant, the best measures would reflect the value created as pointed by Stabell and Fjeldstad (1998). However, we currently lack good measures for this. Other measures describing the type of service include contact time, uniqueness, judgement level and specialisation level of personnel.

4. SUMMARY AND ANALYSIS OF SERVICE EFFICIENCY MEASURES

Based on the analysis of the four quadrants, as well as, the literature review and analysis of measures used to describe various services and measure their efficiency, we can conclude that the range of measures used is wide. However, within each quadrant there is considerable commonality of measures, as observed by Johansson & Olhager (2004) and Shafti et al. (2007). Johansson and Olhager (2004) present an extensive review of dimensions and measures used in services, ranging from degree of customization to service process structure. They use the measures for describing services in the service profiling framework, analyzing also the four quadrants. Shafti et al. (2007) test the different dimensions empirically to recognize the measures best describing different types of services. Verma (2000) tests empirically the management challenges and their relationships with different service dimensions and descriptive measures. Based on their research and analysis of the four quadrants, Table 2 summarizes the typical and most used measures for efficiency, as well as, descriptive measures for classifying services for their type. Also typical values for the four quadrants are presented.

The measures presented in Table 2 contain the synopsis of measurement of service efficiency, as well as, the measures describing the various services of the four quadrants. The use of these multiple measures facilitates the comparison of efficiency between different services. They can also be used to classify services into the four quadrants and finding the right measures for each of them. For example, the main goals of service factories are shortest possible throughput time, minimum variation and maximum standardisation for greatest possible operational efficiency, while professional services create value to customers by more personalised and knowledge-based service. Therefore the measuring rod for them should also be differing.

4.1. Application of the Measurement Scheme

Next, four basic banking services are represented to illustrate the use of measures in the four quadrants of the matrix. They illustrate the use of descriptive measures for each service. Further operationalization and testing of measures requires further empirical studies. However, even the illustrative cases show some efficiency related challenges, as e.g. the traditional over-the-counter service has very high infrastructure and labour costs. This explains why this type of service is in decline and is being replaced by more automated self-services. The illustrative case services are:

- Traditional over-the-counter banking services in branch offices;
- Home banking in the Internet;
- Consumer loan application by service personnel;
- Investment services for professional investors.

Traditional over-the-counter banking services in branch offices represents the typical mass services relying on service personnel. The service range is relatively large, but the greatest volumes are in very simple transactions, such as money withdrawals. Home banking is one of the most used services over the Internet. It is also an example of the impacts of automation on services, with high infrastructure costs and very low operative costs. Consumer loan applications are a typical service shop, offered in branch offices by skilled personnel. Although consumers can today apply for loans in home banking, many still prefer to do so in traditional channel, where interaction is enabled. Finally, Investment services for professional investors are among the most complex services offered by highly expert staff. The Table 3 presents the indicative measures for these services.

Traditional over-the-counter banking services in branch offices provide a relatively large range of

Table 2. Measurement scheme for service quadrants

Measures	Author(s) Include e.g.	Mass Services	Service Factory	Service Shop	Professional Service
Customer contact, contact time and interaction	Schmenner, 1986; Shafti et al., 2007; Verma, 2000	short	short	medium	long
Customisation, standardisation and uniqueness	Collier & Meyer, 1998; Schmenner, 1986; Verma, 2000	standard	highly standardized	modular/customized	highly customized
Diagnosis, level of judgement and discretion	Shafti et al., 2007; Silvestro et al., 1992	some discretion	no discretion	some diagnosis	high level of discretion
Range of services	Tinnilä & Vepsäläinen, 1995	limited range	very limited	medium	large range
Service volume and number of customers and transactions	Johansson & Olhager, 2006; Portela & Thanassoulis, 2007; Silvestro et al., 1992	large volumes	very high volumes	medium	low volumes
Variability	Schmenner, 1986	variation possible	no variation	some variation	high variation
Organizational focus –equipment and systems or people	Silvestro et al., 1992	systems and equipment	systems	both systems and people	people
Value creation focus, front/back office or product/process	Fjeldstad & Sasson, 2010; Gliatis & Minis, 2007; Shafti et al., 2007; Stabell & Fjeldstad, 1998	back office	back office	front and back office	front office
Labour intensity	Shafti et al., 2007; Verma, 2000	relatively labour intensive, some automation	automated	labour intensive with system support	highly labour intensive
Service processes and structure	Johansson & Olhager, 2004; Kellogg & Nie, 1995; Mayer et al., 2003	repeatable	highly repeatable	specialized processes	unique
Human resources	Mackelprang et al., 2012; Mukherjee et al., 2003	skilled	less skilled	specialized	highly specialized
Throughput time	Mayer et al., 2003; Schmenner, 2004	relatively short	short	medium	long
Infrastructure (investments, equity and asset specificity)	Karwan & Markland, 2006; Stratman, 2008; Verma, 2000	low infrastructure costs	high investment in infrastructure	medium investments and asset specificity	high asset specificity

services, which may present challenges, as the personnel needs to know a wide service range, while most of the volumes are focused on a relatively few services. This adds to the staff requirements and increases costs. Also, the labour intensity of the service results in high operative costs, although the service is supported by automated back-office systems. Finally, offering the service over-the-counter in branch offices incurs high infrastructure costs. Consequently, it is hardly surprising that the trend is away from this service type.

Home banking has the highest customer and transaction volumes for services that are highly standardized and automated. The service offers no discretion or variation for differing customer needs, and accordingly, is suitable only to services where the consumer needs are very similar. Home banking also demonstrates the nature of ICT-based

Table 3. Banking services analysed with measures

Measures	Mass Services- Traditional Service	Service Factory- Home Banking	Service Shop – Consumer Loan	Professional Service – Investment Counseling
Customer contact, contact time and interaction	short contact time	very short	medium interaction and time	long customer contact time and relationship
Customisation, standardisation and uniqueness	mostly standard, some customisation	highly standardized, no customisation	modular service range with some customization, modularization	highly customized, to some extent unique
Diagnosis, level of judgment and discretion	some discretion by the personnel	no discretion due to automated processes	some diagnosis and judgment based on customer needs	high level of discretion, discretion based on customer needs
Range of services	relatively large range	limited	medium service range	large range
Service volume and number of customers and transactions	large volumes and many transactions	very high volumes and number of transactions	medium to low number of transaction- possible to automate,	low volumes and few customers
Variability	some variation	no variation between individual service encounters	some variation	high variation as customer needs differ
Organizational focus –equipment and systems or people	systems and equipment and People	systems focus	both systems and people focus	people and knowledge focus
Value creation focus, front/back office or product/process	back office and front office	back office by nature	both front and back office	front office with back office support
Labour intensity	rather labour intensive, some automation	automated	labour intensive with system support	highly labour intensive
Service processes and structure	repeatable	highly repeatable	specialized processes	unique only basic steps determined
Human resources	skilled due to service range	only back office requires personnel	relative specialized due to service requirements	highly specialized and knowledgeable
Throughput time	relatively short	short	medium	long
Infrastructure (investments, equity and asset specificity)	medium infrastructure costs due to office space	high investment in infrastructure, very low operations costs	medium investments and asset specificity	high asset specificity in personnel

services, where development and infrastructure costs are high, but running costs very low. Consequently, they can be applied only for services with very high volumes.

Consumer loan applications are a typical service shop operations, where the customer interaction face-to-face with personnel is an important part of the service encounter. This incurs relatively high labour costs. However, as these services are in fact consisting of service modules, this enables self-services for customers. Consequently, part of the challenge is to convince consumers to use less labour intensive channels.

Investment services for professional investors have typically long term customer relationships, often at personal level between bank experts and customers. The professionals offer a very high level of expertise, which creates the value of the service. The challenge in the service is thus to retain and motivate the personnel. The very high cost structure necessitates high fees for services, making them to some extent vulnerable to competition.

5. DISCUSSION AND CONCLUSION

The diversity of services has been regarded as an obstacle for proper measurement of their efficiency. Despite this, many classifications and frameworks have been proposed for analysing and measuring service efficiency, either at service or service process levels. Lacking appropriate efficiency measures, many researchers have approached the challenge by proposing metrics and measurement sets describing the type of services. By matching services and resources in a right way, the result would be an efficient service. However, no commonly accepted measurement framework has so far emerged. Consequently, it can be maintained, that straightforward measurement of service efficiency is not a simple task, and there is a need for multidimensional measurement frameworks to determine both service efficiency and describe the type of service.

The review of measurement literature reveals a large number of studies analysing service efficiency from different viewpoints, as well as, a wide range of measures used for determining the efficiency of services and describing them. In this study four distinct approaches for measuring service efficiency were recognised. The first looks at service process efficiency by analysing process inputs and outputs, in addition to resources and financial performance. The second approach analyses service quality and its impacts on efficiency. There are also several empirical studies within this area, as well as, in service innovations and their impact on service efficiency. Thirdly, value creation in services has turned out to be a topical issue, but there are still challenges in measuring the value created. Fourthly, there are many service positioning frameworks recognising efficient service matches and structures. Among them the Service process matrix by Schmenner is one of the most widespread, with several applications and extensions.

This study contributes by reviewing different studies and by connecting them to the four quadrants of Schmenner's framework. Consequently, we find that there is a lot of commonality in the measures used for analysing the efficiency of different types of services, as well as, in describing the various service types. Therefore, there are solutions to compare the efficiency of "apples and oranges," i.e. different service types. Furthermore, the framework of Schmenner has been used for classifying services into four main basic types, or quadrants, which cover the typical service range offered to customers. Each of the main types have been analysed separately for their features, measures used to describe the service, as well as, the measures for analysing efficiency of the service. The main focus of the analysis has been on banking services, although other types of services have been used to illustrate the commonalities and differences of the four basic service types. This is of academic and managerial interest, as the goals and drivers for each service category are different.

The analysis of the four quadrants facilitates recognition of pertinent measures for each basic type of service. For mass services, aiming at offering volume services with little variation and with high standardisation level, the appropriate measures include e.g. standardisation and customisation levels, number of customer and transactions in a time unit, as well as, repeatability of service encounters. The very labour-intensive service production emphasizes the significance of labour costs. Service factories offer a standard service range with maximum efficiency, depending on automation and streamlined processes. This approach has facilitated service innovations, such as budget-priced air travels. The measures focus also on standardised service output, and e.g. the ratio of output with time and personnel, automation level, and service range. Service shops offer a wider service range than mass services or service factories, typically with more customised and personalised services relying on service personnel. Measurement includes a variety of measures, as the conflicting demands of personalisation and efficiency make the determination of efficiency

complex. Consequently, we need a range of measures, such as labour intensity, service range, interaction needs, and employee discretion and customisation level. Finally, professional services provide the most personalised and customised services. These are based on expertise knowledge of personnel, and the value created in the service is largely dependent on this. Measures such as uniqueness, judgement level and specialisation level of personnel are deemed as most appropriate.

Based on the literature review of measurement studies, and analysis of service belonging to four quadrants, a set of measures is proposed for describing and determining service efficiency. The use of multiple measures facilitates the comparison of efficiency between different service types. The use of measures is illustrated by analysing four basic banking services, such as, traditional over-the-counter banking services in branch offices, home banking in the Internet, consumer loan applications by service personnel, as well as, investment services for professional investors. Further empirical studies and testing are required to validate the proposed measures for determining efficiency in the basic service types.

The measurement of service efficiency is of interest generally, and in banking services particularly. Some services are by nature more efficient than others. The streamlining of these mass services by using the service factory approach has had tremendous impact in banking industry. Compared to traditional over-the-counter services, for example online banking is an incredibly efficient service factory operation. With costs of approximately $0.01 per transaction (Wu & Wu, 2010) no wonder that on-line or home banking is preferred by banks. However, all services cannot, and should not, be transformed into service factories. There are still requirement for more personalised and customised services. However, there are opportunities to streamline, bundle and modularise also more customised services for greater efficiency by using the right measures to guide the transformation.

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Chapter 61
An Uncertain Decision Making Process Considering Customers and Services in Evaluating Banks: A Case Study

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ABSTRACT

In today's changing environment two properties are required to service namely good relation with customers and service quality. Nowadays no organization can get great achievement unless it can attract sufficient customers providing better service quality is important for service firms. This paper proposes a novel combined approach utilizing group decision making process to evaluate and rank criteria influencing the customer relationship management and service quality of four banks in Iran based on fuzzy decision making trial and evaluation laboratory (Fuzzy DEMATEL) and fuzzy analytic network process (Fuzzy ANP). Defuzzification of decision makers' judgments is handled by Converting Fuzzy data into Crisp Scores (CFCS) method. Fuzzy DEMATEL is applied to deal with inner dependencies among criteria. Fuzzy ANP is used to compute final ranking of four banks as an empirical example. An empirical study is presented to illustrate the application of the proposed method.

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1. INTRODUCTION

The financial stability of a country is an important prerequisite towards economic growth. If a country wishes to attract investments must have a solid and profitable banking branch of the financial services industry (Goosen *et al.* 1999). The banking branch of the financial services industry, are central to the overall performance of the economy and perform functions which affecting all aspects of other sectors of the economy. The fact banks have a fragile and risky structure makes it inevitable to follow-up their structures and their efficiencies continuously. Banks' non-financial performances through the criteria such as service quality, customer satisfaction are also important and must be measured for all stakeholders for more profitability.

Hussain and Gunasekaran (2002) summarized some main reasons for non -financial performance. These reasons are as follows: competition pressure, technological and economic developments, and legal regulations within top managements, socio-economic and political situation, top management and corporate culture. One of the important tools of the management's control function based on nonfinancial performance is the measurement of service quality to improving performance and upgrading customer satisfaction.

Many service firms experience problems with their service quality because unique nature of service is not physical. In order to minimize these problems, it is necessary to truly understand the terms quality, service quality and the dimensions of service quality. Additionally, it is obvious that superior CRM (customer relation management) may possibly increase firms' levels of service quality. Therefore, firms must to equip themselves with the necessary knowledge regarding this new business concept. Through effective CRM strategies and high levels of service quality, customers will receive the manner and level of service delivery for increasing the success of the service provider.

1.1. Customer Relation Management

As CRM is a strategic approach incorporating a process of maintaining valuable, long term relationships with clients, it provides the firm with an enhanced opportunity to understand its clients (Christopher et al., 2002). An improved opportunity for organization to understanding their clients is provided by CRM strategy and it is an efficiency approach incorporating long term relation with clients (Christopher et al., 2002). The relationship between a bank and its clients is very important to both parties, as the bank is entrusted with a scarce resource of the client, which must be managed in the client's best interest to ensure support for the bank (Goosen *et al.* 1999). Gosney and Bohem (2001) get reasons that a CRM strategy has numerous aspects but the basic theme is for a company to become more customer-centric. Anton and Petouhoff (2001) found that primary reason that customers don't have desire to keeping on doing business with a particular company is a poor customer service.

It is therefore important for banks to gain knowledge regarding the variables that can possibly influence its CRM. (Gilbert & Choi., 2003) advocates: "In banks a successful CRM strategy cannot be implemented by only installing and integrating software packages. If a bank develops and sustains a solid relationship with its customers, its competitors cannot easily replace them and therefore this relationship provides for a sustained competitive advantage."

Most researchers have considered using CRM for improving financial services. Peppard (2000) integrated information technology and CRM for improving banks' services. Rigby and Ledingham (2004) studied a broad range of companies that they have had a successful CRM system and defined important key factors for implementing CRM strategy in organizations. Reinartz et al. (2004) conceptualized the process of CRM implementa-

tion and showed CRM process is positively linked to performance. Kim et al. (2010) emphasized technology for the successful implementation of an enterprise wide CRM strategy in retail banks.

1.2. Importance of Service Quality

More choice and awareness is growing therefore customer expectations are increasing and they demand better service quality. The quality of service has become a strategic instrument for evaluating the firms' performance and also it is one of the most dominant themes of research in services (Fisk *et al.,* 1993; Donnelly *et al.,* 1995).In fact, service quality has become a great differentiator, the most powerful competitive weapon which many leading service organizations possess (Berry *et al.,* 1988).

The key purpose of service quality is managing clients by identifying, satisfying and retaining the most profitable clients and generating better results for firms. Parasuraman *et al.* (1985) revealed that consumers generally use similar criteria in evaluating service quality in special industry. These service quality perceptions result from a comparison of clients expectations with actual service performance. Rust and Oliver (1994) emphasized that understanding how customers view service quality is essential to the effective management of a service firm (Fazlollahtabar et al., 2012; Jaggi et al., 2011; Jajimoggala et al., 2011).

Banks have come to accept the view that it is the quality of service that may better recognize them over the long run and because of this, the correct appraisal of bank service quality will be a necessary topic. Service quality impact the operation of banks, because service quality conditions influence a firm's competitive advantage by identifying, satisfying and retaining clients and with this comes profitability (Morash & Ozment, 1994).

Researchers documented several approaches for measuring customer perceptions of service quality and satisfaction with banks (Avkiran, 1994; Bahia & Nantel, 2000; Cronin & Taylor, 1992). Some scholars and practitioners have applied this instrument in retail banking sectors (Taylor & Baker, 1994; Lam, 1995; Newman, 2001; Clemes & Zhang, 2010).

The review of literature reveals that banks face many challenges and they are influenced by many different variables. Banks' success, and therefore the growth of the national economy, may depend on their levels of CRM and service quality, which in return may be influenced by other criteria. As a consequence in this paper we consider both customer relationship management and service quality with their related factors.

As previously mentioned, it is clear that evaluating banks is important and complex because this problem needs the number of attributes. These attributes may be intangible or non-monetary beside the monetary goals. This problem is very important for managers. The multi-criteria decision making (MCDM) approach is appropriate for evaluating service quality expectation. In such a system like banking that has decision units including several inputs and outputs, all criteria which might influence the performance must be integrated and examined at the same time and in the same system. Although it seems quite simple and feasible, it is most of the time impossible to settle all the criteria on the same basis and turn them into a joint unit which can refer to the same value. By the help of MCDM methods, manager is able to acquire quick information (feedback) about advantages of the asset allocation. Consequently, every specific requirement of a contract can be reflected by the applied methods (Sharkey et al., 2011; Khalili-Damghani et al., 2012; Strang, 2012).

Most researchers have employed techniques in both crisp and fuzzy environment and also this technique has become a popular and common tool in literature at least in this problem. Seçme et al. (2009) proposed a fuzzy multi-criteria decision model to evaluate the performances of Turkish banks.Some authors used the multi criteria

decision method for the measurement of bank performances and examined the relation between financial and operating performances. (Lee et al., 1995; Suwignjo et al., 2000; Wang et al., 2004; Frei and Harker, 1999). Yurdakul and Iç (2004) analyzed the bank performances using AHP with the financial and non-financial performance criteria in credit risk assessment. Albayrak and Erensal (2005) analyzed the financial and non-financial performance criteria for the performance evaluation of Turkish banks using fuzzy MCDM.

The usual AHP method has often been criticized, due to its use of unbalanced scale of judgments and its inability to sufficiently handle the uncertainty and imprecision in the pair-wise comparison process (Deng, 1999). Therefore, for solving this difficulty many AHP methods and applications are proposed in fuzzy environment titled fuzzy analytical hierarchy process (Fuzzy AHP) by different authors. For example, Che et al. (2010) used fuzzy AHP for making bank loan decisions to choose the important index in loaning evaluation, establish one complete and efficient loaning decision-making module with its weights.

Research indicates customers are vital for business and banking industry in Iran has to go a long way in meeting the changing needs and demands of customers. These dissatisfactions have many reasons from economical to political, principles to complicated tools for customer satisfaction, from legislation to implementation. By reviewing literature of the CRM and service quality practices the scholar would be able to find out suitable tools and techniques which would improve banking sector performance.

However, the service quality expectation is always approached in uncertain environment and is highly affected by subjective judgments that are vague and imprecise. On the other hand, MCDM methods are often criticized for their inability to adequately deal with the uncertainty and imprecision associated with the mapping of the decision makers' perception to crisp numbers (Deng, 1999; (Sodenkamp & Suhl, 2012; Jenab et al., 2012).

Recently, there have been many approaches to cope with the uncertainty environment. (Taylor & Baker, 1994; Secme et al., 2009; Clemes et al., 2010; Alam et al., 2009).

Many traditional MCDM techniques in crisp or fuzzy environment are based on independence assumption, but each individual criterion is not always completely independent (Leung et al., 2003)**.**In other words, in real circumstances most criteria are basically dependent. The Analytical Network Process (ANP) method proposed by Saaty (1996) overcomes this problem and solves the interactions among elements. In ANP method relation of inner dependences are not complete and perfect. So, Decision Making Trial and Evaluation Laboratory (DEMATEL) method which was by proposed Fontela and Gabus (1976) can be used to consider the inner dependences among criteria.

However, this research differs from prior studies, as it considers inner relation between criteria the possible influence of CRM on service quality in banking institutions in public and private banks in Iran.

As the use of combined fuzzy DEMATEL and fuzzy ANP has several advantages this study seeks to review the bank service quality dimensions and introduce an integrated fuzzy DEMATEL and fuzzy ANP approach for prioritizing these dimensions according to customers' expectations and perception and measurement of service quality of four Irans' banks.

Fuzzy ANP is used to compute final ranking of the four banks. Fuzzy DEMATEL is applied to deal with inner dependencies among criteria. Also, an empirical study is presented to illustrate the application of the proposed method.

Remainder of this paper are structured as follows: Section 2 gives factors; Section 3 describes the proposed methodology based on Fuzzy DEMATEL and Fuzzy ANP; In Section 4, fuzzy set theory, CFCS defuzzification method, fuzzy ANP and fuzzy DEMATEL are described; In section 5, the proposed methodology is applied; and finally, Section 6 concludes our work.

2. CRITERIA INFLUENCING CUSTOMER RELATIONSHIP MANAGEMENT AND SERVICE QUALITY

In order to make certain high levels of customer relationship management and service quality, a number of factors that can influence the quality of the CRM strategies and service quality of a service firm, need to be analyzed.

Rootman et al. (2006) investigated factors that influence the customer relationship management (CRM) of banks from employees' perspectives. Rootman (2006) applied criteria which affect in CRM and service quality of banks and as a result we consider factors based on these criteria. Final, this research considers specific 21 criteria gained by the interview of 10 experts.

Rootman (2006) proposed that customer relationship management can possibly be influenced by the following specific factors:

1. Tow-way communication;
2. Attitude;
3. Knowledgeability;
4. Efficiency of banking services.

Service quality can possibly be influenced by customer relationship so we consider 5 group criteria as (D1, D2, D3, D4, D5).

2.1. Tow-Way Communication

Duncan and Moriarty(1998) considered retailer-consumer relationships, they showed that: " different relationship marketing tactics have a differential impact on consumer perceptions of a retailer's relationship investment; it demonstrates that perceived relationship investment affects relationship quality, ultimately leading to behavioral loyalty; and it reveals that the effect of perceived relationship investment on relationship quality is contingent on a consumer's product category involvement and proneness to engage in retail relationships." Also they pointed that bank employee's role has shifted to financial counseling, which involves the processes of listening, adjusting and matching (Duncan & Moriarty, 1998).

Christopher et al. (1993) explained that service providers should listen to clients and need to design and provide a service that will lead to continued value exchanges between the two customers and.

These processes require bank employees to possess communication, listening and persuasion skills. Specifically, in the banking branch of the financial services industry, banks can communicate with clients through a variety of media. Rootman (2006) specified subcriteria for this factor and we consider four of these subcriteria based on experts' opinion. These subcriteria are:

C1: Customer relationship with bank depends on whether senior managers are always available for appointments (managers);
C2: Customer relationship with bank depends on whether bank's employees communicate effectively (communicate);
C3: Bank regularly informs customers of new or important banking information through various media (information);
C4: Bank regularly informs when certain services will be available and/or unavailable (availability).

2.2. Attitude

The effective management of people takes place in the context of the wider environmental setting, including the changing patterns of organizations and attitudes to work (Mullins, 1996). In organization, attitudes are evaluative statement and they have considerable role because they affect job behavior (Robbins, 1998). Attitude can be described as a tendency to respond in a specific way, based on positive or negative beliefs regarding objects, people and situations (Mullins, 1996). As result, this factor might influence the degree of CRM and upgrade client-firm relationships.

Rootman (2006) explained subcriteria and we select three criteria of them. These subcriteria are:

C5: employees of bank appear satisfied with their jobs (job satisfaction);
C6: relationship with bank depends on whether the employees of bank appear really happy and without stress (happiness).

2.3. Knowledgeability

Rootman et al.(2006) revealed that knowledgeability of bank employees have significant impact on the effectiveness of the CRM strategies of banks. In a banking institution, employees' academic knowledge will depend on their perception and ability to fully understand banking procedures, policies, products and services.

Banking employees' knowledge will depend on their ability to practically implement banking sequence of instructions and perform tasks regarding banking service delivery through the relevant banking systems. The above implies that an employee should have technical, product and firm knowledge (Walker, 1990**).**

Rootman et al. (2006) considered follow subcriteria that they are:

C7: Relationship with bank depends on whether employees of bank can inform customers on banking products and services (inform);
C8: The employees of bank have extensive knowledge regarding the banking products and services (knowledgeable);
C9: Relationship with bank depends on whether the employees can inform customers of banking policies and procedures (policies);
C10: Customers will have a better relationship with bank if the employees of bank can advise them on banking products and services (advise);
C11: Bank knows the bank's procedures of delivering services (procedures).

2.4. Efficiency of Banking Services

Efficiency is defined as the degree to which tasks or activities are performed correctly and as desired (Marx *et al.,* 1998).

A bank needs to ensure that its employees conduct their tasks and responsibilities in an efficient manner. This would result in resources being utilized efficiently and tasks being performed successfully. (Rootman et al., 2006). Asubonteng (1996) concentrated on the appraisal of the productive efficiency of bank branches,and this paper revealed that operations are characterized by the effort made by management to follow the banks' corporate targets. The tangible part of this effort can be assessed by the operating efficiency of the branch while the intangible part is summarized by the quality of the provided services. The assessment of branch efficiency is pursued using data envelopment analysis methods enhanced by the value judgments of individual branch managers (Athanassopoulos, 1997). Thus, the efficiency of services may influence a bank's CRM. The subcriteria are:

C12: Customer relationship with bank depends on the efficiency of its banking services (efficiency);
C13: Relationship with bank depends on whether it provides value for money (value);
C14: Relationship with bank depends on whether it implements strict measurements to ensure the security of funds (security);
C15: Customers will have a better relationship with bank if they know that customers bank treats information exchanged confidentially (confidentiality);
C16: If bank provides technologically advanced services, e.g. internet banking, customers will have a better relationship with bank (technology);
C17: Customers selected bank based on its fees for services (fees selection).

2.5. Service Quality

Service quality can be measured by identifying the gaps between customers' expectations of the service to be rendered and their perceptions of the actual performance of the service. It is the most frequently used model to measure service quality (Mattson, 1994).For assessing a competent service firm, there are several service quality criteria to be approached. Parasuraman et al (1985) formulated a service quality model and identified dimensions such as tangibles, reliability, responsiveness, competence, courtesy, credibility, security, communication, understanding, and access in the original model and using in-depth interviews of executives and focus group interviews of consumers.

Parasuraman et al. (1988) considered ten dimensions were condensed into five tangibles, reliability, responsiveness, assurance, and empathy. Table 1 shows numerous researchers have confirmed the applicability of various dimension in different sectors. In this study Criteria which are considered are:

C18: Individualized attention from bank to its clients of service (Empathy);

C19: Bank can perform the service dependably and accurately (Reliability);

C20: The willingness to help clients and to provide prompt service refers to responsiveness dimension of a bank service (Responsiveness).

3. THE PROPOSED METHODOLOGY

In this section a methodology based on combined Fuzzy DEMATEL and Fuzzy ANP for investigation and ranking banks is proposed. The overall schema of proposed algorithm depicted in Figure 1. All of these steps will be implemented in an empirical study and described in further in detail.

This methodology consists of following steps:

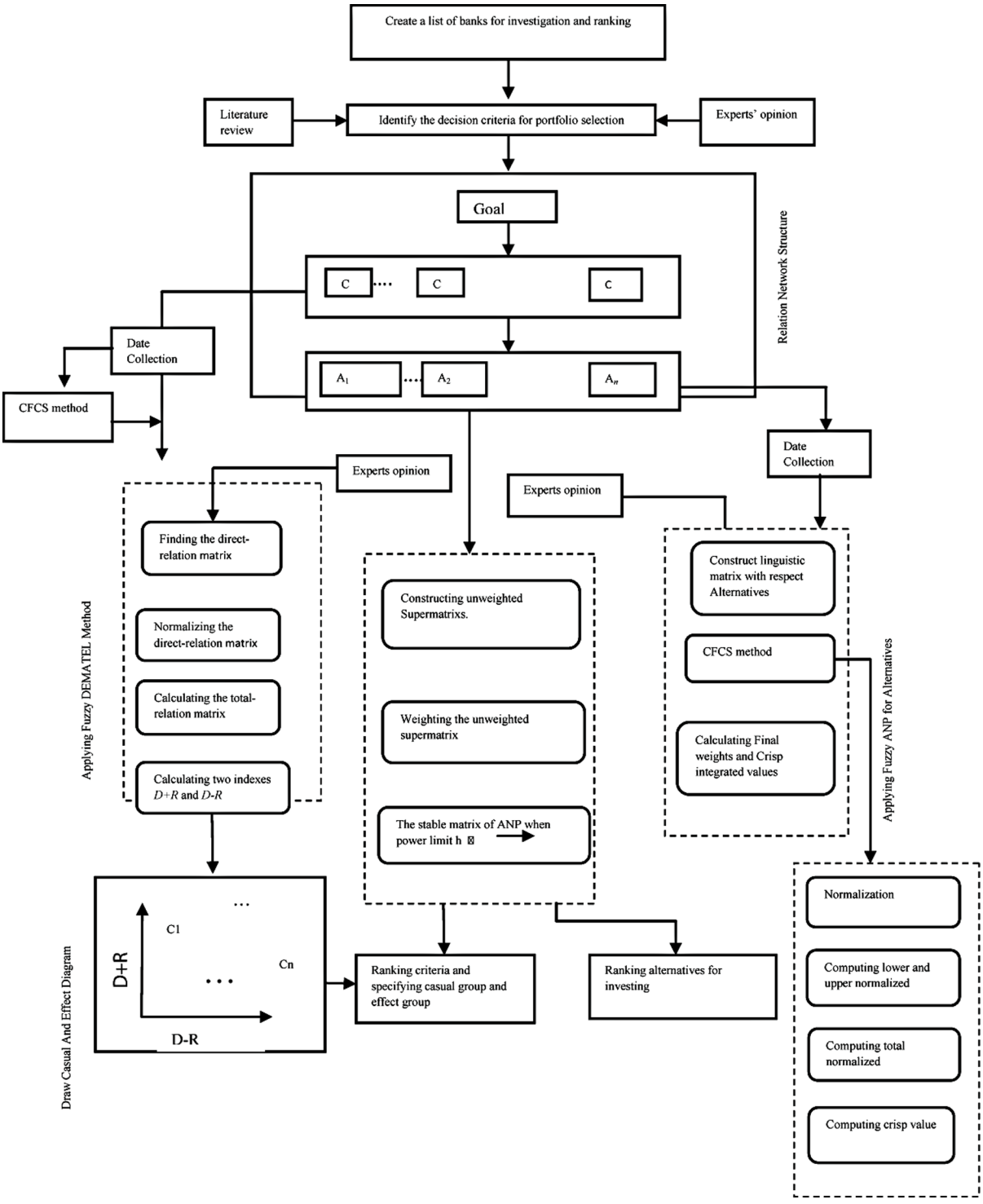
Step 1: Determining goal of problem.

In the first step goal of problem and final output of decision process is defined.

Table 1. A summary of the considered dimension by previous studies

Author	Year	Main Characteristics	Application
Parasurman et al	1985,1988	5 -dimensions	Different type of services
Gabbie and Neill	1996	5 -dimension	Hotel industry
Parasurman et al	1985,1988	5 -dimensions	Different type of services
Mehta and Durvasula	1998	5 -dimensions	business-to-business
Carman	1990	4 -dimensional	Different type of services
Bolton and drew	1991	4- dimensional	Telephone services
Cronin and Taylor	1992	5 -dimensional	Different type of services
Teas	1993	5- dimensional	Retail stores
Babakus and Boller	1992	2 -dimension	Different type of services
Lam	1995	1-dimensional	Health care industry
Nadiri and Hussain,	2005	2-dimensional	Hotel industry
Evangelos et al	2004	2-dimensional	Insurance study
Karatepe and Avci	2002	2-dimensional	Hotel industry
Ekinci *et al*	2003	2-dimensional	holiday market
Rootman et al	2006	5-dimensional	Bank

Figure 1. Diagram of proposed methodology



Step 2: Creating a list of banks for investigation. Alternatives are specified based on goal.

Step 3: Identification evaluation criteria.

The organization should specify criteria for evaluating these alternatives by interviewing with experts and managers.

Step 4: Constructing relation network structure.

Based on results obtained from above steps, the network scheme for evaluating criteria and ranking alternatives according to service quality and customer relation management will be constructed. We also consider relation and dependency among criteria.

Step 5: Collecting data.

In this step, the pair- wise comparisons matrices will be obtained by using experts' judgments. These matrices are the pair wise comparisons of criteria related to the goal, and the pair- wise comparisons of alternatives related to each criterion separately.

Step 6: Collecting data related to criteria based on their inner relation.

In this step, using questionnaires and filling them by using experts' judgments based on linguistic variables, pair wise comparisons in terms of influence among criteria for each expert are separately constructed.

Step 7: Converting data of step 5 to fuzzy numbers based on the scales are mentioned in Table 3;

Step 8: Defuzzyfication of matrices which are obtained from step 7 by CFCS method;

Step 9: Aggregating matrices of step8 and applying fuzzy ANP for calculating crisp integrated values and final weights for twenty one main criteria with respect to goal and crisp integrated values and final weights for alternatives with respect to each criterion;

Step 10: Converting data from step 6 to fuzzy numbers based on scales and constructing pair-wise inner dependencies' matrices;

Step 11: Defuzzyfication of matrices of step 10 by CFCS method;

Step 12: Aggregating matrices of step 11 by geometric mean method.

If k experts are used to construct pair wise comparison matrices for example k pair wise comparison matrices of criteria related to the goal, we will have k matrices that should be integrated to one matrix. Finally, for each integrated defizzified matrix, final weights will be calculated using geometric mean method developed by Saaty (1980).

Step 13: Applying fuzzy DEMATEL for calculating weights of inner relation between criteria and the calculated weights are entered to a supermatrix in fuzzy ANP;

Step 14: Combining Fuzzy DEMATEL and ANP methods;

Step 15: Ranking alternatives and investigating results.

In this step, the final weights of alternatives will be calculated and the best alternatives will be selected by using ANP technique (Figure 1).

4. BASIC MATERIALS

In this section, Fuzzy set theory, CFCS Defuzzification method, Fuzzy ANP, and Fuzzy DEMATEL are described as follows.

4.1. Fuzzy Set Theory

Result of decision-making in a fuzzy environment is highly affected by judgments which are imprecise. To solve this kind of imprecision problem, fuzzy set theory was introduced first by Zadeh

(1965) as a mathematical way to represent and handle vagueness in decision-making. Here some notifications are explained:

Definition 1: A fuzzy set $\tilde{A}$ is a subset of a universe of discourse *X*, which is a set of pairs and is characterized by the membership function $\mu_{\tilde{A}}(x)$. The function value of $\mu_{\tilde{A}}(x)$ for the fuzzy set $\tilde{A}$ is called the membership value of *x* in $\tilde{A}$, which represents the degree of truth that *x* is an element of the fuzzy set $\tilde{A}$. It is assumed that $\mu_{\tilde{A}}(x) \in [0,1]$, where $\mu_{\tilde{A}}(x) = 1$ reveals that *x* completely belongs to $\tilde{A}$, while $\mu_{\tilde{A}}(x) = 0$ indicates that *x* does not belong to the fuzzy set $\tilde{A}$ where $\mu_{\tilde{A}}(x)$ is the membership function and $X = \{x\}$ represents a collection of elements *x*:

Definition 2: A fuzzy set $\tilde{A}$ of the universe of discourse X is convex if we have:

$$\mu_{\tilde{A}}\left(\lambda X_1 + \left(1-\lambda\right)X_2\right) \geq \min\left(\mu_{\tilde{A}}\left(X_1\right), \mu_{\tilde{A}}\left(X_2\right)\right)$$
$$\forall x \in \left[X_1, X_2\right], \lambda \in \left[0,1\right]$$

Definition 3: A fuzzy set $\tilde{A}$ of the universe of discourse X is normal if $\max \mu_{\tilde{A}}\left(X\right) = 1$;

Definition 4: A triangular fuzzy number $\tilde{N}$ can be defined as a triplet (l, m, r) and the membership function $\tilde{N}$ is defined as Equation (1):

$$\mu(x / \tilde{A}) = \begin{cases} 0 & x < l \\ \dfrac{x-l}{m-l} & \mathrm{l} \leq \mathrm{x} \leq m \\ \dfrac{r\text{-x}}{r\text{-}m} & m \leq \mathrm{x} \leq r \\ 0 & \mathrm{x} \geq \mathrm{r} \end{cases} \quad (1)$$

In this article, triangular fuzzy numbers are used as the membership function, which is illustrated in Figure 2. Triangular fuzzy numbers are used, since they help the decision maker to make easier decisions (Kaufmann & Gupta, 1988).The membership function of a triangular fuzzy number can be found in Equation (1) and is usually notated by the triplet (*l, m, r*).

4.2. CFCS Defuzzification Method

Defuzzification is selection of crisp element based on the output fuzzy set and converting fuzzy numbers into crisp scores. Various methods of defuzzification exist, and the method used in this study is CFCS defuzzification `method. This method was introduced by Opricovic and Tzeng (2003).

$A_{ij}^k = (l_{ij}^k, m_{ij}^k, r_{ij}^k)$ indicates the fuzzy assessments between the criterion *i* and criterion *j* of the *k*th evaluator. The steps of CSCF method are described as follow:

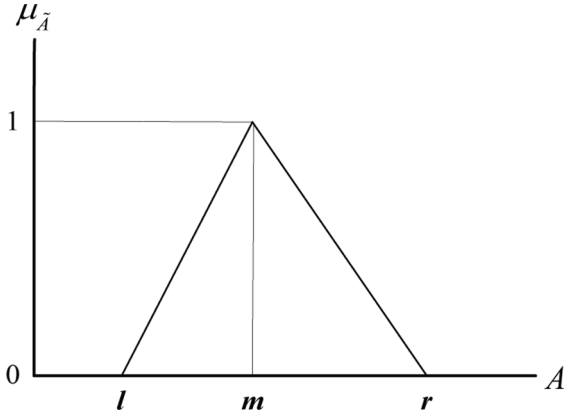
Step 1: Normalization

$$xl_{ij}^k = (l_{ij}^k - \min l_{ij}^k) \Big/ \Delta_{\min}^{\max} \quad (2)$$

$$xm_{ij}^k = (m_{ij}^k - \min m_{ij}^k) \Big/ \Delta_{\min}^{\max} \quad (3)$$

$$xr_{ij}^k = (r_{ij}^k - \min r_{ij}^k) \Big/ \Delta_{\min}^{\max} \quad (4)$$

Figure 2. A triangular fuzzy number



where:

$$\Delta_{min}^{max} = \max r_{ij}^{k} - \min l_{ij}^{k} \tag{5}$$

Step 2: Computing lower (ls) and upper (us) normalized value

$$xls_{ij}^{k} = xm_{ij}^{k} \Big/ (1 + xm_{ij}^{k} - xl_{ij}^{k}) \tag{6}$$

$$xrs_{ij}^{k} = xr_{ij}^{k} \Big/ (1 + xr_{ij}^{k} - xm_{ij}^{k}) \tag{7}$$

Step 3: Computing total normalized crisp value

$$x_{ij}^{k} = [xls_{ij}^{k}(1 - xls_{ij}^{k}) + xrs_{ij}^{k}] \Big/ [1 - xls_{ij}^{k} + xrs_{ij}^{k}] \tag{8}$$

Step 4: Computing crisp value

$$z_{ij}^{k} = \min l_{ij}^{k} + x_{ij}^{k} \Delta_{\min}^{\max} \tag{9}$$

These steps should be followed separately for k evaluators.

4.3. Fuzzy ANP

In order to make decisions in the presence of multiple and conflicting criteria, MCDM is applied. One of these techniques in MCDM that is used widely in decision making process is AHP. The analytic hierarchy process (AHP) has been used to help establish decision models and solve the problem that contains both qualitative and quantitative components by Saaty (1996).The basic assumption of AHP is dependency among each level related to upper level and itself. Many decision problems cannot be structured hierarchically when there is dependency between different level of elements and their interaction between them should be considered for solving problem, for this reason saaty(1996) extended AHP method to ANP. Saaty (1996) suggested the use of ANP to solve the problem when dependency among alternatives or criteria exists. In reality, the elements within the hierarchy are often interdependent. ANP is a nonlinear structure and uses ratio scale measurements based on pair wise comparisons and models a decision problem using a system with feedback approach.The computation of local weights in ANP is exactly the same as AHP method. The result of computations or weights in ANP approach forms a supermatrix. A supermatrix is actually a partitioned matrix, where each matrix section represents a relationship between two groups of clusters in a network (Lee and Kim, 2000).

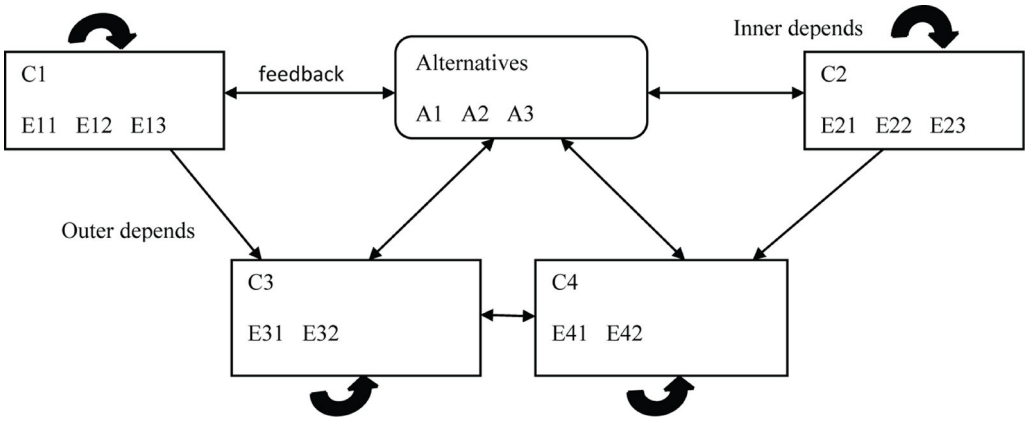
After the computation of all weights in the supermatrix, it is possible to derive the weights of priorities. The ANP methodology is explained in Saaty's (2001) book, so we are not going to explain all the complication of the methodology due to space limitations.

Figure 3 is a general form of the supermatrix introduced by Saaty (1996) to deal with the interdependence characteristics among alternatives and criteria. Figure 4 show the example of structure and relation network. A node represents a component or cluster with its elements; a straight line denotes the interactions between two components; and a loop indicates the inner dependence of elements within a component (Chung et al., 2005; Taha et al., 2011).

Figure 3. The general form of the supermatrix

$$W = \begin{array}{c|cccc} & C_1 & C_2 & \cdots & C_n \\ & e_{11}e_{12}\cdots e_{1m_1} & e_{21}e_{22}\cdots e_{2m_2} & & e_{n1}e_{n2}\cdots e_{nm_n} \\ \hline C_1 & W_{11} & W_{12} & \cdots & W_{1n} \\ C_2 & W_{21} & W_{22} & \cdots & W_{2n} \\ \vdots & \vdots & \vdots & \vdots & \vdots \\ C_n & W_{n1} & W_{n2} & \cdots & W_{nn} \end{array}$$

Figure 4. (a) Hierarchy and (b) network



In Figure 4, there are four clusters with their sub-factors and in this network outer depends are obtained from pair wise comparisons but inner dependences, are calculated by Fuzzy DEMATEL method. Since there is inner dependency among clusters in a network, the sum of columns in the supermatrix is usually more than one and called un-weighted supermatrix. Since there is inner dependency among clusters in a network, the sum of columns in the supermatrix is usually more than one and called un-weighted supermatrix. The columns of un-weighted supermatrix must be normalized first to make it stochastic, it means, each column of the matrix sums should be equal to 1. The result of this normalization is the weighted supermatrix. To achieve a convergence on the obtained weights, the weighted supermatrix is raised to the power of *2p +1*; where *p* is an arbitrarily large number, and this new matrix is called the limited supermatrix. The property of the limited supermatrix is that nonzero columns of this matrix have the equal value correspondingly. Eventually, having the limited supermatrix, the final priorities of all the elements (alternatives, criteria, and sub criteria) can be obtained (Chung et al., 2005).

Because the real world is actually full of ambiguities or in one word is fuzzy, several researches have combined fuzzy theory with ANP. Definitions and descriptions in associated with linguistic variables are shown in Table 2.

After all steps of CFCS method to aggregate opinions of *k* decision maker Equation (10) should be calculated:

$$z_{ij} = \sqrt[k]{z_{ij}^1 \times z_{ij}^2 \times \ldots \times z_{ij}^k} \tag{10}$$

In this equation, z_{ij}^k is a crisp value of evaluation between the criteria or alternative *i* and *j* of the *k*th evaluator that should be calculated through CFCS method. Also, z_{ij} is the aggregated crisp value of evaluations between the criteria or alternative *i* and *j*.

After calculating the aggregated crisp value of all evaluators, the final weight of each criteria or alternative can be calculated through Equation (11) which is introduced by saaty (1980):

$$W_i = \frac{(\prod_{j=1}^{n} z_{ij})^{\frac{1}{n}}}{\sum_{i=1}^{n}(\prod_{j=1}^{n} z_{ij})^{\frac{1}{n}}} \quad i, j = 1, 2, \ldots, n \tag{11}$$

In this equation "*n*" is the number of decision criteria or alternative in pair wise comparisons table.

Table 2. Triangular fuzzy numbers of ANP method

Linguistic Scale for Difficulty	Linguistic Scale for Importance	Triangular Fuzzy Numbers	Triangular Fuzzy Reciprocal Numbers
Just equal	Just equal	(1,1,1)	(1,1,1)
Equally difficult (ED)	Equally important (EI)	(1/2, 1, 3/2)	(2/3,1,2)
Weakly more difficult(WMD)	Weakly more important(WMI)	(1, 3/2, 2)	(1/2,2/3,1)
Strongly more difficult (SMD)	Strongly more important (SMI)	(3/2, 2, 5/2)	(2/5,1/2,2/3)
Very strongly more difficult(WSMD)	Very strongly more important (WSMI)	(2, 5/2, 3)	(1/3,2/5,1/2)
Absolutely more difficult (AMD)	Absolutely more important (AMI)	(5/2, 3, 7/2)	(2/7,1/3,2/5)

4.4. Fuzzy DEMATEL

The DEMATEL was basically developed to deal with intricacy in local and worldwide problems effectively (Fontela & Gabus, 1976). DEMATE L is a comprehensive method for building and analyzing a structural model involving identification of relations between causes and effects of complex problems. The method is based on the concept of pair-wise comparison of decision-making criteria that indicates the effect of the criteria *i* on criteria *j*.

The main application of DEMATEL is the identification of relations between causes and effects of complex problems. In order to apply the DEMATEL in crisp environment for one evaluator, the following steps are needed. The original DEMATEL was aimed a t the fragmented and antipathetic phenomena of world societies and searched for integrated solutions. In recent years, the DEMATEL method has become very popular because it is especially sensible to visualize the structure of complicated causal relationships.

Specifically, the DEMATEL method is based on digraphs, which can separate involved factors into cause group and effect group. A digraph may typically depict a communication network, or some domination relation between individuals. Digraphs illustrate the directed relationships of sub-systems and for this reason they are more applicable than directionless graphs. The flowing steps of this method are as below:

Step 1: Finding the direct-relation matrix.

This matrix shows the degree of effect that each criterion has on other criteria. In this step, an expert fills such a matrix i.e. a matrix which shows the degree of effect criteria *i* on criteria *j*. these amounts of effect can be expressed by words such as 0 (no influence), 1 (low influence), 2 (high influence), and 3 (very high influence). This matrix is called the direct-relation matrix that is a $n \times n$ matrix *Z*. Also, z_{ij} in matrix Z indicates the degree of effect criteria *i* on criteria *j*.

Step 2: Normalizing the direct-relation matrix.

The normalized direct-relation matrix *X* can be calculated through Equation (12) and (13), in which all main diagonal elements in matrix *X* are equal to zero (Chiu et al., 2006). In matrix *X*, each criterion does not affect itself:

$$X = k \times Z \tag{12}$$

$$k = Min\left(\frac{1}{\underset{1\le i\le n}{Max}\sum_{i=1}^{n} z_{ij}}, \frac{1}{\underset{1\le j\le n}{Max}\sum_{j=1}^{n} z_{ij}}\right) \quad i, j \in \{1, 2, 3, \ldots, n\} \tag{13}$$

Step 3: Calculating the total-relation matrix.

After calculating *X* in step 2, the total-relation matrix *S* can be derived by using Equation (14) as follows:

$$S = X + X^2 + X^3 + \cdots = \sum_{i=1}^{\infty} X^i \quad \text{when } i \to \infty \Rightarrow S = X(I - X)^{-1} \tag{14}$$

where, *I* is the *n*×*n* identity matrix.

Step 4: Calculating two indexes *D*+*R* and *D*-*R* for each criterion and drawing causal diagram.

In this step, first we should calculate the sum of row (*D*) and the sum of column (*R*) for each criterion separately. It is clear that *D* and *R* are as vector. Vector *D* and *R* can be calculated as Equation (15) and (16). Then, the value of two indexes *D*+*R* and *D*-*R* for each criterion should be obtained. *D*+*R* index represents "prominence" of each criterion or importance degree of each criterion. Also, *D*-*R* index called "relation" and can divide the criteria into cause group and an effect group. The Positive values *D*-*R* indicates that the criterion belongs to the cause group. Also, the negative values *D*-*R* indicates that the criterion belongs to the effect group. Finally, the causal diagram can be obtained by drawing (*D* + *R*, *D* - *R*) points for each criterion:

$$S = [s_{i,j}]_{n\times n} \quad i, j \in \{1,2,3,...,n\}$$
$$D = \sum_{j=1}^{n} s_{i,j} \quad \forall\ i = 1,2,...,n \tag{15}$$

$$R = \sum_{i=1}^{n} s_{i,j} \quad \forall\ j = 1,2,...,n \tag{16}$$

Several researchers have combined fuzzy theory with DEMATEL. The linguistic scale and corresponding triangular fuzzy numbers to state pair wise comparisons in Fuzzy DEMATEL are illustrated in Figure 5. Definitions and descriptions associated with linguistic variables that are used in Fuzzy DEMATEL are shown in Table 3.

Until now, we have described the crisp DEMATEL for one evaluator. Now, for fuzzy group decision making in DEMATEL by using Linguistic terms in Table 3, direct-relation matrix for all of the evaluators can be obtained. Then, to calculate the defuzzification values of each direct-relation matrix, CFCS method is applied to each evaluator by using Equations (2) – (9). In Group Fuzzy DEMATEL Approach to aggregate all of the direct relation matrixes of *k* evaluators, the following equation should be used:

$$z_{ij} = \frac{1}{k}(z_{ij}^1 + z_{ij}^2 + \cdots + z_{ij}^k) \tag{17}$$

Figure 5. Triangular fuzzy numbers for DEMATEL method

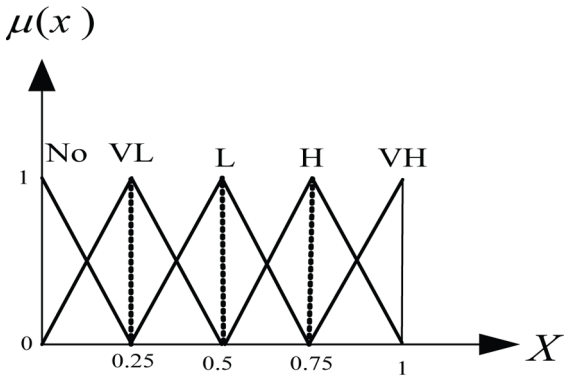


Table 3. Fuzzy comparison scale of DEMATEL method

Linguistic Term	Linguistic Values
Very high influence (VH)	(0.75,1.0,1.0)
High influence (H)	(0.5,0.75,1.0)
Low influence (L)	(0.25,0.5,0.75)
Very low influence (VL)	(0,0.25,0.5)
No influence (NO)	(0,0,0.25)

After aggregating the direct relation matrices, all calculations in fuzzy environment are similar to crisp DEMATEL. Also, total relation matrix *S* can be calculated through Equation (12)-(14).

4.5. Combination of Fuzzy DEMATEL and Fuzzy ANP

In supermatrix inner dependency between criteria can be obtained from Fuzzy DEMATEL method and other weights are calculated from Fuzzy ANP. After calculating the total relation matrix *S* in Fuzzy DEMATEL and before inserting into un-weighted supermatrix, the total relation matrix *S* should be normalized (Wu, 2008). The total relation matrix *S* should be normalized using Equation (18):

$$S = \frac{s_{ij}}{\sum_{i=1}^{n} s_{ij}} \text{ i, j=1,2,…..,n} \qquad (18)$$

Consequently, final weight can be obtained by calculating weighted and limited supermatrix.

5. CASE STUDY

In this section, we implement the proposed methodology in an actual case in private and public banks in Iran to demonstrate that the proposed hybrid method is more appropriate, especially when the characteristics of criteria simultaneously exist as independent and dependent:

Step 1: Determining goal of problem.

To survive in a complex and competitive business environment, banks are required to focus on their customers' needs and can focus on their relationships with clients and levels of service quality. In order to establish the influence of selected variables on the CRM and service quality of banks an empirical investigation was conducted to identify important factors and investigate bank for improving their performance.

Step 2: Creating a list of banks for investigation.

In this case, the four possible alternatives are selected to remain for further evaluation after preliminary screening and evaluate the service quality of private and public banks in Iran.

Step 3: Identification evaluation criteria.

First, we assembled a set of ten evaluators in which included staff from the government sector and different experts from managers of banks who are in charge of economic departments, academic experts.According to the proposals of evaluators, a suitable set of evaluation criteria are be selected. Tow-way communication, Attitude, Knowledge ability and Service quality are selected as main factor for evaluating and these factors have some related criteria.

Step 4: Constructing relation network structure.

The proposed network scheme to ranking banks based on the results gathered in above steps, are depicted in Figure 6. We know also that there are relationships between criteria. This relationship in this section will be considered.

Step 5: Collecting data.

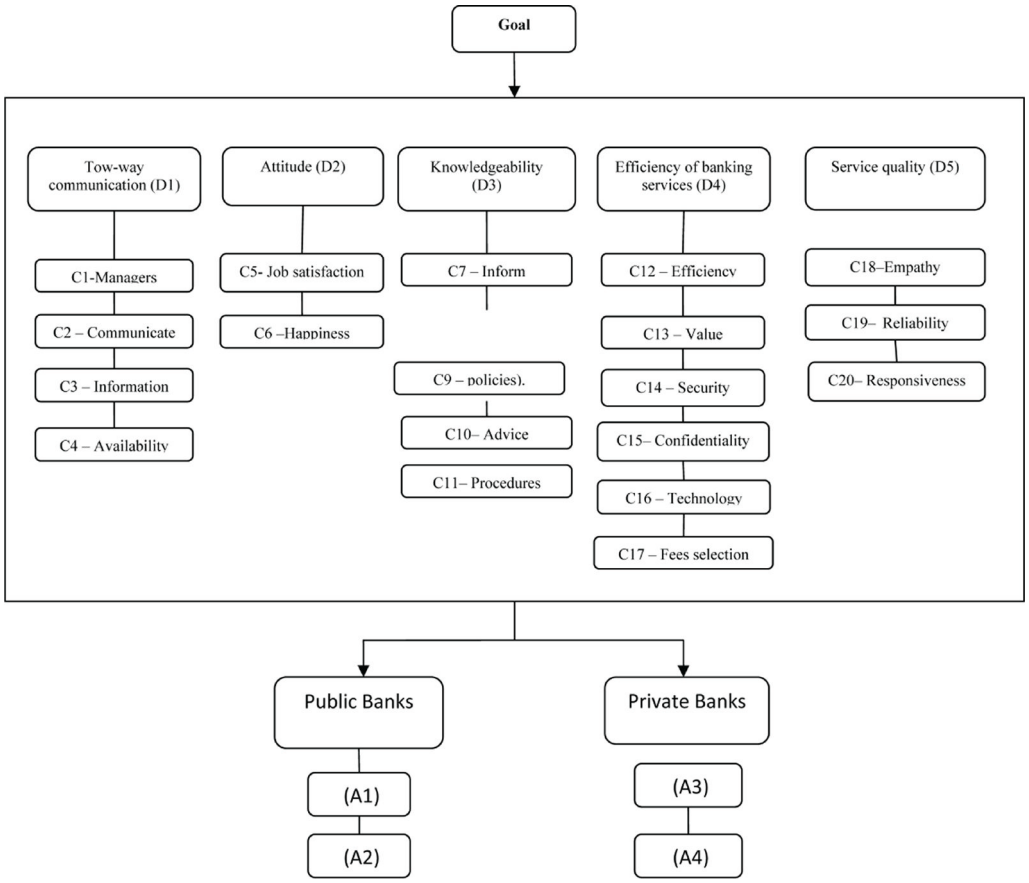
The pair wise comparisons matrices of criteria related to the goal, and comparison matrices for evaluators of criteria with respect to four alternatives are attained from a verbal questionnaire filled by ten different experts.The comparison matrix for one evaluator for twenty main criteria with respect to the overall goal is formed.

Step 6: The results of step 6 are shown in the rest of paper;

Step 7: Because of limitation of space converting for one evaluator which is applied in Step 5 is not shown;

Step 8: Table 4 shows defuzzyfication of matrix for one evaluator from step 7;

Figure 6. The network scheme



Step 9: Aggregation and applying fuzzy ANP for;

Step 10-12: Calculating the final weights with respect to goal (Table5) and crisp integrated values for four alternatives with respect to each criterion are computed.

The results of step 6 and 10-12 are shown in Table 6 and it is called direct relation matrix.

Step 13: Calculate weights using Fuzzy DEMATEL.

In Table 6, the aggregated direct relation matrix is shown. Then, the normalized direct-influence matrix X for criteria can be calculated by Equations (12) and (13), (see Table 7). Third, the total direct-influence matrix S for criteria/dimensions was derived based on Equation (14), (see Table 8).

This article constructs a suitable evaluation hierarchical network framework which is included interdependent, dependent and independent structure based on total influence matrix for dimensions which are group of criteria.

The sum of rows and the sum of columns are separately denoted as vector D and vector R in the following equations (Table 9). We can obtain a useful causal diagram and evaluation hierarchical/network framework by calculating the $D+R$ and $D–R$ (Table 10).The horizontal axis vector (D+R) named ‘‘Prominence” is made by adding D to R, which reveals how much importance the criterion has. Similarly, the vertical axis (D–R) named ‘‘Relation” is made by subtracting D from R, which may group criteria into a cause group. Or, if the (D–R) is negative, the criterion is grouped

Table 4. The final crisp value of one evaluator

Goal	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10
C1	1	0.700107	0.334538	0.40369	0.510052	0.510052	0.40369	0.40369	0.40369	0.700107
C2	1.512533	1	0.40369	0.40369	0.510052	0.510052	0.40369	0.700107	0.40369	1.155628
C3	2.964636	2.480602	1	1	1.512533	2.480602	1.996567	1.996567	1.028498	2.480602
C4	2.480602	2.480602	1	1	1.996567	1.996567	1.512533	1.512533	1.028498	2.480602
C5	1.996567	1.996567	0.700107	0.510052	1	1	1.028498	1.155628	0.700107	1.512533
C6	1.996567	1.996567	0.40369	0.510052	1	1	1.155628	0.700107	0.700107	1.512533
C7	2.480602	2.480602	0.510052	0.700107	1.155628	1.028498	1	1	1.028498	1.996567
C8	2.480602	1.512533	0.510052	0.700107	1.028498	1.512533	1	1	1	1.996567
C9	2.480602	2.480602	1.155628	1.155628	1.512533	1.512533	1.155628	1	1	1.996567
C10	1	1.028498	0.40369	0.40369	0.700107	0.700107	0.510052	0.510052	0.510052	1
C11	2.964636	2.964636	1	1.028498	1.996567	2.964636	1.028498	1.028498	1.155628	2.964636
C12	1.512533	1	0.40369	0.40369	0.510052	0.700107	0.510052	0.510052	0.40369	0.700107
C13	1.028498	1	0.40369	0.40369	0.510052	0.700107	0.510052	0.510052	0.40369	2.480602
C14	1.996567	1.996567	0.700107	0.510052	1.155628	1.155628	1	1.155628	1.155628	0.510052
C15	1.028498	0.510052	0.40369	0.40369	0.40369	0.510052	0.40369	0.40369	0.40369	0.700107
C16	1.028498	0.40369	0.40369	0.40369	0.40369	0.510052	0.40369	0.40369	0.40369	0.40369
C17	1.028498	0.40369	0.334538	0.334538	0.40369	0.510052	0.334538	0.40369	0.334538	0.334538
C18	1.512533	1.512533	0.40369	0.700107	0.510052	0.700107	0.510052	0.334538	0.334538	0.510052
C19	1.028498	1.512533	0.700107	1.155628	1.155628	1.512533	0.700107	0.700107	1.155628	1.996567
C20	1.512533	1.512533	0.700107	0.510052	0.510052	1.155628	0.510052	0.510052	0.40369	1.028498
Goal	**C11**	**C12**	**C13**	**C14**	**C15**	**C16**	**C17**	**C18**	**C19**	**C20**
C1	0.334538	0.700107	1.155628	0.510052	1	1	1.155628	0.700107	0.700107	0.700107
C2	0.334538	1	1	0.510052	1.996567	2.480602	2.480602	0.700107	0.700107	0.700107
C3	1	2.480602	2.480602	1.512533	2.480602	2.480602	2.964636	2.480602	1.512533	1.512533
C4	1.155628	2.480602	2.480602	1.996567	2.480602	2.480602	2.964636	1.512533	1.028498	1.996567
C5	0.510052	1.996567	1.996567	1.028498	2.480602	2.480602	2.480602	1.996567	1.028498	1.996567
C6	0.334538	1.512533	1.996567	1.028498	1.996567	1.996567	1.996567	1.512533	1.028498	1.512533
C7	1.155628	1.996567	1.996567	1	2.480602	2.480602	2.964636	1.996567	1.512533	1.996567
C8	1.155628	1.996567	1.996567	1.028498	2.480602	2.480602	2.480602	2.964636	1.512533	1.996567
C9	1.028498	2.480602	2.480602	1.028498	2.480602	2.480602	2.964636	2.964636	1.028498	2.480602
C10	0.334538	1.512533	0.40369	1.996567	1.512533	2.480602	2.964636	1.996567	0.510052	1.155628
C11	1	2.480602	2.480602	1.512533	2.964636	2.964636	2.964636	2.480602	1.512533	2.480602
C12	0.40369	1	1	0.510052	1	2.480602	2.480602	1.512533	0.510052	1.155628
C13	0.40369	1	1	0.510052	1.028498	1.996567	1.996567	1.028498	0.700107	1
C14	0.700107	1.996567	1.996567	1	2.480602	2.480602	2.480602	1.996567	1	1.512533
C15	0.334538	1	1.155628	0.40369	1	1	1	1.996567	0.510052	0.700107
C16	0.334538	0.40369	0.510052	0.40369	1	1	1	0.510052	0.40369	0.510052
C17	0.334538	0.40369	0.510052	0.40369	1	1	1	0.510052	0.40369	1.155628

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Table 4. Continued

C18	0.40369	0.700107	1.155628	0.510052	1.155628	1.996567	1.996567	1	0.510052	0.700107
C19	0.700107	1.996567	1.512533	1	1.996567	2.480602	2.480602	1.996567	1	0.40369
C20	0.40369	1.028498	1	0.700107	1.512533	1.996567	1.028498	1.512533	2.480602	1

Table 5. Aggregation and final weights and crisp integrated values for twelve main criteria with respect to goal

Goal	**c1**	**c2**	**c3**	**c4**	**c5**	**c6**	**c7**	**c8**	**c9**	**c10**
C1	1	0.365	0.654	0.143	0.674	0.322	0.183	0.144	0.094	0.583
C2	0.267	1	0.284	0.4303	0.514	0.267	0.267	0.289	0.389	0.365
C3	0.788	0.53	1	0.262	0.622	0.564	0.471	0.601	0.152	0.81
C4	0.143	0.516	0.062	1	0.43	0.498	0.217	0.094	0.476	0.404
C5	0.176	0.246	0.415	0.343	1	0.767	0.665	0.624	0.647	0.674
C6	0.1	0.116	0.2	0.143	0.78	1	0.523	0.442	0.624	0.804
C7	0.175	0.143	0.273	0.152	0.73	0.73	1	0.356	0.284	0.788
C8	0.447	0.124	0.379	0.143	0.684	0.718	0.788	1	0.162	0.833
C9	0.066	0.044	0.041	0.703	0.738	0.718	0.295	0.289	1	0.71
C10	0.356	0.262	0.42	0.279	0.507	0.103	0.647	0.551	0.577	1
C11	0.087	0.152	0.045	0.284	0.536	0.389	0.262	0.128	0.056	0.751
C12	0.29	0.033	0.045	0.495	0.73	0.691	0.483	0.691	0.797	0.819
C13	0.24	0.062	0.323	0.303	0.738	0.819	0.788	0.616	0.471	0.81
C14	0.404	0.045	0.356	0.044	0.665	0.57	0.767	0.379	0.547	0.89
C15	0.432	0.044	0.407	0.045	0.73	0.761	0.767	0.447	0.195	0.78
C16	0.432	0.295	0.414	0.044	0.433	0.718	0.679	0.691	0.195	0.733
C17	0.314	0.284	0.303	0.322	0.415	0.508	0.856	0.629	0.343	0.819
C18	0.217	0.047	0.044	0.267	0.833	0.107	0.775	0.2	0.045	0.684
C19	0.453	0.044	0.295	0.314	0.767	0.43	0.732	0.42	0.503	0.866
C20	0.24	0.41	0.045	0.492	0.759	0.842	0.37	0.322	0.489	0.754

Goal	**c11**	**c12**	**c13**	**c14**	**c15**	**c16**	**c17**	**c18**	**c19**	**c20**	**Weights**
C1	0.041	0.267	0.231	0.335	0.71	0.288	0.631	0.132	0.132	0.066	0.035813
C2	0.736	0.302	0.32	0.834	0.335	0.322	0.556	0.302	0.323	0.246	0.042741
C3	0.124	0.607	0.323	0.819	0.649	0.583	0.54	0.104	0.156	0.141	0.050409
C4	0.094	0.797	0.624	0.343	0.365	0.262	0.32	0.176	0.583	0.782	0.04191
C5	0.158	0.583	0.477	0.46	0.58	0.356	0.751	0.343	0.7	0.322	0.052667
C6	0.379	0.607	0.819	0.759	0.541	0.527	0.866	0.217	0.389	0.72	0.054044
C7	0.163	0.547	0.718	0.81	0.718	0.477	0.81	0.842	0.746	0.365	0.055432
C8	0.085	0.691	0.703	0.738	0.71	0.46	0.866	0.094	0.767	0.143	0.053937
C9	0.2	0.833	0.775	0.78	0.24	0.62	0.761	0.231	0.188	0.566	0.050163
C10	0.37	0.166	0.506	0.168	0.477	0.404	0.172	0.359	0.501	0.114	0.040646

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Table 5. Continued

C11	1	0.496	0.365	0.555	0.303	0.751	0.866	0.381	0.348	0.442	0.041967
C12	0.303	1	0.738	0.788	0.471	0.54	0.658	0.303	0.561	0.797	0.05751
C13	0.284	0.71	1	0.842	0.52	0.577	0.593	0.295	0.488	0.606	0.056753
C14	0.295	0.583	0.629	1	0.866	0.622	0.842	0.303	0.71	0.366	0.055718
C15	0.295	0.738	0.718	0.819	1	0.654	0.78	0.356	0.447	0.458	0.055667
C16	0.303	0.488	0.672	0.698	0.819	1	0.782	0.303	0.767	0.366	0.055457
C17	0.303	0.336	0.527	0.476	0.52	0.601	1	0.365	0.47	0.43	0.050281
C18	0.303	0.314	0.379	0.335	0.404	0.326	0.833	1	0.583	0.335	0.041117
C19	0.295	0.629	0.502	0.561	0.495	0.488	0.767	0.295	1	0.322	0.052109
C20	0.295	0.89	0.698	0.767	0.458	0.5	0.94	0.295	0.305	1	0.055657

Table 6. Direct relation matrix

	C1	**C2**	**C3**	**C4**	**C5**	**C6**	**C7**	**C8**	**C9**	**C10**
C1	1	0.365148	0.766763	0.142903	0.674109	0.32201	0.482617	0.447029	0.094281	0.582777
c2	0.266667	1	0.283968	0.303319	0.513928	0.266667	0.266667	0.289397	0.388839	0.365148
C3	0.78824	0.529945	1	0.261553	0.622491	0.564327	0.470978	0.600939	0.152174	0.810319
C4	0.142903	0.515842	0.062202	1	0.430232	0.497657	0.216601	0.094281	0.476032	0.40402
C5	0.175934	0.245618	0.415337	0.342901	1	0.766763	0.664912	0.624401	0.646795	0.674109
C6	0.100398	0.116073	0.200116	0.142903	0.779871	1	0.522714	0.442283	0.624401	0.804176
C7	0.174948	0.142903	0.272599	0.152174	0.730116	0.730116	1	0.356289	0.283968	0.78824
C8	0.447029	0.123604	0.379405	0.142903	0.683536	0.717844	0.78824	1	0.162047	0.833016
C9	0.066238	0.043701	0.041038	0.702682	0.737951	0.717844	0.295054	0.289397	1	0.710223
C10	0.356289	0.262356	0.419794	0.278522	0.506916	0.602783	0.646795	0.750567	0.57659	1
C11	0.087105	0.152174	0.045407	0.283968	0.535631	0.388839	0.262356	0.12843	0.055902	0.750567
C12	0.290285	0.033333	0.045407	0.494866	0.730116	0.690871	0.482617	0.690871	0.796699	0.819014
C13	0.239659	0.062202	0.322998	0.303319	0.737951	0.819014	0.78824	0.615882	0.470907	0.810319
C14	0.40402	0.045407	0.356289	0.043701	0.664912	0.570468	0.766763	0.379405	0.547271	0.889783
C15	0.431552	0.043701	0.406503	0.045407	0.730116	0.760949	0.766763	0.447029	0.194663	0.779871
C16	0.431552	0.295054	0.414066	0.043701	0.432876	0.717844	0.679259	0.690871	0.194663	0.733333
C17	0.314197	0.283968	0.303319	0.32201	0.415337	0.508472	0.856349	0.629171	0.342901	0.819014
C18	0.216601	0.046679	0.043701	0.266667	0.833016	0.107239	0.774991	0.199504	0.045407	0.683536
C19	0.453213	0.043701	0.295054	0.314197	0.766763	0.430232	0.732357	0.419794	0.502998	0.865539
C20	0.239659	0.409608	0.045407	0.492373	0.758622	0.841955	0.370199	0.32201	0.489292	0.753874
	C11	**C12**	**C13**	**C14**	**C15**	**C16**	**C17**	**C18**	**C19**	**C20**
C1	0.041038	0.266667	0.230653	0.334582	0.710223	0.78824	0.631102	0.131623	0.216601	0.066238
c2	0.365148	0.302391	0.320204	0.482617	0.334582	0.32201	0.356289	0.302391	0.322998	0.245618
C3	0.123604	0.607388	0.322998	0.819014	0.648779	0.582777	0.539804	0.104317	0.568638	0.140593
C4	0.094281	0.796699	0.624401	0.342901	0.365148	0.261553	0.320204	0.175934	0.582777	0.782264

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Table 6. Continued

C5	0.158116	0.582777	0.477493	0.459551	0.580134	0.356289	0.750567	0.342901	0.700428	0.32201
C6	0.379405	0.607388	0.819014	0.758622	0.541461	0.526707	0.865539	0.216601	0.388839	0.720047
C7	0.162545	0.547271	0.717844	0.810319	0.717844	0.477493	0.810319	0.841955	0.74587	0.365148
C8	0.084732	0.690871	0.702682	0.737951	0.710223	0.459551	0.865539	0.094281	0.766763	0.142903
C9	0.200116	0.833016	0.774991	0.779871	0.239659	0.619668	0.760949	0.230653	0.487869	0.773959
C10	0.370199	0.622491	0.60553	0.683536	0.477493	0.40402	0.771591	0.359245	0.501459	0.513928
C11	1	0.496135	0.365148	0.554841	0.303319	0.750567	0.865539	0.380569	0.347645	0.442283
C12	0.303319	1	0.737951	0.78824	0.470978	0.539804	0.657852	0.303319	0.560879	0.796699
C13	0.283968	0.710223	1	0.841955	0.519521	0.576503	0.59274	0.295054	0.487869	0.60553
C14	0.295054	0.582777	0.629171	1	0.865539	0.622491	0.841955	0.303319	0.710223	0.366269
C15	0.295054	0.737951	0.717844	0.819014	1	0.653735	0.779871	0.356289	0.447029	0.458145
C16	0.303319	0.487869	0.672047	0.698285	0.819014	1	0.782264	0.303319	0.766763	0.366269
C17	0.303319	0.335608	0.526707	0.476032	0.519521	0.600939	1	0.365148	0.469537	0.430232
C18	0.303319	0.314197	0.379405	0.334582	0.40402	0.326464	0.833016	1	0.582777	0.334582
C19	0.295054	0.629171	0.501534	0.560879	0.494617	0.487869	0.766763	0.295054	1	0.32201
C20	0.295054	0.889783	0.698285	0.766763	0.458145	0.5	0.940328	0.295054	0.304747	1

Table 7. Normalized direct-influence matrix

	c1	**c2**	**c3**	**c4**	**c5**	**c6**	**c7**	**c8**	**c9**	**c10**
c1	0.06171	0.022533	0.047309	0.008817	0.041593	0.019868	0.029777	0.027582	0.005817	0.035957
c2	0.016456	0.0617	0.017521	0.018715	0.031709	0.016453	0.016453	0.017856	0.023991	0.02253
c3	0.048642	0.032698	0.0617	0.016138	0.038408	0.034819	0.029059	0.037078	0.009389	0.049997
c4	0.008819	0.031827	0.003838	0.0617	0.026545	0.030705	0.013364	0.005817	0.029371	0.024928
c5	0.010857	0.015155	0.025626	0.021157	0.0617	0.047309	0.041025	0.038526	0.039907	0.041593
c6	0.006196	0.007162	0.012347	0.008817	0.048118	0.0617	0.032251	0.027289	0.038526	0.049618
c7	0.010796	0.008817	0.016819	0.009389	0.045048	0.045048	0.0617	0.021983	0.017521	0.048634
c8	0.027586	0.007626	0.023409	0.008817	0.042174	0.044291	0.048634	0.0617	0.009998	0.051397
c9	0.004088	0.002696	0.002532	0.043355	0.045532	0.044291	0.018205	0.017856	0.0617	0.043821
c10	0.021986	0.016187	0.025901	0.017185	0.031277	0.037192	0.039907	0.04631	0.035576	0.0617
c11	0.005375	0.009389	0.002802	0.017521	0.033048	0.023991	0.016187	0.007924	0.003449	0.04631
c12	0.017913	0.002057	0.002802	0.030533	0.045048	0.042627	0.029777	0.042627	0.049156	0.050533
c13	0.014789	0.003838	0.019929	0.018715	0.045532	0.050533	0.048634	0.038	0.029055	0.049997
c14	0.024932	0.002802	0.021983	0.002696	0.041025	0.035198	0.047309	0.023409	0.033767	0.0549
c15	0.026631	0.002696	0.025081	0.002802	0.045048	0.046951	0.047309	0.027582	0.012011	0.048118
c16	0.026631	0.018205	0.025548	0.002696	0.026708	0.044291	0.04191	0.042627	0.012011	0.045247
c17	0.019389	0.017521	0.018715	0.019868	0.025626	0.031373	0.052837	0.03882	0.021157	0.050533
c18	0.013366	0.00288	0.002696	0.016453	0.051397	0.006617	0.047817	0.012309	0.002802	0.042174
c19	0.027968	0.002696	0.018205	0.019386	0.047309	0.026545	0.045186	0.025901	0.031035	0.053404

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Table 7. Continued

c20	0.014789	0.025273	0.002802	0.030379	0.046807	0.051949	0.022841	0.019868	0.030189	0.046514
	c11	**c12**	**c13**	**c14**	**c15**	**c16**	**c17**	**c18**	**c19**	**c20**
c1	0.02595	0.04168	0.03	0.032	0.043	0.04509	0.03604	0.029	0.03009	0.025
c2	0.0499	0.05156	0.059	0.053	0.048	0.0501	0.04705	0.047	0.04714	0.055
c3	0.03693	0.04561	0.039	0.049	0.048	0.04709	0.04104	0.035	0.04514	0.035
c4	0.07884	0.0476	0.048	0.048	0.046	0.04409	0.04805	0.048	0.04614	0.05
c5	0.03992	0.04661	0.044	0.043	0.047	0.04208	0.04705	0.047	0.05015	0.043
c6	0.0489	0.04661	0.044	0.044	0.044	0.04409	0.04605	0.044	0.05617	0.042
c7	0.03792	0.04661	0.052	0.052	0.053	0.04709	0.05005	0.07	0.05316	0.046
c8	0.04291	0.05057	0.052	0.051	0.053	0.04709	0.05105	0.039	0.05416	0.039
c9	0.0499	0.0585	0.053	0.052	0.047	0.0491	0.04805	0.047	0.04915	0.061
c10	0.02994	0.04209	0.04	0.033	0.034	0.03206	0.03103	0.032	0.03912	0.051
c11	0.05289	0.05454	0.056	0.056	0.058	0.05611	0.05305	0.057	0.05617	0.048
c12	0.03992	0.03768	0.042	0.04	0.043	0.04509	0.04905	0.045	0.04112	0.043
c13	0.0509	0.03669	0.034	0.037	0.033	0.04509	0.04204	0.042	0.0341	0.04
c14	0.0499	0.04859	0.05	0.056	0.057	0.0521	0.05105	0.048	0.05316	0.046
c15	0.04092	0.02876	0.029	0.032	0.03	0.03006	0.02903	0.034	0.03009	0.029
c16	0.04491	0.04462	0.05	0.049	0.055	0.06012	0.04905	0.047	0.05316	0.045
c17	0.04092	0.02876	0.029	0.032	0.03	0.03006	0.02903	0.034	0.03009	0.029
c18	0.04691	0.03074	0.033	0.031	0.034	0.03206	0.04004	0.067	0.03912	0.034
c19	0.03094	0.05454	0.051	0.05	0.045	0.04609	0.05105	0.046	0.04112	0.066
c20	0.04491	0.03471	0.036	0.04	0.036	0.03707	0.04204	0.042	0.04714	0.037

Table 8. Total direct-influence matrix S

	c1	**c2**	**c3**	**c4**	**c5**	**c6**	**c7**	**c8**	**c9**	**c10**
c1	0.06893	0.05095	0.06206	0.02994	0.03781	0.03194	0.036	0.03893	0.027	0.03596
c2	0.04496	0.03696	0.04905	0.0499	0.04975	0.05489	0.053	0.04918	0.052	0.05095
c3	0.06693	0.06793	0.07908	0.04291	0.04378	0.04391	0.042	0.05021	0.036	0.04695
c4	0.04895	0.04995	0.05205	0.04691	0.04776	0.0479	0.049	0.05635	0.053	0.05295
c5	0.03996	0.04695	0.05105	0.0499	0.05274	0.0509	0.048	0.05225	0.055	0.04496
c6	0.05095	0.03297	0.04505	0.04691	0.04776	0.04192	0.049	0.04508	0.049	0.04795
c7	0.04196	0.04096	0.04705	0.04092	0.04975	0.0509	0.058	0.04611	0.044	0.04995
c8	0.05495	0.03996	0.05305	0.03992	0.04876	0.0519	0.054	0.0666	0.041	0.05095
c9	0.04595	0.03497	0.03604	0.06088	0.03582	0.0519	0.046	0.04816	0.063	0.05095
c10	0.02997	0.06094	0.02603	0.07784	0.03383	0.03693	0.03	0.02869	0.043	0.03297
c11	0.05794	0.03596	0.05806	0.03792	0.05473	0.05489	0.055	0.05635	0.057	0.04995
c12	0.04296	0.04795	0.04404	0.04491	0.04279	0.04192	0.05	0.04918	0.041	0.04496
c13	0.02897	0.03497	0.02703	0.03992	0.04378	0.03493	0.032	0.0543	0.028	0.03996

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Table 8. Continued

c14	0.05195	0.03497	0.05205	0.03593	0.05075	0.0489	0.053	0.03074	0.054	0.05195
c15	0.03297	0.09191	0.03503	0.03792	0.03284	0.02794	0.028	0.03074	0.035	0.02897
c16	0.05295	0.05195	0.05405	0.03393	0.04975	0.0509	0.05	0.04406	0.04	0.04795
c17	0.02297	0.09191	0.03503	0.02792	0.03284	0.02794	0.028	0.03074	0.035	0.02897
c18	0.03297	0.02597	0.02603	0.03792	0.04179	0.02695	0.043	0.03074	0.026	0.03696
c19	0.04196	0.06094	0.03403	0.05888	0.04876	0.05289	0.042	0.04406	0.051	0.04795
c20	0.03996	0.04496	0.04004	0.04092	0.04378	0.03792	0.043	0.04201	0.041	0.04096
	c11	**c12**	**c13**	**c14**	**c15**	**c16**	**c17**	**c18**	**c19**	**c20**
c1	0.002532	0.016453	0.014231	0.020644	0.043821	0.048634	0.038939	0.008121	0.013364	0.004087
c2	0.02253	0.018658	0.019757	0.029777	0.020644	0.019868	0.021983	0.018658	0.019929	0.015155
c3	0.007626	0.037476	0.019929	0.050533	0.04003	0.035957	0.033306	0.006436	0.035085	0.008675
c4	0.005817	0.049156	0.038526	0.021157	0.02253	0.016138	0.019757	0.010855	0.035957	0.048266
c5	0.009756	0.035957	0.029461	0.028354	0.035794	0.021983	0.04631	0.021157	0.043216	0.019868
c6	0.023409	0.037476	0.050533	0.046807	0.033408	0.032498	0.053404	0.013364	0.023991	0.044427
c7	0.010029	0.033767	0.044291	0.049997	0.044291	0.029461	0.049997	0.051949	0.04602	0.02253
c8	0.005228	0.042627	0.043355	0.045532	0.043821	0.028354	0.053404	0.005817	0.047309	0.008817
c9	0.012347	0.051397	0.047817	0.048118	0.014787	0.038233	0.046951	0.014231	0.030102	0.047753
c10	0.022841	0.038408	0.037361	0.042174	0.029461	0.024928	0.047607	0.022165	0.03094	0.031709
c11	0.0617	0.030612	0.02253	0.034234	0.018715	0.04631	0.053404	0.023481	0.02145	0.027289
c12	0.018715	0.0617	0.045532	0.048634	0.029059	0.033306	0.040589	0.018715	0.034606	0.049156
c13	0.017521	0.043821	0.0617	0.051949	0.032054	0.03557	0.036572	0.018205	0.030102	0.037361
c14	0.018205	0.035957	0.03882	0.0617	0.053404	0.038408	0.051949	0.018715	0.043821	0.022599
c15	0.018205	0.045532	0.044291	0.050533	0.0617	0.040335	0.048118	0.021983	0.027582	0.028268
c16	0.018715	0.030102	0.041465	0.043084	0.050533	0.0617	0.048266	0.018715	0.047309	0.022599
c17	0.018715	0.020707	0.032498	0.029371	0.032054	0.037078	0.0617	0.02253	0.02897	0.026545
c18	0.018715	0.019386	0.023409	0.020644	0.024928	0.020143	0.051397	0.0617	0.035957	0.020644
c19	0.018205	0.03882	0.030945	0.034606	0.030518	0.030102	0.047309	0.018205	0.0617	0.019868
c20	0.018205	0.0549	0.043084	0.047309	0.028268	0.03085	0.058018	0.018205	0.018803	0.0617

into the effect group. Therefore, the causal diagram can be acquired by mapping the dataset of the (D+R, D–R), providing valuable insight for making decisions al diagram is shown in Figure 7.

Important cues can be obtained for making decisions from the causal diagram (Figure 4). Consider the results D1 (Tow-way communication), D2 (Attitude), D3 (knowledgeability) are grouped into the cause group, and D4 (efficiency of banking services), D5 (service quality) are grouped into the effect group. If the banks wanted to obtain high performances in terms of the effect group factors, it would be necessary to control and pay attention to the cause group criteria beforehand. This is because the cause group criteria imply the meaning of the influencing criteria, whereas the effect group criteria imply the meaning of the influenced criteria (Fontela & Gabus, 1976). In other words, the cause group criteria are difficult to move, while the effect group criteria are easily moved.

Table 9. Total-influence matrix S for dimensions

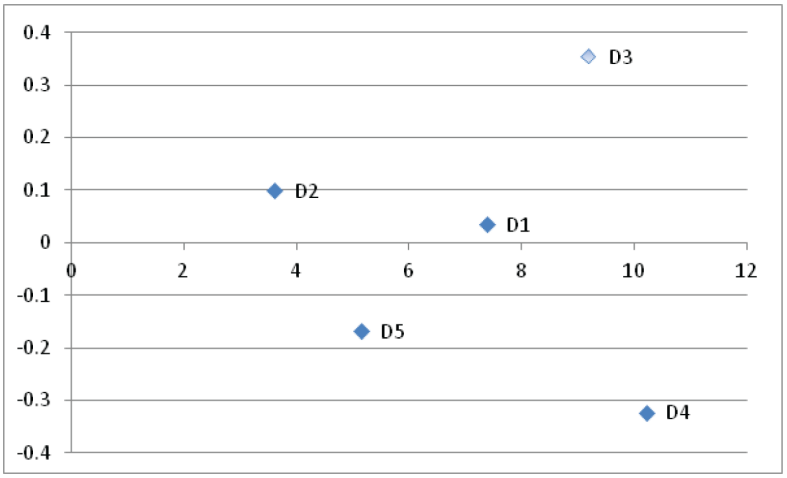
	D1	D2	D3	D4	D5	Di
D1	0.84746	0.35774	0.9211	1.088	0.49251	3.70681
D2	0.36374	0.19332	0.48006	0.53849	0.28232	1.85793
D3	0.92127	0.46941	1.18524	1.45899	0.74176	4.77667
D4	1.05419	0.48528	1.22399	1.46487	0.72372	4.95205
D5	0.48458	0.25209	0.61144	0.72434	0.41938	2.49183
Ri	3.67124	1.75784	4.42183	5.27469	2.65969	

Table 10. Calculation D+R and D-R

	DI	RI	RI+DI	DI-RI
D1	3.70681	3.67124	7.37805	0.03557
D2	1.85793	1.75784	3.61577	0.10009
D3	4.77667	4.42183	9.1985	0.35484
D4	4.95205	5.27469	10.22674	-0.32264
D5	2.49183	2.65969	5.15152	-0.16786

After performing Fuzzy DEMATEL method steps, weight among the criteria for each criterion will be calculated. The calculated weights enter to supermatrix in Fuzzy ANP. Table 11 shows weights of inner dependency among the criteria by normalizing matrix S using Equation (18). The normalized total-relation matrix can be entered to the un-weighted supermatrix directly.

Figure 7. The casual diagram between criteria



Step 14-15: Combine Fuzzy DEMATEL and Fuzzy ANP.

In this step, ranking and selecting the best alternative among banks after completing super-matrix by using Fuzzy ANP is obtained and by this technique the final weights of alternatives will be calculated.

By using the results from DEMATEL and the weights, the supermatrix can be constructed. Table 12 shows unweighted supermatrix. To achieve weighted supermatrix at first the columns of unweighted supermatrix must be normalized, it means, the sum of each column of the unweighted matrix should be equal to 1. The weighted super-matrix is shown in Table 13. To obtain the limited supermatrix, weighted matrix is raised to the power

Table 11. Normalizing matrix T

	c1	c2	c3	c4	c5	c6	c7	c8	c9	c10
c1	0.076665	0.051777	0.068506	0.033938	0.042504	0.036786	0.040495	0.043522	0.030999	0.040719
c2	0.050005	0.03756	0.054145	0.056563	0.055926	0.063218	0.059618	0.054982	0.059701	0.057693
c3	0.07444	0.069032	0.087294	0.04864	0.049215	0.050572	0.047244	0.056133	0.041332	0.053164
c4	0.054443	0.050761	0.057457	0.053174	0.053689	0.055167	0.055118	0.062997	0.06085	0.059958
c5	0.044444	0.047712	0.056353	0.056563	0.059287	0.058622	0.053993	0.058414	0.063146	0.05091
c6	0.056667	0.033505	0.04973	0.053174	0.053689	0.04828	0.055118	0.050398	0.056257	0.054296
c7	0.046668	0.041625	0.051937	0.046384	0.055926	0.058622	0.065242	0.05155	0.050517	0.056561
c8	0.061116	0.040609	0.058561	0.045251	0.054813	0.059774	0.060742	0.074457	0.047072	0.057693
c9	0.051106	0.035538	0.039784	0.069009	0.040267	0.059774	0.051744	0.053841	0.072331	0.057693
c10	0.033333	0.061929	0.028734	0.088234	0.03803	0.042533	0.033746	0.032075	0.049369	0.037334
c11	0.064442	0.036544	0.064091	0.042983	0.061524	0.063218	0.061867	0.062997	0.065442	0.056561
c12	0.047781	0.048728	0.048615	0.050907	0.048102	0.04828	0.056243	0.054982	0.047072	0.05091
c13	0.032221	0.035538	0.029838	0.045251	0.049215	0.040229	0.035996	0.060706	0.032147	0.045249
c14	0.057779	0.035538	0.057457	0.040728	0.05705	0.056319	0.059618	0.034366	0.061998	0.058826
c15	0.03667	0.093402	0.038669	0.042983	0.036917	0.032179	0.031496	0.034366	0.040184	0.032804
c16	0.058892	0.052793	0.059664	0.038461	0.055926	0.058622	0.056243	0.049258	0.045924	0.054296
c17	0.025547	0.093402	0.038669	0.031648	0.036917	0.032179	0.031496	0.034366	0.040184	0.032804
c18	0.03667	0.026391	0.028734	0.042983	0.046978	0.031039	0.048369	0.034366	0.029851	0.041852
c19	0.046668	0.061929	0.037565	0.066742	0.054813	0.060914	0.047244	0.049258	0.058553	0.054296
c20	0.044444	0.04569	0.044199	0.046384	0.049215	0.043673	0.048369	0.046966	0.047072	0.046381
	c11	**c12**	**c13**	**c14**	**c15**	**c16**	**c17**	**c18**	**c19**	**c20**
c1	0.029348	0.047522	0.034443	0.036364	0.048643	0.051138	0.040913	0.032222	0.033594	0.02907
c2	0.056433	0.058787	0.067738	0.060227	0.054299	0.05682	0.053412	0.052222	0.05263	0.063953
c3	0.041765	0.052003	0.044776	0.055682	0.054299	0.053406	0.046589	0.038889	0.050397	0.040698
c4	0.089162	0.054272	0.055109	0.054545	0.052036	0.050004	0.054547	0.053333	0.051513	0.05814
c5	0.045147	0.053143	0.050517	0.048864	0.053167	0.047724	0.053412	0.052222	0.05599	0.05
c6	0.055302	0.053143	0.050517	0.05	0.049774	0.050004	0.052277	0.048889	0.062711	0.048837
c7	0.042885	0.053143	0.059701	0.059091	0.059955	0.053406	0.056818	0.077778	0.059351	0.053488
c8	0.048528	0.057658	0.059701	0.057955	0.059955	0.053406	0.057953	0.043333	0.060467	0.045349
c9	0.056433	0.066699	0.06085	0.059091	0.053167	0.055686	0.054547	0.052222	0.054874	0.07093
c10	0.03386	0.047989	0.045924	0.0375	0.038462	0.03636	0.035226	0.035556	0.043676	0.059302
c11	0.059815	0.062184	0.064294	0.063636	0.065611	0.063636	0.060223	0.063333	0.062711	0.055814
c12	0.045147	0.042961	0.04822	0.045455	0.048643	0.051138	0.055682	0.05	0.045909	0.05
c13	0.057564	0.041832	0.039036	0.042045	0.03733	0.051138	0.047724	0.046667	0.038071	0.046512
c14	0.056433	0.0554	0.057405	0.063636	0.06448	0.059088	0.057953	0.053333	0.059351	0.053488
c15	0.046278	0.032791	0.033295	0.036364	0.033937	0.034092	0.032955	0.037778	0.033594	0.033721
c16	0.05079	0.050874	0.057405	0.055682	0.062217	0.068184	0.055682	0.052222	0.059351	0.052326
c17	0.046278	0.032791	0.033295	0.036364	0.033937	0.034092	0.032955	0.037778	0.033594	0.033721

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Table 11. Continued

c18	0.053052	0.035049	0.037887	0.035227	0.038462	0.03636	0.045454	0.074444	0.043676	0.039535
c19	0.034991	0.062184	0.058553	0.056818	0.050905	0.052272	0.057953	0.051111	0.045909	0.076744
c20	0.05079	0.039575	0.041332	0.045455	0.040724	0.042042	0.047724	0.046667	0.05263	0.043023

of *2p +1*; where *p* is an arbitrarily large number until it reaches the convergence. The results are provided in Table 14 named the limited supermatrix. Finally, having the limited supermatrix, the global priorities of all the elements (alternatives, criteria) can be obtained.

The final ranking of the banks shown in Table 14, A2 has first score and second bank is A1. The result can identify that private banks are most preferable prior to 20 service quality expectation and customer relation management criteria among the four banks in.

According to the analysis results, effect criteria C12, C13, C14, C15, C16, C17, C18, C19, C20 are difficult to be changed. This implies that it is an effective way to expand service quality expectation by the causal criteria group (C1, C2, C3, C4, C5, C6, C7, C8, C9, C10, C11). Further, these criteria can be regarded as the critical criteria in guiding the right benchmark for banks.

According to results, among these 20 criteria, C11 is the most important criterion because it has the highest weight of relation to other criteria; moreover, C2 is the most influencing criterion.

As a result of the above-mentioned calculations and based on Table 14,according the normal weights of twenty criteria the best non-fuzzy performance criteria ranking is:

C11 > C2 > C4 > C8> C9 > C16 > C7 > C14 > C19 > C5 > C3 > C6 > C12 > C20 > C13 > C10 > C1 > C18 > C15 > C17.

The top three important criteria descriptions are as follows:

1. Customers will have a better relationship with bank if the employees of bank know the bank's procedures of delivering services,
2. Customer relationship with bank depends on whether bank's employees communicate effectively, and
3. Bank regularly informs when certain services will be available and/or unavailable.

6. CONCLUSION

The role of CRM in the development and management of banking services has been a subject of debate, discussion and research. The practice of CRM and service quality is critical component of communication management processes in Iranian banks but unfortunately applications of CRM are not desirable. This paper is about identifying important criteria and ranking banks from viewpoint of customer relation management and service quality by multi criteria decision making and fuzzy ANP and fuzzy DEMATEL in banking industrial in Iran. Fuzzy DEMATEL method proposed in this study is comprehensive and applicable to other industries that require group decision making in a fuzzy environment to segment complex criteria and decision making and by this method we obtained weights of inner relation between twenty criteria of customer relation management and service quality. Moreover, the Fuzzy DEMATEL not only can be used as a way to handle the inner dependences within a set of criteria, but also can produce more valuable information for causal and effect relationship.

Table 12. Un-weighted supermatrix

	a1	a2	a3	a4	C1	C2	c3	c4	c5	c6	c7	c8	c9
a1	0	0	0	0	0.270847	0.244386	0.31087	0.250497	0.252687	0.25483	0.352	0.272789	0.31087
a2	0	0	0	0	0.249259	0.275473	0.224074	0.275899	0.250205	0.249013	0.20734	0.278185	0.224074
a3	0	0	0	0	0.23255	0.250671	0.218484	0.23394	0.263686	0.249079	0.223501	0.240901	0.218484
a4	0	0	0	0	0.247344	0.229471	0.246572	0.239664	0.233422	0.247078	0.217159	0.208125	0.246572
C1	0	0	0	0	0.076665	0.051777	0.068506	0.033938	0.042504	0.036786	0.040495	0.043522	0.030999
C2	0	0	0	0	0.050005	0.03756	0.054145	0.056563	0.055926	0.063218	0.059618	0.054982	0.059701
c3	0	0	0	0	0.07444	0.069032	0.087294	0.04864	0.049215	0.050572	0.047244	0.056133	0.041332
c4	0	0	0	0	0.054443	0.050761	0.057457	0.053174	0.053689	0.055167	0.055118	0.062997	0.06085
c5	0	0	0	0	0.044444	0.047712	0.056353	0.056563	0.059287	0.058622	0.053993	0.058414	0.063146
c6	0	0	0	0	0.056667	0.033505	0.04973	0.053174	0.053689	0.04828	0.055118	0.050398	0.056257
c7	0	0	0	0	0.046668	0.041625	0.051937	0.046384	0.055926	0.058622	0.065242	0.05155	0.050517
c8	0	0	0	0	0.061116	0.040609	0.058561	0.045251	0.054813	0.059774	0.060742	0.074457	0.047072
c9	0	0	0	0	0.051106	0.035538	0.039784	0.069009	0.040267	0.059774	0.051744	0.053841	0.072331
c10	0	0	0	0	0.033333	0.061929	0.028734	0.088234	0.03803	0.042533	0.033746	0.032075	0.049369
c11	0	0	0	0	0.064442	0.036544	0.064091	0.042983	0.061524	0.063218	0.061867	0.062997	0.065442
c12	0	0	0	0	0.047781	0.048728	0.048615	0.050907	0.048102	0.04828	0.056243	0.054982	0.047072
c13	0	0	0	0	0.032221	0.035538	0.029838	0.045251	0.049215	0.040229	0.035996	0.060706	0.032147
c14	0	0	0	0	0.057779	0.035538	0.057457	0.040728	0.05705	0.056319	0.059618	0.034366	0.061998
c15	0	0	0	0	0.03667	0.093402	0.038669	0.042983	0.036917	0.032179	0.031496	0.034366	0.040184
c16	0	0	0	0	0.058892	0.052793	0.059664	0.038461	0.055926	0.058622	0.056243	0.049258	0.045924
c17	0	0	0	0	0.025547	0.093402	0.038669	0.031648	0.036917	0.032179	0.031496	0.034366	0.040184
c18	0	0	0	0	0.03667	0.026391	0.028734	0.042983	0.046978	0.031039	0.048369	0.034366	0.029851
c19	0	0	0	0	0.046668	0.061929	0.037565	0.066742	0.054813	0.060914	0.047244	0.049258	0.058553
c20	0	0	0	0	0.044444	0.04569	0.044199	0.046384	0.049215	0.043673	0.048369	0.046966	0.047072
Goal	0	0	0	0	0	0	0	0	0	0	0	0	0

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Table 12. Continued

	c10	c11	c12	c13	c14	c15	c16	c17	c18	c19	c20	Goal
a1	0.257652	0.274202	0.292333	0.350817	0.31087	0.25769	0.31677	0.316753	0.257652	0.367731	0.31087	0
a2	0.251825	0.294166	0.240636	0.25374	0.224074	0.250222	0.214312	0.220982	0.251825	0.200893	0.224074	0
a3	0.250598	0.230553	0.223115	0.193234	0.218484	0.252977	0.239579	0.235806	0.250598	0.22043	0.218484	0
a4	0.239925	0.201079	0.243916	0.202209	0.246572	0.239112	0.229339	0.226459	0.239925	0.210946	0.246572	0
C1	0.040719	0.029348	0.047522	0.034443	0.036364	0.048643	0.051138	0.040913	0.032222	0.033594	0.02907	0.035813
C2	0.057693	0.056433	0.058787	0.067738	0.060227	0.054299	0.05682	0.053412	0.052222	0.05263	0.063953	0.042741
c3	0.053164	0.041765	0.052003	0.044776	0.055682	0.054299	0.053406	0.046589	0.038889	0.050397	0.040698	0.050409
c4	0.059958	0.089162	0.054272	0.055109	0.054545	0.052036	0.050004	0.054547	0.053333	0.051513	0.05814	0.04191
c5	0.05091	0.045147	0.053143	0.050517	0.048864	0.053167	0.047724	0.053412	0.052222	0.05599	0.05	0.052667
c6	0.054296	0.055302	0.053143	0.050517	0.05	0.049774	0.050004	0.052277	0.048889	0.062711	0.048837	0.054044
c7	0.056561	0.042885	0.053143	0.059701	0.059091	0.059955	0.053406	0.056818	0.077778	0.059351	0.053488	0.055432
c8	0.057693	0.048528	0.057658	0.059701	0.057955	0.059955	0.053406	0.057953	0.043333	0.060467	0.045349	0.053937
c9	0.057693	0.056433	0.066699	0.06085	0.059091	0.053167	0.055686	0.054547	0.052222	0.054874	0.07093	0.050163
c10	0.037334	0.03386	0.047989	0.045924	0.0375	0.038462	0.03636	0.035226	0.035556	0.043676	0.059302	0.040646
c11	0.056561	0.059815	0.062184	0.064294	0.063636	0.065611	0.063636	0.060223	0.063333	0.062711	0.055814	0.041967
c12	0.05091	0.045147	0.042961	0.04822	0.045455	0.048643	0.051138	0.055682	0.05	0.045909	0.05	0.05751
c13	0.045249	0.057564	0.041832	0.039036	0.042045	0.03733	0.051138	0.047724	0.046667	0.038071	0.046512	0.056753
c14	0.058826	0.056433	0.0554	0.057405	0.063636	0.06448	0.059088	0.057953	0.053333	0.059351	0.053488	0.055718
c15	0.032804	0.046278	0.032791	0.033295	0.036364	0.033937	0.034092	0.032955	0.037778	0.033594	0.033721	0.055667
c16	0.054296	0.05079	0.050874	0.057405	0.055682	0.062217	0.068184	0.055682	0.052222	0.059351	0.052326	0.055457
c17	0.032804	0.046278	0.032791	0.033295	0.036364	0.033937	0.034092	0.032955	0.037778	0.033594	0.033721	0.050281
c18	0.041852	0.053052	0.035049	0.037887	0.035227	0.038462	0.03636	0.045454	0.074444	0.043676	0.039535	0.041117
c19	0.054296	0.034991	0.062184	0.058553	0.056818	0.050905	0.052272	0.057953	0.051111	0.045909	0.076744	0.052109
c20	0.046381	0.05079	0.039575	0.041332	0.045455	0.040724	0.042042	0.047724	0.046667	0.05263	0.043023	0.055657
Goal	0	0	0	0	0	0	0	0	0	0	0	0

Table 13. Weighted supermatrix

	a1	a2	a3	a4	C1	C2	c3	c4	c5	c6	c7	c8	c9
a1	0	0	0	0	0.1277	0.13967	0.13977	0.03008	0.1112	0.08766	0.13977	0.19355	0.18037
a2	0	0	0	0	0.12137	0.18431	0.18948	0.17434	0.19129	0.16179	0.17615	0.11015	0.13966
a3	0	0	0	0	0.14445	0.10835	0.09654	0.14944	0.10887	0.12527	0.08646	0.08969	0.08713
a4	0	0	0	0	0.10648	0.06767	0.07421	0.14615	0.08865	0.12527	0.09762	0.10661	0.09283
C1	0	0	0	0	0.03447	0.02547	0.03103	0.01497	0.01891	0.01597	0.018	0.01947	0.0135
C2	0	0	0	0	0.02248	0.01848	0.02453	0.02495	0.02488	0.02745	0.0265	0.02459	0.026
c3	0	0	0	0	0.03347	0.03397	0.03954	0.02146	0.02189	0.02196	0.021	0.0251	0.018
c4	0	0	0	0	0.02448	0.02498	0.02603	0.02345	0.02388	0.02395	0.0245	0.02818	0.0265
c5	0	0	0	0	0.01998	0.02348	0.02553	0.02495	0.02637	0.02545	0.024	0.02613	0.0275
c6	0	0	0	0	0.02548	0.01648	0.02252	0.02345	0.02388	0.02096	0.0245	0.02254	0.0245
c7	0	0	0	0	0.02098	0.02048	0.02352	0.02046	0.02488	0.02545	0.029	0.02305	0.022
c8	0	0	0	0	0.02747	0.01998	0.02653	0.01996	0.02438	0.02595	0.027	0.0333	0.0205
c9	0	0	0	0	0.02298	0.01748	0.01802	0.03044	0.01791	0.02595	0.023	0.02408	0.0315
c10	0	0	0	0	0.01499	0.03047	0.01301	0.03892	0.01691	0.01846	0.015	0.01434	0.0215
c11	0	0	0	0	0.02897	0.01798	0.02903	0.01896	0.02736	0.02745	0.0275	0.02818	0.0285
c12	0	0	0	0	0.02148	0.02398	0.02202	0.02245	0.02139	0.02096	0.025	0.02459	0.0205
c13	0	0	0	0	0.01449	0.01748	0.01351	0.01996	0.02189	0.01747	0.016	0.02715	0.014
c14	0	0	0	0	0.02597	0.01748	0.02603	0.01796	0.02537	0.02445	0.0265	0.01537	0.027
c15	0	0	0	0	0.01648	0.04595	0.01752	0.01896	0.01642	0.01397	0.014	0.01537	0.0175
c16	0	0	0	0	0.02647	0.02597	0.02703	0.01697	0.02488	0.02545	0.025	0.02203	0.02
c17	0	0	0	0	0.01548	0.02595	0.02752	0.01596	0.01642	0.01397	0.015	0.01537	0.0165
c18	0	0	0	0	0.01648	0.01299	0.01301	0.01896	0.0209	0.01347	0.0215	0.01537	0.013
c19	0	0	0	0	0.02098	0.03047	0.01702	0.02944	0.02438	0.02645	0.021	0.02203	0.0255
c20	0	0	0	0	0.06642	0.06642	0.06642	0.06642	0.06642	0.08482	0.076	0.07376	0.08601
Goal	0	0	0	0	0	0	0	0	0	0	0	0	0

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Table 13. Continued

	c10	c11	c12	c13	c14	c15	c16	c17	c18	c19	c20	Goal
a1	0.09678	0.1305	0.13967	0.13393	0.1265	0.1265	0.1275	0.13	0.1555	0.176	0.1745	0
a2	0.17863	0.12	0.18431	0.12103	0.125	0.125	0.1245	0.134	0.112	0.1035	0.136	0
a3	0.13831	0.131	0.10835	0.12252	0.132	0.132	0.1245	0.1165	0.109	0.112	0.1015	0
a4	0.08629	0.1185	0.06767	0.12252	0.1165	0.1165	0.1235	0.1195	0.1235	0.1085	0.088	0
C1	0.01798	0.01297	0.02084	0.015	0.016	0.0215	0.02254	0.01802	0.0145	0.01504	0.0125	0.055
C2	0.02548	0.02495	0.02578	0.0295	0.0265	0.024	0.02505	0.02352	0.0235	0.02357	0.0275	0.036
c3	0.02348	0.01846	0.02281	0.0195	0.0245	0.024	0.02355	0.02052	0.0175	0.02257	0.0175	0.051
c4	0.02647	0.03942	0.0238	0.024	0.024	0.023	0.02204	0.02402	0.024	0.02307	0.025	0.066
c5	0.02248	0.01996	0.0233	0.022	0.0215	0.0235	0.02104	0.02352	0.0235	0.02508	0.0215	0.057
c6	0.02398	0.02445	0.0233	0.022	0.022	0.022	0.02204	0.02302	0.022	0.02808	0.021	0.062
c7	0.02498	0.01896	0.0233	0.026	0.026	0.0265	0.02355	0.02502	0.035	0.02658	0.023	0.042
c8	0.02548	0.02146	0.02529	0.026	0.0255	0.0265	0.02355	0.02553	0.0195	0.02708	0.0195	0.041
c9	0.02548	0.02495	0.02925	0.0265	0.026	0.0235	0.02455	0.02402	0.0235	0.02457	0.0305	0.028
c10	0.01648	0.01497	0.02105	0.02	0.0165	0.017	0.01603	0.01552	0.016	0.01956	0.0255	0.04
c11	0.02498	0.02645	0.02727	0.028	0.028	0.029	0.02806	0.02653	0.0285	0.02808	0.024	0.038
c12	0.02248	0.01996	0.01884	0.021	0.02	0.0215	0.02254	0.02453	0.0225	0.02056	0.0215	0.07
c13	0.01998	0.02545	0.01834	0.017	0.0185	0.0165	0.02254	0.02102	0.021	0.01705	0.02	0.032
c14	0.02597	0.02495	0.02429	0.025	0.028	0.0285	0.02605	0.02553	0.024	0.02658	0.023	0.041
c15	0.01449	0.02046	0.01438	0.0145	0.016	0.015	0.01503	0.01452	0.017	0.01504	0.0145	0.057
c16	0.02398	0.02245	0.02231	0.025	0.0245	0.0275	0.03006	0.02453	0.0235	0.02658	0.0225	0.045
c17	0.01449	0.02046	0.01538	0.0145	0.016	0.015	0.01503	0.01452	0.017	0.01504	0.0145	0.057
c18	0.01848	0.02345	0.01537	0.0165	0.0155	0.017	0.01603	0.02002	0.0335	0.01956	0.017	0.041
c19	0.02398	0.01547	0.02727	0.0255	0.025	0.0225	0.02305	0.02553	0.023	0.02056	0.033	0.031
c20	0.07887	0.08035	0.07783	0.0825	0.08	0.076	0.07767	0.08056	0.071	0.07575	0.0865	0.11
Goal	0	0	0	0	0	0	0	0	0	0	0	0

Table 14. Limited supermatrix

	A1	A2	A3	A4	C1	C2	C3	C4	C5	C6	C7	C8	C9
a1	0	0	0	0	0.13395	0.13395	0.13395	0.13395	0.13395	0.13395	0.13395	0.13395	0.13395
a2	0	0	0	0	0.14506	0.14506	0.14506	0.14506	0.14506	0.14506	0.14506	0.14506	0.14506
a3	0	0	0	0	0.11591	0.11591	0.11591	0.11591	0.11591	0.11591	0.11591	0.11591	0.11591
a4	0	0	0	0	0.10508	0.10508	0.10508	0.10508	0.10508	0.10508	0.10508	0.10508	0.10508
C1	0	0	0	0	0.01851	0.01851	0.01851	0.01851	0.01851	0.01851	0.01851	0.01851	0.01851
C2	0	0	0	0	0.02514	0.02514	0.02514	0.02514	0.02514	0.02514	0.02514	0.02514	0.02514
c3	0	0	0	0	0.02321	0.02321	0.02321	0.02321	0.02321	0.02321	0.02321	0.02321	0.02321
c4	0	0	0	0	0.02505	0.02505	0.02505	0.02505	0.02505	0.02505	0.02505	0.02505	0.02505
c5	0	0	0	0	0.02361	0.02361	0.02361	0.02361	0.02361	0.02361	0.02361	0.02361	0.02361
c6	0	0	0	0	0.02292	0.02292	0.02292	0.02292	0.02292	0.02292	0.02292	0.02292	0.02292
c7	0	0	0	0	0.0247	0.0247	0.0247	0.0247	0.0247	0.0247	0.0247	0.0247	0.0247
c8	0	0	0	0	0.02505	0.02505	0.02505	0.02505	0.02505	0.02505	0.02505	0.02505	0.02505
c9	0	0	0	0	0.0248	0.0248	0.0248	0.0248	0.0248	0.0248	0.0248	0.0248	0.0248
c10	0	0	0	0	0.01878	0.01878	0.01878	0.01878	0.01878	0.01878	0.01878	0.01878	0.01878
c11	0	0	0	0	0.02698	0.02698	0.02698	0.02698	0.02698	0.02698	0.02698	0.02698	0.02698
c12	0	0	0	0	0.02165	0.02165	0.02165	0.02165	0.02165	0.02165	0.02165	0.02165	0.02165
c13	0	0	0	0	0.01897	0.01897	0.01897	0.01897	0.01897	0.01897	0.01897	0.01897	0.01897
c14	0	0	0	0	0.0246	0.0246	0.0246	0.0246	0.0246	0.0246	0.0246	0.0246	0.0246
c15	0	0	0	0	0.01676	0.01676	0.01676	0.01676	0.01676	0.01676	0.01676	0.01676	0.01676
c16	0	0	0	0	0.0244	0.0244	0.0244	0.0244	0.0244	0.0244	0.0244	0.0244	0.0244
c17	0	0	0	0	0.01559	0.01559	0.01559	0.01559	0.01559	0.01559	0.01559	0.01559	0.01559
c18	0	0	0	0	0.01759	0.01759	0.01759	0.01759	0.01759	0.01759	0.01759	0.01759	0.01759
c19	0	0	0	0	0.02408	0.02408	0.02408	0.02408	0.02408	0.02408	0.02408	0.02408	0.02408
c20	0	0	0	0	0.02043	0.02043	0.02043	0.02043	0.02043	0.02043	0.02043	0.02043	0.02043
Goal	0	0	0	0	0	0	0	0	0	0	0	0	0

continued on following page

Table 14. Continued

	C10	C11	C12	C13	C14	C15	C16	C17	C18	C19	C20	Goal	Rank
a1	0.13395	0.13395	0.13395	0.13395	0.13395	0.13395	0.13395	0.13395	0.13395	0.13395	0.13395	0.13395	2
a2	0.14506	0.14506	0.14506	0.14506	0.14506	0.14506	0.14506	0.14506	0.14506	0.14506	0.14506	0.14506	1
a3	0.11591	0.11591	0.11591	0.11591	0.11591	0.11591	0.11591	0.11591	0.11591	0.11591	0.11591	0.11591	3
a4	0.10508	0.10508	0.10508	0.10508	0.10508	0.10508	0.10508	0.10508	0.10508	0.10508	0.10508	0.10508	4
C1	0.01851	0.01851	0.01851	0.01851	0.01851	0.01851	0.01851	0.01851	0.01851	0.01851	0.01851	0.01851	**17**
C2	0.02514	0.02514	0.02514	0.02514	0.02514	0.02514	0.02514	0.02514	0.02514	0.02514	0.02514	0.02514	**2**
c3	0.02321	0.02321	0.02321	0.02321	0.02321	0.02321	0.02321	0.02321	0.02321	0.02321	0.02321	0.02321	**11**
c4	0.02505	0.02505	0.02505	0.02505	0.02505	0.02505	0.02505	0.02505	0.02505	0.02505	0.02505	0.02505	**3**
c5	0.02361	0.02361	0.02361	0.02361	0.02361	0.02361	0.02361	0.02361	0.02361	0.02361	0.02361	0.02361	**10**
c6	0.02292	0.02292	0.02292	0.02292	0.02292	0.02292	0.02292	0.02292	0.02292	0.02292	0.02292	0.02292	**12**
c7	0.0247	0.0247	0.0247	0.0247	0.0247	0.0247	0.0247	0.0247	0.0247	0.0247	0.0247	0.0247	**7**
c8	0.02505	0.02505	0.02505	0.02505	0.02505	0.02505	0.02505	0.02505	0.02505	0.02505	0.02505	0.02505	**4**
c9	0.0248	0.0248	0.0248	0.0248	0.0248	0.0248	0.0248	0.0248	0.0248	0.0248	0.0248	0.0248	**5**
c10	0.01878	0.01878	0.01878	0.01878	0.01878	0.01878	0.01878	0.01878	0.01878	0.01878	0.01878	0.01878	**16**
c11	0.02698	0.02698	0.02698	0.02698	0.02698	0.02698	0.02698	0.02698	0.02698	0.02698	0.02698	0.02698	**1**
c12	0.02165	0.02165	0.02165	0.02165	0.02165	0.02165	0.02165	0.02165	0.02165	0.02165	0.02165	0.02165	**13**
c13	0.01897	0.01897	0.01897	0.01897	0.01897	0.01897	0.01897	0.01897	0.01897	0.01897	0.01897	0.01897	**15**
c14	0.0246	0.0246	0.0246	0.0246	0.0246	0.0246	0.0246	0.0246	0.0246	0.0246	0.0246	0.0246	**8**
c15	0.01676	0.01676	0.01676	0.01676	0.01676	0.01676	0.01676	0.01676	0.01676	0.01676	0.01676	0.01676	**19**
c16	0.0244	0.0244	0.0244	0.0244	0.0244	0.0244	0.0244	0.0244	0.0244	0.0244	0.0244	0.0244	**6**
c17	0.01559	0.01559	0.01559	0.01559	0.01559	0.01559	0.01559	0.01559	0.01559	0.01559	0.01559	0.01559	**20**
c18	0.01759	0.01759	0.01759	0.01759	0.01759	0.01759	0.01759	0.01759	0.01759	0.01759	0.01759	0.01759	**18**
c19	0.02408	0.02408	0.02408	0.02408	0.02408	0.02408	0.02408	0.02408	0.02408	0.02408	0.02408	0.02408	**9**
c20	0.02043	0.02043	0.02043	0.02043	0.02043	0.02043	0.02043	0.02043	0.02043	0.02043	0.02043	0.02043	**14**
Goal	0	C11	C12	C13	C14	C15	C16	C17	C18	C19	C20	Goal	Rank

Furthermore, using the suggested analytical procedure; it can effectively handle any problem of selection with multi-faceted attributes. However, there are some limitations, such as the evaluate scales of the Fuzzy ANP and the DEMATEL are not unified. If the study involves large samples, then the combined methodology might be too complicated. Moreover, the assessment scale is required to improve its user friendliness in the future.

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Chapter 62
Analyzing the Efficiency of European Banks: A DEA-Based Risk and Profitability Approach

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ABSTRACT

Basic financial and profitability ratios such as net interest margin, return on assets, and return on equity alone do not measure bank performances effectively as they lack the risks associated. Since the success of banks in managing performance is expected to be largely dependent on the correct pricing and management of risks, a proper measurement of efficiency should include the effects of risks. The purpose of this study is to benchmark risk profiles of European commercial banks and performance indicators during the 2006-2009. The research is implemented based on four models by Data Envelopment Analysis with data of 697 banks from 37 countries. The results suggest that there is an extensive inter- and intra-country risk efficiency of banks. Profitability increase is not always directly proportional to risk increase, and the financial crisis substantially decreased the risk efficiency of banks, especially in 2008 in developed economies.

INTRODUCTION

Conventionally, a set of ratios, net interest margin (NIM), return on average asset (ROAA), return on average equity (ROAE) or cost to income, have been used to analyze the performances of banks. But the recent global crisis has proved that these parameters are not enough to judge the robustness of financial agents and performance should be associated with risk more than ever. All the paradigms have been reevaluated to integrate risk monitoring and control mechanisms into pruden-

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tial regulations, to adopt a stronger regulatory and supervisory framework, to ensure more resistant financial institutions and to attain more rational and effective measures.

All international organizations agree that there is a need for more restricted and regulated financial systems and that risks should be considered more than ever before in the supervising of financial bodies. The basic financial and profitability ratios NIM, ROAA and especially ROAE have been criticized for being insufficient to effectively measure the performance of banks since they lack the risks (credit risk, interest rate risk, foreign exchange risk, liquidity risk, operational risk and leverage) associated with them. Therefore, a proper measurement of bank efficiency should include the effects of risks on measured profitability ratios as well. Risk efficiency indicates whether the profitability ratios of banks are reasonable compared to their risk levels. This relation demonstrates the efficiency of banks in converting their risks to profitability and performance indicators.

With this study we aim to investigate the relationship between the risk levels of European commercial banks and their profitability indicators by using DEA. In this specific area of efficiency, there is a very limited literature and thus the risk efficiency of banks has yet to be analyzed. To our knowledge, this is the first study to extensively associate risk parameters with profitability indicators by using DEA. In utilizing DEA, some proper proxies for the abovementioned risks are used as inputs and profitability ratios are employed as outputs. The study also enables us to compare risk efficiency of different banking sectors throughout wide range of economic and geographical region. The models will be run on the data of 697 from 37 member countries of the European Banking Federation (EBF). The data covers the period 2006-2009 to ensure that any changes in performance during the global financial crisis would be captured as well. The results will enable us to analyze the risk efficiencies of banks in terms of the following: the country within which they are located, the absence or presence of unions, their regions, local development levels, ownership, size, and whether or not they are exchange listed.

The approach used in this paper is based on a DEA (Data Envelopment Analysis) where inputs are risks and outputs are profitability. In the first of four different models, it is assumed that NIM is affected by interest rate risk, liquidity risk and credit risk, and accordingly their effects on efficiency are analyzed via the NIM Model. The second model, or ROAA Model, includes operational risk as a supplement to the abovementioned financial risks. Then third model, or ROAE model, is analyzed in terms of how it adds leverage to the risks included in the other models. Lastly, the final model, referred to as ALL, measures how successful a bank is in maintaining its risks at some specific levels in order to maximize all of its outputs simultaneously.

The rest of the paper proceeds as follows. In section 2, an overview of the European Banking System is presented. Efficiency studies in the banking sector, together with approaches about specifying inputs and outputs, are summarized in section 3. Section 4 provides models, methodology, variables and data. We then present our empirical results and analysis in the next section, with conclusions provided in the final section.

AN OVERVIEW OF THE EUROPEAN BANKING SYSTEM

The European banking sector has undergone continuous changes as a result of a numerous factors since the instatement of the First Banking Directive of the European Community in 1977. Developments related with European Union have been the core factor in shaping these changes. One of the initial steps was The First Banking Directive towards a single European banking sector and its purpose was to harmonize banking laws and eliminate barriers between members. The Directive on Consolidated Supervision (1983) was a further

step in unifying the banking sector and it required that activities of banks be supervised based on their whole domestic and international consolidated financial conditions, thus preventing arbitrage between tight and loose regulated financial centers. The Second Banking Directive (1989), which came into force in 1993, was another cornerstone in regulating the European banking sector. According to the directive, a single banking license was to be recognized among other member states, and based on the license of the home country banks were granted the right to establish branches and to trade in financial markets throughout the European Union (EU). But if it were deemed necessary for the protection of public interest, the host country retained the right to regulate the activities of foreign banks. The Second Banking Directive covered a broad range of activities within the scope of banking, including the principle of universal banking which constitutes the basis of German banking. In 1999, a single currency (Euro) was implemented and a Financial Services Action Plan (FSAP) was developed to ensure fully integrated and competitive capital markets and to remove any remaining barriers to cross-border provision of retail financial services. The overall objective of the FSAP is to attain a single market in financial services and it has been the key component of progress. Specifically, it aims at a single wholesale market, an open and secure retail market, and prudential rules and supervision (Richards, 2003). In 2007 two directives were implemented in light of the FSAP: the Markets in Financial Instruments Directive and the Capital Requirements Directives, which includes the Basel II standards. The creation of single financial market and the introduction of the Euro have led to converged interest rates and market structures of member countries until financial crisis of 2008, but later rates re-diverged based on the credibility of financial system.

Despite all of the EU-specific and global incentives towards convergence and integration, the structure of the banking system and financial regulatory and supervisory framework still displays different characteristics among European countries, as each has gone through unique historical backgrounds and financial experiences (Group of Thirty, 2008).

As a result of mergers and acquisition, number of financial institutions decreased steadily in the last ten years. According to the European Banking Federation's statistics, the number of credit institutions of EU27 countries decreased from 9,496 in 2001 to 8,060 in 2011, and personnel number decreased by 99,126. But number of branches increased with 12,466 in the same period. Despite the 85% of total asset increase, total loans increased by 69% and total deposits by 87%. Excluding monetary financial institutions, loan to deposit ratio decreased from 130% to about 115%. Return on equity decreased to 4.2%, while ratio of non-performing loans to total loans increased to 6.0%.

While the banking sectors in EU countries comprise the main focus of this study, non-EU countries, including the former socialist republics, also fall within the scope of the study. They have experienced similar changes in parallel to the EU, as they all have been exposed to the same global technological and financial developments. But naturally, the concentration and foreign share in developing countries possessing small banking sectors are higher. Some countries are already in the close peripheral for economic integration with the EU and the majority of them accept EU standards as a guide for shaping their sectors (Barisitz, 2008). All the countries in this study are members of the EBF which has as its mission "to position the European banking industry within the European and global regulatory frameworks."

MEASURING EFFICIENCY IN BANKING

Bank performance measurement techniques, generally, can be categorized as frontier efficiency methodologies, ratio analysis, regression analysis

and other techniques (Paradi and Zhu, 2013). Frontier based methods are the most used approaches and they differ based on the assumptions about shape of frontier, whether random error exists or not and distribution of inefficiency and random error components. These methods can be classified as parametric (stochastic frontier approach-SFA, thick frontier approach-TFA and distribution-free approach-DFA) and non-parametric (data envelopment analysis-DEA and free disposal hull-FDH). Here, we will use the Slacks Based Model of data envelopment analysis to benchmark the performance and risk indicator of banks.

Since initial application of DEA in banking sector to measure the efficiency of bank branches in 1985, DEA has been widely used to measure the efficiency of banks and bank branches and there are numerous studies analyzing different aspects of bank efficiency. Berger and Humphrey's (1997) survey is a milestone that summarizes the 130 frontier efficiency studies, from 21 countries, in which 69 applied DEA. Research of Fethi and Pasiouras (2010) is another important stage in reviewing studies after 1997 about bank performance. They specified 196 studies employing either operational research or artificial intelligence methods estimating various measures of bank efficiency and productivity growth from all over the world over the period 1998-2008 and they identified that with 151 studies, DEA is by far the most commonly used operational research technique in assessing bank performance. Of these studies, 30 analyze the efficiency of bank branches. For a bank branch efficiency survey, Paradi and Zhu (2013) found 275 DEA applications (195 about bank efficiency and 80 about branch efficiency) in the banking sector between 1985 and 2011.

Bank Modeling for Inputs and Outputs

Banks function in a broad spectrum of activities and they provide a wide range of heterogeneous services and products to their customers. Deciding input and output parameters for identifying bank efficiency depends on how you model a banking firm, which aspect of a bank you want to analyze and what your purpose is. Therefore, specifying inputs and outputs is a controversial issue in DEA (Berger and Humphrey, 1992). In addition to items derived from balance sheet and income statements, there are also some internal and external parameters that sometimes cannot be measured completely but should be considered in measuring efficiency, e.g., service quality, customer satisfaction, environmental conditions, and socio-economic development levels. Nonetheless, basically, we can indicate three approaches to efficiency measurement in banking; these are production efficiency, intermediation efficiency and profitability efficiency (Drake et al, 2009).

The intermediation approach, which is originated from Sealey and Lindley (1977) and is the most common one in measuring bank efficiency, estimates the efficiency of banks in converting resources (deposits, security issues, owner's equity etc.) into assets (loans, other earning assets, etc.). Since assets are assumed to be output, in some studies the intermediation approach is defined as an asset approach. In this approach, the main function of banks is accepted to collect money from surplus spending units who have an excess of funds and lend these funds to deficit spending units who are in need of money.

The production approach (Benston & Smith, 1976; Berger & Humphrey, 1991) treats a bank as a production unit using some resources (personnel number or salary, equipment, other non-interest expenses, etc.) as input to produce deposits, earning assets, non-earning assets, interest income, non-interest income and other products. There is a large amount of literature on efficiency which treats banks as production units. However, the production approach is more common in analyzing branch efficiency rather than banks.

The profitability approach measures how efficiently a bank maximizes its profits by decreasing expenses while increasing revenue. Therefore,

the cost-related items (personnel expenses, non-interest expenses, loan loss provisions, etc.) are used as inputs and revenue-related items (net interest income, non-interest income, etc.) are used as outputs. It is argued that by using loan loss provisions, a risk dimension also is included in the model (Drake et al, 2006). In contrast to the intermediation and production approach, deposits, loan, equity, personnel and so on are not used as inputs or outputs with the profitability approach. Drake et al (2009) indicate that in bank efficiency, the profit/revenue-based approach is likely to offer the most comprehensive analysis.

In addition to the intermediation, production and profitability approaches, there are many other aspects of banks, such as size, ownership, restructuring, merging, risk and other factors which have also been discussed in the related literature. For details of bank efficiency studies and examples of different approaches, please refer to Fethi and Pasiouras' (2010) study.

Considering Risks in Performance

All of the above approaches can be criticized for not integrating risks into the models employed. Triplett and Bosworth (2004) state that newer developments have not been considered in the theory of banking and they suggest that the risk-managing, information-managing and liquidity-providing roles of banks must be taken into account in future efficiency measurement studies. Allen and Santomero (1998) criticize intermediation theories for focusing excessively on the less important functions and products of financial institutions. They offer two important roles, instead, to be integrated with recent models of banking: the function of risk transfer and the increasing complex nature of instruments and markets.

Generally, loan loss provisions, or an indicator using it, have been accepted as a proxy for risk in bank efficiency studies. Sun and Chang (2011) criticize existing studies for mainly using credit risk indicators, including non-performing loans and allowance for loan losses and risky assets, but not considering other kinds of risk to explain efficiency. They recalled that the Basel Committee classified risks as credit risk, operational risks and market risks, and stated that a non-performing ratio is no longer the only index for risks.

As stated in a recent report published by the European Central Bank (ECB), ROAE is considered to be a poor performance measure of banks (ECB, 2010). The most common bank performance indicator, ROAE, reflects only one side of the coin since a good ROAE level shows either high profitability or low equity capital. The commonly used ROAE measures may not be sufficient to show banks' performance mainly because they are not risk sensitive and ROAE measures can expose banks to higher unexpected risk levels. A traditional risk and return analysis may not be adequate and the complete picture should take into consideration, especially in times of higher volatility, different risk dimensions for predictability and sustainability. In addition to profitability, the risk associated with profitability indicators should also be analyzed.

Bessis (2002) indicates that the disadvantages of ROAE, ROAA and other profitability measures are a lack of risk adjustment. Different assets cannot be compared without looking at their risk levels. The concept of a risk adjusted performance measure has arisen to eliminate this drawback.

In terms of the risk efficiency of banks, Berger and DeYoung's (1997) findings indicate that there is a two-way causality between problem loans and cost efficiency, and a one-way causality between poor capital adequacy and problem loans. Leaven (1999) criticizes the efficiency measurements performed by other academics for not including the risk-taking activities of banks and assuming that banks are risk neutral. In his working paper, he investigates the risk taking activities of banks and their cost efficiencies through the ownership structure of banks. The results suggest that the improved cost efficiency of banks mainly results from excessive risk-taking activities rather than

true efficiency improvements. His results also show that family and company-owned banks tend to assume excessive risk and foreign banks tend to assume little risk.

DeYoung et al. (2001) investigate the relationship between banks' risk-taking activities and regulations. Using data for 356 national US banks, they employ a three-step model to investigate this question. In the first step, they use a structural model of production to estimate the risk and return parameters of those banks. After plotting these results on a scatter diagram they estimate a best practice risk-return frontier for all banks. The inefficiency of each bank is calculated as the difference between its actual return and estimated return. In the third step they investigate the relation between CAMEL rating and expected return, risk, risk-return inefficiency and size for each bank. Their main finding is that regulators not only distinguish between the risk-taking activities of efficient and inefficient banks, but they also grant efficient banks more latitude in their investment strategies than inefficient banks. Fiordelisi et al (2011) examine the relationship between bank efficiency, capital and risk level of banks from 26 European Union countries. They find that lower efficiency lead to greater bank risk in the future, and long-term efficiency gain is important to support financial stability of banks.

Greuning and Bratanovic (2009) point out the importance of risk-based bank analysis which considers significant factors and ratios with a risk assessment perspective. In addition to changes and trends in risks, comparing a bank with the others is also important. In a risk-based bank analysis, a bank's parameters, especially profitability, capital adequacy and structure of balance sheet, should be analyzed to determine whether they comply with industry norms and whether they deviate from other peer banks. At this point, DEA can play an effective role as a powerful benchmarking tool.

By their nature, banks are exposed to different financial and non-financial risks such as credit risk, interest rate risk, liquidity risk, foreign exchange risk and operational risk. Therefore, the success of banks is assumed to be largely dependent on the correct pricing of these risks and their efficiency in managing these risks in order to achieve and/or protect their targeted profit margin.

MODELS, METHODOLOGY, VARIABLES AND DATA

Baltensperger (1980) underlines that a model which explains the behavior of banking firm must include (1) the characteristics of the two sides of the balance sheet, (2) the production aspects of banks and (3) all financial risks that banks are exposed to. In his so called complete model of the banking firm (Equation 1) the profit of banking firm, $E(\pi)$, is expected to be a function of spread, $(rE - tD)$; production cost, the difference between non-interest earnings and non-interest expenses (the burden) C (D,E); liquidity cost, L; solvency cost, S, and opportunity cost of capital, pW:

$$E(\pi)=rE-tD-C(D,E)-L-S-pW \quad (1)$$

In this model rE - tD is named NIM that is simply the difference between weighted average interest earned on assets and weighted average interest paid for liabilities. Baltensperger (1980), as borrowing from Klein (1971), discusses that return on loans is subject to credit risk and therefore it is expected that return on marginal loan to be smaller than the rate of return on previously extended loans due to the increasing level of credit risk. On the other hand in a competitive environment a bank that wishes to increase its deposit volume must pay higher interest that will in turn increase the marginal cost of borrowings. Thus it is implied that there is a negative relationship between size and expected profitability rate within the context of credit risk and funding risk, if the risk is not managed properly. However, it is important to note that the capability of banks in managing their credit and deposit portfolios indeed differ

substantially from each other and that also has great impact on their riskiness and profitability ratios. It is also important to realize that the larger a bank the higher energy that it can allocate to the management of its credit portfolio and/or credit risk. That could well result in a positive relationship between size and profitability.

On the other hand, interest rate movements are exogenous to any bank. Thus any movements in rates could change both the lending and the borrowing rates of a bank. The effect of rate movements on assets and liabilities could not be equal due to the remaining times to maturity of assets and liabilities. An asset or a liability with a short maturity will feel the effect of rate movements immediately and the others with longer maturities will be affected with a time lag. The average maturity of assets could be different than that of liabilities as creating a maturity mismatch. Depending on these maturity mismatches between assets and liabilities of a bank, rate movements could work in favor or against that bank. That makes NIM basically not only subject to default risk but also to interest rate risk as well. Again, it is very likely that all banks have identical maturity mismatch on their balance sheets due to their businesses, expectations; policies etc., besides the capabilities of banks in managing interest rate risk are not identical. Thus the effect of rate movements on their balance sheets will substantially differ from each other.

Moreover banks will be reluctant to increase rates on deposits in a rate rising climate and contrary to that they will push up rates on their loans immediately. Banks will probably react in an opposite direction when rates fall.

Although it is not referred in Baltensperger's Model, the NIM figures of banks those hold foreign assets and liabilities on their balance sheets will also get affected by the movements in foreign exchange rates. The preferences of banks with regard to holding foreign assets and liabilities differ from each other as resulting in different measurements of foreign exchange rate risk for each individual bank as affecting their NIM figures.

Again as borrowing from Klein (1971) Baltensperger (1980) defines liquidity cost, denoted by L, as a function of reserves and deposit withdrawals. The amount of reserves to be hold is determined at the point where the marginal return on reserves equals to the marginal cost (a penalty) paid for reserve deficiency. So investing in cash reserves prevents banks from falling in a reserve deficiency. As a result a liquidity cost occurs for banks that try to eliminate the probability of reserve deficiencies. Keeping less or more reserves could well increase the liquidity risk and liquidity cost of banks. Again depending on each bank's risk appetite, liquidity policies, regulations, environment, expectations, management capabilities and etc. each bank's liquidity risk and liquidity cost is expected to differ from the other banks' risk and cost. Of course, investing in reserves decreases a bank's liquidity risk while diminishing its profitability.

Production cost of assets and liabilities in the Baltensperger's Model, C (D, E), is named burden in banking jargon, which can be defined as the difference between non-interest earnings and non-interest expenses. These interest free income and cost is subject to operational risk which can be defined as a risk arising from the execution of a company's business functions. Banks' preferences, policies and capabilities will result in different levels of operational risk and operational cost for each different bank. Thus each bank's profitability will be affected by different magnitude of operational risk. This risk or cost, since it is not related to interest activities, is not counted amongst risk affecting NIM. Thus it is related to return on assets (ROA) in this article.

The final risk mentioned in Baltensperger's model (1980) is solvency risk, S, which is defined as solvency cost as the cost of capital that is needed to operate the bank. He defines this cost as the difference between cost of capital and cost of deposit. The amount of capital to hold is determined where the marginal cost of deposit is equal to marginal cost of capital. However, since the existence of regulations the amount and the

structure of capital to be hold by banks depend not only on their preferences but also on the capital adequacy standards as well.

A general Return on Equity (ROE) model is formulated as shown in Equation 2.

$$ROE=ROA-LM \quad (2)$$

where ROA stands for return on assets and LM represents leverage multiplier. Replacing ROA in equation with right side of Baltensperger's model as ignoring cost of liquidity, cost of solvency and opportunity cost of capital, we get:

$$ROE=((rE-tD)-C(D,E))LM \quad (3)$$

Developing the efficiency measurement of banks on Baltensperger's (1980) model, the efficiency of a bank can be divided into two parts. The first part can be named "cost efficiency of banks" and the second part of efficiency can be named "risk efficiency of banks." In the related literature on bank efficiency a great attention has been lent to cost efficiency, however risk efficiency has attracted little emphasis.

The measurement of complete efficiency of a bank should include both parts of efficiency that can be derived from the Baltensperger's model. Therefore, NIM, (rE – tD), will be affected by credit risk, interest rate risk, liquidity risk and foreign exchange rate risk. ROA which is equal to (rE – tD) – C (D, E)) is affected by all risks affecting NIM plus operational risk. Finally ROE will be affected by all these risks plus solvency risk.

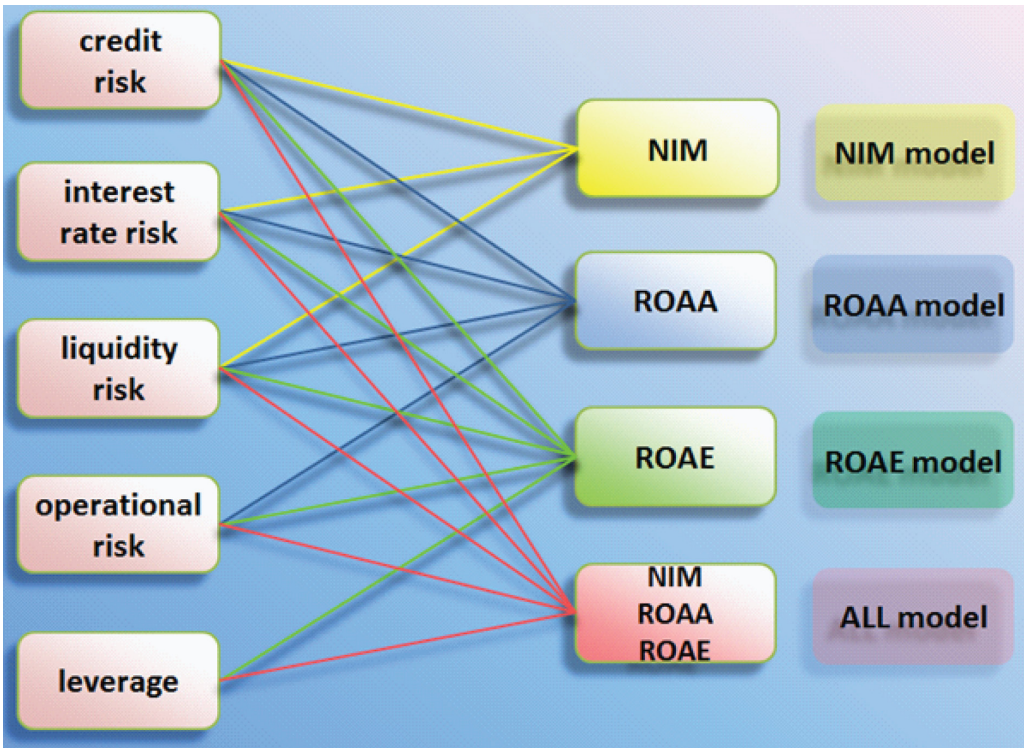
To analyze whether the profitability indicators of European banks are reasonable in comparison to their risk levels, the study is carried out based on four approaches. In the first model we benchmark the NIM of banks assuming that it is mostly influenced by interest rate risk, liquidity risk and credit risk. The ROAA model investigates the success of ROAA considering operational risk in addition to previous risks. In the third ROAE model, we shed light on the success of banks in attaining ROAE ratios based on risk appetite by adding leverage to other risks. The efficiency of utilizing all risks to maximize all profitability indicators simultaneously is measured under the model named ALL (Figure 1).

With the study of Charnes, Coopers and Rhodes (1978), the efficiency measurement method was brought to a new stage. They put into practice the non-parametric Data Envelopment Analysis (DEA) model to measure the efficiency of a decision making unit (DMU) based on frontier analysis. Since then, in addition to basic models, many variations and orientations of DEA have been developed to measure the efficiency of different sectors in a wide range of businesses, including the banking industry as well.

DEA is an effective nonparametric benchmarking and efficiency measurement tool which can be used with multiple inputs and outputs. Since we want to benchmark performance indicators of different banks in comparison to their risk preferences, DEA seems to be the most suitable tool. It measures the efficiency of a unit by maximizing the ratio of weighted outputs to weighted inputs, and the ratio is normalized according to observed best performing peers to be between 0 and 1, as 1 representing efficient unit. Others are compared with best units and then are assigned relative values between 0 and 1.

In this study a Slacks Based Model (SBM) of DEA which was developed by Tone (2001) is used. The radial models, CCR (Charnes, Cooper and Rhodes) and BCC (Banker, Charnes and Cooper) measure efficiencies calculate efficiency ratios, between 0 and 1, and the amount of input or output slacks. The non-radial model SBM deals with input excess and output shortfall simultaneously and incorporates slacks into calculations resulting in a scalar measure again between 0 and 1. Since it takes input slack and output slack into account at the same time, it identifies more sources of inefficiency and in some situations it reflects a more complete picture, and also compared to other models it has more discriminatory power.

Figure 1. Models and their inputs and outputs



Emrouznejad and Amin (2009) warn that utilizing financial ratios may be required in the efficiency measurement of financial institutions and using ratio data in standard DEA models as input and/or output may result in incorrect scores. Hollingsworth and Smith (2003) suggest employing a BCC model instead of CCR to prevent incorrect and perverse results when using ratios as input or output. In addition to neglecting slacks, oriented-radial models may also result in infeasibility (Cooper at al, 2007). Additionally, Avkiran (2011) points out the increasing usage of a tendency in favor of SBM among DEA models in the last ten years.

SBM is not translation invariant; it can be used with inputs that are equal to or greater than zero (semi-positive) and outputs that are either positive, zero or negative (Cooper at al, 2007). Considering our data, choosing SBM seems more reasonable, because in our study we use risk indicators as inputs and performance indicators such as NIM, ROAA and ROAE, which sometimes can be negative because of losses, as outputs.

DEA projects inefficient units to efficient frontier either with input or output orientation. When the purpose is benchmarking rather than input minimization or output maximization, SBM gives the option to use a non-orientation version. We prefer DEA Window Analysis, with a 4 year window, to track changes over time and compare the efficiency in different years by making use of a panel data of the 2006-2009 period. A bank in a particular year is compared with its observations in other years and the observations of other banks, by treating it as if it were a different bank (Paradi, 2011). For us, a four year period was deemed reasonable considering the drawbacks of using a non-optimum length of period, which may be affected by technological changes or display less discrimination, etc.

For this study, we started with the data of active commercial banks in the 44 member countries of the European Banking Federation, and have total assets of a minimum USD 1 billion for the 2009 year end. The data was retrieved from the Bank-Scope database and we started with about 950 banks. Then, banks without proper data, banks with less than 5 branches, banks with less than 20 employees, accidentally listed investment banks, and leasing, factoring and consumer financing companies were eliminated. Since data quality is crucial in frontier efficiency methods, we paid special attention to making sure that outliers were discarded. DEA is quite sensitive to extreme values and to outliers and detecting outliers is a critical matter. Since extreme points constitute the frontier, efficiency scores calculated from datasets that include outliers can be misleading (Tran et al, 2010). In particular, if an outlier belongs to an efficient frontier, it can incorrectly be used as a benchmark and this can distort all other measurements (Ondrich & Ruggiero, 2002). To prepare the data, the banks with unfeasible or unusual ratios such as "average loan/average assets" exceeding 97%, and an ROAE of greater than 100% were discarded. We also truncated banks whose input values (credit risk, interest rate risk, liquidity risk, operational risk and leverage) and output values (NIM, ROAA and ROAE) were inconsistent with the remainder of the set of data. Then we repeatedly ran the non-oriented Super SBM model and deleted banks that had a very high super-efficiency scores compared to the others and banks that had a high frequency in the reference set. As a result, we ended up with 697 banks from 37 member countries of the EBF.

According to EBF statistics, the total assets of the 44 members totals about USD 64 trillion in 2009, and our data covers 78% of a total sum of USD 50 trillion. The UK banking sector constitutes the largest share in our data, at 22%. France, Germany, Italy, Spain, Netherlands, Switzerland are represented at 18%, 13%, 7%, 7%, 6% and 5%, respectively, indicating that the share of seven countries comprises 78% of the total sector studied.

Banks are exposed to risks that can be divided into two components. The first component is exogenous and is generated from outside of banks as a result of volatility, and therefore it can be accepted as the systemic part. The second component is endogenous and is generated within banks as a result of sensitivity, and therefore, it can be treated as the non-systemic part (Eken, 2005 a). Systemic risks cannot be controlled by banks; however, non-systemic risks, to some extent, are controllable.

The more risk a bank takes, the less liquid a bank is; and the longer the term of its assets, the more profitable it should be. Therefore, when designing the DEA models, we considered specifying inputs and outputs in this manner. Since we sought to analyze whether the conventional performance indicators are reasonable in comparison to their risk profiles, the endogenous parts of risks, which are credit risk, interest rate risk, liquidity risk, operational risk and leverage, are used as inputs in this study. These banks belong to very different banking systems across a wide geographical region; therefore we could not collect data about exposure to foreign exchange risks. The proxy used for credit risk is the ratio of "average loans/average assets." An "(average interest sensitive assets-average interest sensitive liabilities)/average total assets" ratio was used to represent interest rate risk and the nominator of the ratio is the gap between interest sensitive assets and liabilities. Since, depending on the volatility of rates and a bank's long or short position, the gap may result in revenue or loss. Liquidity risk, together with deleveraging, is one of the most discussed issues in the post-crisis period because of the suffering from a lack of liquidity. Banks are expected to be prudential enough to fulfill their responsibilities resulting from deposits and funding through liquidity reserves. Therefore, instead of a "liquid assets/total deposits & borrowing" ratio, we preferred to use "liquid assets/deposits & short term

funding" for the liquidity risk. But since more liquidity actually means less liquidity risk and higher risk should cause more profit, we utilized the reciprocal of proxy in our measurements. A "total net non-interest operating income/total equity" ratio was used as a proxy for operational risk. Our assumption parallels Basel Committee's proposed gross income to calculate operational risk which is a basic indicator approach one of three approaches for capital requirement needs. Since it is not reasonable to assign a negative value for risks, we applied absolute values for operational risk indicators. High leverage has been accepted as the main reason for the recent global credit turbulence; in line with this, recent discussions for reforming and restructuring the financial systems have sought the optimum leverage ratios to prevent a similar financial crisis. "Average assets/ average equity" was used as a proxy representing leverage risk.

In this study, ratios related with profitability are employed as outputs. The first output is NIM which is defined as the net interest income over average earning assets (or total assets). It is one of the most important indicators used in observing the performance of banks. Based on this model, the efficiency of banks is related to their interest rate risk, credit risk and liquidity risk. Also some external factors (such as market structure, concentration and competition, regulatory banking environment, degree of information asymmetry, and development level of banking sector) have some influence on the interest margin (Maudos et al, 2004; Demirgüç-Kunt et al, 2003). NIM is the reward of financial risks (credit risk, interest rate risk, foreign exchange risk, and liquidity risk) undertaken and risk management techniques employed by banks to combat risks. For this reason, in order to be regarded as successful, a bank should sustain its NIM ratio in comparison with its risk level. The second output is ROAA and it is calculated by dividing the net income by average assets. ROAA is an indicator reflecting management performance and it measures how efficiently a bank utilizes its assets to generate profit. ROAA is assumed as a reward of exposure to financial risks plus operational risk. The final output ROAE is another critical profitability ratio and can be defined as the net profit earned in comparison with the total amount of average shareholder equity. It can be accepted as the prize received for purchasing and managing financial risks, and operational risk plus leverage risks together. Since ROAE is determined by ROAA and a leverage multiplier, in addition to financial risks and operational risk, it involves compensation for leverage as well. To increase ROAE ratio in comparison to ROAA, which is what shareholders seek, banks tend to leverage their equity within the framework of capital adequacy regulations.

The descriptive statistics of inputs and outputs are presented in Table 1.

Table 1. The descriptive statistics of data

Data	Mean	Std. Dev.	Min	Max	CV
Credit risk	55,3%	25,2%	0,0%	97,2%	45,6%
Interest rate risk	7,0%	6,4%	0,0%	66,0%	90,8%
Liquidity risk	6,6%	17,6%	0,1%	518,1%	266,1%
Operational risk	26,6%	81,6%	0,0%	3700,0%	307,0%
Leverage	1886,7%	2329,7%	126,8%	73675,5%	123,5%
NIM	2,6	2,1	-1,1	19,4	0,8
ROAA	0,7	1,2	-10,9	9,2	1,7
ROAE	8,7	17,0	-245,0	82,2	1,9

Banks are categorized based on the assets size of the 2009 year-end. 32 banks with more than 500 billion USD assets are assumed to be XXL, 17 banks with 250-500 billion are assumed to be XL, 33 banks with 100-250 billion are assumed to be L, 87 banks with 25-100 billion are assumed to be M, 109 banks with 10-25 billion are assumed to be S, and 419 banks with less than 10 billion are assumed to be XS. Banks that are publicly known to suffer from some problems, like capital adequacy, liquidity etc., and/or got government help are assumed as problematic and others as healthy.

EMPIRICAL RESULTS

Risk Efficiency in NIM Model

The NIM values and risk efficiencies for the NIM model are summarized in Table 2 on country basis for the period of 2006-2009. The risk efficiency shows how parallel the profitability of banks is in terms of their risk levels. First of all, the overall weighted average of risk efficiency of all banks for the whole period is 13% which is very low and indicates that despite discarding outliers, banks are spread over a wide range of efficiency, but are mostly on the inefficient side of the range. Low efficiency implies that there is an extensive difference between banks of the same the country and banks in different countries. Nonetheless, NIM and risk efficiency has increased over time, except for 2007, which indicates easy market conditions.

Both correlation and Spearmen's rank correlation between NIM and risk-adjusted NIM are 73%. This indicates a positive correlation as expected but at the same time shows that there are also banks which diverge from the others. It also indicates that the risk-adjusted NIM picture of banks is not entirely the same as the NIM picture alone.

The efficiency scores of 697 banks were estimated first. Then, using a weight (banks' total assets/country's total assets) for each bank, an efficiency figure was generated for each country for each year of the period in analysis. Thus the figures depicted in Table 2 are weighted average NIM and efficiency scores calculated via the NIM model.

Looking at the largest banking sectors, in Germany and Spain and France, (with the exception of a slight decrease in 2007) there is a steady increase in efficiency. Inefficient banks in 2006 experienced greater improvement in the following years which diminished the gap between efficient and inefficient banks. The UK represents a notable case; despite a decrease of NIM, efficiency has gradually increased.

As can be seen from the Table 2, even when the NIM of banks is similar, their risk efficiency may be completely different. For example, while the NIM of the Serbian banking sector was 7.45% in 2008 and the Ukrainian banking sectors was 7.51% in 2006, the risk efficiency of the Serbian sector is 65% in contrast to Ukraine's 47%.

The NIM and risk efficiency components of banks can be analyzed based on four separate regions, as shown in Figure 2. "High NIM-high risk efficiency" is the target region and it is preferred that banks operate in this area. In our study, these sectors generally seem to be composed of small banks in small countries. Banks in the "high NIM low-risk efficiency" region are also small in size and have high risk levels, and they should revise their risk profile considering the alternatives for decreasing risk while maintaining profitability. Banks in the "low NIM-high risk efficiency" region represent banks with low margins but which are exposed to comparatively lower risks. Their risk level may be satisfactory but their profitability is not, and they must increase profitability even further by taking more risks. The largest banks in the most developed and competitive sectors appear in the "low NIM-low risk efficiency" region.

The NIMs and risk efficiencies for different unions, development levels, ownership, and exchange listing status, size, and state of health are presented in Table 3 and Figure 3. The risk

Table 2. NIM and risk efficiency in NIM model (countries)

Country	NIM					Risk Efficiency in NIM model				
	2006	2007	2008	2009	Average	2006	2007	2008	2009	Average
Andorra	1,46	1,45	1,31	1,41	1,41	12%	13%	13%	12%	13%
Austria	1,96	2,23	2,77	2,52	2,37	18%	25%	30%	23%	24%
Belgium	1,06	1,01	1,07	1,26	1,10	12%	12%	12%	13%	12%
Bosnia-Herzegovina	4,24	4,13	4,51	4,57	4,36	33%	31%	26%	28%	29%
Bulgaria	5,51	5,50	4,94	4,70	5,16	45%	46%	35%	33%	40%
Croatia	3,24	3,34	3,45	3,29	3,33	33%	41%	54%	40%	42%
Cyprus	2,64	2,93	2,53	2,09	2,55	27%	27%	21%	18%	23%
Czech Republic	2,88	3,01	3,16	3,21	3,06	31%	36%	30%	31%	32%
Denmark	0,99	1,02	1,15	1,44	1,15	9%	9%	12%	17%	12%
Finland	1,10	1,10	1,07	0,72	1,00	11%	11%	12%	9%	11%
France	0,61	0,50	0,72	1,12	0,74	7%	6%	9%	14%	9%
Germany	0,73	0,76	0,82	0,88	0,80	8%	10%	13%	15%	11%
Greece	3,30	3,18	2,96	2,61	3,01	31%	28%	24%	21%	26%
Hungary	4,75	4,61	3,99	4,55	4,47	44%	37%	28%	30%	34%
Ireland	1,11	1,13	1,26	1,12	1,16	8%	8%	9%	8%	8%
Italy	2,01	2,05	2,30	2,02	2,10	19%	19%	21%	18%	19%
Latvia	3,18	3,27	3,06	2,25	2,94	30%	47%	26%	17%	30%
Liechtenstein	1,16	1,16	1,28	1,07	1,17	12%	12%	15%	16%	14%
Lithuania	2,96	3,08	2,97	1,63	2,66	24%	21%	17%	12%	19%
Luxembourg	0,90	0,91	1,15	1,15	1,03	18%	15%	19%	19%	18%
Malta	2,56	2,67	2,39	2,03	2,41	25%	27%	24%	18%	23%
Monaco	0,74	0,78	0,90	0,88	0,83	21%	27%	24%	17%	22%
Netherlands	0,90	0,86	1,12	1,22	1,02	11%	8%	12%	12%	11%
Norway	1,45	1,56	1,64	1,56	1,55	11%	11%	11%	12%	11%
Poland	2,89	3,11	3,29	3,01	3,08	27%	28%	26%	34%	29%
Portugal	1,89	1,85	1,90	1,66	1,82	20%	19%	18%	15%	18%
Romania	6,58	5,37	5,80	6,03	5,95	36%	29%	32%	35%	33%
Russian Federation	5,74	5,52	5,38	5,58	5,55	55%	47%	44%	45%	48%
Serbia	6,31	6,13	7,45	6,89	6,70	41%	54%	65%	60%	55%
Slovakia	3,29	3,39	3,35	3,16	3,30	37%	35%	39%	24%	34%
Slovenia	2,65	2,58	2,54	2,26	2,51	31%	28%	19%	17%	24%
Spain	1,87	2,00	2,17	2,57	2,15	15%	17%	18%	21%	18%
Sweden	1,78	1,12	1,20	1,04	1,29	17%	9%	10%	10%	12%
Switzerland	0,49	0,50	0,55	0,62	0,54	5%	5%	11%	15%	9%
Turkey	4,65	5,24	5,18	5,90	5,24	31%	33%	42%	48%	38%
Ukraine	7,51	7,07	8,27	7,99	7,71	47%	48%	54%	55%	51%
United Kingdom	1,16	1,07	0,88	0,85	0,99	12%	12%	11%	14%	12%
Weighted Average	**1,17**	**1,16**	**1,24**	**1,38**	**1,24**	**12%**	**12%**	**14%**	**16%**	**13%**

efficiency of EU and non-EU countries are the same in 2006 and in subsequent years generally an improvement has been observed; but by the end of 2009, non-EU levels reached 24% compared to the EU's 15%.

Banks in emerging countries (central and southeastern Europe, the Baltic region, Russia and CIS countries) tend to be more risk efficient than developed countries as a result of their high NIM values. But although the NIMs of emerging countries in the entire period are almost four times that of developed countries, their risk efficiency is a third of that; this shows that developed countries have relatively better risk management. Clays and Vennet (2008) stated that NIM is often higher in inefficient, non-competitive, un-concentrated, inadequately regulated markets that have information asymmetry and entrance barriers. Since the interest rate levels are also high in these countries, they get the reward of high risk taking as high premiums. As a result of more transparency, ease of access to financial products and high competition, together

Figure 2. Risk efficiency in NIM model (countries)

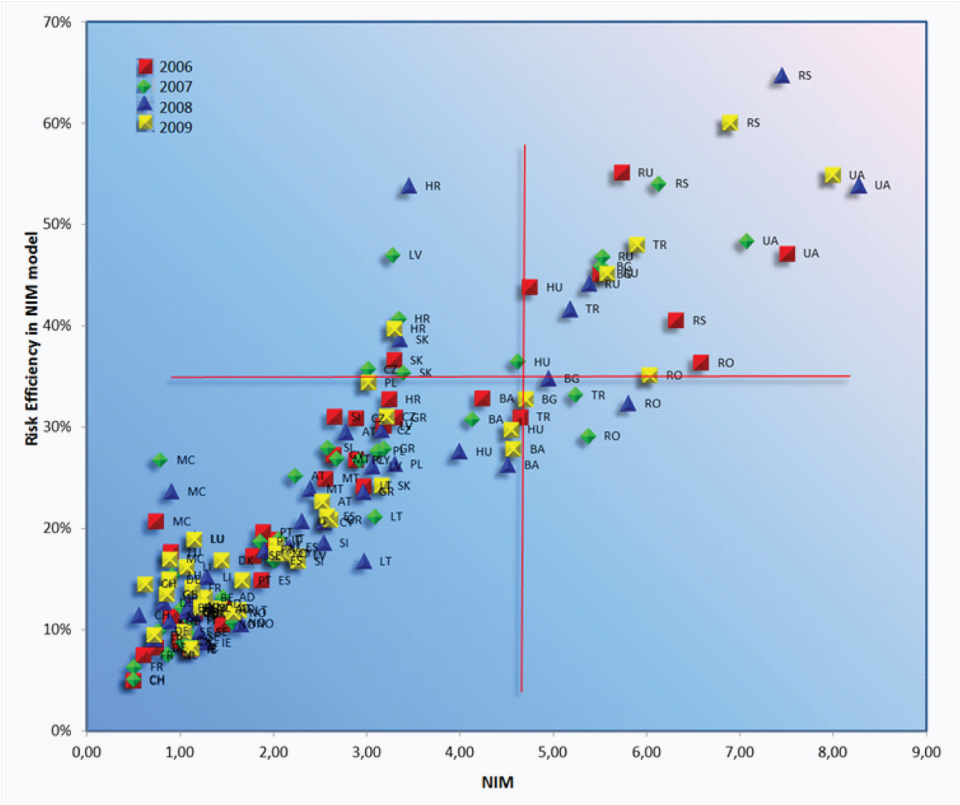
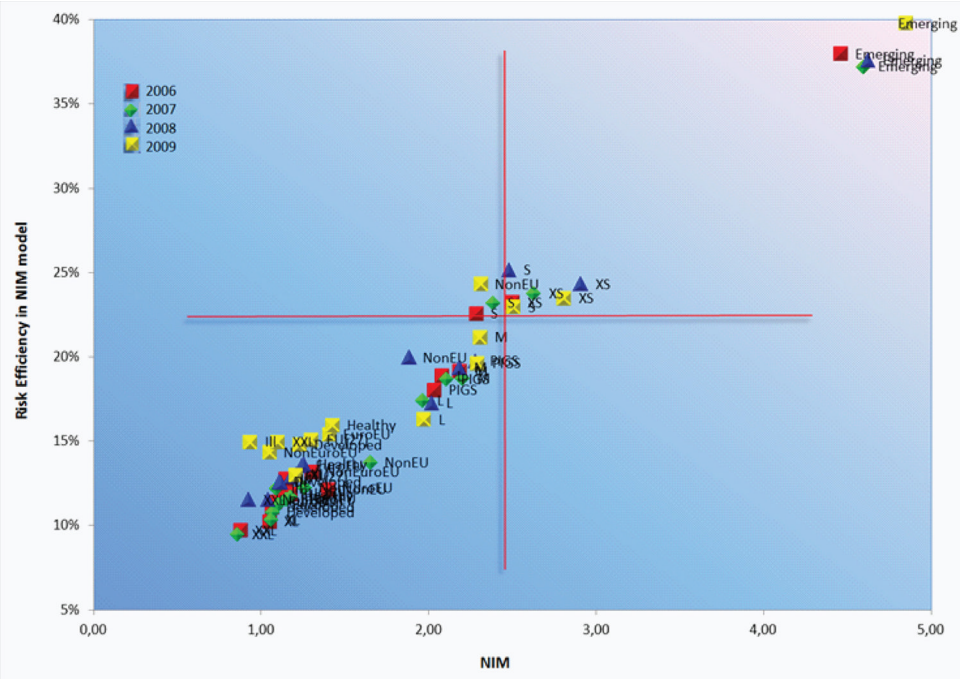


Table 3. NIM and risk efficiency in NIM model (regions, unions, development level, size etc.)

Cathegory	NIM					Risk Efficiency in NIM model				
	2006	2007	2008	2009	Average	2006	2007	2008	2009	Average
EU (27)	**1,14**	**1,15**	**1,18**	**1,30**	**1,19**	**12%**	**12%**	**13%**	**15%**	**13%**
Euro EU (16)	1,08	1,10	1,24	1,40	1,21	11%	11%	14%	15%	13%
Non-Euro EU (11)	1,30	1,26	1,04	1,05	1,16	13%	12%	12%	14%	13%
Non-EU	1,40	1,65	1,88	2,31	1,81	12%	14%	20%	24%	18%
Developed	**1,06**	**1,07**	**1,11**	**1,23**	**1,12**	**11%**	**11%**	**13%**	**15%**	**12%**
Emerging	**4,46**	**4,59**	**4,62**	**4,85**	**4,63**	**38%**	**37%**	**38%**	**40%**	**38%**
Central Europe & I	3,36	3,50	3,40	3,34	3,40	33%	34%	28%	30%	31%
Russia & CIS	5,87	5,90	5,56	5,71	5,76	55%	47%	45%	46%	48%
South-East Europe	4,46	4,51	4,77	5,26	4,75	31%	33%	39%	42%	36%
State	**1,42**	**1,49**	**1,30**	**1,36**	**1,39**	**15%**	**15%**	**14%**	**18%**	**16%**
Non-State	**1,12**	**1,14**	**1,22**	**1,39**	**1,22**	**11%**	**11%**	**13%**	**16%**	**13%**
Listed	**1,30**	**1,32**	**1,48**	**1,69**	**1,45**	**13%**	**13%**	**16%**	**18%**	**15%**
Unlisted	**1,08**	**1,05**	**1,06**	**1,15**	**1,09**	**11%**	**11%**	**12%**	**14%**	**12%**
XXL	**0,87**	**0,86**	**0,92**	**1,10**	**0,94**	**10%**	**9%**	**12%**	**15%**	**11%**
XL	**1,05**	**1,06**	**1,21**	**1,20**	**1,13**	**10%**	**10%**	**13%**	**13%**	**12%**
L	**2,08**	**1,96**	**2,02**	**1,97**	**2,01**	**19%**	**17%**	**17%**	**16%**	**17%**
M	**2,18**	**2,20**	**2,18**	**2,31**	**2,22**	**19%**	**19%**	**19%**	**21%**	**20%**
S	**2,28**	**2,38**	**2,48**	**2,50**	**2,41**	**23%**	**23%**	**25%**	**23%**	**23%**
XS	**2,50**	**2,62**	**2,90**	**2,81**	**2,71**	**23%**	**24%**	**24%**	**24%**	**24%**
PIGS	**2,03**	**2,10**	**2,28**	**2,29**	**2,17**	**18%**	**19%**	**20%**	**20%**	**19%**
Ill	**1,14**	**1,09**	**1,12**	**0,93**	**1,07**	**13%**	**12%**	**13%**	**15%**	**13%**
Healthy	**1,17**	**1,17**	**1,25**	**1,43**	**1,26**	**12%**	**12%**	**14%**	**16%**	**13%**
Weighted Average	**1,17**	**1,16**	**1,24**	**1,38**	**1,24**	**12%**	**12%**	**14%**	**16%**	**13%**

Figure 3. Risk efficiency in NIM model (regions, unions, development level, size etc.)



with the lowest interest rates on the continent, NIMs in banks of developed countries are very low and it may be marginally more difficult to further decrease their risk levels which may result in low risk efficiency. Among emerging countries, those in Eastern Europe have gradually increased their efficiency, in contrast to central Europe, Baltic countries, Russia and CIS countries, which have witnessed decreases. Another noticeable point is that they increased their NIM in spite of the credit crisis of 2008.

In terms of size, banks which are on the smaller side of the scale maintain higher efficiency rates than banks of all other sizes. The least efficient banks are found to be XL and XXL banks. Based on these results, it can be inferred that smaller banks tend to move quickly and/or adapt to changes effectively. Domestic banks are found to be slightly more efficient than foreign banks, and state banks and listed banks were also found to be more efficient than non-state banks and unlisted banks.

Risk Efficiency in the ROAA Model

The ROAA of European banks and their risk efficiency associated with ROAA is summarized in Table 4. In general, as in the case of the NIM model, the weighted average of efficiency is very low at 9%, indicating that there is a great margin for inefficient banks to either increase their profitability or decrease their risk level in comparison to efficient banks. ROAA decreased from 2006 to 2007 but dramatically fell in 2008, as a reflection of the credit crisis. Risk efficiency is in parallel with the ROAA trend, but the recovery in 2009 does not equate with profitability.

In comparison to the NIM model, ROAA's overall risk efficiency is lower, and this shows that since additionally operational risk is integrated, an increase in banks' profitability is not enough to justify the risk increase, so the additional risk does not add more premiums to profitability. The correlation between ROAA and risk efficiency is

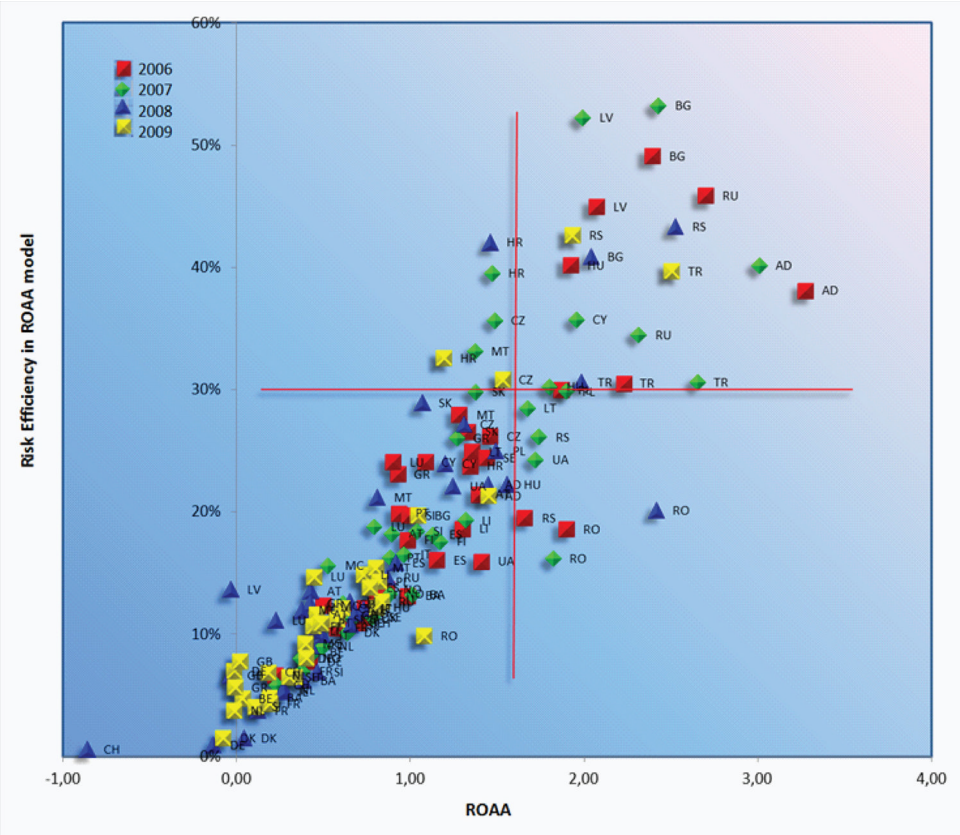
Table 4. ROAA and risk efficiency in ROAA model (countries)

Country	ROAA					Risk Efficiency in ROAA model				
	2006	2007	2008	2009	Average	2006	2007	2008	2009	Average
Andorra	3,27	3,01	1,45	1,45	2,29	38%	40%	22%	21%	30%
Austria	1,39	0,89	0,42	0,46	0,79	21%	18%	14%	12%	16%
Belgium	0,67	0,44	-1,17	0,03	-0,01	11%	9%	2%	5%	7%
Bosnia-Herzegovina	0,98	1,01	0,38	0,19	0,64	13%	13%	6%	5%	9%
Bulgaria	2,39	2,43	2,04	1,04	1,98	49%	53%	41%	20%	41%
Croatia	1,35	1,47	1,46	1,19	1,37	24%	40%	42%	33%	34%
Cyprus	1,08	1,95	1,20	0,61	1,21	24%	36%	24%	12%	24%
Czech Republic	1,46	1,48	1,31	1,53	1,45	26%	36%	27%	31%	30%
Denmark	0,73	0,63	0,04	-0,08	0,33	11%	10%	1%	2%	6%
Finland	0,98	1,17	0,65	0,44	0,81	18%	18%	13%	11%	15%
France	0,58	0,37	0,12	0,19	0,31	11%	7%	4%	4%	6%
Germany	0,42	0,37	-0,14	-0,02	0,16	8%	8%	1%	7%	6%
Greece	0,93	1,27	0,42	-0,01	0,65	23%	26%	13%	6%	17%
Hungary	1,92	1,80	1,55	0,80	1,52	40%	30%	22%	12%	26%
Ireland	0,73	0,66	0,26	-1,86	-0,05	12%	11%	5%	1%	7%
Italy	0,80	0,96	0,49	0,33	0,65	13%	17%	10%	6%	12%
Latvia	2,07	1,99	-0,04	-4,24	-0,05	45%	52%	14%	1%	28%
Liechtenstein	1,30	1,31	0,44	0,73	0,95	19%	19%	10%	15%	16%
Lithuania	1,35	1,67	0,73	-3,54	0,05	25%	29%	12%	0%	16%
Luxembourg	0,90	0,79	0,22	0,44	0,59	24%	19%	11%	15%	17%
Malta	1,28	1,37	0,81	0,80	1,06	28%	33%	21%	15%	24%
Monaco	0,50	0,52	0,37	0,39	0,45	12%	16%	12%	9%	12%
Netherlands	0,22	0,49	0,27	-0,02	0,24	7%	9%	5%	4%	6%
Norway	0,86	0,88	0,68	0,40	0,70	14%	13%	12%	8%	12%
Poland	1,87	1,89	1,49	0,82	1,52	30%	30%	25%	14%	25%
Portugal	0,93	0,88	0,43	0,48	0,68	20%	16%	9%	11%	14%
Romania	1,90	1,82	2,41	1,08	1,80	19%	16%	20%	10%	16%
Russian Federation	2,70	2,31	0,86	0,83	1,68	46%	35%	15%	13%	27%
Serbia	1,66	1,74	2,52	1,93	1,96	20%	26%	43%	43%	33%
Slovakia	1,33	1,37	1,07	0,58	1,09	27%	30%	29%	11%	24%
Slovenia	0,99	1,04	0,46	0,11	0,65	20%	18%	7%	4%	12%
Spain	1,15	1,13	0,91	0,77	0,99	16%	18%	16%	14%	16%
Sweden	1,44	0,78	0,65	0,30	0,79	24%	11%	11%	7%	13%
Switzerland	0,70	0,23	-0,86	0,18	0,06	11%	6%	1%	7%	6%
Turkey	2,23	2,65	1,98	2,50	2,34	31%	31%	31%	40%	33%
Ukraine	1,41	1,72	1,24	-1,89	0,62	16%	24%	22%	9%	18%
United Kingdom	0,62	0,61	-0,04	0,02	0,30	12%	13%	7%	8%	10%
Weighted Average	**0,69**	**0,63**	**0,09**	**0,15**	**0,39**	**12%**	**12%**	**6%**	**7%**	**9%**

also high at 69% and a rank correlation of 89%. Turkey and Serbia are the only countries that have not contended with a decline in efficiency during the whole period. Serbia's efficiency experiences the largest jump in 2008, and as a result of ROAA losses, Latvia's free fall from 2007 to 2008 represents the largest decline.

Figure 4 shows the weighted average of ROAA and risk efficiency in all countries. As can be seen from the figure, when the ROAA of banks are similar, their risk efficiency may be completely different. For example, Romanian banks' risk efficiency was 20% while the ROAA was 2.41 in 2008, and Serbia's risk efficiency was 43% at 2.52 ROAA in the same year. Bulgaria's risk efficiency was 53% at 2.43 ROAA in 2007. Banks are expected to increase both their ROAA and risk efficiency to be located within the "high ROAA-high risk efficiency" region. Turkey and Serbia are examples of this region with efficiency

Figure 4. Risk efficiency in ROAA model (countries)



of 2009 compared to their ROAA. Banks in the "high ROAA-low risk efficiency" region should be careful as they may be content with high ROAA values which actually conceal low efficiency. For example, Romania's high profitability indicators in 2006, 2007 and 2008 were associated with low efficiency and in 2009 a sharp decrease both in ROAA and risk efficiency were experienced. As can be seen from the figure, the risk efficiency of the small banking sector is more volatile as they can more easily be affected by fluctuations.

ROAA and risk efficiency based on ROAA for different categories are presented in Table 5 and Figure 5. In both the Euro and non-Euro EU region, there was a sharp decline in ROAA until 2008 and then a small decrease in 2009; on the other hand, efficiency stayed the same in 2006 and 2007. Then a moderate decrease was experienced in 2008 and in 2009 a small recovery was observed. For the non-EU region, there was a decrease both in ROAA and risk efficiency until 2008; but risk efficiency loss was eliminated in 2009. This may indicate that banks adopted their risk profile to the profitability loss of 2008 with a one-year lag in the non-EU area.

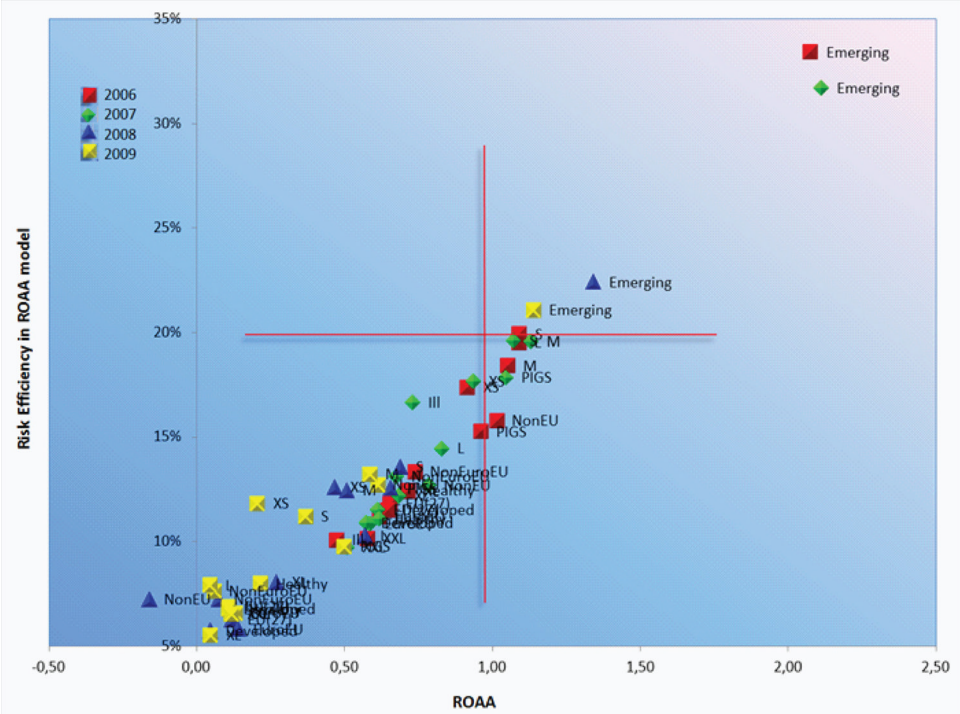
Both developing and emerging markets' banking sectors suffered in terms of efficiency, and generally ROAA loss, during the period under study. Efficiency loss is more apparent especially for Russia and CIS countries, and banks in south-eastern Europe outperformed the others but this could not prevent an overall trend of deterioration in emerging sectors.

Categorizing banks according to size shows that the least efficient XXL banks were the most affected by the financial crisis in 2008 as indicated

Table 5. ROAA and risk efficiency in ROAA model (regions, unions, development level, size etc.)

Cathegory	ROAA					Risk Efficiency in ROAA model				
	2006	2007	2008	2009	Average	2006	2007	2008	2009	Average
EU (27)	0,65	0,61	0,12	0,11	0,37	12%	12%	6%	7%	9%
Euro EU (16)	0,62	0,58	0,14	0,13	0,37	11%	11%	6%	7%	9%
Non-Euro EU (11)	0,74	0,67	0,07	0,06	0,39	13%	13%	7%	8%	10%
Non-EU	1,01	0,78	-0,16	0,61	0,56	16%	13%	7%	13%	12%
Developed	0,64	0,57	0,04	0,11	0,34	12%	11%	6%	7%	9%
Emerging	2,07	2,11	1,34	1,14	1,67	33%	32%	22%	21%	27%
Central Europe & I	1,71	1,71	1,30	0,59	1,33	32%	33%	24%	17%	26%
Russia & CIS	2,61	2,27	0,89	0,69	1,61	44%	34%	15%	12%	26%
South-East Europe	2,03	2,33	1,82	1,99	2,04	28%	29%	28%	32%	29%
State	0,76	0,62	-0,51	-0,14	0,18	16%	14%	3%	8%	10%
Non-State	0,66	0,63	0,17	0,18	0,41	11%	11%	7%	7%	9%
Listed	0,81	0,69	0,24	0,29	0,51	13%	12%	7%	7%	10%
Unlisted	0,60	0,58	-0,01	0,05	0,30	11%	11%	6%	7%	9%
XXL	0,58	0,51	-0,08	0,12	0,28	10%	10%	4%	7%	8%
XL	0,71	0,68	0,27	0,05	0,43	12%	12%	8%	6%	10%
L	1,09	0,83	0,57	0,04	0,63	20%	14%	10%	8%	13%
M	1,05	1,13	0,51	0,58	0,82	18%	20%	12%	13%	16%
S	1,09	1,07	0,69	0,37	0,80	20%	20%	14%	11%	16%
XS	0,92	0,93	0,47	0,20	0,63	17%	18%	13%	12%	15%
PIGS	0,96	1,04	0,66	0,50	0,79	15%	18%	13%	10%	14%
III	0,47	0,73	-0,23	-0,53	0,11	10%	17%	2%	1%	7%
Healthy	0,71	0,62	0,13	0,21	0,42	12%	11%	7%	8%	10%
Weighted Average	0,69	0,63	0,09	0,15	0,39	12%	12%	6%	7%	9%

Figure 5. Risk efficiency in ROAA model (regions, unions, development level, size etc.)



by decreasing ROAA and risk efficiency. Smaller banks seem to be more risk efficient but recently there has been a trend towards conglomeration with large banks. In terms of ill and healthy banks, we see a sharp decline in both ROAA and the efficiency of ill banks after 2007. Healthy banks experienced a slight recovery in 2009 but the risk efficiency improvement was not proportional to the increase in ROAA.

Risk Efficiency in the ROAE Model

Table 6 shows the ROAE and risk efficiency of different countries based on ROAE. ROAE slightly decreased in 2007 but the financial crisis reduced it to a negative figure in 2008. Although a slight improvement was indicated, risk efficiency showed no recovery in 2009.

Table 6. ROAE and risk efficiency in ROAE model (countries)

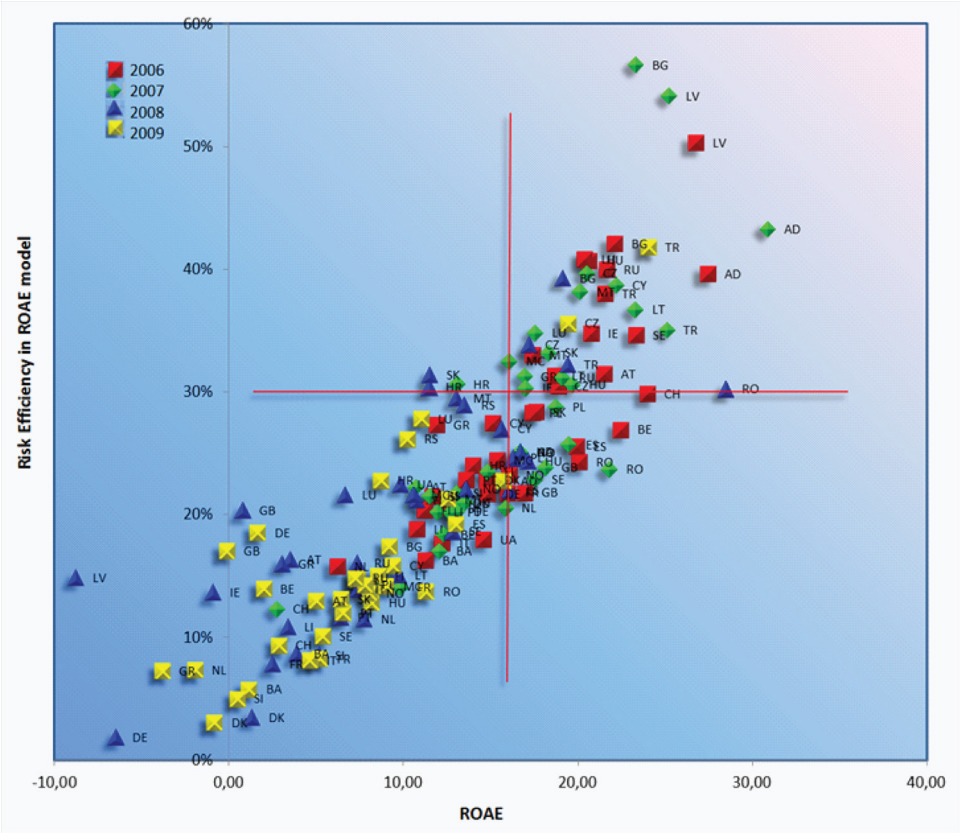
Country	ROAE					Risk Efficiency in ROAE model				
	2006	2007	2008	2009	Average	2006	2007	2008	2009	Average
Andorra	27,44	30,86	16,70	15,74	22,69	40%	43%	25%	23%	33%
Austria	21,50	10,68	3,49	5,00	10,17	31%	22%	16%	13%	21%
Belgium	22,47	12,29	-33,00	1,99	0,94	27%	18%	7%	14%	17%
Bosnia-Herzegovina	11,25	12,03	3,86	1,12	7,07	16%	17%	9%	6%	12%
Bulgaria	22,10	23,29	19,12	9,17	18,42	42%	57%	39%	17%	39%
Croatia	14,00	13,07	11,46	8,71	11,81	24%	31%	30%	23%	27%
Cyprus	15,14	22,19	15,58	9,38	15,57	27%	39%	27%	16%	27%
Czech Republic	18,86	20,50	17,17	19,43	18,99	30%	40%	34%	36%	35%
Denmark	14,80	13,03	1,30	-0,86	7,07	23%	21%	4%	3%	13%
Finland	11,19	14,81	10,73	8,53	11,31	20%	23%	21%	15%	20%
France	15,98	9,79	2,49	5,18	8,36	22%	14%	8%	8%	13%
Germany	14,85	13,03	-6,50	1,62	5,75	22%	20%	2%	19%	16%
Greece	11,90	16,91	3,02	-3,82	7,00	27%	31%	16%	7%	20%
Hungary	20,61	19,67	17,12	8,14	16,38	41%	31%	24%	13%	27%
Ireland	20,76	17,00	-0,92	-40,35	-5,88	35%	30%	14%	3%	20%
Italy	12,21	13,53	7,36	4,61	9,43	18%	21%	14%	8%	15%
Latvia	26,74	25,21	-8,79	-59,96	-4,20	50%	54%	15%	1%	30%
Liechtenstein	10,75	11,91	3,37	7,34	8,34	19%	20%	11%	15%	16%
Lithuania	18,70	23,28	9,71	-52,25	-0,14	31%	37%	15%	0%	21%
Luxembourg	20,38	17,54	6,64	11,01	13,89	41%	35%	22%	28%	31%
Malta	17,38	20,09	13,03	12,55	15,76	33%	38%	30%	21%	31%
Monaco	15,36	16,03	10,57	8,98	12,73	24%	33%	22%	14%	23%
Netherlands	6,21	13,83	7,72	-1,95	6,95	16%	21%	11%	7%	14%
Norway	16,06	16,69	13,58	8,02	13,59	23%	25%	22%	14%	21%
Poland	17,38	18,71	16,29	7,78	15,04	28%	29%	25%	14%	24%
Portugal	13,58	12,65	6,37	6,52	9,78	23%	20%	12%	12%	17%
Romania	20,08	21,80	28,45	11,28	20,40	24%	24%	30%	14%	23%
Russian Federation	21,66	19,08	7,34	7,23	13,83	40%	31%	16%	15%	26%
Serbia	12,71	11,50	13,47	10,20	11,97	21%	22%	29%	26%	24%
Slovakia	17,59	18,29	11,50	6,40	13,45	28%	33%	31%	13%	27%
Slovenia	11,66	13,02	5,14	0,48	7,57	21%	22%	9%	5%	14%
Spain	19,93	19,45	16,05	12,99	17,10	26%	26%	22%	19%	23%
Sweden	23,33	17,53	12,80	5,36	14,76	35%	23%	19%	10%	22%
Switzerland	23,99	2,73	-36,95	2,85	-1,85	30%	12%	1%	9%	13%
Turkey	21,55	25,09	19,40	24,05	22,52	38%	35%	32%	42%	37%
Ukraine	14,58	16,66	9,82	-27,12	3,48	18%	25%	22%	8%	18%
United Kingdom	16,97	18,12	0,77	-0,13	8,93	22%	24%	20%	17%	21%
Weighted Average	**16,49**	**14,09**	**-0,71**	**1,87**	**7,93**	**24%**	**21%**	**12%**	**13%**	**18%**

In general, risk efficiency is still low within and among countries; however, it is greater than the efficiency based on NIM and ROAA which implies that banks are more similar as regards the managing of risks associated with ROAE compared to other models. Since only leverage is integrated as an additional risk factor, the capital adequacy regulations which are part of all banking sectors may have facilitated the convergence. 59% of correlation and 90% of rank correlation values show that as ROAE increases so does risk efficiency.

Another noticeable figure is that only a few countries' banking sectors (Germany, Turkey, Czech Republic, and Luxembourg) experienced increases in efficiency from 2008 to 2009. In 2009 although the ROAE of France almost tripled that of Germany, its risk efficiency was less than half, which means that Germany was more successful in managing risks to attain profitability levels. Comparing the four year period, only Turkey, Serbia and the Czech Republic indicated efficiency increase. The most dramatic decrease was measured for Latvia, with a drop from 50% to 1%. Among the largest five, the German banking sector was the most heavily affected by the financial crisis in 2008, but taking into account all four years it has been the least affected.

Figure 6 compares the weighted average of ROAE and risk efficiency in all countries. Like other models, the ROAE of banks does not necessarily reflect their risk level. The largest difference in the rank of ROAE and rank of efficiency was noted for Slovakia, with values of 87 and 29 in 2008. Romania's ROAE rank was 15, its efficiency rank was 61 in 2007. Similarly, as in the other

Figure 6. Risk efficiency in ROAE model (countries)



models, we can classify the banks in terms of high/low ROAE and high/low risk efficiency results.

Table 7 and Figure 7 indicate ROAE and the efficiency of different regions and sizes. The sharp decline in efficiency of the Euro-EU area in 2008 was followed by a slight recovery in 2009. ROAE of non-EU area banks was the worst in 2008, but in parallel to improvements in 2009, efficiency also doubled, converging with the Euro-EU region.

Banks in developed countries suffered from a substantial decrease in ROAE in 2008, but because of deterioration in all countries, the efficiency loss was not as noticeable as the profitability losses. Emerging countries underwent a steady decrease between 2006 and 2009. As in the case of the ROAA model among emerging sectors, south-eastern Europe displayed better risk efficiency performance.

A classification of banks based on size shows that in both 2006 and 2007 ROAE and risk efficiency were homogenously distributed across all categories. In 2008, XXL banks experienced profitability loss and then, with a one year lag, XL and X banks experienced the same. The same situation was observed in terms of efficiency progress. Despite the ROAE fluctuations for different years, efficiency volatility comparatively was more stable. As regards ill and healthy banks, both the ROAE and efficiency loss of ill banks was clearly and increasingly noticeable in 2008 and 2009.

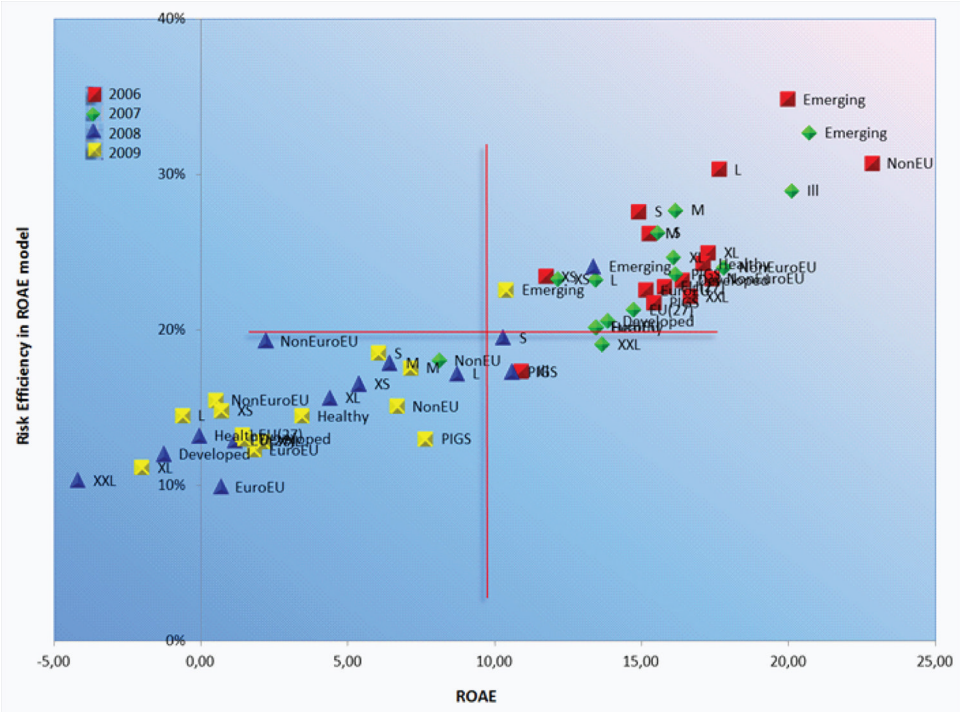
Risk Efficiency in the ALL Model

The risk efficiencies calculated in the ALL model, where inputs are credit risk, interest rate risk, liquidity risk, operational risk and leverage, and outputs are NIM, ROAA and ROAE, are presented in Table 8 on a country basis. The weighted average of risk efficiency is low, as in the other models. In the NIM model, efficiency increased from 12% to 16% in the last four years, whereas in the ALL model when operational risk and leverage were integrated it declined from 15%

Table 7. ROAE and risk efficiency in ROAE model (regions, unions, development level, size etc.)

Cathegory	ROAE					Risk Efficiency in ROAE model				
	2006	2007	2008	2009	Average	2006	2007	2008	2009	Average
EU (27)	15,78	14,71	1,16	1,42	8,27	23%	21%	13%	13%	18%
Euro EU (16)	15,14	13,42	0,67	1,81	7,76	23%	20%	10%	12%	16%
Non-Euro EU (11)	17,39	17,79	2,20	0,51	9,47	23%	24%	19%	15%	21%
Non-EU	22,84	8,12	-19,98	6,68	4,42	31%	18%	8%	15%	18%
Developed	16,37	13,85	-1,27	1,48	7,61	23%	21%	12%	13%	17%
Emerging	19,97	20,69	13,35	10,38	16,10	35%	33%	24%	23%	29%
Central Europe & I	19,12	19,95	14,53	5,49	14,77	33%	34%	27%	19%	28%
Russia & CIS	21,14	18,89	7,50	5,38	13,23	38%	31%	16%	14%	25%
South-East Europe	19,93	22,70	18,08	18,83	19,88	34%	33%	29%	33%	32%
State	17,98	12,02	-18,14	-4,05	1,95	27%	21%	5%	16%	17%
Non-State	16,30	14,56	1,59	2,49	8,73	23%	21%	14%	13%	18%
Listed	17,75	13,07	-0,13	4,82	8,88	24%	20%	10%	12%	16%
Unlisted	15,57	14,84	-1,14	-0,42	7,21	23%	22%	14%	15%	18%
XXL	16,65	13,64	-4,21	2,10	7,04	22%	19%	10%	13%	16%
XL	17,26	16,08	4,37	-2,01	8,93	25%	25%	16%	11%	19%
L	17,63	13,42	8,72	-0,62	9,79	30%	23%	17%	14%	21%
M	15,26	16,15	6,42	7,13	11,24	26%	28%	18%	18%	22%
S	14,90	15,55	10,29	6,04	11,69	28%	26%	19%	19%	23%
XS	11,73	12,15	5,37	0,69	7,49	23%	23%	17%	15%	20%
PIGS	15,41	16,14	10,57	7,64	12,44	22%	24%	17%	13%	19%
Ill	10,91	20,11	-7,35	-14,98	2,17	17%	29%	5%	2%	13%
Healthy	17,10	13,45	-0,06	3,44	8,48	24%	20%	13%	14%	18%
Weighted Average	16,49	14,09	-0,71	1,87	7,93	24%	21%	12%	13%	18%

Figure 7. Risk efficiency in ROAE model (regions, unions, development level, size etc.)



to 11% which means that most of the banks have not been successful enough at managing these risks to increase profitability.

As regards the largest banking sectors, France and Germany underwent a decrease in efficiency in 2008, followed by recovery. The UK and Italy suffered losses in 2009.

The risk efficiencies for different categories in the ALL model are summarized in Table 9. All sectors experienced efficiency loss in 2008 and that remained the same in 2009. In terms of size, the efficiency of S banks outperformed the others in all periods and the same situation is observed in all other models. Further analysis is needed to examine whether there is an empirical optimum bank size in terms of ability to adapt to new situations. Similarly, for all of the models, the efficiency of XXL banks is the lowest. One reason is the competitive market conditions in which they operate and the other reason may be the difficulty of changing the structure of their balance sheets to decrease exposure to risks, or the difficulty of improving profitability.

In 2008, there was a notably sharp decline in the efficiency of ill banks, and deterioration continued at a slower rate in 2009. The same trend is observed in the efficiency of PIGS banks to a smaller extent. Healthy banks kept the decrease to a narrow limit and even in 2009 they demonstrated small improvements.

CONCLUSION

NIM, ROAA and ROAE have traditionally been used to analyze the performances of banks. But these ratios have been criticized for being insufficient in the effective measurement of the performance of banks, since they do not take into account the risks (credit risk, interest rate risk, foreign exchange risk, liquidity risk, operational risk and leverage) associated with them. The recent

Table 8. Risk efficiency in ALL model (countries)

Country	Risk Efficiency in ALL model				
	2006	2007	2008	2009	Average
Andorra	25%	28%	20%	20%	24%
Austria	25%	25%	22%	16%	22%
Belgium	15%	12%	4%	13%	11%
Bosnia-Herzegovina	19%	20%	10%	8%	14%
Bulgaria	59%	58%	49%	53%	55%
Croatia	30%	45%	61%	38%	43%
Cyprus	30%	39%	28%	17%	28%
Czech Republic	33%	45%	34%	38%	37%
Denmark	13%	12%	2%	3%	7%
Finland	18%	17%	15%	12%	15%
France	10%	7%	5%	7%	7%
Germany	10%	11%	2%	15%	9%
Greece	31%	32%	18%	9%	22%
Hungary	51%	40%	29%	18%	35%
Ireland	15%	14%	8%	2%	10%
Italy	17%	20%	15%	9%	15%
Latvia	51%	59%	19%	1%	32%
Liechtenstein	18%	18%	11%	16%	16%
Lithuania	30%	31%	17%	0%	20%
Luxembourg	27%	26%	17%	22%	23%
Malta	32%	37%	30%	20%	30%
Monaco	15%	28%	16%	13%	18%
Netherlands	9%	10%	8%	5%	8%
Norway	17%	17%	16%	12%	15%
Poland	31%	34%	30%	32%	32%
Portugal	23%	20%	13%	13%	17%
Romania	28%	24%	30%	16%	25%
Russian Federation	57%	45%	24%	23%	37%
Serbia	36%	36%	66%	71%	52%
Slovakia	35%	37%	38%	15%	31%
Slovenia	28%	25%	10%	6%	17%
Spain	20%	23%	21%	20%	21%
Sweden	26%	13%	13%	8%	15%
Switzerland	11%	6%	1%	9%	7%
Turkey	41%	40%	39%	49%	42%
Ukraine	26%	36%	42%	31%	34%
United Kingdom	15%	15%	17%	10%	14%
Weighted Average	**15%**	**14%**	**11%**	**11%**	**13%**

Table 9. Risk efficiency in ALL model (regions, unions, development level, size etc.)

Cathegory	Risk Efficiency in ALL model				
	2006	2007	2008	2009	Average
EU (27)	14%	14%	14%	11%	13%
Euro EU (16)	13%	13%	13%	11%	13%
Non-Euro EU (11)	17%	15%	15%	10%	14%
Non-EU	18%	15%	17%	17%	17%
Developed	14%	13%	13%	10%	13%
Emerging	42%	40%	40%	31%	38%
Central Europe & I	38%	40%	39%	26%	36%
Russia & CIS	55%	45%	45%	23%	42%
South-East Europe	38%	37%	37%	41%	38%
State	20%	17%	19%	16%	18%
Non-State	14%	14%	13%	10%	13%
Listed	16%	15%	10%	11%	13%
Unlisted	14%	13%	11%	11%	12%
XXL	12%	12%	9%	10%	11%
XL	14%	13%	9%	8%	11%
L	24%	19%	15%	13%	18%
M	23%	24%	17%	18%	20%
S	26%	25%	20%	19%	23%
XS	24%	23%	19%	18%	21%
PIGS	19%	22%	18%	14%	18%
Ill	13%	18%	3%	2%	9%
Healthy	15%	14%	11%	12%	13%
Weighted Average	**15%**	**14%**	**11%**	**11%**	**13%**

global crisis has led to discussions for adopting a stronger regulatory and supervisory framework, to ensure more resistant financial institutions against redefined risks and to implement more rational and effective measures. For this reason, these ratios need further analysis as regards their association with risk to see whether profitability is proportional to risk levels or not. Even apparently perfect values of performance parameters may prevent a situation of deterioration in which decreasing risk efficiency is on the backstage. In line with this, a proper measurement of efficiency should include the effects of risks on these indicators, since the success of banks in managing their performance is expected to be largely dependent on the correct pricing and management of risks resulting from banking activities. With this study, we aim to benchmark the relationship between the risk profiles of European commercial banks and their performance indicators during the 2006-2009 period using Window analysis with SBM of DEA so that any changes in the performance during the global financial crisis can be captured too. The results make it possible to observe the risk

efficiencies of banks based in different countries as regards unions, regions, development levels, whether or not they are domestic or foreign, types of ownership, if they are exchange listed or not, and in terms of size.

The results of all of the models show that there is an extensive difference between banks of the same country and banks in different countries based on exposed risks and performance indicators. Risk increment is not always compensated by a profitability increase. Although there is a positive correlation between risk and performance indicators, this relationship is not observed in all banks. Identifying those banks which do not hold to this basic risk and reward relation may provide additional insight about such banks.

The financial crisis substantially decreased the risk efficiency of all banks, especially in 2008 and some banks began to recover slightly in 2009. Deterioration was more notable for banks in developed countries while some emerging markets, such as southeastern Europe, even boasted improvements. Nonetheless, during the whole period, the banks in developing countries were found to be more efficient than those in developed countries. It was also found that small banks with 10-25 billion in assets outperformed all banks of other sizes. That may indicate that their size gives them the ability to quickly adapt to new developments.

Benchmarking banks allows banks to revise their position, as high risk levels associated with comparatively low profitability is not sustainable. These banks should search for ways to move towards a highly profitable and high risk-efficient region.

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KEY TERMS AND DEFINITIONS

Data Envelopment Analysis: A frontier-based nonparametric method that measure and benchmark the efficiency of a unit by maximizing the ratio of weighted outputs to weighted inputs and then normalizes the ratio according to best performing units.

Intermediation Approach: Assumes banks as intermediary and estimates the efficiency in converting resources (deposits, security issues, owner's equity etc.) into assets (loans, other earning assets, etc.).

Net Interest Margin: Net interest income over average earning assets. It is one of the most important indicators used in observing the performance of banks.

Production Approach: Treats a bank as a production unit and measures the success of using some resources (personnel number or salary, equipment, other non-interest expenses, etc.) as input to produce deposits, earning assets, non-earning assets, interest income, non-interest income and other products.

Profitability Approach: Measures how efficiently a bank maximizes its profits by decreasing expenses while increasing revenue. Therefore, the cost-related items (personnel expenses, non-interest expenses, loan loss provisions, etc.) are used as inputs and revenue-related items (net interest income, non-interest income, etc.) are used as outputs.

Return on Assets: An indicator reflecting how efficiently a bank utilizes its assets to generate profit and it is calculated by dividing the net income by average assets.

Return on Equity: An indicator reflecting how efficiently a bank utilizes its equity to generate profit. ROE is one of the most important indicators that reflect the performance of banks.

Risk Efficiency: The success of maximizing performance indicators in comparison to the lowest possible risk indicators.

Slacks Based Model: A DEA model that, different than basic models, deals with input excess and output shortfall simultaneously and incorporates slacks into calculation.

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Chapter 63
Does Geography Matter?
A Study of Determinants of Bank Office Size in Illinois

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ABSTRACT

This study investigates the role of geography in shaping the average bank office size in Illinois banking. "Geography" here refers to a host of socioeconomic, demographic, and local community characteristics at the bank market level. The study finds that larger bank markets, higher levels of market concentration, higher percentages of whites within the total population, and less physical fragmentation within a geographical bank market contribute to larger average bank office sizes. The use of technology, represented by higher percentages of physical capital and premises in the total assets, is found to reduce the bank office size. This tendency is further reinforced by a lack of economies of scale at the bank office level. At the same time, the study finds that the greater adoption of internet banking is associated with larger bank offices. These findings provide indirect evidence that market structure has an impact on the adoption of alternative banking technologies. A study of bank office size has practical implications in providing insights into the future branch strategy, as well as the inadequate nature of measures of market power currently used in antitrust regulation.

INTRODUCTION

This study investigates the role of local socioeconomic, demographic, and community factors as determinants of bank office size, along with the role of technology, economies of scale, and bank market conditions that have long been recognized as factors in shaping bank office size. Over the past thirty years, the U.S. banking industry has undergone significant restructuring. Three areas of restructuring can be identified: banking consolidation and institutional changes, portfolio changes and product and service diversification, and geographical deregulation in the form of nationwide interstate banking and branching. In light of the 2008-2009 financial and banking crisis and current economic difficulties, the merit of these transformations is called into question. Nonetheless, given the changes that have already taken place, studies on characteristics of banking structure can still

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provide valuable insight into the state of the U.S. banking industry. One particular facet of banking structural change is bank office size. As banks in the United States become increasingly large, the average size of bank offices becomes increasingly small (Hannan & Hanweck, 2007). In addition to a drastically changed regulatory environment, overall banking consolidation, and adoption of the latest technologies, changes in bank office sizes may have also been associated with locally based conditions, which can be collectively subsumed under "geography." Important geographical factors include the size of bank geographical markets, market structure, the physical configuration of local communities within a market, local ethnic composition, per capita income, population density, level of urbanization, level of education, characteristics of the local economy and the local banking industry, etc. Although market structure, economies of scale, and bank market conditions have long been recognized as contributing to the bank office size, other factors have yet to be adequately analyzed for their potential roles in shaping bank office size. This paper intends to fill this void, using Illinois banking as a case study.

Focusing on Illinois banking is of particular significance. As a traditional unit banking state where banks were prohibited by law to open branch offices outside their head offices, branch banking in Illinois has undergone dramatic development and the average size of bank offices has experienced constant changes since the banking geographical deregulation, making them one key area of structural change in Illinois banking. To understand structural changes in Illinois banking is in part to understand changes in branch banking and bank office sizes. In contrast, in states such as New York where branch banking was allowed historically, branch development and changes in office size have not been a significant issue since banking deregulation. For example, between 1980 and 2007, while the number of commercial bank offices in New York increased by 4%, the same time span saw an increase of over 180% in bank offices in Illinois. As a result, 64 out of 84 (76%) Illinois banking markets experienced a decline in the average office size, while only 10 out 33 (30%) banking markets in New York did so.

A study of determinants of bank office size has practical implications for the banking industry in general. As bank office size and banking at bank offices experience dynamic changes in part driven by banking technologies, the future branch strategy and the related bank office design have become important issues within the banking community. A study of geographical factors of bank office size may provide additional insight into the issues. In addition, the rising number of bank offices improves customers' accessibility to bank services and reduces the market power exerted by banks within the spatial market. This calls into question the measures of market power currently used in antitrust regulation, which take into account the firm level market shares but leave out characteristics of branch banking and community configuration within a bank market. Arguments can be made for the need for more inclusive measures.

THE LITERATURE

A traditional perspective relates the bank office size to economies of scale at the bank office level. While some find significant economies of scale at the branch level (Longbrake & Haslem, 1975; Zardkoohi & Kolari, 1992), Nelson (1985) finds that branches display constant returns to scale up to the $20 million deposit size level, followed by increasing returns to scale after that. Benston, Hanweck, and Humphrey (1982) observe that average branch size stabilizes at the $25 to $35 million range and that further banking growth is more likely to be accommodated through opening new branches. To a certain extent, the notion of economies of scale is related to the "optimal" level of resource deployment at the bank office, alluded to by Nas, Ray, and Nag (2005). They find

that the personnel cost efficiency at the branch office level is in part related to the branch office size, and that the medium-sized offices have lower cost efficiency than small and large-sized offices. That is, the cost curve at the branch office level is reverse U-shaped. They also find that labor productivity is lowest at the smallest offices. As a result, consolidation of these offices would generate more productive offices through economies of scale.

With the U.S. banking industry undergoing significant structural changes in recent decades, attention has shifted to the role of structural factors in shaping branch banking and thus bank office size. A number of authors point out paradoxical roles of technology in branch banking in recent decades (Hirtle, 2007; Nam & Ellinger, 2008). On the one hand, the technological advances such as ATMs, internet banking and electronic delivery, and centralized call centers have diversified the delivery of, and lowered the cost of, banking services. The traditional "brick and mortar" bank offices, as a relatively expensive channel of delivering banking services (Orlow, Radecki, & Wenninger, 1996), seem at a disadvantage. On the other hand, as shown previously, there has been a steady growth of branch bank offices in the United States since the 1980s (Nam & Ellinger, 2008). Despite the rapid adoption of technologies in banking, the need for bank offices has not disappeared.

Indeed, Spieker (2004) believes that branch offices are still a highly effective and profitable distribution channel for retail banking compared with internet banking and call centers. Some researchers note that neither ATM nor online banking provides full service banking, especially with regard to lending. Thus they are at present a service enhancement to conventional bank delivery, a supplement to the bank office, rather than a substitute (Brevoort & Wolken, 2008). With changing technologies, the transaction mix at bank offices is changing too. The reduction in check-related transactions at bank branches is being replaced by the marketing of certificates of deposit, personal and commercial loans, mortgages, and credit cards (Contributor, 2009). There are still over 80% of bank customers who use an office once a month and 30% use an office 4 to 5 times each month (Wall Street Journal, 2003). Building branches has been one of the most effective ways for banks to compete for retail customers in recent years (Hirtle & Metli, 2004). Bank offices still matter in retail banking.

Hannan and Hanweck (2007) report a general trend of declining average bank office sizes since the late 1980s, with the office size being measured by the average number of bank employees per office. Indeed, for the U.S. commercial banking industry as a whole, the average number of employees per bank office was 27 in 1980. In 2009, it was 21. Hannan and Hanweck attribute the office size reduction to technological factors such as the use of ATMs, which substitute for expensive bank tellers and results in smaller office sizes. They also see in-store bank offices as a broadly defined technological change causing the bank office size to be small. They also find that markets experiencing greater growth in branch offices experience greater reduction in the average size of bank offices. They take this as evidence that new technology may help reduce office size since in markets with faster office growth, new offices are more likely to incorporate newer technologies than old offices. They further speculate that with fewer numbers of employees needed to handle the operation of a branch, a larger number of smaller branch offices in a market becomes desirable. Hannan and Hanweck's conclusions are important in providing insight into the role of new banking technologies. That is, although the latest banking technologies may not eliminate the need for, or reduce the number of, bank offices, they cause the bank offices to become smaller. In other words, there is a substitution of technology for office size, rather than for the number of bank offices. Lower banking cost may come as

a result of building smaller bank offices, rather than eliminating offices altogether.

Among conditions that prevail at the local geographical level, market structure has long been recognized as contributing to bank office size. For example, Rice and Davis (2007) attribute changes in branch banking to the changing market structure and find that market structure becomes more competitive in cities experiencing rapid growth of branch offices. This is conceivable when many banking institutions engage in active branching. Since rapid branch building is also frequently associated with steady decline of the bank office size (as discussed later in the case of Illinois), Rice and Davis essentially associate competitive markets with smaller average size of bank offices. On the other hand, Avery, Bostic, Calem, and Canner (1999) find that mergers of banking networks with overlapping market areas may lead to the reduction of bank offices when the post-merger institutions consolidate the banking network within a market. Closing branches while maintaining the same volume of business may cause the average bank office size to rise. Kim and Vale (2001) point out that banks act strategically in their branching decisions, taking into consideration the future response by rival banks within the same geographical market. This leads to a situation where in a more concentrated market, banks are sensitive to actions from rival banks, thus may show restraints in branching. Increasing the size of operation at an existing branch may be a preferred or less provocative option. Indeed, Hannan and Hanweck (2007) find that at least in rural markets, more concentrated markets tend to be associated with large office sizes.

In discussing retail banking, mention should be made of central place theory pioneered by German geographer Walter Christaller and further developed by German economist Augusta Lösch (Lloyd & Dicken, 1977), and more recently by Berry and Parr (1988), among others. Central place theory studies the relationship between the size of places and their functions, and the spacing between places of various sizes and functions. Although the size of establishments is not the central focus, it is nonetheless alluded to through notions such as range and threshold. The former refers to the maximum distance a customer would travel to purchase a service while the latter is the minimum aggregate demand (measured by population, customers, etc.) necessary for a firm to stay in operation (Lloyd & Dicken, 1977). Thus threshold provides a reference to the low bound of firm size while range defines the physical size of a firm's market area. In the context of retail banking, it is conceivable that the traditional restrictions on branch banking would cause a bank office to serve a market significantly larger than its threshold, but force many customers to travel a distance close to their ranges. Branch restrictions were intended to protect the interest of local banks while the interests of consumers and the overall economy were inadvertently sacrificed (Calomiris, 2000). Indeed, studies find that traditional unit banking and restrictive branch regulations caused lower numbers of bank offices on a per capita basis than otherwise at both the county (Guttentag & Thomas, 1979) and state (McCall, 1980) levels. On the other hand, Dick (2003) finds rising branch density as a result of nationwide branching. Zhou (2010) finds Illinois, as a unit banking state, traditionally had a level of geographical concentration of bank offices much higher than the concentration of population, indicating a high degree of supply-demand mismatch. However, bank office concentration, along with the supply-demand mismatch, has drastically decreased amid geographical deregulation and rapid branch expansion over the last three decades (Zhou, 2010).

An important insight from central place theory is that service functions found at different places are associated with the size of places, with basic functions being available at both small and large places, and specialized functions available only in large places. Basic functions have lower thresholds which can be easily met in both small and large

places. In comparison, specialized functions have higher thresholds and thus can only be met in large places (Berry & Parr, 1988). A connection is clearly seen between the size of places, the degree of specialization of functions, and the low bound of firm sizes. Holmes and Stevens (2004) drive this notion home by associating higher levels of specialization in services with larger plant size of service firms. Thus there is the logic of large market - higher end and specialized service - large office. This logic conceivably applies to banking, though there has not been any efforts seeking to prove such a connection in recent banking study.

THE ILLINOIS BANKING

For a long time, Illinois had one of the most restrictive branch banking laws in the United States (Rice & Davis, 2007). In 1870 the Illinois constitution declared Illinois a unit bank state. For the next one hundred years, most banks in Illinois remained unit banks. For example, in 1966 while a quarter of banks in the United States had branches, only 0.4% of Illinois banks did. A change came in 1967 when Illinois permitted a drive-in facility within 1500 feet of a unit bank. In 1970 when the state re-wrote its constitution, the prohibition on branch banking remained. In 1976, the state allowed a bank to establish a second facility within 3500 yards of the bank. Regional recession and a banking crisis in the 1980s forced the state to speed up banking deregulation. In 1982, a third "community service facility" within the same county was allowed. In 1985 up to 5 facilities or branches were allowed for a bank with the first facility being within 500 yards of the main bank, the second within 3,500 yards, and the remaining three within the same county. A branch could be located outside the county if it was within ten miles of the main bank. In 1987, prohibition of branch banking was formally repealed. However, restriction on branching died hard. Even in 1990, the state still set a limit of up to 10 branches in the home county, 5 in each contiguous county, and 5 in any other county within 10 miles of the main banking premises, though branching through mergers or acquiring troubled banks were not restricted. In 1993, the state finally allowed statewide branching without limitations on location or number.

Since the geographic deregulation, branch banking has become one of the most prominent developments in Illinois banking. Table 1 summarizes selected facts that reveal changes in the Illinois economy and banking, in comparison with those in the U.S. from 1980 to 2008. As can be seen, although increasing in population, real income, and deposits, the most dramatic growth in Illinois is that of branch offices with a 702% growth between 1980 and 2008 compared with 113% for the U.S. as a whole. For the U.S., the average number of bank office per 10,000 people barely changed from 1980 to 2008. For Illinois, the average number of bank offices per 10,000 people rose from below the national average in 1980 to above the national average in 2008. The ratio of the percentage of unit banks to the percentage of branch banks in Illinois changed from significantly larger than that in the U.S. in 1980 to a level comparable with the national average. From the last two rows of Table 1, it is clear that although increasing significantly, the average size of the branch banking network in Illinois still lags behind the nation.

The above comparison indicates important characteristics of change in Illinois banking. Branch banking has been a key development in Illinois during the past thirty years, after being shackled by the state law and regulations over a century. However, in understanding the nature of branch banking expansion in Illinois, it is necessary to go beyond the general interpretation of these developments as a response to fundamental geographical deregulation. Branch banking in Illinois is most likely uneven and responding to varied local dynamics in terms of socioeconomic, market, and community conditions. As rapid branch banking development has come only in recent decades and

Table 1. Selected facts of changes in banking: Illinois vs. the U.S.

	Illinois	U.S.
Bank Branch Growth: 1980 - 2008	702%	114%
Real Bank Deposit Growth: 1980 - 2008	8%	142%
Population Growth: 1980 - 2008	13%	34%
Real Personal Income Growth: 1980 - 2008	99%	136%
Average Number of Bank Offices per 10,000 People: 2008	3.75	2.95
Average Number of Bank Offices per 10,000 People: 1980	1.56	2.34
Percent of Unit Bank vs. Percent of Branch Banks: 2008	26% vs. 74%	25% vs. 75%
Percent of Unit Bank vs. Percent of Branch Banks: 1980	67% vs. 33%	47% vs. 53%
Average Number of Branches per Bank: 2008	8.5	12.6
Average Number of Branches per Bank: 1980	1.4	3.7

Sources: Calculated from the FDIC data.

is still ongoing, Illinois banking offers a fresh case study opportunity for researchers to investigate how a variety of current and prevailing local conditions, rather than historical inertias, have helped shape bank office size.

METHOD, VARIABLES, AND DATA

Following Hannan and Hanweck (2007), a multiple linear regression model, as shown in Equation 1, is used. In the equation, the dependent variable Y_i is the average bank office size, while independent variables, X_{ij} are a vector of determinants *1…j*. Equation 2 is an alternative, spatial autoregressive model, which adds a spatial lag, $\boldsymbol{WlgY}$ to the original Equation 1, with $\boldsymbol{W}$ being the first order continuity matrix (Anselin, 1993), entries of which are binary values with W_{ij} being 1 when two geographic markets are adjacent and 0 otherwise. The reason for a potential need for a spatial autoregressive model is that the observations used in the study are geographic markets in Illinois. Among spatially adjacent markets there may exist spatial autocorrelation. That is, the office size of one market may be influenced by those in neighboring markets as a result of operating in similar geographic areas or under a similar business environment. If statistical tests point to the existence of significant spatial autocorrelation, the spatial autoregressive model should be used. This is similar to a regression that uses time series data and thus needs to incorporate a time lag to account for possible serial correlation. In Equation 1 and/or Equation 2, a, α and β_i are parameters to be estimated, and ε_i is an error term:

$$LgY_i = a + \sum \beta_i LgX_{ij} + \varepsilon_i \quad (1)$$

$$LgY_i = a + \alpha \mathbf{W} LgY_i + \sum \beta_i LgX_{ij} + \varepsilon_i \quad (2)$$

An important departure from Hannan and Hanweck (2007) is that this study adopts deposits as a measure of bank office size, rather than using the number of employees. Hannan and Hanweck estimate the average number of employees per bank office by using data from *County Business Patterns*. *County Business Patterns* reports the number of bank offices falling within size categories such as 1-4 employees, 5-9 employees, 10-19 employees, 20-49 employees, 50-99 employees, 100-249 employees, etc. They estimate the total number of employees working in a particular size category by multiplying the mid-point (or the mean of the

lower and upper bound) of the size category (e.g. 2.5 for 1-4 category, 7 for 5-9 category, etc.) with the number of bank offices in that size category. For example, in 2008, 6 bank offices in Madison county, Illinois fell in the 1-4 employee size category. The total number of employees working in bank offices of that size category would be estimated to be $2.5 \times 6 = 15$. Applying this method to all size categories would produce an estimated total number of commercial bank employees in a county. Dividing this number by the total number of bank offices in the county gives the estimated average number of employees per bank office in the county. Such estimation can be done for rural bank markets (non-metro counties) as well as the metropolitan markets.

The Hannan and Hanweck estimation method assumes an identical number of offices of various sizes within a size category. For example, within the size category 1-4, for the estimation to be accurate, there should be equal numbers of firms with one employee, two employees, three employees, and four employees. When this assumption is not met, distortion will occur. The amount of distortion can be demonstrated to be $N \times R/2$, where N is the number of offices within a particular size category and R is the width of a size category (difference between the upper and lower bounds). The details in deriving this expression of distortion and a graphic demonstration can be found in the Appendix. In general, the extent of distortion will rise with the number of offices within a size category and with the office size category.

As stated earlier, the present study adopts deposits as a measure of the bank office size. The amount of financial resources, such as asset or loan or deposits, has always been used as measures of the size of banking institutions. In examining economies of scale at the bank office level, Hanweck and Humphrey (1982) and Nelson (1985) use deposits as a measure of bank branch sizes. Distinction can be made between bank outputs and bank inputs (Gandhi & Swizter, 1988; Das, Ray, & Nag, 2005), with assets, deposits, lending, mortgages, total bank credits, etc. being bank outputs while staff members, equipment, office space, etc. are bank inputs. As a result, the bank office size can be alternatively measured using outputs or inputs. Hannan and Hanweck (2007) adopt an input measure of the bank office size while the present study uses an output measure of bank office size. The advantage of using deposits as a measure of office size is the data availability through the FDIC *Summary of Deposits* data. Under certain circumstances, input and output measures of office sizes may be consistent. For example, in Illinois, the average bank office size measured by the number of employees and that measured by the amount of deposits declined in lockstep from 1980 to 2009, leading to a correlation coefficient of 0.89.

In the Hannan and Hanweck (2007) estimation, the vector of independent variables includes local socioeconomic conditions such as population, per capita income, profitability measured by the rate earned on interest bearing assets, market concentration, immigrants, traffic congestion, and a dummy variable for intrastate banking deregulation. The present study adopts a more comprehensive set of independent variables fully represent local as well as general conditions. These variables can be divided into several categories. The first category includes socioeconomic variables within a local bank geographical market such as per capita personal income (PCI), the percentage of whites in the total population (WHITE), the percentage of population aged between 16 and 21 who are enrolled in public schools (SCHOOL) and the percentage of population aged between 18 and 65 (LABOR). Although these socioeconomic variables have not been widely adopted as bank office size factors, there are reasons to examine their potential roles. In terms of income level, it is conceivable that wealthy markets generate more deposits and thus demand for more sophisticated financial services, which tend to be associated with large bank offices, everything else being equal. The level of school enrollment is closely associated

with the general level of education, which may affect the adoption of technologies in banking. More educated customers are more likely to adopt latest banking delivery technologies than the less educated. Similarly, of all adult bank customers, those still in the labor force are more likely to be open to the latest technology than retirees. Thus through their effects on using the latest banking technology, both more educated and active working customers would be associated with smaller bank office sizes.

The above hypotheses are supported by many surveys concerning consumer banking behaviors. Surveys by the American Bankers Association, a trade group, consistently find that younger age groups are more likely to use internet banking than older age groups (ABA Banking Journal, 2011). Surveys by the Federal Reserve Bank of Boston on consumer payment methods also reveal that when comparing the likelihood of adopting online payment among various socioeconomic groups, Asians and whites are more likely than African Americans and Hispanics to adopt these methods; high income-high net worth groups are more likely than lower income- lower net worth groups to adopt online payments; more educated groups are more likely than less educated groups to do the same (Schuh & Stavins, 2008). In addition, there is a large body of literature devoted to the issue of discrimination in banking against racial minorities (Bradbury, Case, & Dunham, 1989; Canner & Smith, 1991; Holmes & Horvits, 1994). To the extent that discriminatory practices are widespread, we would expect a smaller amount of resources available to banking, thus a smaller average bank office, in markets with higher racial minorities. In the years leading up to the 2008-2009 financial crisis, some banks aggressively expanded into sub-prime products serving the needs of lower income and/or racial minority populations. If such efforts led to rapid office expansion, they would act as additional contributing factors for smaller office sizes.

The second category of independent variables reflects the economic characteristics of the local bank markets. Banks serve consumers as well as businesses. Banks are always seen as the major source of financing for small businesses (or firms with employees under 500, a criterion set by the U.S. Small Business Administration except some manufacturing sectors for which the standard goes beyond 500). For example, the latest Survey of Small Business Finances, conducted in 2003 by the Federal Reserve System, shows that 87% of small businesses used financial services from commercial banks (Mach & Wolken, 2006). Even large businesses use banks for crucial financial services such as deposits, loans, and lines of credit to hedge their finances from the securities markets (Saidenberg & Strahan, 1999). The latest Federal Reserve System Survey of Terms of Business Lending by U.S. commercial banks shows that loans with a loan-size over $1 million constitute 2/3 of total commercial and industrial loans, and loans with a loan-size over $10 million account for nearly 1/3 (Federal Reserve System, 2012). These mid and large-sized bank loans clearly indicate that banks are still important sources of finance for mid and large-businesses, in addition to being the major source of finances of small businesses. As discussed previously, businesses with higher levels of specialization tend to have larger establishment sizes (Holms & Steven, 2004). Thus within a bank market, bank office size is expected to increase with rising levels of specialization of the local economy. This is so because larger establishments are more likely to be financed through larger bank offices staffed with financial officers who have expertise in more specialized business areas. To capture such an effect, proxies of local economic conditions are introduced. These are the location quotients of business and economic activities including construction (CONSTRUCT), manufacturing (MFG), wholesale (WHOLESALE), retail (RETAIL), transportation (TRANSPORT), information (INFO), finance (FINANCE), real estate

(ESTATE), professional (PROFESSION), support services (SUPPORT), healthcare (HEALTH), arts and entertainment (ARTS), and accommodation (ACCOM). A few industries are not included due to missing values in too many observations. These include agriculture, mining, utilities, management, and education. In 2006, the year for which the data are used for estimation, management, which had the largest size of labor force among all industries not included, hired less than 3% of the total labor force in Illinois. Thus the impacts from missing industries are not expected to be significant. In fact, it is exactly the small size of these industries in some Illinois counties that makes the identity of individual establishments a privacy issue and thus results in their exclusion from *County Business Patterns* by the Census. The location quotient for an industry is calculated as the ratio of the percentage of the labor force in the industry within a bank market in Illinois, to the corresponding percentage for the U.S.

The third category of independent variables represents various local bank market conditions, including the market size, market concentration, profitability, and the use of technology. The market size can be alternatively represented by the total real personal income, the total population, labor force, the total real deposits, etc. There are generally high correlations among these measures. To avoid multi-collinearity, only one such size measure is introduced. In the end, the total real income (INCOME) is used since the model containing INCOME produces a regression with the highest R^2 and more significant independent variables. This is not an entirely surprising result since INCOME is a direct measure of the monetary wealth the banking industry would target. As previously discussed, central place theory associates high end and specialized service functions with large places or large markets (Berry & Parr, 1988), and Holmes and Stevens (2004) associate higher levels of specialization of service activities with large plant sizes. This logic of large market - higher end and specialized service - large office conceivably applies to banking. As a result, a positive relationship between the market size and the office size is expected. In addition, the physical configuration of local communities within a bank geographical market may also affect the bank office size. According to convention, a metropolitan area is defined as an urban banking market and a non-metro county as a rural market. However, within a bank market (rural or urban) there are likely multiple sub-markets (cities and communities). Standard economic theory considers a "geographical market" as a frictionless space where consumers can obtain bank services available at different locations with the same cost (Blair & Kaserman, 1985). Such a naïve conception of the geographical market implies that the physical configuration of local communities within a geographical market has no impact on the bank office size. All a banking firm needs to do is to operate one single office to serve the entire market. The entire banking sector within the market can be situated at one location. In reality, there is no such frictionless space and there exist sub-markets consisting of cities and local communities. The banking sector diffuses among communities, and a banking firm may split its operation across sub-markets. For example, a bank may choose to split into many offices and be present in many sub-markets, leading to a smaller average size. On the other hand, in a market containing only a small number of sub-markets, a firm of the same size needs only split into a smaller number of offices, leading to a larger average office size. The actual combinations of bank offices (number and size) and sub-markets (number and size) may vary. The point is, the economic concept of the bank geographical market without incorporating the physical configuration of local communities within the market is too simplistic to accommodate the reality. Thus, in conjunction with the measure of market size, this study introduces a variable COMMUNITY, which is the number of communities per 10,000 people within a bank market, in order to account for the

physical configuration of the local communities within a bank geographical market.

Following convention, the well-known Herfindahl-Hirschman Index (HHI) is used to capture the effect of market concentration. The HHI is calculated as the sum of squared market shares of all banking firms within a bank market. A higher value means a more concentrated market and a smaller number of large firms may exert more influence. As discussed above, more concentrated market structure is expected to be associated with larger offices (Kim & Vale, 2001; Hannan & Hanweck, 2007) due to firms' strategic behaviors.

Incorporation of profitability variables in the regression is to account for possible economies of scale at the office level. Everything else being equal, a positive association between office size and bank profitability would indicate higher levels of profit associated with larger offices, and thus the existence of office level economies of scale. Three alternative bank profitability measures are considered. One measure is the weighted rate of return on assets for a bank's geographic market or WROA. The measure is constructed by first weighing a bank's rate of return on assets with the bank's deposit share within a geographic market in Illinois. Summing up such a measure over all banks within the geographic market generates the weighted rate of return on assets for the market. Banks with a larger share within the market contribute more to the WROA than those with smaller shares. Using a similar method on the rate of return on equity produces the weighted rate of return on equity or WROE. A third profitability measure is developed using the following procedure. First, estimate a bank's assets within a geographic market in Illinois. This is done by multiplying a bank's total assets by the percentage of that market within the bank's total operation (e.g. deposit share or the share of the bank's offices located within the market). To avoid the possible bias associated with using either deposit share or the share of offices alone, this study uses an average of the two share values. Summing up estimates of bank assets within a geographic market over all banks within that market leads to an estimate of aggregate bank assets within that market. Applying the same method on banks' before tax profit produces an estimate of aggregate bank profit within that market. Dividing the estimate of aggregate bank profit by the estimate of aggregate bank assets generates the aggregate rate of return on assets by the banking sector within that market or AROA. It turns out that WROA, WROE, and AROA are highly correlated with each other. To avoid multi-collinearity, only one profitability measure is introduced into the model at a time. The model with AROA generates the highest R^2 and thus is preferred.

A bank's use of banking technologies is measured utilizing two alternative proxies. One proxy of technology is WINTERNET or weighted use of internet banking. This proxy is created by summing up deposit shares of all banks within a geographic market that use the internet in banking. To construct the second proxy of technology, the percentage of a bank's premises and physical capital with respect to total assets is multiplied by the bank's deposit share within a geographic market in Illinois. Summing up this measure over all banks within the market leads to a weighted share of bank premises and physical capital (WCAPITAL). Banks with larger shares within the geographic market contribute more to the measure than those with smaller shares. Possession of a higher percentage share of physical capital and premises within the total assets can come for two reasons. The first is due to the "newness" of a bank as newer premises and physical capital experience less depreciation and thus constitute a larger percentage of the bank assets. According to Hannan and Hanweck (2007), "newness" implies higher content in terms of the latest technology. The second reason for a higher percentage of physical capital and premises within the total assets is the adoption of expensive technologies. Both reasons

provide rationale to treat WCAPITAL as a proxy for the use of technology. A negative association between the average office size and the measures of the use of technology would indicate the role of technology in reducing the bank office size. Since WINTERNET and WCAPITAL are not highly correlated, both variables are simultaneously introduced into the model.

Finally, the present study includes alternative measures of market dynamics such as the rates of population growth (POPGROW), total real personal income growth (INCGROW), or total real bank deposit growth (DEPGROW) from 2000 to 2006. Market growth is a more general measure than the measure of immigrants as used in Hannan and Hanweck (2007). Again, these alternative measures of market dynamics are highly correlated and thus are introduced into the regression one at a time to avoid collinearity. In order to account for possible different effects from rural markets and urban markets, two more variables are used. One is population density (POPDENSITY) and the other is a bi-value dummy variable (MSA) with the value being 1 for metropolitan markets and 0 otherwise. Population density also in part substitutes for the measure of traffic congestion used in Hannan and Hanweck (2007).

Since the study is focused on Illinois where an undifferentiated regulatory environment prevails, no regulatory variable is used. All variables are converted to logarithm of base 10 to ensure that the data is better conformed to the distribution requirements. Following Hannan and Hanweck (2007), the independent variable has a one year lag from the dependent variable. Specifically, the model uses 2007 data for dependent variable and 2006 data for the independent variables. The dynamic variables use data from 2000 to 2006.

The personal income data are obtained from the Bureau of Economic Analysis at the U.S. Department of Commerce. All monetary values (income and deposits) are converted into the 2005 value. Other socioeconomic variables such as education, population structure, racial data, etc. are from the U.S. Census. As discussed above, location quotients are calculated using employment data for various economic sectors obtained from *County Business Patterns*. The banking data are from the FDIC. Following convention, bank markets in Illinois are divided into rural markets represented by non-metro counties and metropolitan markets represented by the metropolitan areas.

RESULTS

The first task in estimation is to determine whether Equation 1 or Equation 2 should be used. This is necessary to determine whether there is significant spatial autocorrelation within the dataset. That is, whether the average bank office size of a market is influenced by those of spatially adjacent markets. An index in assessment is the Geary's C, as shown in Equation 3 (Griffith, 1987):

$$C = \frac{(N-1)\sum_{i=1}^{N}\sum_{j=1}^{N} W_{ij}\left(Y_i - Y_j\right)^2}{2(\sum_{i=1}^{N}\sum_{j=1}^{N} W_{ij})\sum_{i=1}^{N}\left(Y_i - M_Y\right)^2} \qquad (3)$$

In Equation 3, N is the number of observations (or the geographic markets), Y_i and Y_j the average office sizes of a geographic markets i and j respectively, and M_y the mean of average office sizes in all geographic markets. Here W_{ij} is the entry in the contiguity matrix, whose value is 1 if two geographic markets are spatially adjacent to each other and 0 otherwise. The sample Geary's C is 1.019.

An alternative spatial autocorrelation index is the Moran's I, as shown in Equation 4 (Griffith, 1987). All terms in the equation are identically defined as in Equation 3:

$$I = \frac{N\sum_{i=1}^{N}\sum_{j=1}^{N} W_{ij}\left(Y_i - M_Y\right)\left(Y_j - M_Y\right)}{\sum_{i=1}^{N}\sum_{j=1}^{N} W_{ij}\sum_{i=1}^{N}\left(Y_i - M_Y\right)^2} \qquad (4)$$

The sample Moran's I is calculated to be 0.0039. Both the Geary's C and Moran's I are asymptotically normally distributed as N increases. Thus they can be tested for significance after converting to standard normal deviates or z scores. Following the procedures defined in Cliff and Ord (1973), the sample Geary's C and sample Moran's I are converted to z scores of 0.703 and 0.4457 respectively, both of which are not significant at the 0.05 level. The null hypothesis of non-existence of spatial autocorrelation cannot be rejected. Since the Geary's C directly compares the difference between adjacent geographic markets while the Moran's I measures covariance of adjacent geographic markets around a global mean, the former is sensitive to the local spatial autocorrelation while the latter to the global spatial autocorrelation. Thus, the significance test results of both measures confirm at different levels the non-existence of the spatial autocorrelation. As a result, Equation 1 should be used in estimation.

Given a vector of 25 independent variables, a stepwise approach is adopted to select the most suitable variables to enter and retain in the model. This method enters variables one at a time depending on their ability in improving R^2 or reducing residuals significantly. The most significant variables are selected before the less significant. Not all selected variables will eventually be retained. Each time a new variable is entered, certain existing variables within the model may become less significant, and thus may be removed from the model. The selection process stops when additional variable cannot improve R^2 significantly (Hair, Black, Babin, Anderson & Tatham, 2005). In the end, 7 variables are retained in the model and the results of estimation are shown in Table 2.

Before discussing the estimated results, a brief discussion of the estimation by Hannan and Hanweck (2007) is in order. Of the three variants of their model, R^2 ranges from 0.19 to 0.48. The parameter estimate for variable *the number of immigrants into a bank market* (log form) has a positive sign and is significant at the 0.1 level in all three models. In addition, the parameter estimate for variable *the rate of return on interest earning assets* (log form) has a negative sign and is significant at the 0.01 level for their second model; and the parameter estimate for variable *Herfindahl-Hirschman Index* (log form) has a positive sign and is significant at the 0.01 level for their third model. The low R^2 and the limited number of significant independent variables of their models provide only limited insight into the determinants of the bank office size, though their models contain very large samples (Observations range from 1386 to 29800).

In comparison, the model in present study reveals much richer information with a higher R^2 (0.68) and seven significant independent variables. All parameters retained are significant at the 0.01 level except LogWCAPITAL which is significant at the 0.05 level. A positive parameter estimate for LogINCOME suggests that the average office size increases with the size of the bank geographical market. This result is consistent with the conclusions from Holmes and Stevens (2004) and central place theory that postulate that larger markets are associated with more sophisticated and specialized functions and these specialized functions are provided by larger plants or offices. Although the present study does not directly test

Table 2. Estimation results

Dependent Variable: LogDepOffice R^2=0.68; F=22.056*; Sample size N =84		
Variable	**Parameter**	**t Value**
Constant	1.615	1.600
LogINCOME	0.158**	3.618
LogHHI	0.274**	3.952
LogWHITE	0.992**	2.686
LogWINTERNET	0.230**	3.099
LogAROA	-0.378**	-2.849
LogCOMMUNITY	-0.225**	-3.331
LogWCAPITAL	-0.231*	-2.568

* Significant at the 0.05 level; **significant at the level 0.01

how banking functions differ between markets of different sizes, it seems reasonable to see the large office size as an indication of more sophisticated and specialized banking services.

The positive parameter estimate for LogHHI conforms to expectations, indicating that higher market concentrations bring about larger office sizes within a bank market, in line with the pattern identified by Kim and Vale (2001), and Hannan and Hanweck (2007). This evidence is also consistent with the textbook case of a competitive market where many small players prevail. Here the "small player" literally means physically small offices, though they may be part of larger institutions.

A positive parameter estimate for LogWHITE seems to suggest that in markets with a larger percentage of whites within the population, office sizes tend to be large. This reveals a significant social dimension of bank office size. Within the banking literature, discussions on race and banking are mostly focused on whether or not there are discriminatory practices against racial minorities such as loan denials, higher rates and/or high down-payments, poor services, etc. Evidence here seems to point to the smaller office size as another dimension in racial discrimination in banking. To the extent that racial discrimination in banking exists, as argued by Bradbury, Case and Dunham (1989), Canner and Smith (1991), and Munnell, Browne and McEneraney (1992), smaller bank offices may be indicative of inadequate resources devoted to banking, along with the above mentioned discriminatory practices. To those who reject the existence of systematic discrimination in banking (Benston, Horsky, & Weingartner, 1992; Holmes & Horvits, 1994), smaller offices in markets with concentrated racial minorities may be regarded as a sign of lower end banking and less than specialized service matching the limited banking demand from the racial minorities rather than race-based lending policies. A detailed examination of race and banking along these lines should introduce proxies of banking functions in the model in order to clarify whether the small office size is indeed an indication of limited banking services offered to racial minorities even though they have effective demand for higher-end banking services. An elaborate modeling along these lines is beyond the scope of this study. Nonetheless, evidence here does point to a new dimension of study on race and banking.

A seeming paradox occurs with respect to the effect of using technologies in banking on bank office size. On the one hand, the parameter estimate of LogWCAPITAL has a negative sign, indicating that markets with larger physical capital and premises relative to total bank assets tend to have smaller bank offices. As discussed previously, a high percentage of physical capital and premises in total bank assets are interpreted either as "newness" of the banking sector or as a result of adopting substantial technologies. Either interpretation implies a stronger role for new technologies in banking. Thus this result confirms the expected role of new technology in reducing the bank office size (Hannan & Hanweck, 2007). On the other hand, the parameter estimate of LogWINTERNET has a positive sign, suggesting that markets with higher adoption rates of internet banking tend to have larger office sizes, contrary to general belief about the role of new banking technology in reducing the bank office size.

One possible explanation of this contradiction can be found in the impact of bank market structure on the adoption of different types of banking technologies. According to Allen, Clark, and Houde (2008), when banks can operate through both offline technology within bank offices and online technology such as internet banking or remote deposit, they have incentives to manipulate the relative attractiveness of the two options to encourage customers to adopt the relatively less costly one. The ability of banks to do so depends on market structure. In a competitive market where fierce competition has improved bank office service to a high quality, banks' preemptive motive of adopting online technology yields to the fear of losing customers to rival banks (business stealing

effect) as a result of cutting back on bank office service if online technology is set as priority. The result is to slow internet banking penetration but improve bank office technology. In a concentrated market where each bank faces less competition, the business stealing effect is not as important. As a result, banks expedite adoption of online technology due to the preemptive motive and internet banking penetrates faster and wider than otherwise. Chang (2006) directly associates the adoption of internet banking as a way to provide differentiated banking services, a typical behavior for firms in concentrated markets.

The essential argument here is that the trade-off between offline technology at bank offices and online technology through internet banking is mediated through market structure. In a study of the adoption of ATMs in banking, Hannan and McDowell (1984) find that banks in concentrated markets are more likely to adopt ATMs than banks in competitive markets. Recent studies on the adoption of internet banking arrive at a similar conclusion (Chang, 2006; Allen, Clark, & Houde, 2008). There has not been empirical research on the diffusion of offline banking technology. However, in studies on the adoption of numerically controlled machine technology by U.S. industries, Mansfield (1968) and Romeo (1977) find that firms in competitive markets are more likely to adopt the new technology. In a recent study on the adoption of a new treatment technology for infertility, Hamilton and McManus (2005) find that the new treatment technology diffuses faster in competitive markets than in concentrated markets. A common characteristic in these examples is that the new technologies are adopted by the firms or clinics at their premises, and thus provide indirect evidence that competitive markets help penetration of offline technology. Anecdotal evidence shows that banks are adopting various technologies to improve competitiveness at bank offices, such as on-site scanning ATMs that reduce the need for tellers (Wilchins & Rauch, 2011), branches with no tellers but with screens connected to tellers at the headquarters (Lariviere, 2012), ATM-teller interfacing facilities allowing partial automation of cash withdrawal transactions and teller multi-tasking (Adams, 2012), video-conferencing technology that allows a financial expert to work for several offices (Ghaziri, 1998), in-store branches (Hannan & Hanweck, 2007), and increased ratios of financial advising, brokerage and investment experts to tellers and loan officers within the branch network (Kolakowski, 2012).

In the context of the present study, WCAPITAL is the percentage of physical capital and premises in the total assets. Since the study uses the percentage of physical capital and premises in total assets as a measure of "newness" in terms of technology, it is reasonable to approximate this percentage as the use of offline banking technology. If small office size is taken as a sign of low market concentration, as discussed previously, the fact that the parameter estimate of LogWCAPITAL is negative can be taken as indirect evidence that in competitive markets, offline banking technologies are invested heavily.

Similarly, WINTERNET measures the percentage of offices in a market that adopt internet banking. The parameter estimate of LogWINTERNET is positive, meaning that markets with higher adoption rates of internet banking have large office sizes. Again, if large office size is indicative of concentrated markets, as discussed previously, it would seem logical to see this as indirect evidence that in concentrated markets, online banking technologies have higher penetration rates. In other words, the seemingly contradictory behavior of LogWCAPITAL and LogWINTERNET may actually indicate the effects of market structure on the adoption of offline and online technologies in banking, consistent with theory and previous study.

It should be noted that this study only finds indirect evidence that market structure has an impact on the adoption of alternative banking technologies. For a true proof, estimation should be done directly between market structure mea-

sures and the adoption rates of alternative banking technologies.

The parameter estimate of LogAROA is negative, consistent with a pattern identified by Hannan and Hanweck (2007). This seems to suggest the non-existence of economies of scale at the office level since lower profitability is associated with larger offices. Thus, the use of technology and the non-existence of economies of scale at the office level work together to reduce the size of bank offices in Illinois. That is, the use of technology helps reduce the office size, and a smaller office is not penalized by a lack of economies of scale.

Finally, the parameter estimate for LogCOMMUNITY is negative, indicating that the office size decreases when the number of communities per 10,000 population increases. That is, the presence of many physically separate sub-markets (communities) within a bank geographical market leads to smaller bank offices. Stated another way, the fewer the sub-markets or communities within a geographical market, the larger the bank office size. The point is, physical configuration of local communities within a bank geographical market does matter. It affects the corporate strategy in competing for banking market, and thus affects the banking structure.

While seven independent variables are selected and retained in the model, most variables are not. Specifically, socioeconomic variables such as per capita income, the percentage of population aged between 18 and 65, the percentage of population aged between 16 and 21 who are enrolled in public schools are excluded from the model. All location quotient variables showing economic specialization are also excluded. In addition, population density, the rural-urban dummy variable, and market dynamics variable are also excluded. This suggests that at the level of analysis adopted by this study, not all local geographical characteristics are relevant. However, this does not suggest that these excluded variables are insignificant in shaping bank office sizes under different circumstances.

SUMMARY AND CONCLUDING REMARKS

This study investigates the role of geography in shaping bank office size within Illinois banking, along with technology, economies of scale, and the local bank market conditions. It incorporates a host of proxies for local socioeconomic, demographic, and community characteristics in modeling the bank office size, along with factors such as technology, economies of scale, and local bank market conditions. Although the local bank market conditions are also geographical, they have long been recognized as contributing to the bank office size. The focus of this study is on the local socioeconomic, demographic, and community factors that have not been given sufficient attention in past bank office size modeling. In addition, this study focuses on Illinois banking due to the significant change in the bank office size there in the last few decades. The study also departs from convention by using deposits as a measure of bank office size.

The study finds that geography matters in shaping bank office size. It finds that market size, market concentration, racial composition, and the physical configuration of local communities within a geographical market are factors that affect the bank office size, along with the impacts of banking technology. The roles of market concentration, technology, and economies of scale as determinants of the bank office size have long been known. However, this study also finds the physical configuration of local communities and racial composition within a geographical market are contributors to bank office size. It also confirms the role of the local market size in shaping the bank office size. Specifically, the study finds that bank office size is positively associated with the market size, market concentration, and the percentage of whites within the total population. Bank office size also tends to be larger in markets with a less fragmented physical configuration of local communities. In addition, the study finds

that the use of the latest technology in banking may indeed help reduce bank office size. This tendency can be further reinforced by a lack of economies of scale at the bank office level. At the same time, this study finds that the greater adoption of internet banking is associated with larger bank offices. These findings may be taken as indirect evidence that bank market structure has an impact on the adoption of alternative banking technologies. Specifically, in competitive markets, offline banking technologies (or banking at the office) are invested in more heavily while in concentrated markets, online banking technologies have higher penetration rates. The finding that larger offices are associated with higher percentages of white population may be indicative of small bank office size as a form of discrimination in banking against racial minorities, and thus opens up a potentially new dimension in the study of the relationship between race and banking. Finally, finding the non-existence of economies of scale at the bank office level is also significant since it contrasts with existing studies.

A study of determinants of bank office size in Illinois may have relevance to changes in banking in other traditional unit banking states such as Missouri, Kansas, North Dakota, Nebraska, Montana, Oklahoma, Texas, West Virginia, Colorado, Wyoming, Arkansas, Minnesota and Florida. These states have also experienced rapid branch expansion in the last few decades. The average growth of branch offices of all unit banking states (above states plus Illinois) was 1014% between 1980 and 2008 with North Dakota being the lowest at 155% and Wyoming the highest at 6067%. In comparison, the growth in the U.S. as a whole was 114% for the same period. Similarly to Illinois, rapid branch banking developments in these states have occurred only in recent decades. Thus they would be fertile ground for studies that examine how prevailing local conditions and on-going changes help shape the bank office size. However, since market, socioeconomic, and community conditions vary significantly across states, one should expect some of these local conditions to act differently in shaping the bank office size than was found in this study. In particular, given that different states had various banking regulations prior to geographical deregulation, comparison studies may help shed light on the role of banking regulation in affecting the bank office size.

The study of the bank office size has at least two practical implications for U.S. banking in general. First, it may provide insights into banking firms' future branch strategy. Amid increasing competition in the last three decades and the rapid development of remote banking such as ATMS and especially internet banking, traffic to physical offices has declined over 20% in the past decade. Some industry commentators declared the demise of branch offices (Barr, 2010). However, there has been a consensus among most industry analysts that brick and mortar bank offices are here to stay since, despite an exodus of banking transactions toward non-branch options, 80% of sales in banking still occur in branches (EFMA & Microsoft, 2007) and recent surveys show that a majority of people still prefer certain face-to-face interactions with bank staff (Miller, 2011). As a result, the need to combine technology and the face-to-face contacts has become an important debate concerning future branch strategy and bank office design within the banking community. Many envision that future bank offices should move toward being a smaller size, have unconventional interior layouts to create a welcoming atmosphere, have increasing automation of transactional functions, and emphasize sales and advisory functions, etc. (Bills, 2009; Raab, 2009; Adams, 2012).

A study of the determinants of bank office size from a geographical perspective draws attention to geographical factors such as local demographic characteristics, the physical structure of a community, and the hierarchical nature of geographical markets in shaping future branch strategy and bank office design. Geography matters and one format does not fit all. Instead of looking for a single blueprint for an ideal bank office (Sisk,

2009), the branch strategy should place bank offices in an entire banking network and design office functions to cater to varying hierarchical positions in a central place system, different community (sub-market) sizes, and unique community demographic characteristics. In other words, there should be a strategy for the entire office network and a design of a hierarchy of bank offices instead of designing a bank office in isolation. For example, a bank network can be a "hub-and-spoke" type of structure (Adams, 2012), in which small lower level branches function as feeders with no or only a few service staff and highly automated transactional banking (deposit, cash withdrawal, account inquiry, etc.) while larger high level offices at major market centers focus on mid-level decision-making, sales and advising functions mixed with automated transaction banking. At the top of the hierarchy is the flagship office with the top-level decision making, state of the art customer-interactive technology, the whole range of transactional and sales and advisory functions assisted by various combinations of automation.

Another practical implication from the study of bank office size relates to measures of market power, an issue vital in the U.S. antitrust regulation. Most measures of market power currently used are based on the firm level market shares. For example, as discussed previously, the Herfindahl-Hirschman Index or HHI is the sum of squared market shares of all banking firms within a bank market. A higher HHI value means a more concentrated market and thus a higher market power exerted by a smaller number of large firms. Alternative measures use the combined market shares of the top 3 to 5 firms. From a geographical point of view, these measures do not take into account how a bank market is spatially divided among bank branches and how local communities constitute many sub-markets within a bank market. As a result they do not adequately measure the market power associated with a market that is spatial in nature.

Greenhut and Ohta (1975) apply neoclassical price theory in the examination of central place-market area structure as seen originally in central place theory and prove that it is theoretically equivalent to a monopolistic competitive model developed by Chamberlin (1956). In a standard monopolistic competitive market, sellers compete through providing differentiated products (similar products with slightly different characteristics which help distinguish them). Customers who prefer a particular product are captive to the product and thus are under the monopolistic power of the producer. The source of product differentiation and thus the market power is the set of characteristics of the product. However, when the producer charges too high a price, or a rival producer lowers the price sufficiently, customers may switch to the product offered by the rival producer. In spatial markets where sellers at different central places sell identical product, customers within certain distances of a center are captive to, and thus under the monopolistic power of, the seller due to the longer travel distance (thus the higher cost) to rival sellers further away. Here the source of product differentiation and market power is the location of sellers and distance between sellers. Each seller's location is unique and the distance from the rival sellers provides cushion against competition. However, too higher a price from the seller or sufficiently lower prices from a rival seller may cause customers to travel to the rival seller.

It is conceivable that as sellers branch out and form additional spatial markets, the size of spatial markets would shrink and so would the spatial monopolistic power since it would now cost less for customers to travel to rival sellers' markets. The more branch offices there are, the smaller the spatial markets, and the lower the market power each office possesses. In a bank market with two banks, when each operates out of one location, customers can only choose one of the two locations for services. If each bank now operates 10 offices, customers then can obtain services from 20 different locations. Even if each bank applies the same product mix and prices across all of its 10 offices, customers would still have a much easier

time choosing between the two sets of product mix and prices than when facing only two locations. The reduced market power by branching directly translates to increased convenience for the customers. Thus market power arises not only from a limited number of firms, but also from a limited number of branch locations. As this study shows, the physical configuration of local communities has an impact on how banking firms establish their branch offices. The conventional measures of market power are based on the notion of a frictionless geographical market, ignoring the monopolistic nature of spatial markets, and leaving out information about community configuration within a bank market. Thus these measures are inadequate. Appropriate measures should incorporate office level information and the community configuration within a bank market.

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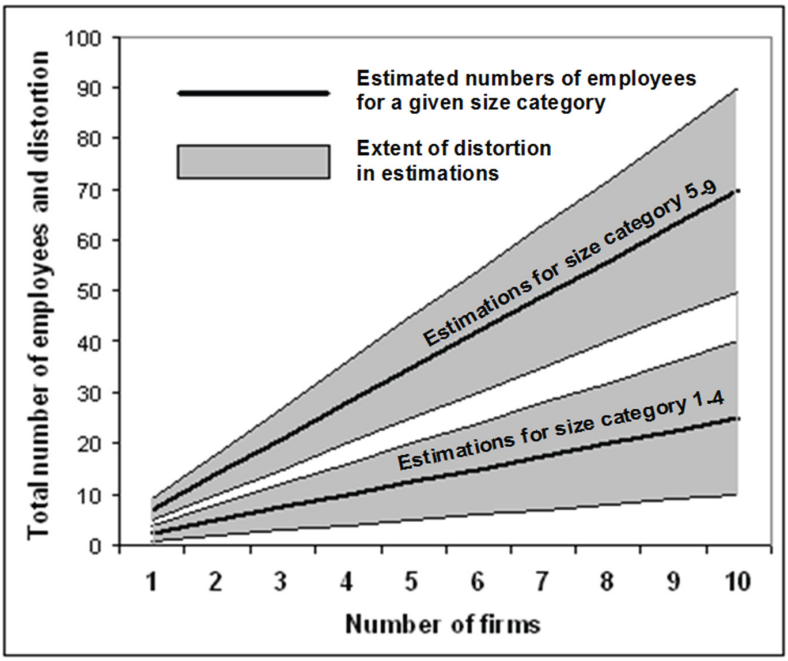
APPENDIX

Distortion Using the Hannan and Hanweck Estimation Method

Hannan and Hanweck (2007) use information from *County Business Patterns* to estimate the number of employees within a county's banking sector. Their estimation method is discussed in the paper. The potential distortion using their estimation method can be demonstrated as follows. Suppose a size category has the lower bound L and upper bound U. The number of firms in that size category is N. The mid-point of the size category is thus (L+U)/2 and the total number of employees in the size category, using the Hannan and Hanweck method, is estimated to be N×(L+U)/2. Now suppose the actual situation is that all firms in the size category have U (number of) employees. Thus the actual total number of employees in the size category is N×U. The Hannan and Hanweck method will under-estimate by N×U-N×(L+U)/2=N(U-L)/2. Similarly, if all firms have L (number of) employees, the Hannan and Hanweck method will over-estimate by N(U-L)/2. Define R=(U-L), the distortion (over-estimation or under-estimation) will be N×R/2, a product function of N and R. The extent of distortion will rise with the number of firms N within a particular size category and with the size category width R. In other words, the more the firms and the larger the firm size, the more the distortion.

The amount of distortion in the estimations discussed above can be shown in Figure 1, which shows amounts of distortion for size categories 1-4 and 5-9. For a particular size category, the dark line in the middle shows the estimates of the total number of employees for various numbers of firms using the Hannan and Hanweck method. The upper limit shows the actual numbers of employees within the size category if all firms have U (number of) employees. The gray area between the upper limit and the dark

Figure 1. Estimations of the total number of employees and estimation distortions



line shows the amount of under-estimation. Similarly, the gray area between the lower limit and the dark line shows the amount of over-estimation when all firms have L (number of) employees. For a particular size category (e.g. 1-4 size category), the gray area fans out, indicating rising distortion with the number of firms. Comparing the 1-4 size category with the 5-9 size category, the gray area for the latter is wider for the same number of firms, indicating larger distortions. The upper and lower limits of the gray area are based on extreme situations where all firms are of the largest or smallest size within a size category. The actual distortion may be smaller since the actual number of employees may fall within the gray area. Nonetheless, the potential distortion is beyond control and there will always be uncertainty regarding the extent of inaccuracy in size estimation.

Chapter 64
A Diagnosis of the Determinants of Dividend Payout Policy in India:
A Factor Analytical Approach

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ABSTRACT

Dividend decision involves the portion of a firm's net earnings that are paid out to the shareholders, and the remaining is ploughed back in the company for its growth purpose. Despite comprehensive theoretical and empirical explanations, dividend policy and its determinants are a puzzle to be fixed in corporate finance. This chapter is an attempt to assess the dynamics and determinants of dividend-payout policy using a factor analytical tool and a multiple regression analysis as a supportive tool. The authors take into account the sample of ten automobile companies based on Market Capitalization listed on the Bombay Stock Exchange (BSE) for a period of 10 years from 2002-2003 to 2012-2013. The results of the factor analysis show that six factors, current ratio, cash flow, retained earnings per share, earnings per share, equity dividend, and corporate dividend tax, are identified as the most critical factors determining dividend payout in Indian automobile companies. However, regression results depict only three factors (i.e. cash flow, equity dividend, and corporate dividend tax) have been found statistically significant in determining dividend payout policy.

1. INTRODUCTION

Dividend policy decision is an integral part of a company's financial decision making as it is explicitly related to the other two major decisions-investment and financing decision. Management should develop such a dividend policy, which divides the net earnings into dividends and retained earnings in an optimum way to achieve the objective of maximizing the wealth of shareholders. It

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refers to the practice that corporate management follows in taking dividend payout-decisions (Lease et al., 2000).

The development of such policy will be greatly influenced by investment opportunities available to the firm and the value of dividends as against capital gains to the shareholders. Since the dividend policy determines whether distribute the earnings to shareholders or self-finance through retained earnings, so it is an important issue that receives more attention these days from financial analysts, academics and practitioners. The corporate dividend policy contributes not only at the micro level but also to the analysis of several macroeconomic issues, as cash dividends constitute a part of national income and any variation in corporate dividend payouts may affect the corporate propensity to save and reinvest. Therefore, it is of great importance not only for the corporation itself but also for the economy as whole.

The study of dividend policy has captured the attention of finance scholars since the middle of the last century. The roots of the literature of determinants of dividend policy and dynamics relates to Lintner's classic study (1956), Darling (1957), Brittain (1966), and Fama and Babiak (1968). They have attempted to solve several issues pertaining to dividends and formulate theories and models to explain corporate dividend behavior. However, empirical evidences many times provide inconclusive results as to what determines the optimal dividend policy. Almost three decades ago Black (1976) epitomizes the lack of consensus by stating "The harder we look at the dividend picture, the more it seems like a puzzle, with pieces that just don't fit together." Corporate dividend policy is not an easy, straight forward and simple aspect of finance as many people conceive it (Hackett, 1981). It has long been regarded as an unresolved economic puzzle, which require rational resolution if the prevailing economic paradigm of corporate finance is to continue (Miller, 1986). Despite many studies conducted by financial economists, the issue of dividend policy determinants still remains debatable.

2. REVIEW OF LITERATURE

Lintner (1956) conducted a classic study on how U.S. managers make dividend decisions, which is focused in the behavioral aspect of dividend policy and concluded that managers only increase dividends when they believe that the level of the firm's earning has permanently increased.

Miller and Modigliani (1961) argued that in a perfect market dividend policy has no effect on either the price of a firm's stock or its cost of capital, shareholders wealth is not affected by the dividend decision and therefore, they would be indifferent between dividends and capital gains.

Friend and Puckett (1964) concluded that in growth industries retained earnings are more important than the dividends in determining share price. While, in case of non- growth industries, dividends seem to be more important than retained earnings.

Brittain (1966) indicated that the capacity of a firm to pay dividends has been better explained in terms of cash flows as a variable, i.e., profits after taxes plus depreciation as against the Lintner's profits net of taxes, as it reflected true earnings.

Farrar and Selwyn (1967) viewed that investors would normally prefer low dividends as the dividends are subject to higher tax rate than that of capital gains resulting out of earnings capitalization.

Fama and Babiak (1968) concluded that net income seems to provide a better measure of dividend than either cash flows or net income and depreciation included as separate variables in the model.

Van Horne and McDonald (1971) found that the payment of dividends through excessive equity financing reduced share prices. While new

equity financing and value of share was not found significant in electronics and electric components industry.

Bhole (1980) found that Lintner's model of stable and active dividend policy did not perform well on Indian data over the study period.

Chawla and Srinivasan (1987) stressed that the impact of dividend was more pronounced than that of the retained earnings but the market started shifting more weight for retained earnings.

Bhat and Pandey (1994) supported the Lintner's findings and revealed that Indian managers maintained an uninterrupted record of dividend payments and also try to avoid sudden changes in their dividend policies.

Mishra and Narender (1996) examined the dividend behavior pattern of State Owned Enterprise (SOEs) in India by applying Lintner's model. The study concluded that the number of dividend paying SOEs in India is comparatively small compared to the total number of profit sharing SOEs. In majority of the SOEs, the DPS has remained stagnant irrespective of the continuous increase in the EPS.

Pradhan (2003) found that dividend payment was more important as compared to retained earnings in Nepal. The market price of share would decline if company retained more its earnings.

Eriotis (2005) suggested that distributed earnings and size of firms has been significant impact on dividend payment in Greek market.

Husam et al.(2007) suggested that the proportion of stocks held by insiders and state ownership significantly affected the amount of dividends paid. Size, age, and profitability of the firm seemed to be determinant factors of corporate dividend policy in Jordan.

Kapoor (2008) concluded that existing literature did not explain the dividend payment pattern of IT sector. Only liquidity and beta (year to year variability in earnings) was found to be a noteworthy determinant.

Chen, Huang and Cheng (2009) found that Cash Dividend has significantly positive effect on the Stock Prices. When Cash Dividend increases, Stock Prices also increase and When the Cash Dividend decreases, Share Prices decreases.

Okpara and Godwin Chigozie (2010) showed that three factors-earnings, current ratio and last year's dividends impact significantly on the dividend payout and dividend yield in Nigeria.

Asif, Rasool, and Kamal (2011) showed the negative relationship between dividend payout and financial leverage while dividend yield showed the positive relationship between dividend yield and dividend per share.

Summinder and Prabhjot (2012) concluded that Lintner's model and Dobrovolsky's model has been best fit in the present scenario in case of Indian Manufacturing MSMEs as per cross-sectional regression results.

3. STATEMENT OF THE PROBLEM

The study of dividend policy has captured the attention of finance scholars since the middle of the last century. Existing literature on dividend policy and its determinants provides an insight into the dynamics of corporate dividend policies and their implications. However, empirical evidence many a times provides inconclusive results as to what determine the optimal dividend policy. Starting from Lintner (1956) and Miller and Modigliani (1961) irrelevance proposition to date, innumerable theories and empirical findings have been presented but still dividend policy is one of the most important unresolved issues in modern corporate finance.

The capacity of a firm to pay dividends has been better explained in terms of cash flows (Brittain, 1966). Major changes in earnings were the most important determinants of an enterprise's dividend decisions (Lintner, 1956). DeAngelo et al. (1992) argued that an annual loss is essentially a necessary, but not sufficient condition for dividend reductions in enterprises with established earnings and dividend records. Empirical evidence suggests that

profitability, investment opportunities, and size are the important factors determining dividends (Fama and French, 2001). The distributed earnings and size of firms has been significant impact on dividend payment (Eriotis, 2005). Size, age, and profitability of the firm seem to be determinant factors of corporate dividend policy (Husam et al., 2007). Though there are these findings on determinants of dividend policy mainly in developed countries, they are not yet clearly known in India. Therefore, this study attempts to explore the determinants of dividend payout in Indian scenario.

4. OBJECTIVE

The major objective of this study is to identify and analyze the various determinants of dividend payout and dividend yield of Indian companies.

5. DATA AND METHODOLOGY

5.1. Research Design

For the purpose of this study, "Descriptive Research Design" has been employed to deal with the issues prevailing in the research area.

5.2. Data and Study Period

This study is an empirical in nature and makes use of secondary data. The study period for this study is of ten years i.e., from 2003-2004 to 2012-2013.

5.3. Sampling Technique

In order to select the samples more representative of the population "*convenience sampling technique"* will be used. For a company to be included in the sample should meet the following criteria:

- Companies were listed at Bombay Stock Exchange (BSE) during study period.
- The necessary financial data for calculating the measures of dependent and independent variables pertaining to the years 2003-2004 to 2012-2013 are available.
- The companies did not skip dividend for any two successive years between 2003-2012.
- Further, only those companies whose price data is available are retained in the sample size.

5.4. Selection of Companies

This study takes into account only top 10 automobiles companies listed at BSE based on market capitalization. The Market Capitalization as on *29 April 2013* was used as *sorting criteria*.

5.5. Methods of Analysis

Factor Analysis

In analyzing the determinant of dividend payout in Indian automobile companies, we employed factor analytical tool and also used regression analysis as a supportive tool. Factor analysis is often used in data reduction to identify a small number of factors that explain most of the variance observed in a much larger number of manifest variables.

The factors used as explanatory variables for the determination of dividend payout ratio are outlined below:

X_1=Natural logarithm of total assets of company 'i' during period 't' (in Rs crore),
X_2=Amount of depreciation(in Rs. crore) of company 'i' during period 't',
X_3=Net profit after taxes of company 'i' during period 't' (in Rs crore),
X_4= Cash flows of company 'i' during period 't'(in Rs. crore),
X_5= Current year equity dividend,
X_6=Lagged equity dividend of company 'i' during period 't-1' (Rs. crore),

X_7 = Corporate dividend tax of company 'i' during period 't-1' (Rs. crore),
X_8 = Earnings per share of company 'i' during period 't-1' (Rs. crore),
X_9=Book value per share of company 'i' during period 't-1' (Rs. crore),
X_{10}=Dividend per share of company 'i' during period 't-1' (Rs. crore),
X_{11}=Retained earnings per share of company 'i' during period 't-1' (Rs. crore),
X_{12}=Return on net worth,
X_{13}= Return on assets,
X_{14}=Total debt to owners fund,
X_{15}= Fixed charges coverage ratio,
X_{16}= Current ratio,
X_{17}=Quick ratio, and
X_{18}= Price earnings ratio.

The statistical techniques of *Principal Component Factor analysis* and *regression analysis* have been used to explain the relationship between these variables. Since the variables identified as per the available literature were not on same scale. Therefore, they were standardized and converted into the same scale.

6. EMPIRICAL RESULTS AND DISCUSSIONS

Factor Analysis

The estimates of the extent each factor impacts on dividend payout as analyzed based on maximum communalities likelihood extraction analysis are presented in Table 1. The communalities table shows how much of the variance in the variables has been accounted for by the extracted factors. The results of the communalities in Table 2 show that all the variables are well and completely fit with the factor solution and none could be possibly dropped from the analysis. In view of this, we employed the principal component analysis of the extraction method presented in Table 3. The results showed that six (6) components were extracted less than 1.069 eigenvalue. The clustering of decision factors affecting dividend payout within the six components generated normalized

Table 1. List of automobile sample companies

Automobile Sector		Market Capitalization Rs Crore
1.	Tata Motors	95, 017.60
2.	Mahindra and Mahindra Ltd	55, 331.95
3.	Bajaj Auto Ltd.	55, 130.20
4.	Maruti Suzuki	50, 898.98
5.	Hero Motorcorp	33, 195.05
6.	Eicher Motors Ltd.	7, 911.29
7.	Ashok Leyland Ltd.	5, 999.83
8.	TVS Motor	1, 848.09
9.	Force Motors	503.33
10.	Maharastra Schooters	430.29

Table 2. Communalities

	Initial	Extraction
Natural logarithm of Total Asset	1.000	.777
Depreciation Charges	1.000	.820
Net Profit After Tax	1.000	.898
Cash Flows	1.000	.960
Equity Dividend	1.000	.925
Lag Equity Dividend	1.000	.718
Corporate Dividend Tax	1.000	.915
Earnings Per Share	1.000	.933
Book Value Per Share	1.000	.750
Dividend Per Share	1.000	.840
Retained Earnings Per Share	1.000	.939
Return on Net Worth	1.000	.786
Return on Assets	1.000	.864
Total Debt to Owners Funds	1.000	.708
Fixed Charges Coverage Ratio	1.000	.880
Current Ratio	1.000	.971
Quick Ratio	1.000	.971
Price Earnings Ratio	1.000	.870

Extraction Method: Principal Component Analysis.

Table 3. Total variance explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	6.396	35.536	35.536	6.396	35.536	35.536
2	3.230	17.945	53.480	3.230	17.945	53.480
3	2.313	12.848	66.329	2.313	12.848	66.329
4	1.336	7.423	73.752	1.336	7.423	73.752
5	1.181	6.560	80.312	1.181	6.560	80.312
6	1.069	5.938	86.250	1.069	5.938	86.250
7	.932	5.178	91.428			
8	.430	2.386	93.814			
9	.364	2.023	95.837			
10	.308	1.711	97.548			
11	.173	.960	98.509			
12	.114	.633	99.142			
13	.069	.385	99.527			
14	.052	.289	99.815			
15	.032	.177	99.993			
16	.001	.007	100.000			
17	-1.52E-016	-8.43E-016	100.000			
18	-3.56E-016	-1.98E-015	100.000			

Extraction Method: Principal Component Analysis.

cumulative sums of squared loading of 86.25 percent. This showed that the six decision variables depict about 86.25 percent of the characteristics of the eighteen (18) isolated factors. In other words, 86.25 percent of the total variation in the level of dividend determination in explained by cumulative effect of the six components extracted. The six components were indicative in the Scree plot. To identify the variables that form the six components, the component matrix was presented in Table 4. The table showing the loading of the factors into the six principal components indicated that the variables (factors), current ratio, cash flow, retained earnings per share, earnings per share, equity dividend and corporate dividend tax were identified as the most critical factors determining dividend payout in automobile companies.

Correlation Matrix

The correlation matrix (Table 5) provides a summary of extracted variables used in the study and matrix of multiple correlations of regression variables. This table displays Pearson correlation coefficients of variables. It depicts that the dividend payout ratio (DPRt) is positively related to equity dividend and corporate dividend tax and negatively related to CRt, CFt, REPSt and EPSt.

Regression Analysis

The alternative econometric method using the multiple regression equations on the six factors identified, are presented below:

Table 4. Component matrix (a)

	Component					
	1	**2**	**3**	**4**	**5**	**6**
Natural logarithm of Total Asset	.652		.533			
Depreciation Charges			.643			
Net Profit After Tax	.890					
Cash Flows	.790		.509			
Equity Dividend	.873					
Lag Equity Dividend	.777					
Corporate Dividend Tax	.863					
Earnings Per Share	.514	.764				
Book Value Per Share		.666				
Dividend Per Share	.752					
Retained Earnings Per Share		.840				
Return on Net Worth	.681					
Return on Assets	.711					
Total Debt to Owners Funds					-.613	
Fixed Charges Coverage Ratio						.683
Current Ratio		.617		.536		
Quick Ratio		.561		.541		
Price Earnings Ratio					.559	-.730

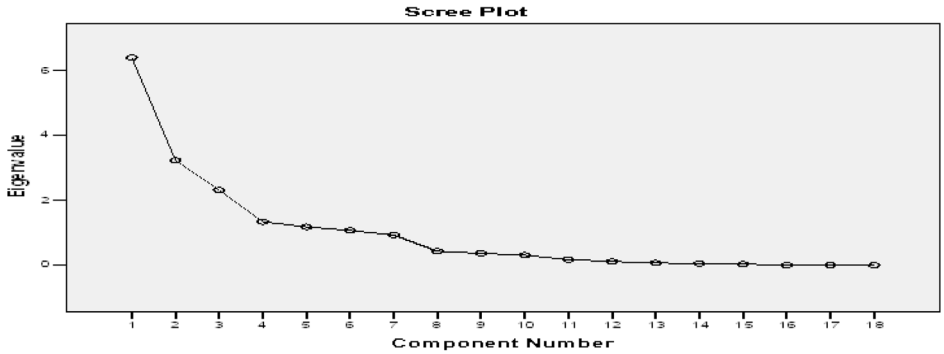
Extraction Method: Principal Component Analysis.
a 6 components extracted.

Table 5. Correlation matrix

	DPR_t	**CR_t**	**CF_t**	**$REPS_t$**	**EPS_t**	**ED_t**	**CDT_t**
DPR_t	1	-0.203 (0.051)	-0.030 (0.774)	**-0.231*** (0.026)	-0.126 (0.231)	**0.368**** (0.000)	**0.366**** (0.000)
CR_t		1	-0.086 (0.415)	0.295** (0.004)	0.219* (0.039)	-0.287** (0.005)	-0.276** (0.007)
CF_t			1	0.148 (0.157)	0.227* (0.029)	0.627** (0.000)	0.592** (0.000)
$REPS_t$				1	0.968** (0.000)	-0.006 (0.956)	-0.002 (0.986)
EPS_t					1	0.205* (0.049)	0.214
ED_t						1	0.996** (0.000)
CDT_t							1

The figures in parentheses are p-value. The asterisk (*) shows that the correlation is significant at the 0.05 level. While the asterisk (**) shows that the correlation is significant at the 0.01 level.

Figure 1. Screen plot of total variance explained



$$DPR_t = \beta_0 + \beta_1 CR_t + \beta_2 CF_t + \beta_3 REPS_t + \beta_3 EPS_t + \beta_4 ED_t + \beta_3 CDT_t + U_t. \quad (1)$$

where, DPR_t = Dividend payout ratio in period 't'; CR_t = Current ratio in period't' CF_t = Cash flow in period 't'; $REPS_t$ = Retained earnings per share in period 't'; EPSt = Earnings per share in period 't'; EDt = Total equity dividend in period 't'; CDTt = Corporate dividend tax in period 't', and U_t = Error term.

The results from the regression analysis for the sample observations are presented in Table 6, which shows that CR_t, EPS_t and ED_t positively affected DPR_t since their coefficients were positive. While the coefficients of CFt, REPSt and CDTt were negative which showed that they negatively affect DPRt. The adjusted R squared value is 26.5 percent. It indicated that all explanatory variables explain on average 26.5 percent of the variation in DPR_t. The p-value of CF_t, EDt, and CDTt were 0.001, 0.013 and 0.036. It showed that only CFt, EDt and CDTt were significant at 5 percent level of significance. Further, the regression equation was found significant as calculated F = 6.51 > F = 2.17 at 5 percent level of significance for 6, 86 degree of freedom. The value of the Durbin-Watson test statistic ranges from 0 to 4. As a general rule of thumb, the residuals are uncorrelated if the Durbin-Watson statistic is approximately 2. In this study, we found the value of Durbin-Watson statistic is 1.52, which indicated no serial correlation. Thus, only three factors (CFt, EDt, and CDTt) out of six factors (extracted from factor analysis) had been found statistically significant using multiple regression analysis.

7. SUMMARY AND CONCLUSION

The behavior of dividend policy is the most debatable issue in the corporate finance literature and still keeps its prominent place in developed and emerging markets. This study is an attempt to explore the factors determining dividend-payout

Table 6. Regression results of dividend payout ratio (dpr) and the identified variables

M	C	CR_t	CF_t	$REPS_t$	EPS_t	ED_t	CDT_t	R^2	$\bar{R}^2$	F	DW
1	3.71 (0.000) (1.000)	0.033 (0.329) (.743)	-0.477* (-3.38) (.001)	-1.02 (-1.23) (.222)	0.90 (1.06) (.291)	3.27* (2.54) (.013)	-2.79* (-2.12) (.036)	.313	.265	6.51	1.52

Note: The figures in parentheses in first row are t-value and second row are p-value. The asterisk (*) sign indicates that the coefficient is significant at 5 percent level of significance.

policy using factor analysis and regression analysis statistical tools. The results of factor analysis showed that six factors, current ratio, cash flow, retained earnings per share, earnings per share, equity dividend and corporate dividend tax were identified as the most critical factors determining dividend payout in Indian automobile companies. However, regression results depicted that only three factors i.e. cash flow, equity dividend and corporate dividend tax have been found statistically significant. The regression results show that current ratio, earnings per share, and equity dividend positively affect dividend payout ratio. While cash flow, retained earnings per share, and corporate dividend tax negatively affect dividend payout. The explanatory variables explain on average 26.5 percent of the variation in DPR_t. Only cash flow, equity dividend, and corporate dividend tax had been found statistically significant using multiple regression analysis.

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KEY TERMS AND DEFINITIONS

Dividend Puzzle: A concept in finance in which companies that pay dividends are rewarded by investors with higher valuations, even though, according to many economists, it should not matter to investors whether a firm pays dividends or not. The reasoning goes that dividends, from the investor's point of view, should have no effect on the process of valuing equity because the investor already owns the firm and, thus, he/she should be indifferent to either getting the dividends or having them re-invested in the firm.

Payout Policy: Dividend policy decision is an integral part of a company's financial decision making, as it is explicitly related to the other two major decisions–investment and financing decision. Management should develop such a dividend policy, which divides the net earnings into dividends and retained earnings in an optimum way to achieve the objective of maximizing the wealth of shareholders.

Shareholders' Wealth: Maximisation of shareholders' purchasing power. It is any attempt made by a shareholder to accumulate as much wealth as possible, by whatever means possible. Wealth maximisation is a long term objective, although in some instances a short term effort may be carried out to provide shareholders with wealth.

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Chapter 65
An Empirical Investigation on Credit Card Adoption in India

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ABSTRACT

In India, the credit card usage as well as the penetration has been found to be very low compared to that of debit cards. Though banks offer the best of the services, still there are apprehensions about the risks involved in using a credit card in India. Hence, this study investigates the customer's adoption behavior of credit cards and determines the factors which influence the acceptance among Indian customers. Many studies have been reported in the literature to analyze the customer's adoption behavior of online banking, Automated Teller Machines, e-shopping etc. But, there are not many studies that analyze the adoption behavior of credit cards. In this study, an empirical model that includes ten behavioral factors has been proposed. Along with the main determinants identified from the literature, two new parameters such as perceived benefits and self-esteem have been included in the model. The analysis of the model reveals that factors such as perceived usefulness, perceived ease of use, perceived risk, relative advantage, perceived trust, social influence and perceived benefits have been found to be the main determinants of credit cards adoption in India. The findings are of great use primarily for the banks which are planning to offer credit cards, and for already existing banks to focus on the gaps.

INTRODUCTION

Services are central parts of developed economies which are growing in numbers, varieties and complexities (Geczy et al., 2010). Banking sector is the potential sector which has a vibrant growth. The revolutionary advancements in the banking sector brought a dramatic change in the banking operations over the past two decades. With an increasingly competitive global market, cost, quality, and technology leadership are no longer sufficient for businesses to secure competitive advantage (Ryan, 2012). With the advancement in technologies, banks started offering innovative

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products and services to secure the competitive advantage. Credit cards have emerged as the most widely used means of financial transactions. These plastic cards have become the best solution for those who do not have money at present, but want to fulfill their needs. Debit cards, credit cards, Automated Teller Machine (ATM) cards, shopping cards etc. are examples of plastic cards. Depending on the type of application, their utility also varies. Credit card is a vital payment tool for bank customers globally. The working mechanism of a credit card has been illustrated in Figure 1.

It is evident from the mechanism that customer, merchant, network and bank are all equally responsible for a smooth and hasslefree credit card transaction. In India, Visa and MasterCard are the main players in credit cards who provide the network. According to the latest bulletin of Reserve Bank of India (Feb 2012), there are over 180 lakhs of valid credit cards in circulation.

Figures 2 and Figure 3 give an overview of the status of credit card usage in India.

The Banks in India that offer credit card facility to its customers are Axis Bank, Bank of Baroda, Canara Bank, Corporation Bank, HDFC, ICICI Bank, Indian Overseas Bank, Kotak Mahindra, Punjab National Bank, State Bank of India, Syndicate Bank, Union Bank of India, Vijaya Bank. The major foreign banks offering credit card services in India are ABN Amro, American Express, ANZ, Barclays Bank, Citibank, Diners Club, HSBC, Royal Bank of Scotland, Standard Chartered. Despite these many banks offering credit cards in India, still the credit card penetration is less than 10% of the total bank customers of India. Hence, this encourages the researchers to explore the possible impediments to the credit card adoption in India. Therefore, the main objective of this behavioral study is to explore the major determinants which influence the adoption of credit cards among Indian customers. Based on a review of the relevant literature, an empirical model has been proposed with two new factors; perceived benefits and self esteem. This empirical model has been analyzed using various statistical methods. Different hypotheses were tested to find the behavioral factors which affect the adoption and acceptance of credit cards among Indian

Figure 1. Working mechanism of credit cards

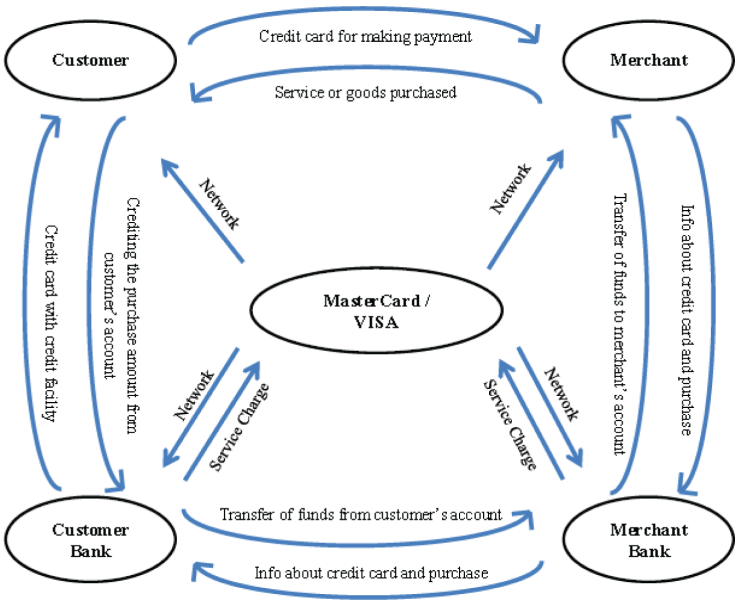


Figure 2. Total amounts of transactions using credit cards

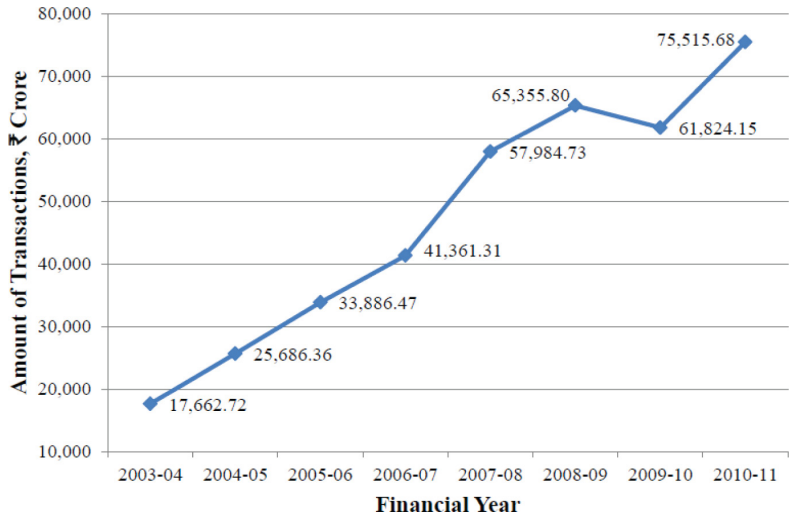
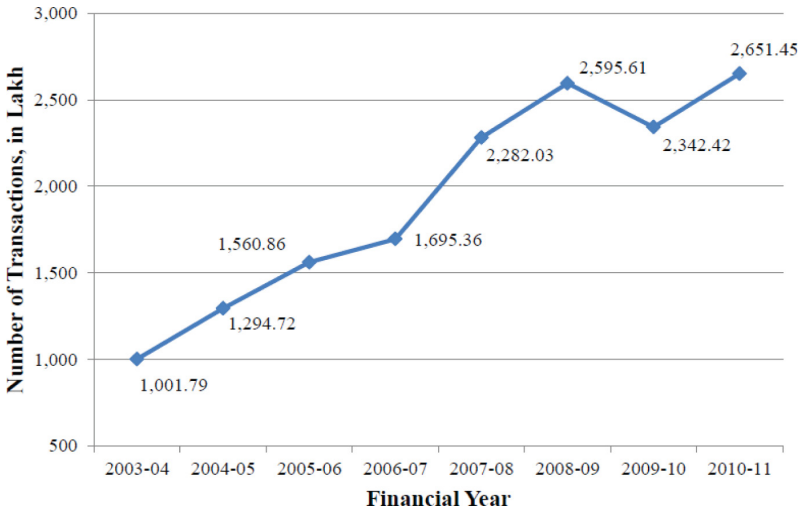


Figure 3. Total number of credit card transactions



customers. The rest of the paper is organized as follows. First, we deal with the review of the relevant literature. Then we go on to outline the proposed research model and the hypotheses. Afterwards we describe the salient aspects of data collection. Then we provide data analysis and results. Followed by managerial implications and the conclusion.

LITERATURE REVIEW

Based on the behavioral theories, many studies have been reported in the literature to analyze the adoption and acceptance of new information systems. Similar kind of studies have also been conducted in banking sector related to the adoption of online banking, debit cards, mobile banking, credit cards etc. Moore and Benbasat (1991) had found the relative advantage and compatibility are

relevant with respect to technology innovations. They have integrated diffusion of innovations and theory of reasoned action models to predict utilization of information technology by end-users. Many studies have found the effect of income in credit card usage. The various studies on credit cards from the literature have been summarized in Table1.

Kaynak et al. (1995) exposed the preference of lower and middle income consumer's on credit features over the service features, such as security and convenience. Kalakota and Whinston (1996) posit the nature of small-value transactions using credit cards. According to them, credit cards were not appropriate for small-value transactions compared to other forms of electronic payment system. The effect of low annual fee among consumers of Hong Kong was analyzed by Chan (1997). He found the importance of this factor in adopting credit cards. Lee and Hogarthe (1999) revealed that most of the customers in general are unaware of how to use a credit card and this unawareness has caused the customers to reject the credit card which led to a decline in the credit card market. Venkatesh and Davis (2000) have introduced the construct social influence to predict the adoption of internet. They proposed a modified technology acceptance model (TAM) in their study. Studies conducted by Hsieh (2001) and Chou et al. (2004) indicate that credit cards are the most frequently used form of e-payment. They compared different e-payment systems and found the nature of usage of different systems. The influence of social status in adopting new mobile services was explained by Teo and Pok (2003). According to Wang et al. (2003), perceived ease of use was also a significant antecedent of the behavioral intention to use credit cards. Goyal (2004), found that supplementary services would promote credit card use and could help in reducing risk perception of customers towards using credit cards. Sun and Wu (2004) revealed the usage difference of credit cards among rural and urban population of China. Pin and Lin (2005) found a significant direct relationship between perceived financial cost and behavioral intention to use mobile banking. Amin (2008), examined that perceived usefulness, perceived ease of use, perceived credibility and

Table 1. Summary of factors considered in various studies on credit cards

Author and Year	Country	Factors Considered/Investigated
Kaynak et al. (1995)	Turkey	Age and income
Chan (1997)	Hong Kong	Income and changes in education system
Goyal (2004)	India	Supplementary services promote credit cards usage and helps to reduce risk
Sun and Wu (2004)	China	differences in rural and urban population
Gan et al. (2008)	Singapore	Age and gender
Willis and Worthington (2006)	China	Status symbol
Amin (2007)	Malaysia	Perceived usefulness, perceived ease of use, credibility and amount of information
Phau and Woo (2008)	Australia	Power and prestige
Wickramasinghe and Gurugamage (2009)	Srilanka	Status symbol
Foscht et al. (2010)	Italy	payment mode and personal characteristics
Wang et al. (2011)	China	self-control, self-efficacy, deferring gratification, internal locus of control and impulsiveness
Worthington et al. (2011)	China	Perceived ease of use, self esteem, new product adoption, knowledgeable
Khare et al. (2012)	India	Use, convenience and status attributes

the amount of information as the important determinants to predict customers' intentions to use mobile credit card. A study by Gan et al. (2008) found the effect of age and gender in the adoption of credit card. The findings in the study by Phau and Woo (2008) revealed that compulsive buyers perceived money as a symbol of power and prestige. They were more likely to use credit cards as compared to non-compulsive buyers. Dalia et al. (2009) suggested that perceived ease-of-use was the strongest predictor of intentions to continued usage of credit cards services in Egypt. Liu (2009) found that awareness about reward points could improve consumers' attitude and credit card use behavior. Lee (2009) studied about the factors influencing the adoption of credit cards. He found perceived risk and perceived benefit to have a positive influence on the adoption. He also found a positive influence of perceived usefulness in the adoption. Yoon (2010) revealed that ease of use, demographic variables and perceived usefulness does not have a significant influence on customer satisfaction. Zafar (2010), examined life style to have a positive influence towards credit cards use while other factors like self-esteem, time consciousness, peer group pressure, exposure to advertisement and gregariousness were found to be insignificant. Wang et al. (2011) found self-control, self-esteem, self-efficacy, deferring gratification, internal locus of control and impulsiveness to have an influence on credit card usage. In a study on early adopters of credit cards in the Chinese context, Worthington et al. (2011), examined that perceived ease of use, self esteem, knowledge about the new product will have a positive effect on the adoption of credit cards. Convenience, customization, security/privacy, web appearance and entertainment value were the key characteristics of e-retail environment impacting e-satisfaction of online purchase (Kim et al., 2011). Khare et al. (2012) found use, convenience and status to have an influence on credit card adoption.

In the present research, two new constructs perceived benefits and self-esteem have been introduced. The utilization of the traditional theoretical models with minor modifications and variety of analyses in the Indian context makes this study unique. This study focuses on individual perspective and proposes to identify factors that influence adoption and use of credit cards in India.

RESEARCH MODEL

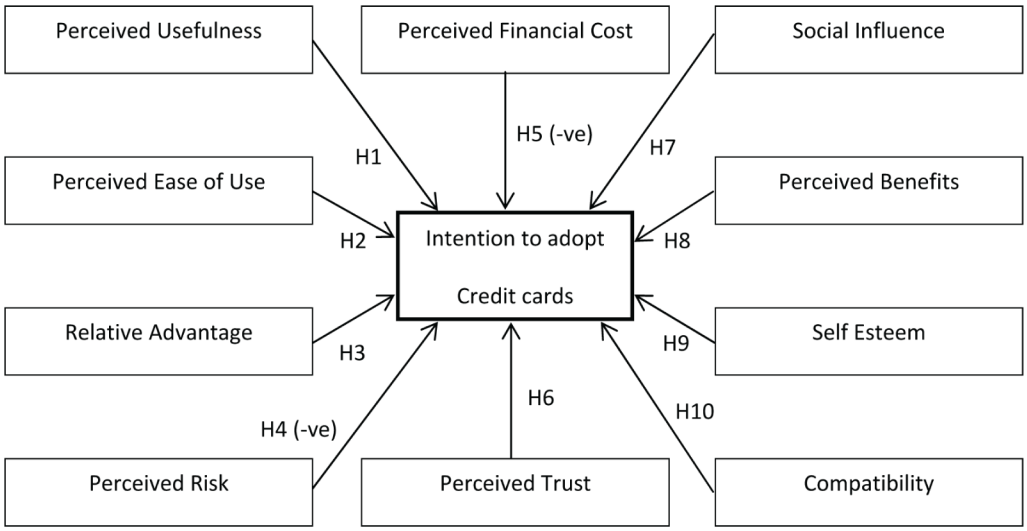
Based on the literature review, the crucial factors which influence the attitude towards credit card adoption have been identified as perceived usefulness, perceived ease of use, perceived risk, relative advantage, perceived financial cost, social influence, self esteem, compatibility, perceived benefits and perceived trust. An empirical model has been proposed as shown in Figure 4 and the following hypotheses have been formulated and tested.

FORMULATION OF HYPOTHESES

Perceived Usefulness

Technology Acceptance Model (TAM) proposed by (Davis et al., 1989) posits that perceived usefulness (PU) is a significant factor affecting acceptance of an information system. Davis et al., 1989 define PU as the degree to which a person believes that using a particular system would enhance his or her job performance. In simple words, PU is defined as, the usefulness of credit cards perceived by the customer. If a person doesn't have money in his/her wallet or his/her account, he/she can still make a purchase/payment using his/her credit card. The customer can even use the credit card to withdraw money from any ATM. So, the customer expects some enhanced performance in his/her banking activities when he/she uses credit card. Thus, the following hypothesis has been formulated:

Figure 4. Proposed model



H_1: Perceived usefulness will have a positive effect on the adoption of credit cards.

Perceived Ease of Use

Davis et al. (1989) define Perceived Ease of Use (PEOU) as the degree to which a person believes that using a particular system would be free of effort. According to TAM, perceived ease of use is a major factor that affects acceptance of information system. If the procedure of making a credit card transaction is easy to learn and less complex, then the user would be more comfortable in making transactions using credit cards and it motivates him to adopt it. So, the perception of ease of use may affect the intention to adopt credit cards. This leads to the following hypothesis:

H_2: Perceived ease of use will have a positive effect on the adoption of credit cards.

Compatibility

Compatibility is defined as degree to which an innovation is perceived as consistent with the existing values, past experiences and needs of potential adopters (Rogers, 1983). The more compatible the innovation is, the more likely that users will adopt it. In this research, the compatibility of credit cards in small shops and outside the country, relationship between credit cards and the users' life style etc. are investigated. Thus, the following hypothesis has been proposed:

H_3: Compatibility will have a positive effect on the adoption of credit cards.

Relative Advantage

The rate of adoption is positively related to relative advantage of any innovation (Rogers, 1983). According to Rogers (1983), relative advantage is the degree to which an innovation is perceived as being better than the idea it supersedes. Here, the advantage of credit cards over other forms of money is considered. While traveling abroad, credit cards can be used for making payments. Compared to cash, credit cards are easy to carry and hassle free as they are just plastic cards. So, these advantages can influence the adoption of credit cards. This leads to the following hypothesis:

H_4: Relative Advantage will have a positive effect on the adoption of Credit Cards.

Perceived Risk (PR)

Bauer (1960) introduced the concept called perceived risk. In credit card context, perceived risk may be associated with the financial loss as a result of using the services. The lack of security and privacy are the main concerns of risk. In this study, perceived risk focuses on users' concerns about fraud, unprotected transactions, reliability of the merchant etc. The following hypothesis has been formulated:

H_5: Perceived risk will have a negative effect on the behavioral intention to use credit cards.

Social Influence

Social influence (SI) is defined as the degree to which an individual's emotions and feelings are affected by others in using an innovation (Venkatesh & Morris, 2000). SI simply means the influence of friends, relative and the society in one's decision. Bank users will perceive credit cards to be useful when they see colleagues, friends and family members use it and get a recommendation of using it from them. The adoption of a new technology can be affected by this social influence. Thus, the following hypothesis has been tested:

H_6: Social Influence will have a positive effect on the adoption of credit cards.

Perceived Trust (PT)

Trust is defined as the willingness to rely on an exchange partner in whom one has confidence on the other party (Moorman et al., 1992). The base of credit card system itself is the mutual trust between different parties. The customer trusts the merchant, the merchant trusts the merchant bank and the merchant bank trusts the customer bank. So, trust has a big influence in the credit card system and the adoption also depends on the trust of customer on this system. Thus, the following hypothesis has been formulated:

H_7: Perceived trust will have a positive effect on the adoption of credit cards.

Perceived Benefits

Customers are very much interested in the benefits offered by the services before actually using the services. Perceived benefits are the add on benefits offered at free of cost to the customers along with the core services. Many banks offer rewards and benefits packages to their credit card holders. The offerings include enhanced product warranties at no cost, free membership in elite clubs, and points which may be redeemed for cash, products, or airline tickets etc. These benefits are provided to attract new customers and also to retain the existing credit card holders. In this research, perceived benefits (PB) focus on users' interest in reward points, special offers and discount coupons which they get while making credit card transactions. These benefits may influence the bank users in adopting credit cards and thus, the following hypothesis has been tested:

H_8: Perceived benefits will have a positive effect on the adoption of credit cards.

Self Esteem (SE)

Self esteem is a term used in psychology to reflect a person's overall evaluation or appraisal of his or her own worth. Some individuals consider credit cards as a status symbol. A few individuals make purchase using credit cards just to show off. Studies conducted by Willis (2006) in China and Wickramasinghe (2009) in Srilanka suggest that status symbol has an effect in the adoption of credit cards. Zafar et al. (2010) had developed a model to identify the psychographic factors that influence the consumer attitudes toward using credit cards in Malaysia. Hence, self-esteem

has been considered as a factor in the behavioral intention to adopt credit cards. This leads to the following hypothesis:

H_9: Self esteem will have a positive effect on the adoption of credit cards.

Perceived Financial Cost

Perceived financial cost (PFC) is defined as the extent to which a person believes that using credit cards will cost money to the individual. Mathieson et al. (2001) suggests that perceived financial resources are a significant antecedent of the behavioral intention to use an information system. In order to own and possess a credit card one has to pay a certain amount in the form of processing fee apart from the fixed annually fee. Also, the defaulters are summoned with a huge fine for a delayed payment of credit amount. Hence, the customers would have a negative perception of these financial charges and these perceived financial charges can have a negative impact on the adoption of credit cards. Therefore, the following hypothesis has been tested:

H_{10}: Perceived financial cost will have a negative effect on the adoption of credit cards.

DATA COLLECTION

The data for this study has been collected by means of a survey instrument. The sample consists of corporate professionals working in IT companies and faculty of different IITs, IIMs and NITs. 950 credit card holders participated in the survey and 640 were completely filled and valid for analysis leading to a response rate of 67%. This results in a sample that is well distributed in terms of demographics. In the questionnaire, a five point Likert scale ranging from strongly agree to strongly disagree are used as a basis to know the respondent's views. The questionnaire consists of questions that are related to demographic information, the possible factors affecting the acceptance of credit card usage. The questionnaire has been developed and tested with a focus group consisting of banking professionals. Before proceeding with the main survey, the questionnaire was validated through pre-testing. This resulted in an error-free final questionnaire. The focus groups verified that the hypotheses developed might be the crucial factors in explaining the adoption of credit cards. Based on the feedback from the focus group and from the pilot study, some of the questionnaire items were dropped and some items were added and the wordings of some of the questions have been changed to improve clarity. Items have been jumbled in a random order to avoid the stereotype and biasness. The intention to use credit cards has been chosen as the dependent variable in the model. In this study it is assumed that there is no interaction effect among the independent variables.

SAMPLE SIZE DETERMINATION

The data for this study has been collected only from credit card holders. The sample size was determined using the general formula for finding the sample size of an infinite population. If the total population is more than 50000, it can be assumed as infinite population (Maria, 2006):

$$N = P(1 - P)\, Z_{\alpha/2}/e^2$$

where, ***N*** is the sample size required, ***P*** represents the percentage of proportion of credit card holders among bank users in India. According to RBI Bulletin (November 2011), 9.11% of bank users are credit card holders. A 5% tolerable error (***e***) is desired with 95% reliability. While the error is equal to 0.05, Z=1.96. Thus, the sample required has been obtained as 128. In the actual study, the sample size is chosen as almost six times the required sample size so that the resultant sample represents the entire population.

DATA ANALYSIS AND RESULTS

The data was analysed using SPSS version 16.0 (statistical package for social sciences). The demographic profile of the respondents is shown in Table 2. From Table 2, it is found that 40.5% of the respondents are in the age group 26-35 years, 88% of the respondents are male, 40.6% of the respondents are post graduates, 42.2% of the respondents are professionals/officers, 31.4% of the respondents are in the income range Rs.3Lakhs - 5Lakhs. The credit card usage patterns of the Indian customers are shown in Table 3.

Table 2. Descriptive statistics of respondent's demographics

Profile	Description	Percentage
Gender	Male	88
	Female	12
Age	18-25	38.1
	26-35	40.5
	36-45	12
	46-55	5.9
	56-65	3.4
	>65	0.2
Education	Pre Degree	2
	Degree	40.6
	P.G	25.2
	Research/Doctoral	25
	Diploma/Technical	7.2
Annual Income	`1.6-3 lakhs	15.5
	`3-5 lakhs	31.4
	`5-8 lakhs	33
	`8-10 lakhs	8
	`>10 lakhs	12.2
Occupation	Student	9.4
	Faculty/Teacher	32.8
	Professional/Officer	42.2
	Technician	1.1
	Business	2.5
	Retired	1.3
	Others	10.8
Area	Rural	11
	Urban	89

Reliability Analysis has been carried out by calculating the values of Cronbach's alpha. Nunnally (1978) recommends the value of Cronbach's alpha to be at least 0.7 to show high internal consistency. In the present study, the Cronbach's alpha value of the factor perceived financial cost has been found to be lower than the recommended value. Hence, this factor has not been dropped for the further analyses. Rest all factors have been found to have a higher Cronbach Alpha value higher than the recommended value, which shows a high internal consistency of the measures. Construct reliability of the factors are obtained as shown in Table 4:

A confirmatory factor analysis has been conducted on the items comprising perceived usefulness, perceived ease of use, perceived risk, relative advantage, self esteem, social influence, compatibility, perceived benefits, perceived trust and intention to use. The Kaiser criteria of eigen values greater than 1 has been used to determine the initial number of factors to retain. The Kaiser-Meyer-Olkin (KMO) measure was 0.873. From the Bartlett's sphericity test the value of chi-square is found to be 26380 with a significance of 0.000. Hence, the constructs have been found to be valid.

Table 3. Attitude of credit card usage

Attitude of Usage	Description	Percentage
Frequency of credit card usage in a month	<5 times	50
	5-15 times	40.5
	>15 times	9.5
Minimum amount of transaction	`100	19
	`100-500	39
	`500-1000	42
Maximum amount of transaction	`<50,000	93.6
	` 50,000 - 1,00,000	6.4
	`> 1,00,000	0.0

Table 4. Cronbach's alpha values

Factor	Cronbach's Alpha
Perceived Usefulness	0.840
Perceived Ease of Use	0.838
Compatibility	0.805
Relative Advantage	0.828
Perceived Risk	0.946
Social Influence	0.901
Perceived Trust	0.860
Self Esteem	0.793
Perceived Benefits	0.907
Perceived Financial Cost	0.600
Intention to Adopt	0.700

Multi-regression analyses are performed to test the hypotheses and to examine the associations among the constructs. The results have been reported in Tables 5 through Table 6

A linear multiple regression analysis has been carried out on the proposed model, where intention to use is the dependent variable and perceived usefulness, perceived ease of use, perceived risk, relative advantage, self esteem, social influence, compatibility, perceived benefits, perceived trust are the independent variables. From the ANOVA result shown in Table 6, it is evident that the model applied is significantly good enough in predicting the outcome variable. From the results of regression analysis shown in Table 5 it is found that, the coefficient of determination R^2 is 0.722. This means that 72.2% of the variability in the dependent variable (i.e. intention to use credit cards) can be explained by the independent variables such as perceived usefulness, perceived ease of use, perceived risk, relative advantage, self esteem, social influence, compatibility, perceived benefits, and perceived trust. The R^2 value and the adjusted R^2 value are very close which implies that the model includes only the factors that are significant, i.e., the model is not over specified.

Hence, the multiple regression equation is:

*Intention to use credit cards = 0.137 - 0.079*Perceived usefulness + 0.691*Perceived ease of use + 0.036*Compatibility - 0.076*Relative advantage +0.109*Perceived risk + 0.117*Social influence + 0.191*Perceived trust - 0.073* Perceived benefits* + 0.036 * Self esteem

Table 5. Regression model

Model	R^2	Adjusted R^2	Standard Error of Estimate
1	0.722	0.718	0.38106

Independent Variables: perceived risk, perceived ease of use, self esteem, social influence, relative advantage, compatibility, perceived benefits, perceived trust, perceived usefulness

Dependent Variable: intention to adopt

According to the hypothesis H_1, perceived usefulness will have a positive effect on the intention to use credit cards. The findings from Table 7 perceived usefulness is found to be statistically significant at 0.05 level (β = -0.102, p = 0.018). Thus, the hypothesis H_1 has been supported. This suggests that the bank customers perceive credit cards to be useful.

The hypothesis H_2 states that perceived ease of use will have a positive effect on the behavioral

Table 6. ANOVA result

Model	Sum of Squares	Degrees of Freedom	Mean Square	F	*P*-Value
Regression	237.901	9	26.433	182.042	0.000[a]
Residual	91.479	630	0.145		
Total	329.380	639			

Table 7. Regression result

Model	Unstandardized Coefficients		Standardized Coefficients	t	P-value
	B	Standard Error	*Beta*		
(Constant)	0.137	0.126		1.090	0.276
Perceived usefulness	-0.079	0.034	-0.102	-2.364	0.018
Perceived ease of use	0.691	0.027	0.772	25.833	0.000
Compatibility	0.036	0.020	0.040	1.829	0.068
Relative advantage	-0.076	0.022	-0.087	-3.388	0.001
Perceived Risk	0.109	0.032	0.145	3.440	0.001
Social Influence	0.117	0.029	0.113	4.026	0.000
Perceived Trust	0.191	0.030	0.179	6.290	0.000
Perceived Benefits	-0.073	0.023	-0.105	-3.186	0.002
Self Esteem	0.036	0.021	0.044	1.744	0.082

intention to use credit cards. Table 7 that perceived ease of use is found to be statistically significant at 0.05 level ($\beta = 0.772$, $p = 0.000$). Thus, the hypothesis H_2 is supported. This suggests that the bank customers perceive credit cards as easy to use.

According to the hypothesis H_3 compatibility will have a positive effect on the behavioral intention to use credit cards. It is found from Table 7 that compatibility is statistically insignificant at 0.05 level ($\beta = 0.040$, $p = 0.068$). Thus, the Hypothesis H_3 is negated. This means that the bank customers are not finding credit cards transactions to be compatible. In India, other than big shopping malls, not many retailers accept credit cards. The credit card system is not yet so significant in small shops and also among the general public. Hence, respondents might have felt credit cards to be incompatible.

The hypothesis H_4 states that relative advantage will have a positive effect on the behavioural intention to use credit cards. The findings from Table 7 shows that relative advantage is statistically significant at 0.05 level (β = -0.087, p = 0.001). Thus, the hypothesis H_4 is supported. This means that bank customers are perceiving credit card transactions to be relatively advantageous than the traditional banking.

Hypothesis H_5 states that perceived risk will have a negative effect on behavioral intention to adopt credit cards. It is observed from Table 7 that perceived risk is statistically significant at 0.05 level ($\beta = 0.145$, $p = 0.001$). H_5 is therefore negated. The possible reason for the failure of the hypothesis may be because of the efforts taken by banks in making the credit card transactions more secure.

The hypothesis H_6 states that social influence will have a positive effect on behavioral intention to adopt credit cards. Table 7 reveals that social influence is found to be statistically significant at 0.05 level ($\beta = 0.113$, $p = 0.000$). Thus, the hypothesis H_6 is supported.

The hypothesis H_7 states that perceived trust will have a positive effect on the behavioral intention to use credit cards. Table 7 that perceived trust is found to be statistically significant at 0.05 level ($\beta = 0.179$, $p = 0.000$). Thus, the hypothesis H_7 is supported. This suggests that the bank customers trust the credit card system.

According to the hypothesis H_8 perceived benefits will have a positive effect on the behavioral intention to use credit cards. It is found from Table 7 that perceived benefits is statistically significant at 0.05 level (β = -0.105, p = 0.002). Thus, the

Hypothesis H_8 is supported. This means that the bank customers are adopting and using the credit cards for the perceived benefits.

According to the hypothesis H_9 self esteem will have a positive effect on the behavioral intention to use credit cards. It is found from Table 7 that self esteem is statistically insignificant at 0.05 level ($\beta = 0.044, p = 0.082$). Thus, the Hypothesis H_9 is negated.

In summary, out of the nine hypotheses, seven were found to be statistically significant in this empirical study. The hypotheses H_3, H_5 and H_9 have been rejected. Rejection of hypothesis H_5 reveals that perceived risk has a positive effect on credit cards adoption.

From the model testing, it is understood that out of the two new factors considered, only one has shown a positive effect on the adoption. It is apparent, but confusing that in India, people use credit cards as a status symbol as hinted by the focus group interviews. However, from this study, it is evident that there is no effect of self esteem on the adoption of credit cards. The other factor proposed by the focus groups was perceived benefits. The focus group interviews opined that customers like to adopt or use credit cards for the benefits it offers and the same has been proved from this study.

In India, not many retailers accept credit cards. The credit card system is not yet so significant in small shops. Hence, respondents might have felt credit cards to be incompatible with their lifestyle. This is one of the reasons for the non-adoption of credit cards in India.

Security issues are the major concerns when it comes to financial matters. Because of various frauds, credit cards have been perceived to be risk prone in India. But, from this study, it is apparent that the trend is slowly changing and this is a good sign for the banking sector.

MANAGERIAL IMPLICATIONS

The findings of this study are particularly important for banks to concentrate on the problem areas to attract more customers and to help decide how to allocate resources to retain and expand their customer base. They can concentrate on those factors which are really influencing the bank users in adopting credit cards. The outcome of the study can be used to formulate new market strategies to increase the customer base of the credit card market. Based on demographics results, 90% of the card users are from urban sector. But, it does not mean customers in rural sectors are not willing to use credit cards. Educating all segments of the market is highly recommended as statistics show that the credit card penetration is only 9.1%. Therefore, financial institutions as well as government need to seriously think of educating the general public to see that everyone adopts the credit cards, which in turn helps the government to boost up the economy. The positive influence of perceived usefulness and perceived ease of use in the adoption can be exploited by the credit card issuing banks in framing or modifying the transaction procedures and services. Demirkan and Spohrer (2010) Agility and innovation are essential for survival in today's business world. Banks and financial institutions should add more useful features and services to credit cards and they should simplify the procedures in making a credit card transactions.

In addition, the nation's culture also plays a major role in the adoption of new advanced technologies. In the Indian context, power distance, and uncertainty avoidance have been found to be the main dimensions of culture apart from individualism versus collectivism, and masculinity versus femininity (Hofstede, 2001). With the modifications in the proposed research model and incorporating culture as an external variable, this study may be generalised universally.

In all major industrialized countries, the service sector is the largest economic segment maintaining the highest growth rate (Kett, 2011). In India, credit card is still a grape vine for the people who are in the middle and lower income groups. The credit cards are issued to only those whose monthly income is a minimum of Rs.10000 to 15000/-. The bank customers are denied a credit card on the basis of economic back ground. Though the customers have an urge to own a credit card, their economic conditions and the bank's stringent conditions do not allow them to adopt credit cards.

The ability to design innovative services is an important capability for organizations in the 21st century (Schindlholzer et al., 2011). Banks need to strive hard to educate the general public by campaigning and creating awareness about the credit card system and the benefits it offers. Also, integrating products and services into customized solutions can help firms to gain competitive advantage (Bonnemeier et al., 2010; Burianek et al., 2011). Apart from banks, it is the responsibility of the government also to see that the credit card system flourishes in the Indian market. The stronger the nation's credit card system, the stronger is the country's economy. The evil of black money can be completely culminated at all levels with a fool proof credit card system. Therefore, the government should play a major role in implementing the credit card system throughout the country, and this will help in the adoption of credit cards in India.

CONCLUSION

The results support the view that perceived ease of use and perceived usefulness are the predicting variables in the intention to adopt. Both of them have positive influence along with the determinants such as relative advantage, social influence, perceived trust and perceived benefits. But, compatibility and self esteem are found to have negative influence on the adoption of credit cards. Interestingly, customers are not finding the credit card transactions to be risky. This could be because of the efforts of financial institutions to see that the credit card transactions are well protected with a high level of security. The introduction of chip based credit cards and instant short message service (SMS) to the customer upon any transaction helps to enhance the level of security in the transactions. Therefore, because of these security features, customers might be feeling the credit card transactions to be non-risky.

Since the data for the present study has been collected using online survey, the customers who are not familiar with computers and internet have been ignored in this study. The results pertain to only the credit card holders of public sector banks in India and hence the results may not be generalized.

A study on private sector banks and next generation banks could be an area for further research. Also, a comparison of the nationalized banks and private sector banks could be an ideal area for further research. Another area of research could be a study on the satisfaction levels of the customers of public sector banks.

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Chapter 66
The Adoption Process of Payment Cards: An Agent-Based Approach

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ABSTRACT

The authors investigate the payment adoption rate under consumers' and merchants' awareness of network externalities, given two levels of interchange fees in a multi-agent card market. For the purpose of their research, in multiple instantiations of the model (scenarios) the investigated effects are analyzed over the complete process of adoption, until the market's saturation point is achieved. Then, for each scenario, a comparison is made between two different levels of interchange fees and different degrees of consumers' and merchants' awareness. To this end, the authors model explicitly the interactions between consumers and merchants at the point of sale. They allow card issuers to charge consumers with fixed fees and provide net benefits from card usage, whereas acquirers can charge fixed and transactional fees to merchants.

INTRODUCTION

During the last decade, interest on studying the retail side of the payment systems has grown. The driving factor behind this study is that electronic payment methods are of ever-increasing importance for making payments. Among these instruments, payment cards–more commonly referred to as credit and debit cards–are replacing cash and check payments at a rapid rate and are competing strongly with new payment methods. In terms of relative importance, for instance in Canada and the USA payment cards are the most commonly used instruments, accounting for 68% and 58%,

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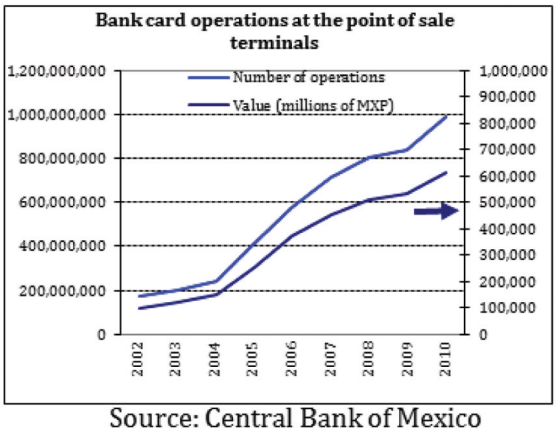
respectively, of all registered transactions made in 2010 (Bank for International Settlements, 2011). According to the European Central Bank (2010), in the European Union their market share is reported to be 38%, which is the highest of all payment methods available, well ahead of direct credits, direct debits, and checks.

Electronic payments have also been expanding in emerging and developing countries. For example, in Mexico, the average growth rate of transactions with non-cash payment instruments (payment cards, direct debits, checks, and electronic funds transfers) between 2002 and 2010 was 14%. That of transactions with payment cards was 26%; they totaled almost 1 billion operations in 2010 with a value of nearly 600 billions of pesos (Figure 1a). In turn, electronic funds transfers (direct credit) and direct debits have grown at positive rates also, while checks have decreased. As a result of these dynamics, during that period bank card payments as a share of non cash retail payments increased from 22% to 46% (Figure 1b) and card payments per inhabitant per year more than duplicated from 4 to 9[1] (Figure 1c), still well below of what is observed at either Canada, the United States, or Europe.

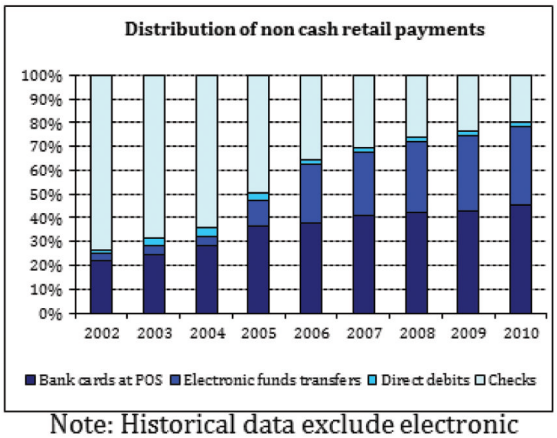
Given the prominent growth in the usage of payments cards, the line of research dedicated to study the competitive nature of the payment card market has attracted considerable attention from policy makers (e.g. Vickers, 2005; Reserve Bank of Australia, 2008; Bolt & Chakravorti, 2008; Weiner, 2008). We have recently witnessed several regulatory initiatives such as the code of conduct for the credit and debit card industry in Canada. The aim of the code is to ensure that merchants are fully aware of the costs associated with accepting credit and debit card payments, including the Interchange Fee (IF). Furthermore, in order to encourage consumers to choose the lowest-cost payment option, merchants are provided with increased pricing flexibility and are able to freely choose which payment options they will accept. Another prominent example is the USA financial

Figure 1. The growth of electronic payments



Source: Central Bank of Mexico

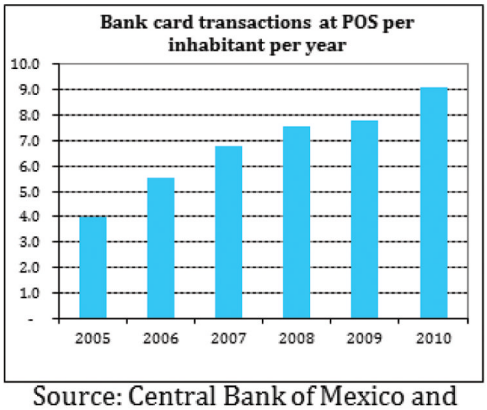
(a)



Note: Historical data exclude electronic funds transfers of 100,000 pesos or more

Source: Central Bank of Mexico

(b)



Source: Central Bank of Mexico and National Institute of Statistics, INEGI.

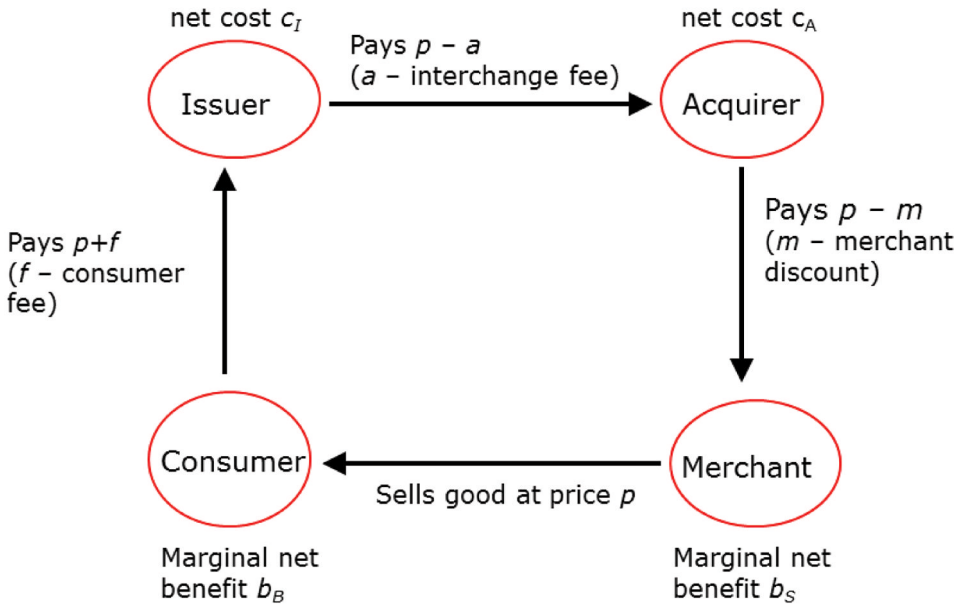
(c)

reform, which among other regulatory provisions, is aimed to set up a new bureau in the Federal Reserve to regulate mortgages and credit cards. In addition, the bill also includes a reduction on the fees charged on debit card transactions, including the IF that card issuers can charge to card acquirers whenever their cardholders use their cards at the merchant's point of sales terminal set by a different acquirer. On June 29, 2011, the Federal Reserve Board issued its final rule to implement the debit card IF and routing regulation rules pursuant to the "Durbin amendment" to Dodd-Frank. Among other things, the amendment sets standards for assessing whether debit card IF received by debit card issuers are "reasonable and proportional" to the costs incurred by issuers for electronic debit transactions and a maximum permissible IF.

Let us briefly point out that both analysts and policy makers concede IFs a paramount role in the functioning of payment card systems with four parties (i.e. issuers, acquirers, cardholders, and merchants). The reason is that this transfer between issuers and acquires, which can flow from either side to the other, impacts the prices charged to both cardholders and merchants, who are the final users of the payment instrument (Figure 2). For instance, the IF charged by issuers to acquires sets a minimum to the merchant service fee that acquirers can charge to the establishments for accepting card operations, which in turn permits the issuer promotes the use by means of offering rewards to cardholders. In contrast, when the issuers pay acquirers the IF, cardholders may have to pay an annual fee or a fee per transaction and merchants may receive a stimulus (we will discuss this issue further in the following section).

Regulations to develop card payments have also been undertaken in Mexico (Negrín, 2005). The implementation of the Payment System Law (2002) and the Law for Transparent and Ordered Financial Services (2004) increased the central bank's powers to oversee payment systems in general and foster electronic payment systems in particular. In the case of bank payment cards, since Mexico's market for bank retail payment cards in Point of Sale (POS) had remained underdeveloped, both with respect to international standards and vis-à-vis other emerging economies

Figure 2. IF flow



in the region, the Mexican authorities were concerned that lack of competition may be one of the culprits and implemented measures to foster market competition and depth, including a reduction of IFs (see Castellanos, Cordella, Medina, Mendoza, Negrín, Rochet, & Solís, 2008). Another particularly important measure to promote card transactions was the launch, in November 2004, of the Electronic Payments Infrastructure Fund (Fondo de Infraestructura de Medios de Pago Electrónicos, FIMPE) by the Ministry of Finance (Secretaría de Hacienda y Crédito Público). The FIMPE was a private, non-profit-making trust fund formed by acquirers that aimed towards promoting and extending access to the electronic payment network among small and middle size business, as well as to increase consumers' usage of them. Besides the fiscal incentive provided by the Ministry of Finance to install new electronic funds point of sales terminals, FIMPE funds were dedicated to implement a series of campaigns to advertise through multiple media the advantages of using bank cards among both consumers and merchants; that is, to increase market participants' awareness of the potential benefits of adopting this payment platform (Castellanos, et al., 2008). More recently, after the financial crisis of 2008, the Law for Transparent and Ordered Financial Services has been further reformed (2009 and 2010) and the Central Bank issued the Rules for Credit Cards which regulate minimum payments and improve cardholder protection in case of card loss or robbery, among other aspects (November, 2010). Besides, it also prohibited the banks to charge commissions in the case of payment default, if they already charge delinquency interest rates, and in the case that the cardholder has not used her card during one year, if they already charge an annual fee (July, 2010).

In this context, the authorities' interest is also focused on understanding the changing nature of our payment habits. In the last years, those habits have moved slowly from the use of paper-based instruments to the use of more efficient electronic payment instruments, merely payment cards. It is fair to say that the efficient use of payment instruments could have consequences beyond the payment system, i.e. the use of less expensive electronic payment means at the point of sale could results in considerable savings not only for businesses and banks, but also for the society as a whole. For instance, in Norway, where around 95% of the payments from deposit accounts are made electronically with 278 card transactions per habitant for 2010, the social cost of using and producing payment services is under half a percent of the country's GDP according to the Norges Bank (2010). Another example is Portugal, where the share of card transactions has grown from 52% in 2001 to 66% in 2009 (European Central Bank, 2010). The total costs for operations related to payment systems are estimated around 0.8% of GDP (Banco de Portugal, 2007).

In the present chapter, we develop a multi-agent model to simulate transactions at the point of sale between consumers and merchants in order to investigate the impact of the network externalities, such as those that FIMPE's campaigns can achieve, over the complete process of adoption. Our aim is to explore how consumers' and merchants' awareness of the network externalities modifies the adoption curve. This study is performed under two different levels of IF. The rest of the chapter is organized in the following way: in Section 2, we briefly review the economic literature on payment card systems, sketching potential complementarities with the agent-based model approach. Then in Section 3, the motivation of why using a multi-agent model is presented. Brief descriptions of the model elements, which are calibrated to broadly match Mexico's payment card market[2], are presented in Section 4. Next, in Section 5, we explain the agents' decisions and in Section 6, we present the settings of the model. In Section 7, we present our findings. Finally, in Section 8, we discuss our conclusions and suggest related lines of research.

1. ECONOMIC LITERATURE ON PAYMENT CARD SYSTEMS

What distinguishes the market for payment cards from most other markets is that it is a two-sided market, i.e. both partners in the transaction, consumers and merchants, using a payment card need a subscription to this specific payment method. Platform operators, as Visa and Mastercard, organize their business in a four party scheme: consumers, merchants, issuers (banks that provide cards to the consumers), and acquirers (financial institutions which become creditors of transactions to the merchant and provide them electronic terminals[3,4]. Each network establishes a specific level of IF, which is charged per transaction and usually flows from acquirers to issuers (Figure 2).

The economic literature has studied payment card systems, externalities and the role of IF for some time, using the framework of two sided markets. Therefore, for the sake of briefness, we present some analytical models and discuss how an agent-based approach can be used to complement those models insights. We refer our readers to the thorough and complete surveys written by Chakravorti (2003, 2010) for further references.

A two-sided market can be formally defined as a market where end-users are unable to negotiate prices based on costs to participate on a platform and the price structure affects the total volume of transactions (Rochet & Tirole, 2002). At first, the two-sided market literature assumed that the decision to adopt and use a payment instrument was made simultaneously; that is, if consumers adopt payment instruments they will always use them when possible. In Baxter (1983), it is argued that the equilibrium quantity of payment card transactions occurs when the total transactional demand for payment card services, which are determined by consumer and merchant demands jointly, is equal to the total transactional cost for payment card services, including both issuer and acquirer costs. A key result of this seminal model is that pricing each side of the market based on marginal cost–as would be suggested by economic theory for one-sided competitive markets–need not yield the socially optimal allocation. To arrive at the socially optimal equilibrium, a side payment–that is, an IF–may be required between the issuer and acquirer.

While in Baxter (1983), issuers and acquirers are competitive and merchants cannot price discriminate between consumers who pay with cash or those who pay with cards, the model developed by Schmalensee (2002) considers that issuers and acquirers that have market power, but still assumes that merchants operate in competitive markets. This framework also supports the conclusion that the IF balances the demands for payment services by each end-user type and the cost to banks to provide them. Moreover, IF of issuers and acquirers that maximizes profits can be socially optimal. That is, given the simultaneous consumption of payment services by consumers and merchants, a side payment may be necessary to get both sides on board if there are asymmetries of demand between consumers and merchants, and/or of costs to service consumers and merchants.

In contrast with the approaches described before, Rochet and Tirole (2002) study policies set by law, card networks, or acquirers that require consumers to pay the same price regardless of the type of payment instrument used (e.g., "the no surcharge rule" or the "honor all cards rule") in a model that assumes issuers have market power, a perfectly competitive acquiring market, and merchants compete in a Hotelling framework. Consumers purchase one unit of a good and are heterogeneous in terms of net benefits received from using the payment card. Two results of these framework stand out. First, the IF that maximizes profit for the issuers may be more than or equal to the socially optimal interchange fee, depending on the issuers' margins and the cardholders' surplus. Second, merchants are willing to pay more than the socially optimal fee if they can steal customers

from their competitors. However, overall social welfare does not improve when merchants steal customers from their competitors by accepting payment cards.

To summarize, the theoretical framework initially developed in Baxter (1983) and later in the models in Schmalensee (2002) and Rochet and Tirole (2002), has propelled a significant amount of research in this area. Furthermore, our understanding of the fundamental relationship among the participants of the payment card market has been straitened by the contributions of Wright (2003), Evans (2003), Evans and Schmalensee (2005a, 2005b), Roson (2005), and more recently of Chakravorti and To (2007) and Rochet and Tirole (2006). Those models are built on the assumption that the payment cards are accepted by all consumers and merchants and the analysis is focused on the usage externalities, which arise by the use of payment cards over the cash or other payment methods. In those studies, the market dynamics are evaluated through the most representative players (namely the cardholders, the merchants, the card issuers, and the acquirers) and the attention is placed on the setting of IF. These models only give cursory considerations to the interactions among heterogeneous market participants and consequently do not take into account the impact that those interactions could have on the competition in the market. For these reasons, we believe that an alternative approach is required to study the social dynamic of the market under more realistic fashion, such as agent-based modeling.

2. AGENT-BASED MODELING: THE ALTERNATIVE APPROACH

If we try to visualize a model's development spectrum in terms of complexity degree, those models whose creation requires high computational skills stand among the most complex ones. They challenge the conventional way of representing social phenomena and try to expand the frontier in the process of understanding reality. The agent-based approach is one of these modeling techniques that use programming languages, which allows us to represent explicitly agents with bounded rationality and heterogeneous preferences. Given specific social structures, the simulation of the interaction among agents is the key strength of the Agent-Based Modeling (ABM) (Axelrod, 2003). The representation of the behavior of the autonomous decision-making entities allows researchers to analyze emergent phenomena in order to gain a better understanding of the object of study. Inside the field of agent-based modeling, is the Agent-Based Computational Economics (ACE) approach that we follow to develop our model (see LeBaron, 2000, 2006).

One of the main purposes of ACE is to handle the complex dynamics of economic systems on a more realistic fashion (Colander, Goldberg, Haas, Juselius, Kirman, Lux, & Sloth, 2009). Given the necessity imposed by the latest financial crisis to better understand the complexity of the world's economy, ACE is developing rapidly, in particular the studies related to the Agent-based Financial Economics (Kirman, 2010; Johnson & Lux, 2011). Among the different ways of applying the agent-based approach, is the so called bottom-up modeling of market processes (Tesfatsion, 2006). The idea behind this simulation technique is to explicitly represent the participants of the market, modeling them as software programs (agents) able to take autonomous decisions. The behavior rules generally allow each agent to interact with a small fraction of agents, independent from the total number of participants built into the model. For that reason, each modeled individual exhibits significant differences with respect to the other participants. Consequently, the interactions among the agents at the micro level (locally) give rise to regularities at the macro level (globally). The intention is to observe the emerging self-organizing process for a certain period of time, in order to study the presence of patterns or the lack of them. Cur-

rently the study of this self-organizing capability is one of the most active areas of ACE research.

Regarding our object of study, the payment card market, the focus of the literature, as we said before, is on the IF and the analytical models make a number of very simplified assumptions on the behavior of consumers and merchants. Nevertheless, in reality, the behavior of market participants is determined by a set of complex interactions between consumers and merchants, as well as within the group of consumers and the group of merchants. The partners in the transaction will face network externalities as a larger number of users in one side using a certain card, makes the subscription more valuable to the other side. Card issuers/acquirers will also affect behavior by charging subscription fees and giving benefits associated with the cards.

Given the degree of complexity, modeling the payment card market is a challenge. The first attempt to tackle this issue using computational methods is presented in Alexandrova, Tsang, and Krause (2008). In that study, a competition among several payment card schemes is simulated through a multi agent-based approach. In particular, the behavior of consumers and merchants at the point of sale is modeled using equations, whereas evolutionary computational algorithm is applied to represent the decision of issuers to price the payment cards. In this artificial market, a card provider is also the entity that offers an electronic payment method to merchants. This study was further extended in Alexandrova, Tsang, and Krause (2011a, 2011b).

In a similar setting in Alexandrova (2009), an intranetwork competition is modeled among issuers and acquirers, given that in the artificial market there is one payment card scheme. The author simulates the consumers' and merchants' decisions related to commercial transactions, in order to study the effect of IF on the payment adoption rate in a non-saturated market. In the present chapter, in order to go further in the understanding of the underlying structure of the market, we implement the same model. This approach allows us to analyze all the fees paid by consumers and merchants using payments cards rather than only the IF. Thus, the contribution of the present study is that we calibrate the market, using real data of the Mexican market and analyze the complete process of card adoption, under the specified conditions.

We investigate the payment adoption rate under consumers' and merchants' awareness of network externalities, given two levels of IFs in a multi-agent card market. We acknowledge that the saturation point of the market is not only determined by network externalities and the level of Interchange Fees, but also by macroeconomic factors, which we are not exploring at this stage of research. For the purpose of our research, in multiple instantiations of the model (scenarios) the investigated effects are analyzed over the complete process of adoption, until the market's saturation point is achieved. Then, for each scenario, a comparison is made between two different levels of Interchange Fees and different degree of consumers' and merchants' awareness. To this end, we model explicitly the interactions between consumers and merchants at the point of sale. We allow card issuers to charge consumers with fixed fees and provide net benefits from card usage, whereas acquirers can charge fixed and transactional fees to merchants. The IF flows from acquirers to issuers.

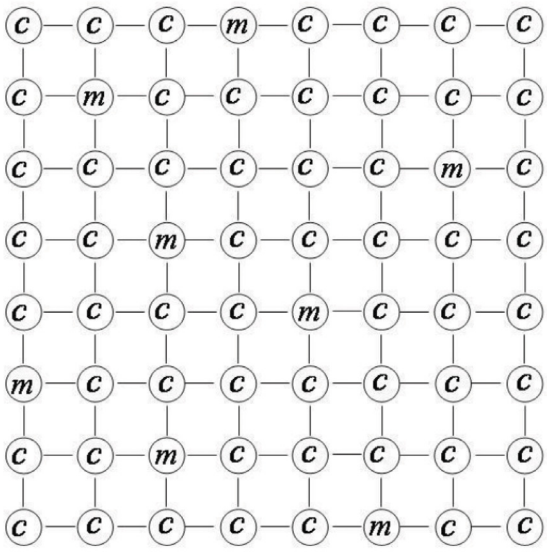
3. THE ELEMENTS OF THE INTRANETWORK COMPETITION MODEL

In this section, we introduce the notation used to represent our model of intranetwork competition in one network payment card market. We describe the attributes of market participants–merchants, consumers, card issuers, and acquirers.

3.1. Merchants

Suppose we have a set of merchants M with $|M|=N_M$ and a set of business sectors[5] B. Each merchant m can belong only to one business sector b M_b belonging to a specific business sector has an individual $\left|M_b\right| = N_{M_b}$. The merchants are located at random intersections of a $N\times N$ lattice, where $N^2 \gg N_M$ (see Figure 3). Let the top and bottom edges as well as the right and left edges of this lattice be connected into a torus. The goods offered cross business sector are heterogeneous, whereas inside each business sector merchants are offering a homogeneous good at a common price and face individual marginal cost of production lower than this price. We have adjusted the number of merchants per business sector and the merchants' marginal profit distribution ϱ according to the 2004 Economic Census performed by the National Institute of Statistics, Geography, and Informatics (Instituto Nacional de Estadística y Geografía, INEGI).

Figure 3. Sample of a lattice with consumers (c) and merchants (m)



3.2. Consumers

The set of consumers is denoted C $|C|=N_C$. They occupy all the remaining intersections of the above lattice, where $N_C \gg N_M$ and $N^2=N_M+N_C$. Each consumer has an individual budget constraint adjusted according to the income distribution obtained by the 2006 Income Census performed by INEGI. On each time period, consumers perform a single interaction with one merchant. The business sector to which the merchant belongs determines the frequency with which consumers shop at a particular merchant as well as the amount of the consumers' budget spent with it.

In order to perform commercial transactions, any consumer $c\in C$ $m\in M$. We assume that making transactions increases consumers' utility, whereas the travelled distance imposes costs on consumers. Given that these costs reduce the attractiveness of visiting a merchant, in this study, we explore the case where the connections among consumers and merchants are local. Moreover, the distance between the intersections on the lattice is measured by the "Manhattan distance" $d_{c,m}$. The distance between two neighboring nodes has been normalized to one. We further restrict the consumer to visit only the nearest merchants and denote by , the set of merchants from all existing business sectors in the model. In subsection 4.1, we explain in detail the way this decision is designed.

3.3. Payment Methods

In the four party scheme that we have developed, we consider two sets of payment card providers: card issuers I with $|I|=N_I$ and acquires A with $|A|=N_A$. The issuers offer electronic payment cards to consumers, whereas in order to accept those cards the merchants require the electronic payment method offered by the acquirers. The payment method offered by each of the payment

card providers has the same characteristics, except for the price, which may differ among issuers and acquirers.

Additionally, there is a benchmark payment method, which can be interpreted as a cash payment. Cash is available to all consumers and accepted by all merchants. For a card payment to occur, the consumer as well as the merchant must have a subscription to any of the issuing financial institutions that belong to the network. We assume that card payments, where possible, are preferred to cash payments by both consumers and merchants. In each time period a fixed subscription fee of $F_i \geq 0$ is charged to the consumer, and $\Gamma_a \geq 0$ to the merchant.

Merchants obtain a convenience benefits b_m from accepting cards, e.g. timesavings at the counter relative to cash payments, accounting facilities, and fraud protection. Additionally, for each payment card transaction merchants pay a discount[6] γ_a to the acquirer. We assume that if the merchants' discount exceeds the convenience benefits, merchants will surcharge consumers that are using cards. Furthermore, the merchants' discount is established as a proportion of the IF acquirers pay to issuers[6]. Cash payments do not provide any net benefits.

Due to the reduced risk for cash handling and delayed payment, consumers also obtain a convenience benefits from using a card. In addition, they receive a transaction benefits from the card issuer as cash-back points. We assume that those points are used instantaneously, i.e. the final amount spent increases. For that reason, cardholders, wherever possible prefer to use card to cash in a transaction. Nevertheless, in the case when the merchant has surcharged card usage, the cardholder will use cash if the price increase exceeds the convenience and the transactional benefits that he receives. Cash payments however do not provide any net benefits

4. DECISION-MAKING OF MARKET PARTICIPANTS

This section explains how the interactions among the consumers and merchants drive their decisions. These decisions are made under the condition that the prices charged by card issuers and acquirers are randomly assigned at time and are fixed throughout the simulation.

4.1. Consumers' Decisions

In the model, there are two sets of consumer decisions. The first relates to the activities of shopping, which are performed at each time period. The second set of decisions relates to the subscription to the electronic payment instrument and is taken with certain periodicity determined by an individual Poisson distribution. This section addresses each of these set of decisions in turn.

4.1.1. Consumers' Shopping Decisions

We have modeled the process of shopping with four consumers' decisions. First he has to select a business sectors; then, from the set of the nearest merchants belonging to this business sector consumer chooses a merchant to visit; further, he must decide how much to spend[7]; and, finally, he selects a payment method to use in the transaction.

We assume a random consumer choice for the selection of business sectors. This decision is adjusted according to the patterns of cardholders' behavior observed in the data reported quarterly to the Mexican Central Bank during 2007.

With respect to the consumer choice of a merchant, we suppose it is driven by two factors: the payment methods that the consumer can use at the merchant and the distance between this consumer and the merchant. Regarding the possible payment methods used, we assume that when

deciding which merchant to visit, the consumer has not yet decided which payment method he will use. In order to handle this relation, suppose P_c is the set of payment methods the consumer $c \in C$ has and $P_{c,m}$ $m \in M$. Let $|P_c| = N_{P_c}$, $|P_{c,m}| = N_{P_{c,m}}$ and $N_{P_c} \geq N_{P_{c,m}}$, i.e. any cardholder knows in advance which merchant in the neighborhood accepts card payments. Furthermore, in the case when a cardholder has previously visited a particular merchant, the consumer will also know that he will prefer a cash payment to card if card usage surcharge is applied and it is higher than the consumer's card benefits.

In addition, we assume that the smaller the distance $d_{c,m}$ between the consumer and the merchant, the more attractive this merchant will be to the consumer. From these deliberations we propose to use a preference function for the consumer to visit the merchant as follows:

$$v_{c,m} = \frac{\frac{1}{d_{c,m}} \frac{N_{P_{c,m}}}{N_{P_c}}}{\sum_{m' \in M_c} \frac{1}{d_{c,m'}} \frac{N_{P_{c,m'}}}{N_{P_c}}} \quad (1)$$

Each consumer $c \in C$ chooses a merchant $m \in M$ with probability $v_{c,m}$ as defined in Equation (1). Consumers will continuously update their beliefs on the number of payment methods they share with a particular merchant, by observing the acceptance of card payments of all shops in their neighborhood - as subscriptions may change over time in the way introduced below.

After choosing a merchant, the next decision the consumer must take is how much he will spend in his purchases. This is constrained in two ways. First, we assume that only a fraction of the consumers' income is spent, given that the higher the income the lower the fraction dedicated to consumption. This fraction is adjusted according to the data reported in the 2006 National Survey of Income and Expenses performed by INEGI. Secondly, even when the exact amount of the transaction is assumed to be a random choice, the possible maximum amount spent is exogenously determined and it is business sectors dependent. The adjustment of this decision is made by using data reported quarterly to the Mexican Central Bank regarding cardholders' transactions during 2007.

Finally, the cardholder decides which payment method he wants to use at the merchant he has selected. We assume a card is preferred in the case when the merchant has not surcharged. In the case the merchant charges for card usage, the decision is determined by the consumer's convenience benefits b_c from using card, the transactions benefits b_i received by the issuer and the surcharge rate sr_m applied by the merchant. Let b_c, b_i and sr_m are normalized to zero. If $sr_m > b_c + b_i$, then the cardholder will use cash, otherwise he will prefer a card payment. In the case when the merchant does not accept card payments, the transaction is settled using cash.

4.1.2. Consumer Card Subscriptions

In parallel to the shopping decisions, periodically[8] non-card consumers may decide to adopt an electronic payment method and consequently they have to choose to which issuers to subscribe to. Similarly, cardholders could decide to drop their card or to switch to a different card issuer.

Initially the number of cardholders is determined randomly in the market. Then payment cards, randomly selected from different issuers, are allocated to the selected cardholders. After certain number of interactions individually determined, cardholders may decide to drop their card subscription or change the card issuer they are dealing with. In a similar fashion, the rest of consumers have to decide whether to have a payment card or not and in the case they do, they must select a card issuer. The frequency with which consumers take these decisions is defined by an

individual Poisson distribution with a mean of λ time periods between decisions.

In the model, there are two mayor factors that drive the consumer decision to have a payment card: merchants' card acceptance and consumers' convenience benefits b_c from using an electronic payment method. For that reason, every consumer $c \in C$ keeps track of the merchants accepting cards, whereas the convenience benefits b_c are exogenously given. Let ω_c^+ be the consumer's score for merchants accepting cards. Each time the merchant $m \in M_c$ that he is visiting accepts card payments, the consumer increases ω_c^+ by one. Assume that he decides to have a payment card with probability:

$$\pi_c^+ = \frac{\exp\left(\alpha^+ \frac{\omega_c^+}{\omega_c} + b_c\right)}{x_c^+ + \exp\left(\alpha^+ \frac{\omega_c^+}{\omega_c} + b_c\right)} \tag{2}$$

where ω_c denotes the number of merchants visited, a x_c^+ is a constant that accounts for the propensity of the consumer to have payment card and α^+ is another constant representing the consumers' awareness of the benefits arriving from the existing payment card network externalities[9]. For instance, suppose we have two scenarios with two different values of α^+. Ceteris paribus, in the case when the value of α^+ is smaller, the payment adoption rate on the consumers' side will be lower in comparison to the case when consumers have a higher awareness of the existing positive network externalities, i.e. α^+ has a larger value. Given the parameter constellation used below, we are able to explore the impact of the different degree of consumers' awareness on the payment adoption curve by scaling the values of α^+. Those experiments have been performed under two different level of IF. On the other hand, cardholders may decide to drop their payment cards. They will do so with the probability:

$$\pi_c^- = \frac{1}{x_c^- + \exp\left(\alpha^- \frac{\omega_c^+}{\omega_c} + b_c\right)} \tag{3}$$

where x_c^- is a constant accounting for the consumers' inertia to abandon the payment card network and α^- is another constant representing the cardholders' awareness of the existing positive network externalities.

Finally, the cardholders' decision to which card issuer to subscript is driven by the fees F_i and transaction benefits b_i associated with the payment card. A card becomes more attractive to subscribe and existing subscriptions are less likely to be changed if the fixed fee charged is low and the benefits from each transaction are high. From these deliberations we propose to use a preference function for the consumer to select an issuer as follows:

$$v_{c,i} = \frac{\alpha_1 b_i - \alpha_2 F_i}{\sum_{i^* \in I} \alpha_1 b_{i^*} - \alpha_2 F_{i^*}} \tag{4}$$

where α_1 and α_2 are constants. Furthermore, with an exogenously given threshold τ_c, if $(\alpha_1 b_i - \alpha_2 F_i) < \tau_c$, the consumer will change his current subscription to a different issuer.

4.2. Merchants' Decisions

On the merchants' side, as with consumers, to a random number of retailers is assigned an initial subscription to a randomly selected acquirer. The merchants' decisions are limited to the acceptance of cards, the choice of acquirers and the application of a surcharge for the card usage in the case of high merchant discount . These decisions are taken periodically, after observing the consumers' behavior at the point of sale. A Poisson distribution specific to each individual with a common mean of time periods governs the frequency with which merchants review them.

Merchants that do not accept cards keep track of the number of consumers presenting a card to them. Every time a consumer wants to pay with a card the score of θ_m^+ is increased by one and the probability to join the payment card network is given by:

$$\pi_m^+ = \frac{\exp\left(\delta^+ \frac{\theta_m^+}{\theta_m} + b_m\right)}{x_m^+ + \exp\left(\delta^+ \frac{\theta_m^+}{\theta_m} + b_m\right)} \quad (5)$$

where θ_m denotes the number of transactions made and x_m^+ is a constant. The interpretation of the term δ^+ follows the same lines as for consumers, i.e. it accounts for merchants' awareness of the positive network externalities. Similarly here, in order to explore the effect of δ^+ on the merchant adoption rate, in separated experiments ceteris paribus we gradually increase its value. The observed curve of adoption is reported for each value change. These set of experiments are performed under two different level of interchange fee IF. The results are reported in section 6.

$\Gamma_a \gamma_a$ charged by the different financial institutions. The preference function proposed for this case is the following:

$$v_{m,a} = \frac{\frac{1}{\delta_1 \gamma_a + \delta_2 \Gamma_a}}{\sum_{a^* \in A} \frac{1}{\delta_1 \gamma_{a^*} + \delta_2 \Gamma_{a^*}}} \quad (6)$$

where δ_1 and δ_2 are constants.

If the merchant $m \in M$ accepts cards, every time a card is presented to him, he increases the score of θ_m^- by one. The probability to stop accepting a card then is given by:

$$\pi_m^- = \frac{1}{x_m^- + \exp\left(\delta^- \frac{\theta_m^-}{\theta_m} + b_m\right)} \quad (7)$$

where x_m^- is a constant that requires the merchants' inertia to leave the payment card network.

$b_m < \gamma_a$, i.e. if consumers prefer to use a card instead of cash, they will have to pay a higher price for the good they are buying.

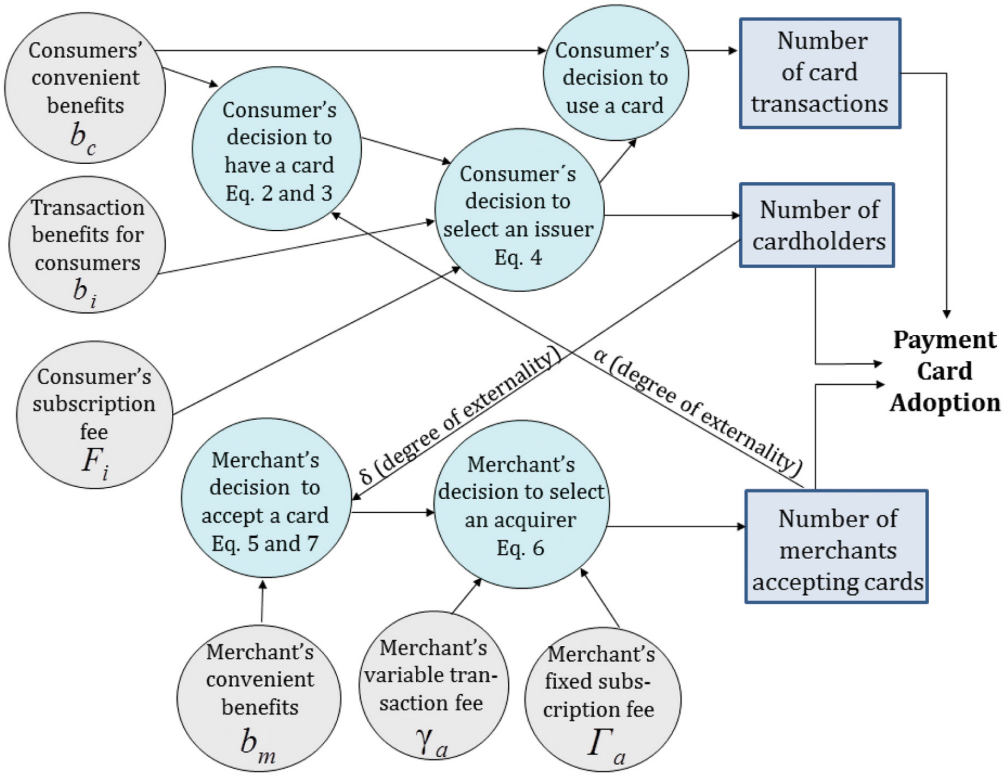
Finally, in Figure 4, we present a global view, which allows the reader to understand the payment card model by presenting the parameters and variables that have been used to construct agents' decisions. For instance, it can be seen that the cardholder's decision to select an issuer is directly affected by the transaction benefits for costumers, the consumer's subscription fee, and the consumer decision to adopt a card. The last one is affected by the consumers' convenient benefits, which means that this parameter affects indirectly the Consumer´s decision to have a card. The diagram gracefully shows that the number of card transactions, the number of cardholders, and finally the number of merchants accepting cards are the variables we have chosen to evaluate the model's results, which is the adoption of payment cards.

5. EXPERIMENTAL SETTING

In this section, we explain the way the experiments have been conducted and how we have studied the impact that the positive network externalities have on the network's growth.

We study the effects on the payment adoption rate in a multi-agent based payment card market of the consumers' and merchants' degree of awareness of the network externalities under two levels of Interchange Fees. To this end, first, we have explored the parameters' search space in

Figure 4. General view of the model



order to find a feasible set of scenarios, in which the emerging patterns of studied phenomenon are similar to those observed in reality. We assume that the saturation point of the market is not determined by the network externalities, but rather by other factors such as consumers' income, merchants' market power among others, which we are not exploring at this stage of research. Using the selected set of scenarios the investigated effects are analyzed over the complete process of adoption, until the saturation point in the market is achieved. For each scenario then a comparison is made between two different levels of IFs in a state where the usage/acceptance of the payment cards is at saturation point.

The criteria applied for the selection of the scenarios are the presence of a positive growth of the payment card usage/acceptance and the existence of network externalities among the two sides of the payment card market, namely among consumers and merchants. Regarding the modeling of network externalities, our research question is how aware of those positive externalities the consumers and the merchants are. In order to answer this question, we assume that any increase either of the consumers' or the merchants' awareness will have an impact on both sides of the market. We model the different degree of consumers' and merchants' awareness by scaling separately the values of α^+ and δ^+. The selected scenarios result from the combinations of values between α^+ and δ^+.

In Tables 1 and 2 we present the values for the main parameters and constants, which are kept the same for all scenarios, whereas the values of α^+ are taken from the interval [6, 7], the values of δ^+ are taken from the interval [5, 6] and the scaling of these two variables is made with a regular increase of 0.2. Figures 5 and 6 show the impact on the network growth, when the degree of consumers' or merchants' awareness of network externalities

is increased. In other words, when the values of α^+ or δ^+ are gradually increased[10]. Each of these figures contains six panels (3 lines x 2 columns). The three lines that depict the impact on number of cardholders, number of merchants accepting cards and card transactions, respectively. In each of the two columns, impacts are compared across two IF environments that broadly correspond with the average values observed in Mexico in 2004, before the central bank asked the banks' association to modify the scheme to set IF, and 2010, after two rounds of reductions based on the scheme proposed by the banks' association took place (Castellanos, et al., 2008). All figures use the same scale so that the intensity of the effects can be appreciated more easily.

6. RESULTS

In this section, we present our main results. We argue that our observations are related to the whole process of adoption. To this end, we present for each side of the market two different levels of the IFs: case 1 - Interchange Fees = 1.2%, and case 2 - IFs = 4.2. We compare those two cases over 121 scenarios, resulting from the combinations of values between α^+ and δ^+. We present the outcomes related to the proportion of consumers having cards, the proportion of merchants accepting cards and transactions achieved after 12000 interactions.

Let us describe the impact on network growth obtained when the degree of consumers' or merchants' awareness of network externalities is increased, in other words when the values of α^+ or δ^+ are gradually increased[11].

First, we show the effects of increasing consumers' awareness. In panel (a) of Figure 5, we observe that low degrees of consumer awareness correspond to slower growth in the number of cardholders. Besides, for low degrees of consumer awareness, a higher IF slows down cardholder

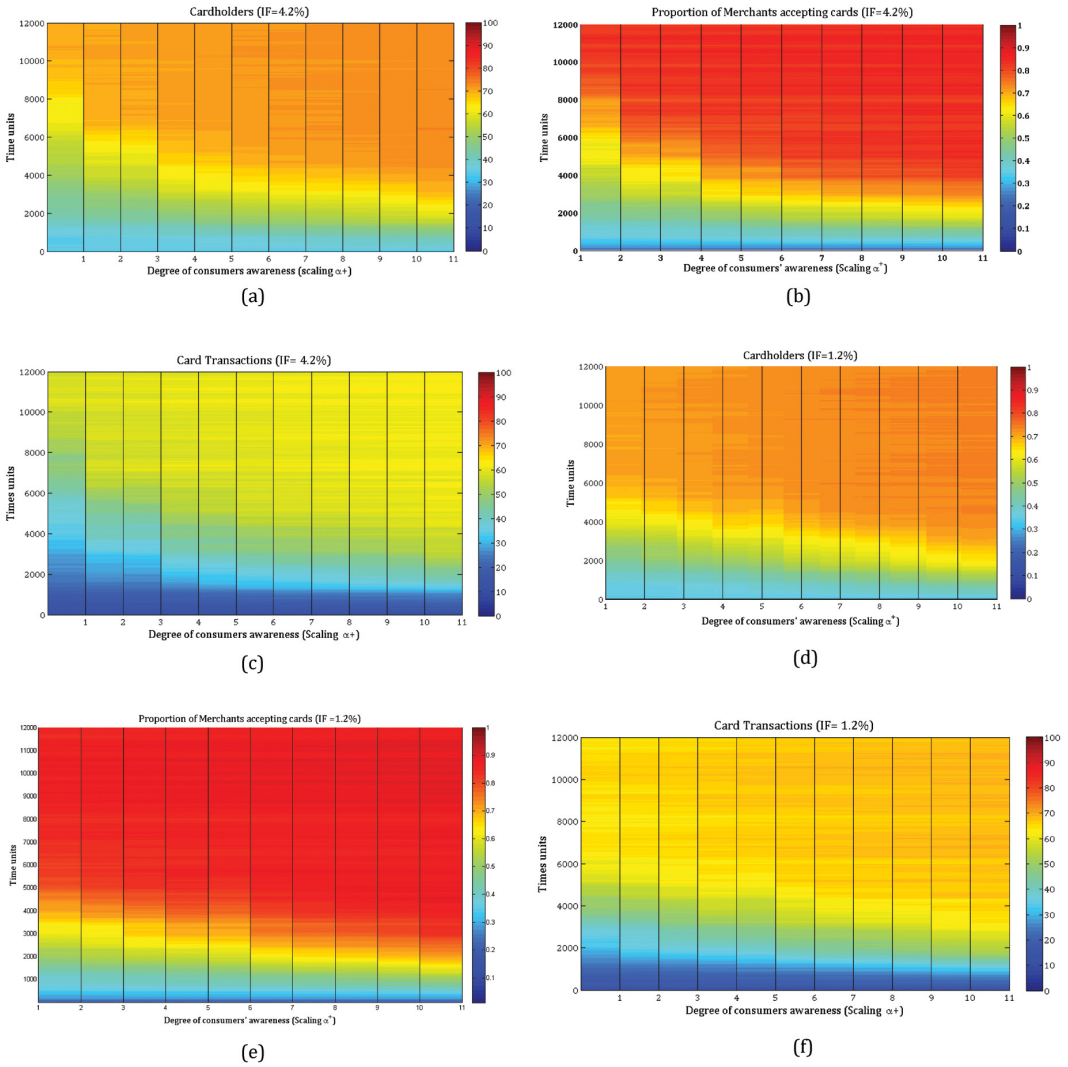
Table 1. Parameters

Symbol	Description	Value
N_M	Number of Merchants	864
N_C	Number of Consumers	20745
N_I	Number of Issuers	10
N_A	Number of Acquirer	7
N_B	Number of business sectors	5
N_{M_b}	Total number of merchant to be visited by the consumer	23
N_{M_1}	Number of merchant to be visited by the consumer (Sector 1-3)	1
N_{M_2}	Number of merchant to be visited by the consumer (Sector 4)	3
N_{M_3}	Number of merchant to be visited by the consumer (Sector 5)	1
N_{M_4}	Number of merchant to be visited by the consumer (Sector 6)	17
N_{M_5}	Number of merchant to be visited by the consumer (Sector 7)	1

Table 2. Constants

Symbol	Description	Value
x_c^+	Consumers' inertia to add new cards	40
x_c^-	Consumers' inertia to drop cards	2
b_c	The consumers' convenience benefits	0.03
α^-	Consumers' awareness of externalities when drop cards	0.8
x_m^+	Merchants' inertia to add new cards	45
x_m^-	Merchants' inertia to drop cards	1
δ^-	Merchants' awareness of externalities when drop cards	4
b_m	The merchants' convenience benefits	0.03

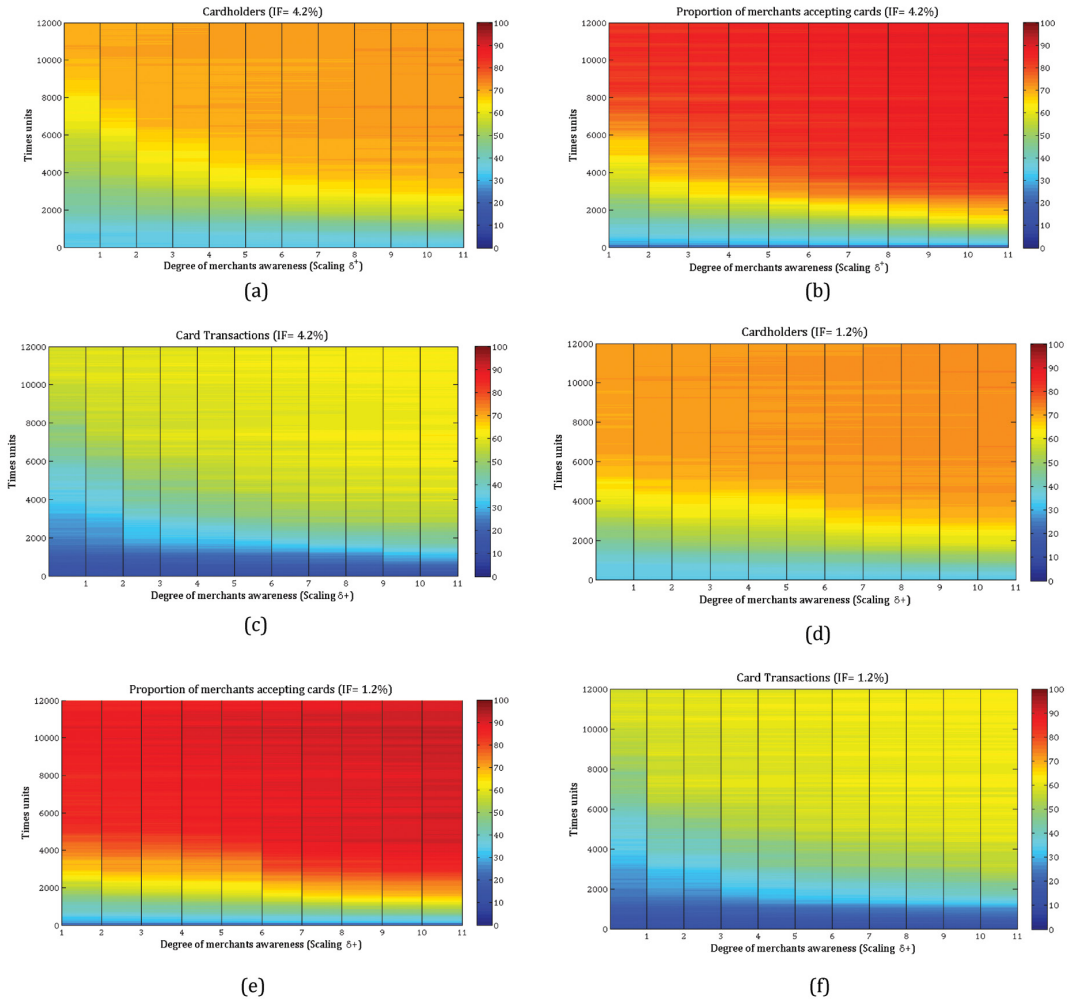
Figure 5. The impact of consumer awareness on number of cardholders, number of merchants accepting cards, and number of card transactions: High vs. low IF environments



growth even further (see, for example, the dynamics for a value of 1 of consumer awareness depicted in panels 5a and 5d). However, these differences in the speed of growth become less important for higher degrees of consumer awareness (see, for example, the dynamics for a value of 9 of consumer awareness depicted in panels 5a and 5d). However, when 12000 iterations have elapsed, differences are practically negligible, regardless of the initial degree of consumer awareness.

Figure 5(b) show the effects on the number of merchants that accept credit cards. As before, a lower degree of consumer awareness is associated with a slower growth in the number of accepting merchants and growth speed differences across IF levels become less important as the degree of consumer awareness increases (see, for example, the dynamics for a value of 9 of consumer awareness depicted in panels 5b and 5e). However, even after 12000 iterations have elapsed, there is a noticeable difference in the final number of accepting

Figure 6. The impact of merchant awareness on number of cardholders, number of merchants accepting cards, and number of card transactions: High vs. low IF environments



merchants across the two IF scenarios considered. Clearly, in the low IF scenario the number of accepting merchants is higher than in the high IF one. This suggests that the degree of consumer awareness weights more on the merchants' side than on the consumers' side. According to panel 5c and 5f, as a result of the aforementioned dynamics, the number of card operations grows at a faster pace in the low IF scenario, for any degree of consumer awareness considered.

Now let us show the impact of increasing merchants' awareness, depicted in Figure 6. As before, the higher is the degree of merchants' awareness, the larger are the proportions of cardholders, accepting card merchants and transactions (see panels 6a, 6b, and 6c). However, the comparison with the case of increasing consumers' awareness shows that in this case the adoption rates among cardholders are slightly lower and among merchants are higher. As before the comparison of the high and low IF environments show that under the latter, the network evolves faster than under the former.

Finally, when we compare the final impact on the number of transactions, it is clear that the scenario with consumer externalities and low

IF achieved the highest number of transactions (panel 5f). It is worth noticing that these general trends suggest the importance that implementing complementary strategies (i.e., lowering IF and use public funds to coordinate acquirers' advertisement campaigns) may have had to promote card usage, as Mexico's Central Bank and Ministry of Finance. This, given that the initial adoption rates that prevailed among both consumers and merchants were very low in Mexico.

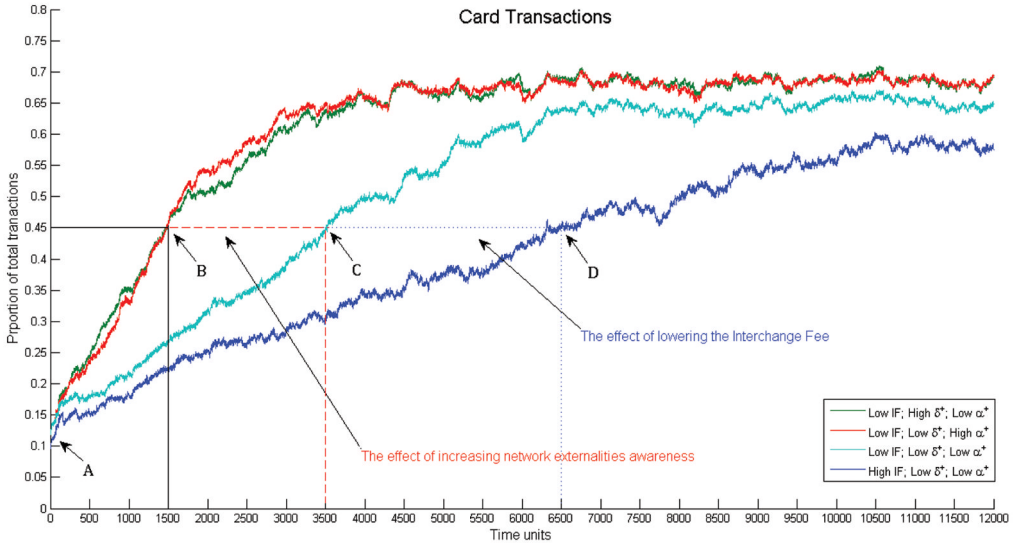
To further illustrate this last point, in Figure 7 we compare the proportion of card transactions achieved through time under four scenarios with different initial combinations of IF, consumer awareness, and merchant awareness that allow us to "discompose" the impact of IF and the impact of the advertisement campaigns:

1. IF=4.2% (high), δ^+= 1 (low) and α^+= 1 (low);
2. IF=1.2% (low), δ^+=1 (low) and α^+=1 (low);
3. IF=1.2% (low), δ^+= 1 (low) and α^+= 11 (high); and finally,
4. IF=1.2% (low), δ^+=11 (high) and α^+=1 (low).

We have taken from Figure 1a two levels of the proportion of card transactions observed in Mexico in 2002 and 2010 that is 12% and 45%, respectively. Point A illustrates the initial 12% of card transactions. This point, from which all scenarios start, serves to illustrate the situation of high IF, low α^+ and low δ^+; that is, a scenario without policy interventions. Along the adoption trajectory of scenario (1), it takes 6,500 periods to reach point D with 45% on of card transactions. In the case that only the IF is lowered, that same level of adoption is reached after 3,500 periods, illustrated by point C along scenario (2). So the speed of adoption increases by 3000 periods. In the case that the IF is lowered and either consumer or merchant awareness is increased, the level of adoption is reached after only 1,500 periods, point B scenarios (3) and (4). Therefore, the speed of adoption is further increased by 2000 periods. Therefore in this example 25% time reduction to reach the level can be attributed to the IF reduction and the other 15% to the advertisement campaign that raises users awareness.

To complete our analysis, it is interesting to underline in Figure 7 that after 11000 periods all

Figure 7. Comparing the impact of changes on IF levels and degrees of awareness



four scenarios exhibit stationarity. Hence, we can conclude that by then all scenarios have achieved the market saturation point. It can be seen that in the cases in which either consumers or merchants exhibit high degree of awareness (scenarios [3] and [4]) the adoption of the use of the payment method reaches around 70% of the market, while in case (2) with low IF and low consumers' and merchants' awareness the cards payments are around 65% of the transactions and in case (1) with high IF y low awareness card transactions are less than 60%. In turn, we also notice that the saturation point for the cases (3) and (4) is achieved after only 4000 periods, which is faster than in cases (2) and (1), where this condition is reached after 7000 periods and 11000 interactions, respectively.

In sum, rather than take these results as conclusive about what is the relative importance of the two policy instruments considered, we deem them as very suggestive of how much more intuition we can get about real policy issues by adding agent based models to the analysis toolkit and of the need to incorporate into these models real life data.

7. CONCLUSION

In this chapter, we have developed an agent based economic model that allows us to understand the relative importance of IF and agents' awareness on the expansion of a card payment network. The values of the model have been chosen to broadly match the characteristics of a country, Mexico, which has undertaken several policies to promote payment card usage. Lastly, we have used the results to conduct counterfactual exercises to get a grasp of the impact of using one policy or two simultaneous policies in a fashion that is very similar to the basic economics comparative statics. These exercises besides illustrating the power of the tools of agent based modeling illustrate some interesting complementarities with other techniques of analysis.

Given the present results, we consider necessary to explore in depth the scenarios we have studied. Here, we have analyzed the cases, in which consumers' and merchants' have different degree of network externalities awareness. We believe that studying the impact of the fixed and variable fees on the consumers and merchants sides may open the number of cases that need to be analyzed in detail. Furthermore, we think that exploring these possibilities through experimentation will allow us to understand better in which cases lowering the level of IF can result in a situation with high adoption of payment cards.

On the other hand, a different research question would be what may happen in a framework in which an asymmetric impact (either on the consumers or on the merchants' side) of network externalities is observed. It is worth noticing that in this chapter we use advertising as a tool to raise awareness as a natural way to approach this concept. However, consumer awareness has been conceptualized as a very multifaceted phenomenon. Therefore, for deeper policy contributions, in future research it may be important to consider different mechanisms to raise awareness (such as density of card users in consumer segment).

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ENDNOTES

1 For further details about credit card usage among different population segments in Mexico see the appendix.

2 The data used to calibrate the model is included in the appendix.

3 It is worth noticing that in some countries the provision of terminals is not a generic acquirer task, nor do acquirers need to be financial institutions in all jurisdictions.

4 In a three party payment system, the same institution that issues the cards to consumers is the acquirer at merchants' shops. The best-known example of the three party payment scheme is American Express.

5 For more detailed information about how economic units are organized in business sectors in Mexico, please see the Appendix.

6 In the model the value of the convenience benefits and the merchant discount is normalized to one.

7 For a more detailed study of the relationship between the merchants' discount and the IF, please see Alexandrova and Negrin (2009).

8 The constraint on the maximum amount of budget spent varies across business sectors.

9 The periods are determinate by individual Poisson distribution.

10 The awareness in this case is of those consumers that do not belong to the network.

11 In those figures, when the value of α^+ is increased, the value of δ^+ is on its lowest limit and vice versa.

12 In those figures, when the value of α^+ is increased, the value of δ^+ is on his lowest limit and vice versa.

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APPENDIX

In this appendix, we present a brief summary of the data we have used to calibrate the multi-agent based model.

We start with the merchant side. Our data source is the 2004 Economic Census produced by the Instituto Nacional de Estadística y Geografía, INEGI. The data about economic units in Mexico is classified into the sectors and categories that match the business classification employed by acquiring banks to offer payment accepting services (Table 3). In Tables 4 through 8 for each sector we have calculated the percentage of earnings for multiple subcategories of economic units that belong to each sector (i.e., for more segments than those reported in Table 3). These data could be used in a further extension of the model to introduce more heterogeneity at the merchants' side of the market.

In Tables 9 through 12, we present the information related to the IF. We present in Table 9 the credit card IF applied before October 2005 and in Table 10 the way the credit card IF is charged afterwards. Similarly, in Table 11 we present the debit card IF applied before October 2005 and in Table 12 the way the IF is charged after. The source of this information is the Central Bank of Mexico.

Table 3. Description of sectors and categories

Sector	Sector Description	Category Description
1	Charity	Charity
2	Special	Colleges and Universities
3	Special	Goverment
4	Strategic	Supermarkets
4	Strategic	Land passenger transportation
4	Strategic	Car rental
4	Strategic	Travel agencies
4	Strategic	Hotels
4	Strategic	Entertainment
4	Strategic	Air Transportation
5	Gasoline Stations	Gasoline Stations
6	General	Telecommunications
6	General	Insurance Companies
6	General	Hospitals
6	General	Restaurants
6	General	Retailers
6	General	Others
7	Stimulus	Fast food
7	Stimulus	Pharmacies
7	Stimulus	Tolls
7	Stimulus	Parking lots

Table 4. Sectors 1-3: Charity and special

% Earnings	% Economic Units	Economic Units
-9.81%	0.32%	105.00
8.64%	0.61%	203.00
11.84%	20.89%	6,931.00
18.49%	32.94%	10,931.00
20.85%	44.28%	14,695.00
25.10%	0.96%	320.00

Table 5. Sector 4: Strategic

% Earnings	% Economic Units	Economic Units
-8.47%	0.31%	1,716.00
4.87%	1.22%	6,698.00
12.53%	0.47%	2,577.00
17.01%	2.27%	12,452.00
23.55%	4.69%	25,723.00
27.96%	0.38%	2,085.00
50.51%	90.65%	496,841.00

Table 6. Sector 5: Gasoline stations

% Earnings	% Economic Units	Economic Units
33.57%	100.00%	13,692.00

Table 7. Sector 6: General

% Earnings	% Economic Units	Economic Units
-85.15%	0.57%	9,615.00
1.89%	0.05%	930.00
7.93%	0.15%	2,511.00
12.80%	0.77%	13,081.00
16.77%	11.40%	193,850.00
22.17%	17.91%	304,543.00
28.09%	14.60%	248,162.00
32.54%	33.37%	567,280.00
36.13%	7.23%	122,846.00
40.21%	3.26%	55,363.00
47.36%	10.62%	180,503.00
53.27%	0.08%	1,393.00

Table 8. Sector 7: Stimulus

%Earnings	% Economic Units	Economic Units
16.85%	79.60%	185,189.00
37.50%	20.40%	47,448.00

Table 9. Credit card IF

Until Aug. 2004			Until Aug. 2005		
From	To	IF	From	To	IF
300	ABOVE	2.00%	300	ABOVE	1.80%
100	300	2.40%	100	300	2.20%
10	100	2.75%	10	100	2.50%
0.2	10	3.00%	0.2	10	2.70%
0	0.2	3.50%	0	0.2	--

IF was determined on the basis of merchant's monthly transaction value (millions of MXN)

Table 10. Credit card IF

Category Decription	Since Oct-05 until Jan-08	Since Jan-08
Charity	0.00%	0.00%
Gasoline Stations	1.10%	1.10%
Government	1.25%	1.25%
Colleges and Universities	1.25%	1.25%
Fast food	1.75%	1.61%
Parking lots	1.75%	1.22%
Pharmacies	1.75%	1.53%
Tolls	1.75%	1.61%
Wholesale stores	1.75%	1.64%
Air transportation	1.80%	1.62%
Car rental	1.80%	1.71%
Entertainment	1.80%	1.37%
Hotels	1.80%	1.80%
Land passenger transportation	1.80%	1.30%
Supermarkets	1.80%	1.77%
Travel agencies	1.80%	1.80%
Insurance companies	1.85%	1.66%
Retailers	1.85%	1.68%
Telecommunications	1.85%	1.56%
Hospitals	1.95%	1.74%
Restaurants	1.95%	1.91%
Others	1.95%	1.68%

Table 11. Debit card IF

Until Aug. 2004			Until Aug. 2005		
From	To	IF	From	To	IF
300	ABOVE	2.00%	300	ABOVE	0.75%
100	300	2.40%	100	300	1.25%
10	100	2.75%	10	100	1.60%
0.2	10	3.00%	0.2	10	1.95%
0	0.2	3.50%	0	0.2	--

IF was determined on the basis of merchant's monthly transaction value (millions of MXN)

Table 12. Debit card IF

Category Decription	Since Oct-05 until Jan-08	Since Jan-08
Charity	0.00%	0.00%
Gasoline Stations	0.50%	0.50%
Government	0.75%	0.75%
Colleges and Universities	0.75%	0.75%
Fast food	1.10%	0.75%
Parking lots	1.15%	1.00%
Pharmacies	1.00%	1.00%
Tolls	1.40%	1.00%
Wholesale stores	1.55%	0.93 MXN
Air transportation	1.76%	0.75%
Car rental	0.75%	1.10%
Entertainment	1.15%	1.10%
Hotels	0.75%	1.10%
Land passenger transportation	1.10%	1.10%
Supermarkets	1.10%	1.10%
Travel agencies	0.90%	1.10%
Insurance companies	1.15%	1.15%
Retailers	1.00%	1.15%
Telecommunications	1.10%	1.15%
Hospitals	1.15%	1.15%
Restaurants	1.00%	1.15%
Others	1.15%	1.15%

Table 13. General information

Number of consumers	59,499,202.00
Number of economic units	2,527,683.00
Number of economic units in sectors 1-3	33,185.00
Number of economic units in sector 4	548,092.00
Number of economic units in sector 5	13,692.00
Number of economic units in sector 6	1,700,077.00
Number of economic units in sector 7	232,637.00

Table 14. Ratios of economic units and consumers

Economic units/Consumers	0.0425
Sectors 1-3/total economic units	0.0131
Sector 4/total economic units	0.2168
Sector 5/total economic units	0.0054
Sector 6/total economic units	0.6726
Sector 7/total economic units	0.0920
Consumers/Total Economic units	23.5390
Sectors 1-3/consumers	0.0006
Sector 4/consumers	0.0092
Sector 5/consumers	0.0002
Sector 6/consumers	0.0286
Sector 7/consumers	0.0039

In Table 13, we present general data related to number of consumers (from the the 2006 National Household Income and Expenses Survey performed by INEGI) and the total number of economic units and the number of units per sector (from the 2004 Economic Census, INEGI).
Next, in Table 14, we present some calculation we have made to obtain ratios of economic units to consumers, which allow us to calibrate the model. We have used this calibration in all scenarios presented in the present chapter. In Table 15, we present the parameter used in the model.
In Table 16, we present the data used to calibrate the consumers' side of the model, which is obtained from the 2006 National Household Income and Expenses Survey, INEGI.
Finally we present in Figure 8 the usage of credit cards among different population segments divided by income level. The data is obtained from the 2008 National Household Income and Expense Survey produced by INEGI.

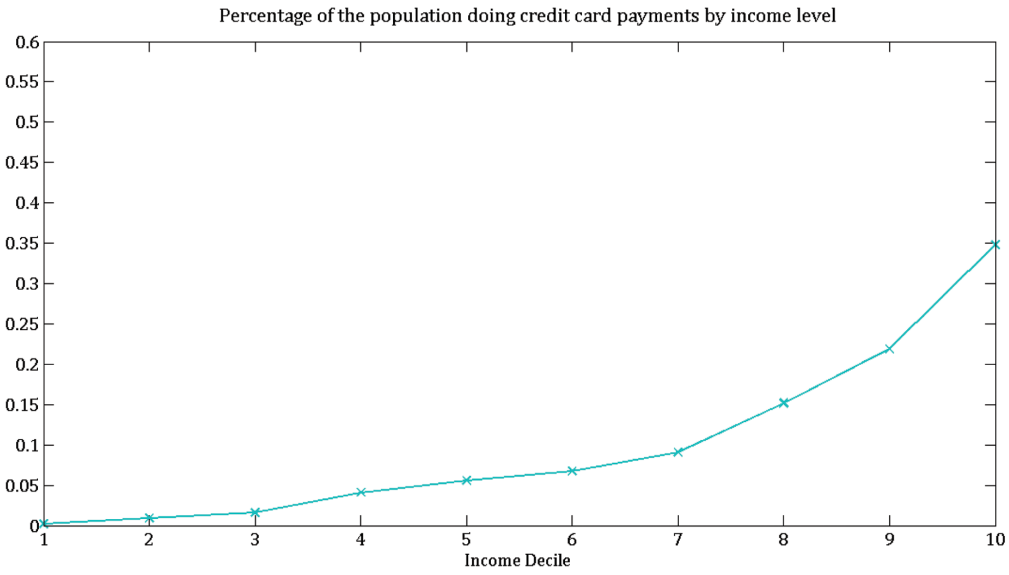
Table 15. Model's parameters

Sector	Number of Economic Units by Sector in the ABM	Number of Economic Units by Sector per Consumer in the ABM
1-3	11	1
4	187	3
5	5	1
6	581	17
7	80	1

Table 16. Data used to calibrate the consumers' side of the model

Monthly Income Level per Decile	Actual Percentage of the Population	Income Applied in the ABM	Decile
1,411.95	0.0665	1,400	I
2,013.74	0.0802	2,000	II
2,515.25	0.0847	2,500	III
2,864.20	0.0923	2,850	IV
3,348.89	0.0968	3,350	V
3,853.77	0.1013	3,850	VI
4,303.81	0.1131	4,300	VII
5,074.22	0.1208	5,070	VIII
6,780.49	0.1242	6,780	IX
16,297.80	0.1201	16,300	X

Figure 8. Credit card payments by income level



Chapter 67
Determinants of Behavioral Intention to Mobile Banking in Arab Culture

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ABSTRACT

Nowadays, new tools and technologies are emerging rapidly. They are often used cross-culturally before being tested for suitability and validity. However, they would be validated to ensure that they work with all users, not just part of them. Mobile banking (as a new technology tool) has been introduced assuming that it performs well concerning authentication among all members of the society.

We aim to validate mobile banking intention to use, through Technology Acceptance Model (TAM), focused on security, in Arabic countries, namely Yemen. The results confirm the previous studies that have shown the importance of perceived ease of use and perceived usefulness.

INTRODUCTION

Rapid and continuously growth of wireless and mobile technologies made it possible to banking service customers' to access use those services at any place at any time. For that reason most banks provide mobile access to their customers (Selvan, 2011).

Internet and its related technologies have been growing exponentially (Cho, 2007). Technologies make our lives easy but not so secure (Sukhai, 1998), especially for financial applications (Rashed, 2013). Service industry has been changed the way business is conducted (Selvan, 2011). Most organizations already provide services via the Internet and mobile appliances (Segev, 1998). Furthermore, during the last ten years, the improvement of mobile communication technologies has changed the banking industry, so users are able to conduct banking services anyplace anytime (Gu, 2009). Mobile Banking provides customers many services such as: requesting the

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balance and the latest transactions; transferring funds between accounts; buying and selling orders, for the stock exchange; and receiving portfolio and price information (Barati, 2009). Concerning authentication, for individuals it is known to be difficult to remember their user names and PINs. For that reason, many users select easy to remember passwords (Coventry, 2003), which is considered a security trade-off. Security specialists are looking for more advanced techniques that would improve authentication performance (Rashed, 2010c).

Limited understanding of customer requirements, as well as lack of technology infrastructure, is considered a barrier towards innovation (Wu, 2005). In spite of the efforts of key players such as banks, mobile network operators and mobile service providers, it still lacks to study and promote customer acceptance (Eze, 2008).

Insufficient user acceptance has been an obstacle to the successful adoption of new information systems and information technologies (Wu, 2005). It is important to understand user acceptance in order to identify the factors that affect user intention to use mobile banking. This would help developers in producing more acceptable systems or help them to discover why users avoid using mobile banking (Selvan, 2011). Numerous empirical tests and studies have shown that TAM is robust to be used in variety of IT-related studies (Rashed, 2010b).

Mobile banking is still in a development phase in most countries especially middle- east, where small markets with few users have been reported. Among other reasons there are lack of customer acceptance and poor time response services (Barati, 2009). Besides, mobile payments are mainly used with popular mobile services since there are few alternative payment solutions available (Mallat, 2004). In spite of being the latest and most innovative service offered by banks, it is not studied well regarding how customers perceive it (Safeena, 2011).

Sufficient user acceptance is a main obstacle to the successful adoption of new technologies (Cho, 2007). Key players in mobile commerce must understand how to make customers satisfied to ensure market growth (Cho, 2007).

Concerning the payment models, mobile payment is not widely accepted (Eze, 2008).

Mobile banking Transactions volume in India is very low (Selvan, 2011). However, it is expected that mobile commerce will gain greater importance in the near future (Cho, 2007).

Concerning authentication methods there are three types (Coventry, 2003):

1. **Something you know:** A PIN; used almost by everyone.
2. **Something you have:** A passport, key, ATM (Automated Teller Machine) card or cell-phone (Herzberg, 2009).
3. **Biometrics (something you are):** Fingerprints, signature, ear shape, keystroke, voice, finger geometry, iris, retina, DNA, hand geometry (Prashanth, 2009) and odour (Rashed, 2010a).

In this chapter we investigate the user acceptance of different authentication technologies within mobile appliances, in Arabic countries.

MOBILE BANKING

The increasing importance of mobile payment accelerates e-commerce (Mallat, 2004). Many companies in the financial sector have implemented mobile services (Safeena, 2011). As an example of a successful story, Helsinki City Transport implemented mobile subway and metro ticket. Customers buy a ticket using mobile payment. Approximately 55% of the metro tickets and nearly 10% of all individual tickets for Helsinki public transportation are currently purchased via mobile phones. This successful story shows that

mobile ticket users are comfortable with the new service, which has also presented a new solution for traveling without a ticket (Mallat, 2004). In Malaysia (2006), 17.6% of mobile phone users purchase services and products using mobile phones (Eze, 2008). But a large number of projects (e.g., eCash, ePurse) have failed because of the awareness campaign focused on technical aspects which were less relevant for most users (Eze, 2008). Nokia and Master card have carried out several joint tests since 2003 (Eze, 2008).

Advantages of mobile banking are stated as follows (Safeena, 2011; Cho, 2007; Selvan, 2011):

- It is a self-service delivery channel that provides bank service in convenience way.
- Many applications are possible due to the availability of wireless and secure approach.
- It enables customers to transfer money, check balance and make bill payment.
- Mobile banking increases both efficiency and reduces transaction costs.
- Broad reach at any time and portability.
- Mobile technologies provide capabilities that continuously expand.
- Mobile commerce satisfies user requirements for time response.
- Mobile banking inherits some characteristics from digital world such as flexibility in time and place.

Disadvantages of mobile banking are stated as follows (Cho, 2007):

- It is difficult to conduct banking operations with small mobile devices.
- Depending on culture and experience, users don not trust mobile devices.
- Business strategies and values are not fully understood.
- Limited and insufficient information about transactions and constraints of mobile terminals.

RELATED WORK

Khanfar et al. (2005) conducted a survey about customer satisfaction with internet banking web site for a bank. The covered factors were: customer support, security, ease of use, digital products/ services, transaction and payment, information content, and innovation. They found that all factors have a positive impact on the customer satisfaction. Moreover, they found that there was no relation between demographic data and customer satisfaction due to the high computer literacy among customers (Khanfar et al., 2005).

AlZomai (2008) discussed the authentication problems in online banking using SMS for transactions. Their experiment aimed to simulate the online bank using website to do the transactions. They suggest enhancing online banking security by focusing on usability more than security technics and mechanisms. They suggested SMS authorization scheme. They attacked their approach to make sure that it would work properly (AlZomai, 2008).

Gu et. al. (2009) examined and validated the determinants of users' intention to use mobile banking. They used a structural equation modeling (SEM) to test the causalities in the proposed model. They verified the effect of perceived usefulness, trust and perceived ease-of-use. The results indicated strong support for the validity of proposed model with 72.2% of the variance in behavioral intention to use mobile banking. The study also found that self-efficiency was the strongest pillar of perceived ease-of-use, which directly and indirectly affected behavioral intention through perceived usefulness in mobile banking. In addition, they found that structural assurances* were the strongest pillar of trust, which could increase behavioral intention to use mobile banking (Gu et al., 2009).

Hua and Prashant (2009) investigated the factors affecting mobile commerce adoption in China and the United States. They conducted a survey on 190 individual mobile commerce users. Results showed that there are several significant cultural

differences impacting on consumer intention to use mobile commerce (Hua & Prashant, 2009).

Yaseen and Zayed (2010) used the TAM model to study the m-commerce technology deployment in Jordan. They distributed 210 questionnaires among mobile commerce users in Stock Exchange for Brokers and Investors. They test trust, perceived usefulness, perceived ease of use, social and cultural values and economic issues, as fundamental influence factors of a decision maker to adopt this type of technology. Their results showed that all factors had significant association with intention to use mobile commerce technology while economic issues are not significant (Yaseen & Zayed, 2010).

Maiyaki and Mokhtar (2010) studied determinants of consumer behavioral intention in Nigerian commercial banks. They investigated the influence of perceived service quality, perceived value, corporate image and switching cost on the consumer behavioral intention in the context of commercial banks in Nigeria. They found that the quality of service, customer perceived value and image of the corporate had significant influence on customer behavioral intention (Maiyaki & Mokhtar, 2010).

Barati and Mohammadi (2009) studied the factors that affect acceptance of mobile banking. They presented a set of factors that could positively affect the success of mobile banking and should be taken into account by banks while adopting mobile technology. They found that perceived usefulness and perceived ease of use are significant. Moreover they found that facilitating conditions in acceptance of mobile services have a very important role (Barati & Mohammadi, 2009).

Ramayah et al. (2010) studied and examined the intention to use an online bill payment among part time MBA students in University Sciences of Malaysia, Penang. They developed and modified the extended TAM and Social Cognitive Theory to identify factors that would determine and influence the intention to use an online bill payment system. They conducted a survey that involved 120 students. They found that perceived ease of use and perceived usefulness are the significant drivers of intention to use the online bill payment system. In addition, they found that subjective norm, image, result demonstrability and perceived ease of use were the key determinants of perceived usefulness, whereas perceived risk was found to be negatively related to usefulness. Moreover, computer self-efficacy played a significant role in influencing the perceived ease of use of the online bill payment system (Ramayah et al., 2010).

Eze et al. (2008) studied the security factors that affect the user acceptance of mobile payment in Malaysia. Their conceptual design examined the impact of security dimensions on trust and their influence on user intention to use mobile payment systems. Their results highlight the importance of perceived security of mobile payments on consumer intention to use mobile payment. They recommended creating massive awareness campaigns to inform potential consumers about the safety of transactions. Besides, they expected that internet security protocols like SET (Secure Electronic Transaction) should be exploited to build more secure mobile payment systems. Their security worries can be overcome by awareness campaigns (Eze et al., 2008).

Cho et al. (2007) studied the limiting factors of new technologies in order to understand and manage e-commerce activities. They focused on the trust and other factors. Using TAM, their results showed that mobile commerce should be differentiated from e-commerce. They found that it is important for users to perceive security of mobile payment. They recommended awareness campaigns by key players, to show that all security mechanisms are robust. Moreover, they recommended using subjective measures for assessing the effectiveness of security mechanisms, to enforce trust and convenience when developing and advertising the mobile payment schemes (Cho et al., 2007).

Safeena et al. (2011) studied five factors: ease of use, perceive usefulness, subjective norms, perceive associated risks and customer awareness.

They found that all factors have strong positive effect on customer decision.

Most of these studies show the importance of security and, simultaneously, the ease of use perception. However, when we try to enforce security most of the time we end up with a less flexible and more annoying system, which is difficult to accept by users. Authentication mechanism is determinant for security and so it is pertinent to find out how much authentication enforcement users are ready to accept.

METHODOLOGY

We developed a survey questionnaire and distributed it via web. The survey questions use a five-point Likert-type scale as follows: 1: extremely dislike, 2: slightly unlikely, 3: neither, 4: slightly likely and 5: extremely likely. The survey questions include participant profile: gender, age, nationality, job, major and education.

The research hypotheses are:

H1: Customers' intention to use mobile banking is positively influenced by certain perceptual factors, in Yemen such as:

Ha: Perceived usefulness of mobile banking application

Hb: Perceived ease of use of mobile banking application

H2: Customers' intention to use mobile banking is positively influenced by certain personal factors such as:

Ha: Prior experience with mobile banking

Hb: Prior experience with ATM

Hc: Customer's educational level

H3: Demographic factor (such as gender, age . . .) will have a positive effect on the intention to use mobile banking.

H4: Perceived usefulness is influenced by certain perceptual factors such as:

- Perceived performance
- Perceived saving time and effort
- Perceived increase in the productivity
- Social and cultural factors

Perceived performance is the degree to which users expect the target system would support the performance perceive. Saving time and effort is defined as the degree to which the users expect that the target system would save the time and effort when comparing with the old method. Social and cultural factors affect the decision to use the target system (Al-Eryani et al., 2010). We directly asked the respondents about the mentioned factors to measure their impact on behavioral intention.

DISCUSSION

We aim to measure the general trend towards mobile banking. We use descriptive statistics to describe the basic features of the data in this study. We use both descriptive statistics and simple graphics as the basis of virtually every quantitative data analysis. Due to the sample size, it should be noted that it is difficult to generalize the results.

Overview

Our sample, including a total of 100 individuals, consisted of 76% males and 24% females. The majority of the respondents were young people, 54% of them were within the interval [15-30]; 6% were less than 21; and 33% were within the interval [31-40] (Table 1). 47% of the respondents have a post graduate degree, 41% have a bachelor degree and most of them (54%) are proficient IT users. 89% of the respondents use ATMs and 98% prefer to use it rather than interacting with a human being clerk. 74% of the respondents consider mobile bank easy to use, 10% consider it difficult and 16% have no opinion.

87% of the respondents pointed mobile banking as a brilliant idea whereas 8% were neutral about this concept. 5% of the respondents considered it as a stupid idea. 45% intended to use mobile

Table 1. Sample profile

Variable		Frequency
Gender	Male	76
	Female	24
Race	Yemenis	79
	Arab	21
Age	15-20	6
	21-30	48
	31-40	33
	More than 41	13
Specializations	IT	54
	Finance	5
	Administration	10
	Medicine	7
	Engineering	13
	Others	11
Jobs type	Public Sector	23
	UN and international organizations	5
	Private Organization	41
	Family business	3
	Other	28

banking whereas 46% were indecisive about using it. 9% of the respondents clearly stated that they would not use it.

Customers' Intention to Use Mobile Banking Due to the Impact of Perceptual Factors

83% of the respondents perceived mobile banking as useful, while 15% were indecisive about it. Only 2% of the respondents did not perceive it as useful. Besides, 90% of the respondents think that using mobile banking will improve their live performance. 89% considered the idea would save them time.

Customers' Intention to Use Mobile Banking Due to the Impact of Personal Factors

Experience variable measures the users' familiarity with mobile banking. We found that experience was a significant factor since most of the respondents who used mobile banking before, reported that they found it easy and acceptable. 23% of the respondents have used mobile banking before. However, 77% have not tried mobile banking yet.

Customers' Intention to Use Mobile Banking Due to the Impact of Demographic Factors

Figure 1 shows that 83% of females have not used mobile banking before whereas 75% of male respondents had prior experience with mobile banking.

When the findings were analyzed due to the professions of the respondents, it was found out that "administration" category scored the highest in perceived ease of use, usefulness and intention to use (Table 2).

Age correlates with the intention to use, indicating that older participants are less willing to use the mobile banking than the younger ones. Furthermore, mobile banking was accepted more by master degree holders than Ph.D. and undergraduates.

The Impact of Performance, Time, Effort, and Productivity on the Customers' Intention to Use Mobile Banking

This study proposes a revised version of the Technological Acceptance Model (TAM) .Six key variables have been included in the model proposed. These variables are saving time and effort, performance, experience, trust, innovation acceptance and social - cultural factors.

Figure 1. Prior mobile banking experience

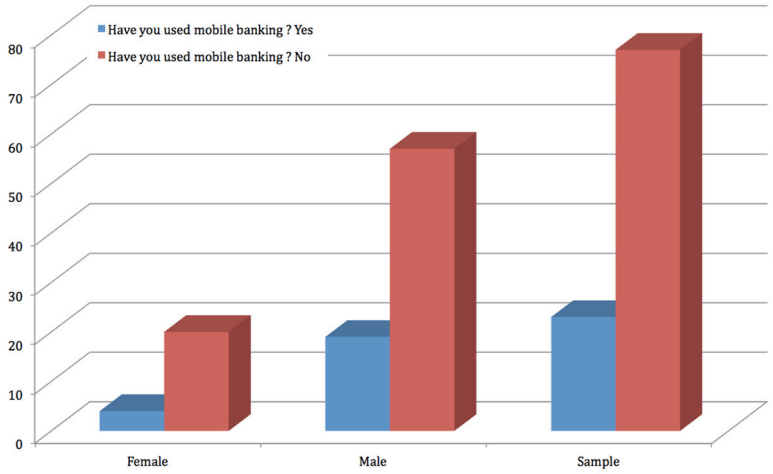


Table 2. Effect of major factor

	Administration	Finance	IT	Engineering	Medicine
The Idea of Using Mobile Banking	100%	100%	89%	92%	86%
Ease-of-Use Mobile Banking	70%	60%	78%	77%	57%
Performance of Mobile Banking	100%	80%	89%	92%	86%
Intention to Use Mobile Banking	60%	60%	44%	54%	57%
Like/Dislike the Idea of Using Mobile Banking	90%	60%	72%	85%	86%
Using Mobile Banking Would Save Time and Effort	90%	80%	87%	100%	86%
Using Mobile Banking Would Increase the Productivity	100%	100%	83%	92%	57%

Figure 2 shows the proposed model for mobile banking acceptance. The experience of using mobile platforms would affect the responses and similar technologies would help users to perceive both ease of use and usefulness.

The literature review concerning demographic characteristic like age, gender and experience of mobile use emphasize the impact on technology adoption. However, our findings support the notion that age has no effect on intention to use mobile in financial transactions. Furthermore, we found that gender has significant effect as males have strong intention to use the new technologies more than females (Figure 3). Experience factor is significant. Social and cultural factors are important in acceptance of mobile banking. In this context, it is probable that mobile services might face resistance of consumers. 83% of the respondents who found mobile banking very easy have experienced ATMs before. Moreover, 97% of the respondents who found mobile banking very easy preferred using an ATM instead of dealing with human clerk at the bank.

This study aims to validate mobile banking intention to use, through Technology Acceptance Model (TAM), focused on security, in Arabic countries, namely Yemen.

Our sample consisted of young educated individuals. Moreover, most of them were frequent users of ATMs and preferred to use new technologies rather than conventional banking methods.

Figure 2. Proposed framework

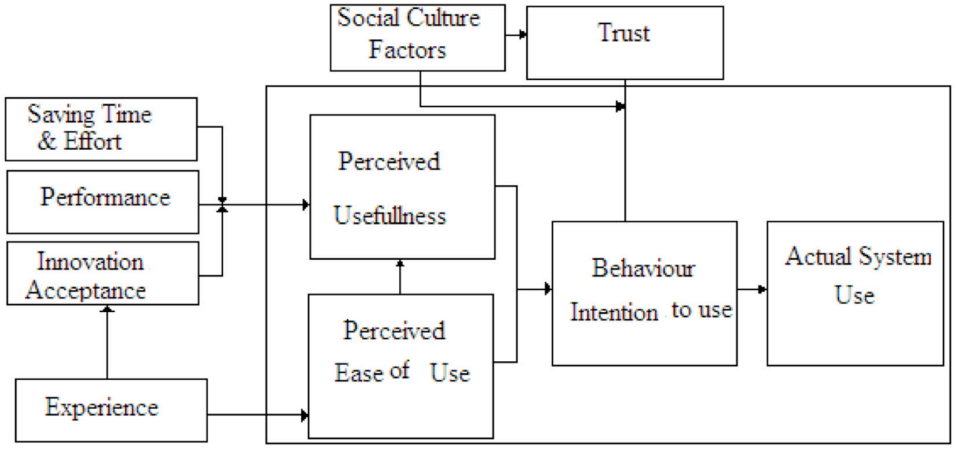
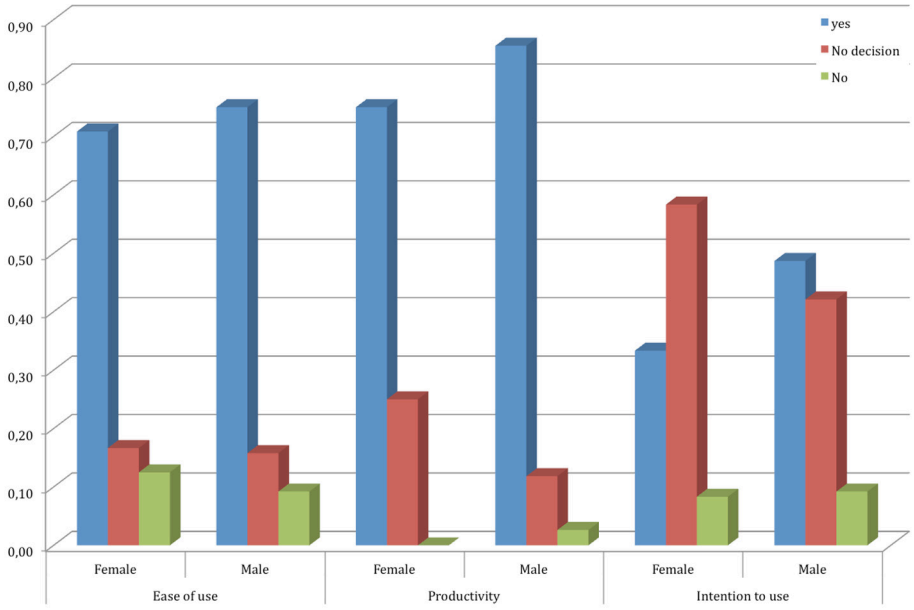


Figure 3. Gender and intention to use



Our results are mostly inline with the findings of the previous studies, but also present some contradictory findings in some cases as well. Our results reveal that both perceived ease-of-use and perceived usefulness are significant factors that impact the customers' intention to use online banking.

Findings of this study support the notion that mobile banking is accepted mostly for reasons such as saving time and efforts as well as for improving the performance in the lives of the users. Most of participants find mobile banking easy-to-use whereas some still think that they need help in using these platforms. This finding can be interpreted as a strong factor to support deploying mobile bank. However, it should also be mentioned that the intention to use mobile banking is only 45% and 40% of the participants are still indecisive about

mobile banking. It is evident that there is still a gap between the acceptance of a new platform and the actual use of it.

It should also be noted that the relative small size of the sample limits the generalization of the findings. However, it is believed that the study will provide contributions for further studies concerning the use of mobile banking in local cultures.

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KEY TERMS AND DEFINITIONS

Arabic Culture: It is the culture in the countries in which the official language is Arabic. It spread in countries located Western Asia and North Africa, from Morocco to the Persian Gulf.

Mobile Banking: It is a system that allows customers to conduct a number of financial transactions through a mobile device such as a mobile phone or personal digital assistant.

Technology Acceptance Model (TAM): TAM is used to predict the acceptability of a tool (e.g. information technology) in a specific environment and to identify the modifications which must be brought to the system in order to make it acceptable to users. It depends upon two pillars: perceived ease to use and perceived usefulness.

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Chapter 68
Assessing the Maturity of Control Objectives for Information and Related Technology (COBIT) Framework in the Egyptian Banking Sector

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ABSTRACT

Banking sector in Egypt is one of the largest business sectors in terms of contributing to country economic growth and in terms of investing in information technology (IT). Thus, implementing a good Information Technology (IT) governance framework inside Egyptian banks is a rather critical issue. The purpose of this chapter is to assess the importance and the implementation of Control Objectives for Information and Related Technology (COBIT) high level processes in the Egyptian banking sector. A total of 25 working banks in Egypt which are registered in the Central Bank of Egypt (CBE) from (public sector, private and joint venture and foreign) banks were interviewed in a series of one-to-one interviews. The results of this study showed that although the majority of interviewed Chief Information Officer (CIO), IT Managers, IT Auditors and others perceived the importance of COBIT high level processes in their organizations, the majority of the Egyptian banks have a below average maturity level for most of the COBIT processes.

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INTRODUCTION

Information systems do not exist in isolation. Clearly, they are developed and operate within an environmental – most commonly business - context that has a significant effect on them. This environment is increasingly complex and dynamic. But, few organizations have realized the full potential of their information assets, although most consider their information to be essential to the operation. So, as Information Technology (IT), in general, contributes a larger and more noticeable role in driving business success, senior executives are under mounting pressure to clearly demonstrate the business value of IT, and to prove that IT investments can generate a positive return while supporting business objectives (Sarvanan and Kohli, 2000). Despite of a lot of talk about business alignment of ICT, a permanent link between the mandates of business and IT management remains yet to be established, even in organizations well aware of their information management and the business alignment issue (Pulkkinen and Hirvonen, 2005).

The past few years witnessed an increased attention to many standards and worldwide accepted frameworks that support the assessment and the implementation of IT governance in various organizations. These include:

1. Control Objectives for Information and Related Technology (COBIT) with a focus on the IT processes in organizations;
2. Information Technology Infrastructure Library (ITIL) with a focus on IT service management; and
3. ISO/IEC 17799:2000 which is an information security standard.

The objectives, the scope, and the structure of each framework vary considerably. But, these all aim toward – or can be used for – improving IT governance in organizations.

Corporate governance is "a general term that is defined as "the system by which companies are directed and controlled" (Cadbury Report, 1992). Among the various aspects of corporate governance, IT governance is the one responsible for guaranteeing the effective alignment between use of (and investments in) IT and organization's business objectives. IT governance is, thus, a subset regulation of Corporate Governance (Dellit, 2002; Hamaker, 2003), which is focused on IT systems and their performance and risk management and it has developed into a discipline of its own. IT governance provides "specifying the decision rights and accountability framework to encourage desirable behavior in the use of IT," (Weill and Ross, 2004) and is "an integral part of enterprise governance and consists of the leadership and organizational structures and processes to ensure that the organization sustains and extends its strategy and objectives." (ITGI, 2000)

The value of IT governance to corporate governance has raised based on the understanding that the most important IT issues in the near future are not technology-related, but governance-related (Guldentops 2002), IT governance is the capability of organization's senior management to direct, measure and evaluate the use of IT resources to support the achievement of the organization's strategic goals (Gray, 2004).

The primary goal for IT governance is to (1) ensure that the money invested in IT would be able to produce the expected business value, and (2) ensure the risks associated with IT are well mitigated (Williams, 2006). Good IT governance system can help organizations manage their IT internal and external costs by running efficient IT processes, aligning these processes with business objectives, introducing needed control and monitoring these processes to provide better visibility and feedback over IT (Gray, 2004).

Among various IT governance frameworks and standards, COBIT has shown as a strong and powerful framework and has been used increasingly by

many organizations in public and private sectors throughout the world. COBIT was developed by the Information Systems Audit and Control Association (ISACA) and the IT Governance Institute (ITGI) in 1992. The first edition of COBIT was published in 1996, COBIT was intended to serve as an IT process and control framework linking IT to business requirements, the 2nd edition was published in 1998. Since then, COBIT is being used as a framework for IT governance, providing management tools such as metrics and maturity models to complement the control framework.

The third version was released in 2000. In this edition, COBIT has been focused on IT governance because management guidelines were added to it. Since its original release, COBIT was enhanced with emerging international technical, professional, regulatory and industry-specific standards. In 2005, the 4th version of COBIT has released. And in May 2007, the IT Governance Institute (ITGI) has released an incremental update 4.1 of the COBIT, which has transitioned from an IT tool to an IT governance framework. The main changes introduced with COBIT 4.1 included streamlined control objectives, streamlined application controls, improved process controls, and an enhanced explanation of performance measurement.

COBIT is a comprehensive framework of 34 control objectives (high-level processes) divided into four categories which are: Plan and Organize (PO), Acquire and Implement (AI), Deliver and Support (DS) and Monitor and Evaluate (ME). The 34 high-level processes are linked to 318 tasks and activities to define an internal control framework that is powerful for communicating effectiveness and value to the business.

The COBIT framework was created with the main characteristics of being business-focused, process-oriented, controls-based and measurement-driven. To satisfy business objectives, information needs to conform to some control criteria, which COBIT refers to as business requirements for information, control criteria. These are: effectiveness, efficiency, confidentiality, integrity, availability, compliance and reliability. While these criteria provide generic business requirements, COBIT defines a set of generic business and IT goals to offer a business-related and more refined basis for establishing business requirements and developing the metrics that identifies the performance of the seven information criteria; as well as which of the IT resources (people, applications, technology, facilities and data).

For the management and control over IT processes in the organization, COBIT defines six maturity levels of these processes:

0. **Non-Existent:** Management processes are not applied at all.
1. **Initial:** Processes are ad hoc and disorganized.
2. **Repeatable:** Processes follow a regular pattern.
3. **Defined:** Processes are documented and communicated.
4. **Managed:** Processes are monitored and measured.
5. **Optimized:** Good practices are followed and automated.

Maturity levels are not designed for use as a threshold model, where one cannot move to the next higher level without having fulfilled all conditions of the lower level, but rather as a means to identify where issues are and how to set priorities for enhancements.

Banking sector is one of the major contributors to Egypt economic growth, and it is one of the largest sectors in investing in information technology. Investing in IT should add value to business and this is where IT governance importance came into view. COBIT is one of the important and famous IT governance frameworks today. The current research aims to assess the implementation of the Control Objectives for Information and Related Technology (COBIT) high-level processes in Egyptian banking sector and therefore to better understand the IT governance performance and importance in this sector.

Following the introduction section, the rest of this book chapter is organized as follows. Section 2 provide a review on related research work on IT governance and COBIT in particular, followed by a brief introduction to the context (Egyptian banking sector) in Section 3. Objectives, data collection, and analyses methods are provided in Section 3, while detailed results and discussions are presented in Section 4. Finally, conclusions are given in Section 5.

LITERATURE REVIEW

Although IT governance in general and COBIT in particular is a hot topic at the present time because of the continuous raise of the governance awareness and importance, there are no many published studies and researches about it (Ridley et al., 2004; Williams, 2006).

Sohal and Fitzpatrick (2002) investigated the IT governance and management of information in Australian organizations using a questionnaire survey that was mailed to the most senior IT officer within the organization. The respondents were categorized into three groups based on the intensity with which the company uses information, namely high tier, medium tier and low tier industries. The findings showed some interesting differences among the three groups regarding the measurement and accountability of IT delivery. The majority of senior IT executives surveyed believed it was imperative that their organizations addressed aligning their IT with their business strategy in the near future. Hadden (2002) studied the role of audit committees in monitoring IT risks. Their instrument was developed from the 34 high-level control objectives identified in the COBIT model and the results of the study showed that audit committee oversight assessments were partially affected by prior COBIT experience.

The IT Governance Institute (ITGI) had a study that covered 335 Chief Executive Officers (CEOs) and Chief Information Officers (CIOs) in 21 countries. It was reported that while more than (91%) of executives recognise that IT is vital to their business success, more than two-thirds of CEOs were not comfortable answering questions about governance and control over their IT processes. The paper validates that the major problem continues to be "the inadequate view of how well IT is performing" (Son et al., 2005). Another study by ITGI for the entities currently using COBIT revealed that 75% of these researched entities found COBIT somewhat useful or very useful, and 15% were unsure and fewer than 10% showed a negative response. The main negative problem identified by the respondents was the perceived complexity of the framework (Williams, 2006).

The role of information technology (IT) governance in corporate strategy was discussed in Brown (2006). The study examined the four elements of IT governance, including value delivery, managing risk, maintaining accountability, and measurement of on-going programs and activities. This research showed that management' commitment and involvement with IT development at the senior management level, the IT management level, and the project management level significantly enhances the probability of success.

Luthy and Forcht (2006) compared COBIT and COSO in their study for the purpose of compliance with rules and regulations. The results of the comparison showed that both COSO and COBIT take an organization-wide view. However, COBIT only considers an organization-wide view to the extent of ensuring that IT governance is aligned with overall business objectives and organization governance. COBIT also provides very detailed IT control suggestions within its presentation of detailed control objectives. The study also concluded that COSO on its own might not provide sufficient guidance for organizations and auditors as they

consider compliance with laws and regulations. The study also suggested that it might be useful, if not needed, to use more than one framework for assessing compliance with rules and regulations.

The factors influencing the IT governance effectiveness in an organization has been studied by Bowen et al. (2007). This study addresses the gap that exists between theoretical frameworks, prior empirical research, and contemporary practices on effective IT governance. Tuttle and Vandervelde (2007) studied internal consistency of the conceptual model that lies beneath the COBIT internal control framework as it applies to an audit setting (including operational, compliance, and financial audit settings). The study studied the auditor perceptions of audit risks. From a practical standpoint, the results of this study suggested that it is very important and potentially very useful for the audit profession to seek academic examination of its practices. The findings suggest that the COBIT framework is significantly related to overall risk assessments of the COBIT processes for which they are associated. The results should give auditors and policy-makers assurance that COBIT is an appropriate supplement to COSO in an IT setting.

Abu-Musa (2008) researched the importance and implementation of the COBIT processes in Saudi organizations. The study showed that the majority of respondents perceive the importance of the COBIT processes and domains, but a lower percentage believe that such processes are adequately implemented in their organizations. It is observed that banks, financial institutions, and service organizations show more concern and application of COBIT processes compared with other organizations. The results also showed that IT specialists, internal auditors, and executive managers perceive and appreciate the importance of COBIT processes more than the others.

In Egypt, El-Morshedy (2008) developed a framework that enables effective and efficient application of the COBIT within audit and assessment activities. The proposed framework integrates four methodologies which they are:

1. Soft Systems Methodology (SSM),
2. Viable System Model (VSM),
3. Balanced Scorecard (BSC), and
4. Quality Function Deployment (QFD).

CONTEXT: EGYPTIAN BANKING SECTOR

The banking sector in Egypt is among the oldest and largest in the region. It has gone through many stages since the establishment of the first bank in 1856, followed by the emerging private sector and joint venture banks during the period of the Open Door policy in the 1970s (Egypt State Information Service, 2009). In June 1998, major amendments to the Banking Law, which permitted private ownership in public banks were approved by the Parliament.

Later in the nineties, as part of Egypt's economic and financial reform program, the banking sector has been undergoing reforms, privatization, mergers and acquisitions and was completely liberalized. The goal of this banking reform was creating an efficient banking sector which offers better quality services. The reform program was mainly based on promoting transparency and use of adequate accounting and supervision standards. According to the law, banks are required to publish their financial statements on quarterly basis in compliance with the International Accounting Standards (IAS). Also, the Law requires all banks to be audited by two different independent auditors, with auditors changing every two years.

Banks are supervised by the Banking Control Department of the Central Bank of Egypt (CBE), which has made considerable progress in developing its supervisory framework and staff using materials, procedures, and techniques obtained from other countries' supervisory systems. According to the Financial Sector Assessment Program (FSAP) report of 2003, CBE complied with most of the Basel Core Principles for Effective Banking Supervision.

Based on central bank of Egypt reports, Egyptian banking sector currently consists of thirty nine banks composed from (5) five public sector banks, (27) twenty seven private and joint venture banks and (7) seven branches of foreign banks.

Many Egyptian banks are making huge investments in technology to maintain and upgrade their infrastructure, not only to provide new electronic information-based services, but also to manage their risk positions and pricing. At the same time, new off-the-shelf electronic services, such as on-line retail banking, are making it possible for very small institutions to take advantage of new technologies at quite reasonable costs. These developments might in the end change the competitive landscape in financial services in ways that we cannot predict today.

More than other industries, financial institutions rely on gathering, processing, analyzing, and providing information to meet their customers' needs. Given the importance of information in banking, it is not surprising that Egyptian banks were among the earliest adopters of automated information processing technology. Leveraging information technology assets can help institutions manage risks more efficiently, as outlined by Basel II. The financial sector will, therefore, rely significantly on IT service providers to provide a more coherent architecture for process automation, integration, and cost reduction mechanisms.

The IT Governance Institute, US (Pathak, 2005), outlines 11 potential business drivers for COBIT adaptation. Among these, four drivers would be the reason behind potential interest of the Egyptian banking sector in COBIT. These are;

1. There is a need for IT governance;
2. Mergers and acquisitions are taking place;
3. A considerable part of the IT function is outsourced; and
4. Compliance with external requirements is of concern.

CBE has directed banks to start building their own internal rating systems in preparation for Basel II (Egyptian Banking Sector Reform Policy: Areas of Future Actions, 2003).

RESEARCH METHODOLOGY

Objectives

This paper intends to explore the current status of COBIT practice in the Egyptian banking sector. More specifically, the paper attempts to:

1. Assess how the importance of COBIT high-level processes are perceived;
2. Measure the extent to which these processes are performed;
3. Examine whether any significant differences among respondent groups regarding their perception of the importance of COBIT high-level processes; and
4. Examine whether any significant differences among respondent groups regarding the implementation of these processes.

Three variables will be considered as moderating ones, these are: bank type, familiarity of IT governance inside the bank, and the number of IT employees. In Egypt, there exists three types of banks; public sector, private and joint venture, and branch of foreign banks.

Data Collection and Analysis

In this research, a questionnaire was developed to assess and evaluate the importance and implementation of Control Objectives for Information and Related Technology (COBIT) high-level processes in the Egyptian banking sector. The questionnaire was developed based on the COBIT standard domains and 34 high-level processes

which were introduced in COBIT 4.1 edition. The questionnaire was pre-tested on selected sample of Egyptian banks (2 public sector banks and 3 private and joint venture banks). Comments and suggestions were considered in the development and revision of the final questionnaire version.

A series of sixty one-to-one interviews with managerial levels in the IT departments of the Egyptian banks have been conducted in order to collect questionnaire data and to correctly assess the implementation of the COBIT high-level processes inside the Egyptian banks. The managerial levels involved in these one-to-one meeting included IT CIOs, IT Directors, IT Managers, IT Project Managers, IT Quality Assurance Managers, IT Governance Managers and IT Auditors.

The questionnaire consisted of three main sections: demographic data, questions regarding the importance of COBIT high level processes, and questions regarding the maturity if these processes. While the importance of different processes represents how such importance is perceived in different banks, maturity assessment was conducted by the researchers and included examination of related evidences of IT governance practice.

In this research, the sample unit is a 'bank.' A total of 25 banks from the 39 registered banks in Central Bank of Egypt (public sector, joint venture and foreign) have been interviewed and included in the research sample representing 64% of banks.

The collected data were processed using the Statistical Package for Social Sciences (SPSS) version 16. Descriptive statistics of the collected data were analyzed for the purpose of understanding the main characteristics of the research variables. To investigate the significant differences among independent groups of respondents related to the investigated COBIT's processes, two non-parametric tests (Kruskal-Wallis and Mann–Whitney–Wilcoxon) were used.

RESULTS AND DISCUSSION

Sample Characteristics

The research sample, as Table 1 depicts, was stratified as following: (1) three public sector banks out of 5 working public sector banks (60%) registered in Central Bank of Egypt (CBE); (2) four foreign banks out of 7 working foreign banks (57%) registered in CBE, and (3) eighteen private banks out of 27 working private banks (66.7%) registered in CBE.

Importance of COBIT High-Level Processes

Overall

Table 2 provides summary statistics of how the respondents perceived the importance of various COBIT high level processes. Generally, as the Table shows, the majority of these processes (33 out of 34) were seen as above 'medium' importance with a tendency towards 'important' and 'critical'; 12 process were seen as 'important' and 'critical.' This can be further illustrated with Figure

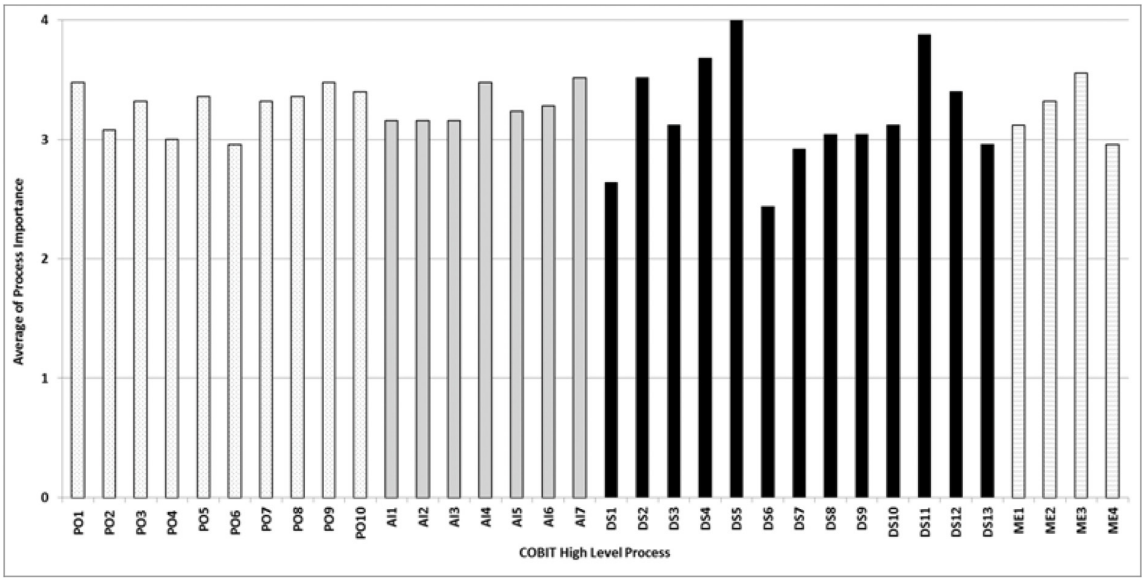
Table 1. Research sample

Type of Bank	Population	Respondents	Respondents % to Total Sample	Respondents % to Total Population
Public Sector Banks	5	3	12 %	7.7 %
Private and Joint Venture Banks	27	18	72 %	46 %
Branches of Foreign Banks	7	4	16 %	10.3 %
Total	25	39	100%	64 %

Table 2. Importance of COBIT high-level processes in Egyptian banks: Summary statistics

COBIT High Level Processes		Importance									
		Not Important		Low Important		Medium		Important		Critical	
		No.	%	No.	%	No.	%	No.	%	No.	%
Plan and Organize	PO1 Define a Strategic IT Plan	0	0	0	0	0	0	13	52	12	48
	PO2 Define the Information Architecture	0	0	0	0	0	0	23	92	2	8
	PO3 Determine Technological Direction	0	0	0	0	1	4	15	60	9	36
	PO4 Define the IT Processes, Organisation and Relationships	0	0	0	0	1	4	23	92	1	4
	PO5 Manage the IT Investment	0	0	0	0	2	8	12	48	11	44
	PO6 Communicate Management Aims and Direction	0	0	0	0	3	12	20	80	2	8
	PO7 Manage IT Human Resources	0	0	0	0	0	0	17	68	8	32
	PO8 Manage Quality	0	0	0	0	0	0	16	64	9	36
	PO9 Assess and Manage IT Risks	0	0	0	0	1	4	11	44	13	52
	PO10 Manage Projects	0	0	0	0	2	8	11	44	12	48
Acquire and Implement	AI1 Identify Automated Solutions	0	0	0	0	1	4	19	76	5	20
	AI2 Acquire and Maintain Application Software	0	0	0	0	0	0	21	84	4	16
	AI3 Acquire and Maintain Technology Infrastructure	0	0	0	0	0	0	21	84	4	16
	AI4 Enable Operation and Use	0	0	0	0	1	4	11	44	13	52
	AI5 Procure IT Resources	0	0	0	0	1	4	17	68	7	28
	AI6 Manage Changes	0	0	0	0	1	4	16	64	8	32
	AI7 Install and Accredit Solutions and Changes	0	0	0	0	1	4	10	40	14	56
Deliver and Support	DS1 Define and Manage Service Levels	0	0	0	0	9	36	16	64	0	0
	DS2 Manage Third-party Services	0	0	0	0	0	0	12	48	13	52
	DS3 Manage Performance and Capacity	0	0	0	0	0	0	22	88	3	12
	DS4 Ensure Continuous Service	0	0	0	0	0	0	8	32	17	68
	DS5 Ensure Systems Security	0	0	0	0	0	0	0	0	25	100
	DS6 Identify and Allocate Costs	0	0	1	4	13	52	10	40	1	4
	DS7 Educate and Train Users	0	0	1	4	3	12	18	72	3	12
	DS8 Manage Service Desk and Incidents	0	0	0	0	1	4	22	88	2	8
	DS9 Manage the Configuration	0	0	0	0	3	12	18	72	4	16
	DS10 Manage Problems	0	0	0	0	1	4	20	80	4	16
	DS11 Manage Data	0	0	0	0	0	0	3	12	22	88
	DS12 Manage the Physical Environment	0	0	0	0	3	12	9	36	13	52
	DS13 Manage Operations	0	0	0	0	3	12	20	80	2	8
Monitor and Evaluate	ME1 Monitor and Evaluate IT Performance	0	0	0	0	4	16	14	56	7	28
	ME2 Monitor and Evaluate Internal Control	0	0	0	0	0	0	17	68	8	32
	ME3 Ensure Compliance With External Requirements	0	0	0	0	0	0	11	44	14	56
	ME4 Provide IT Governance	0	0	0	0	2	8	22	88	1	4

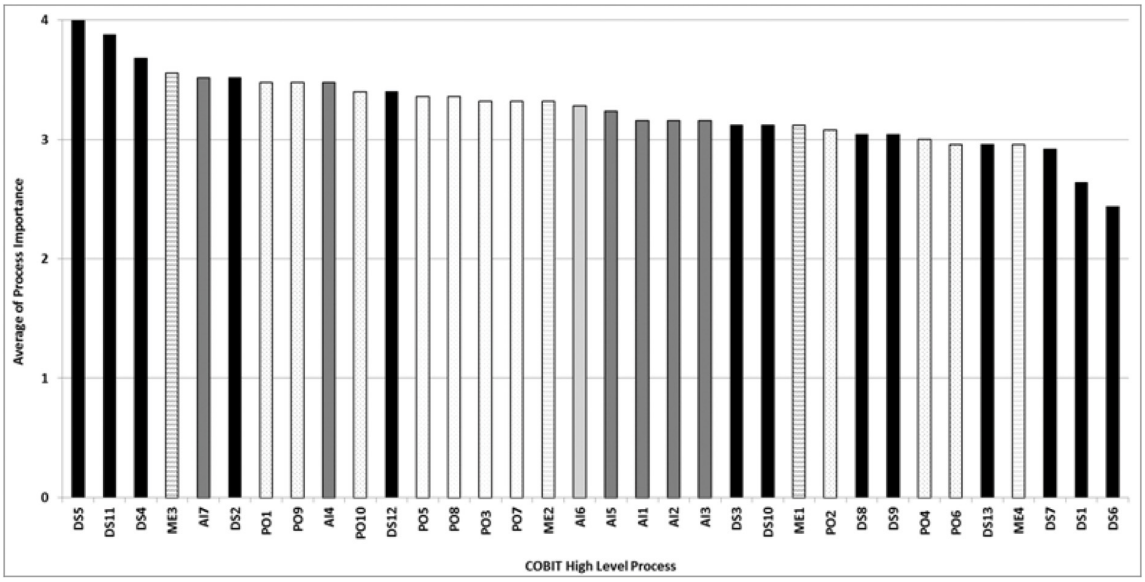
Figure 1. Importance of COBIT high-level processes in Egyptian banks: Means



1 that provides the average importance of these processes. As shown, all of them are above2.5 (on a 5 point scale). On the domains' level, the four of them; Plan and Organize, Acquire and Implement, Deliver and Support, and Monitor and Evaluate have shown to have the same importance with averages of 3.28, 3.29, 3.21, and 3.2, respectively.

On the processes level, however, Figure 2 depicts that the first three highest processes belong to the Deliver and Support domain while the highest

Figure 2. Importance of COBIT high-level processes in Egyptian banks: Ranked means



ranked Plan and Organize process (PO1) came the 7th followed by PO2. On the other hand, the lowest three processes from the important perspective were also from the Deliver and Support domain. In fact, 5 out of the lowest 10 processes belong to the Deliver and Support domain.

Effect of Moderating Variables

Table 3 illustrates summary statistics of respondents group difference regarding their perception of the importance of the COBIT high-level processes based on three moderating variables; bank type, familiarity of IT governance inside the bank, and the number of IT employees in the bank.

The effect of bank type was tested using Kruskal-Wallis test. The results of the test showed that there are no significant differences among respondent groups regarding their perception of the importance of the COBIT 34 high-level processes based on bank type.

Mann-Whitney test was used to test the effect of the second variable – familiarity of IT governance inside the bank – and as shown in the table, there was a significance difference in five processes (PO10, AI4, AI5, AI7, and DS1) only.

Finally, the effect of the number of IT employees was tested using Kruskal-Wallis test and the results showed no significant differences among respondent groups regarding their perception of the importance of the COBIT high-level processes based on that variable.

Maturity of COBIT High-Level Processes

Overall

Table 4 provides summary statistics of the how mature is the implementation of COBIT 34 high level processes. Overall, as the Table shows, there is a noticeable range of variability in the maturity of these processes; from 'non-existent' to 'optimized.' This variability is further illustrated in Figure 3 that the average maturity of these processes. As shown, average score of process maturity ranges from 1.24 (DS10) to 4.16 (DS6).

On the average, the Acquire and Implement domain showed the highest maturity with 3.14, followed by the Deliver and Support domain with 2.98 and then by the Plan and Organize and Monitor and Evaluate domains with 2.85 for both of them.

On the processes level, Figure 4 depicts that the first three highest processes belong to the Deliver and Support domain and the lowest process is D10. Out of the lowest 10 processes, 5 belong to the Plan and Organize domain.

Effect of Moderating Variable

Table 5 illustrates summary statistics of group difference regarding the maturity of COBIT high-level processes based on the three moderating variables; bank type, familiarity of IT governance inside the bank, and the number of IT employees in the bank. While Kruskal-Wallis test showed no significant differences based on the number of IT employees, significant difference were shown in 7 processes based on bank type (using Kruskal-Wallis test), and significant difference were shown in 28 processes based on bank type (using Mann-Whitney test).

COBIT Domains' Maturity: Comparison of Different Bank Types

Plan and Organize

This domain covers strategy and tactics as proper organisation and technological infrastructure should be put in place. This domain tackles management areas related to the alignment of IT and business strategy, quality, projects, risk assessment, and human resources.

In this study, Plan and Organize (PO) processes shown to be considerably high matured as for of them were repeatable and higher. Two processes (PO7 and PO 10) showed optimized

Table 3. Importance of COBIT high-level processes: Testing the moderating variables

COBIT High-Level Processes		Bank Type (Kruskal Wallis Test)		Familiarity of IT Governance inside the bank (Mann-Whitney)		Number of IT Employees (Kruskal Wallis Test)	
		x^2	p	W	P	x^2	P
Plan and organize	PO1 Define a Strategic IT Plan	4.98	0.083	141.0	0.079	5.35	0.254
	PO2 Define the Information Architecture	5.52	0.063	144.0	0.165	6.61	0.158
	PO3 Determine Technological Direction	2.16	0.340	157.0	0.448	3.66	0.454
	PO4 Define the IT Processes, Organisation and Relationships	3.67	0.160	169.0	1.000	3.20	0.525
	PO5 Manage the IT Investment	0.19	0.911	142.5	0.108	3.45	0.485
	PO6 Communicate Management Aims and Direction	2.07	0.354	152.0	0.185	2.33	0.675
	PO7 Manage IT Human Resources	0.72	0.699	142.0	0.069	0.40	0.983
	PO8 Manage Quality	0.27	0.872	148.0	0.170	5.88	0.209
	PO9 Assess and Manage IT Risks	1.57	0.456	150.0	0.711	3.51	0.476
	PO10 Manage Projects	1.45	0.484	114.0	0.001	0.92	0.922
Acquire and Implement	AI1 Identify Automated Solutions	2.72	0.257	157.0	0.380	2.12	0.714
	AI2 Acquire and Maintain Application Software	1.38	0.501	144.5	0.325	3.64	0.456
	AI3 Acquire and Maintain Technology Infrastructure	1.38	0.501	144.5	0.325	4.24	0.375
	AI4 Enable Operation and Use	4.14	0.126	133.0	0.026	2.66	0.617
	AI5 Procure IT Resources	0.88	0.646	133.0	0.016	2.38	0.667
	AI6 Manage Changes	1.81	0.405	163.0	0.698	9.66	0.047
	AI7 Install and Accredit Solutions and Changes	1.05	0.591	139.0	0.061	1.99	0.738
Deliver and Support	DS1 Define and Manage Service Levels	2.70	0.259	127.5	0.007	3.17	0.530
	DS2 Manage Third-party Services	0.50	0.780	140.5	0.330	1.63	0.804
	DS3 Manage Performance and Capacity	2.54	0.281	150.5	0.595	3.70	0.449
	DS4 Ensure Continuous Service	2.19	0.335	146.0	0.122	2.60	0.626
	DS5 Ensure Systems Security	0.00	1.000	169.0	1.000	0.00	1.000
	DS6 Identify and Allocate Costs	3.82	0.148	144.0	0.128	5.57	0.234
	DS7 Educate and Train Users	0.91	0.635	142.0	0.063	0.64	0.958
	DS8 Manage Service Desk and Incidents	0.14	0.932	150.0	0.563	4.89	0.298
	DS9 Manage the Configuration	2.06	0.357	153.0	0.270	2.51	0.643
	DS10 Manage Problems	0.60	0.739	150.0	0.639	4.76	0.313
	DS11 Manage Data	1.27	0.529	163.5	0.595	3.55	0.471
	DS12 Manage the Physical Environment	3.90	0.142	163.0	0.717	6.70	0.152
	DS13 Manage Operations	7.60	0.022	163.5	0.668	4.29	0.368
Monitor and Evaluate	ME1 Monitor and Evaluate IT Performance	0.19	0.910	152.5	0.316	4.96	0.291
	ME2 Monitor and Evaluate Internal Control	0.10	0.950	154.5	0.329	2.60	0.626
	ME3 Ensure Compliance With External Requirements	0.84	0.657	153.0	0.312	6.53	0.163
	ME4 Provide IT Governance	0.14	0.932	151.5	0.092	0.54	0.969

Table 4. Maturity of COBIT high-level processes in Egyptian banks: Summary statistics

COBIT High Level Process Name		Maturity											
		Non-existent		Initial/ Ad Hoc		Repeatable		Defined		Managed		Optimized	
		No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Plan and Organize	PO1 Define a Strategic IT Plan	0	0	0	0	2	8	3	12	20	80	0	0
	PO2 Define the Information Architecture	0	0	2	8	2	8	18	72	3	12	0	0
	PO3 Determine Technological Direction	0	0	0	0	4	16	12	48	9	36	0	0
	PO4 Define the IT Processes, Organisation and Relationships	0	0	0	0	4	16	19	76	2	8	0	0
	PO5 Manage the IT Investment	0	0	3	12	11	44	5	20	6	24	0	0
	PO6 Communicate Management Aims and Direction	0	0	2	8	16	64	7	28	0	0	0	0
	PO7 Manage IT Human Resources	0	0	5	20	8	32	10	40	0	0	2	8
	PO8 Manage Quality	0	0	9	36	2	8	8	32	5	20	1	4
	PO9 Assess and Manage IT Risks	0	0	0	0	11	44	6	24	8	32	0	0
	PO10 Manage Projects	0	0	2	8	2	8	11	44	8	32	2	8
Acquire and Implement	AI1 Identify Automated Solutions	0	0	5	20	11	44	7	28	2	8	0	0
	AI2 Acquire and Maintain Application Software	0	0	1	4	5	20	14	56	5	20	0	0
	AI3 Acquire and Maintain Technology Infrastructure	0	0	0	0	5	20	5	20	15	60	0	0
	AI4 Enable Operation and Use	0	0	0	0	2	8	9	36	12	48	2	8
	AI5 Procure IT Resources	0	0	0	0	2	8	13	52	8	32	2	8
	AI6 Manage Changes	0	0	3	12	8	32	10	40	3	12	1	4
	AI7 Install and Accredit Solutions and Changes	0	0	0	0	0	0	5	20	20	80	0	0
Deliver and Support	DS1 Define and Manage Service Levels	0	0	11	44	9	36	5	20	0	0	0	0
	DS2 Manage Third-party Services	0	0	0	0	0	0	4	16	13	52	8	32
	DS3 Manage Performance and Capacity	0	0	1	4	9	36	5	20	10	40	0	0
	DS4 Ensure Continuous Service	0	0	1	4	0	0	12	48	11	44	1	4
	DS5 Ensure Systems Security	0	0	0	0	0	0	5	20	18	72	2	8
	DS6 Identify and Allocate Costs	5	20	14	56	1	4	5	20	0	0	0	0
	DS7 Educate and Train Users	0	0	3	12	7	28	12	48	3	12	0	0
	DS8 Manage Service Desk and Incidents	1	4	2	8	5	20	6	24	11	44	0	0
	DS9 Manage the Configuration	0	0	2	8	6	24	9	36	8	32	0	0
	DS10 Manage Problems	0	0	6	24	9	36	8	32	2	8	0	0
	DS11 Manage Data	0	0	0	0	0	0	2	8	21	84	2	8
	DS12 Manage the Physical Environment	0	0	0	0	4	16	5	20	16	64	0	0
	DS13 Manage Operations	0	0	0	0	4	16	14	56	7	28	0	0
Monitor and Evaluate	ME1 Monitor and Evaluate IT Performance	0	0	4	16	9	36	9	36	1	4	2	8
	ME2 Monitor and Evaluate Internal Control	0	0	0	0	2	8	8	32	15	60	0	0
	ME3 Ensure Compliance With External Requirements	0	0	0	0	1	4	7	28	17	68	0	0
	ME4 Provide IT Governance	2	8	12	48	4	16	5	20	2	8	0	0

Figure 3. Maturity of COBIT high-level processes in Egyptian banks: Means

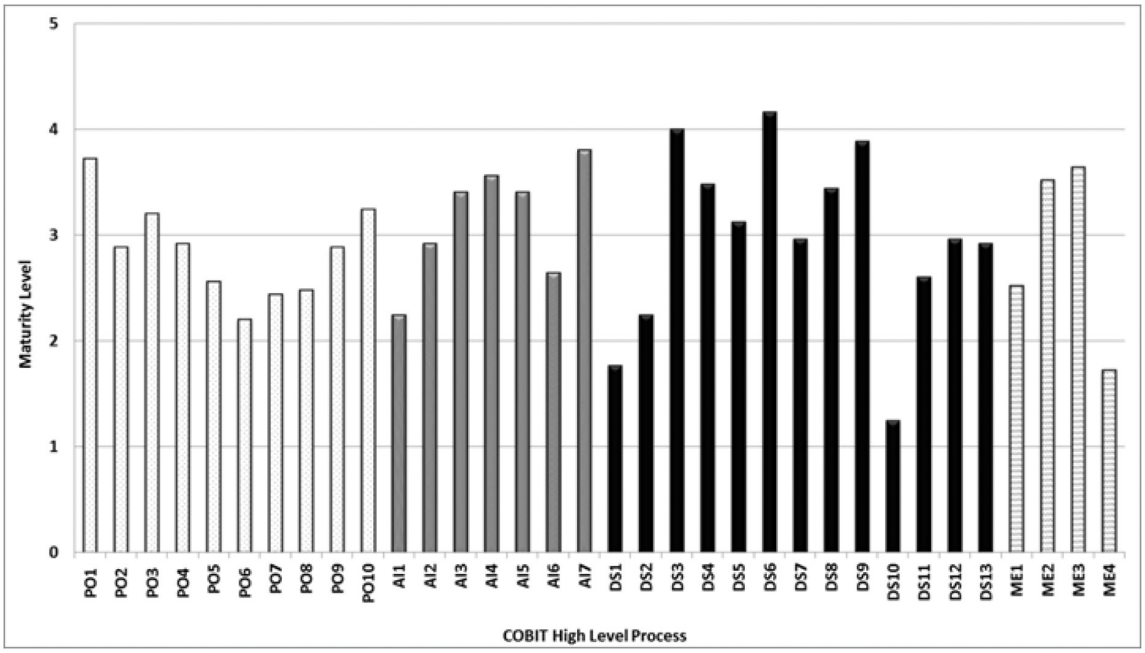


Figure 4. Maturity of COBIT high-level processes in Egyptian banks: Ranked means

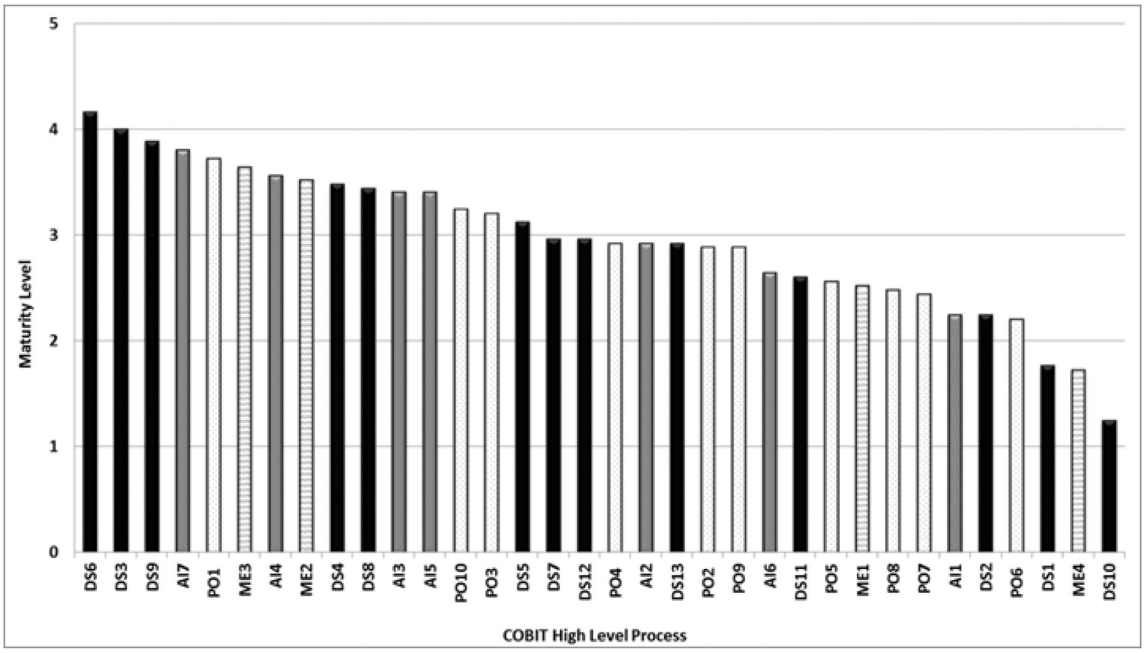
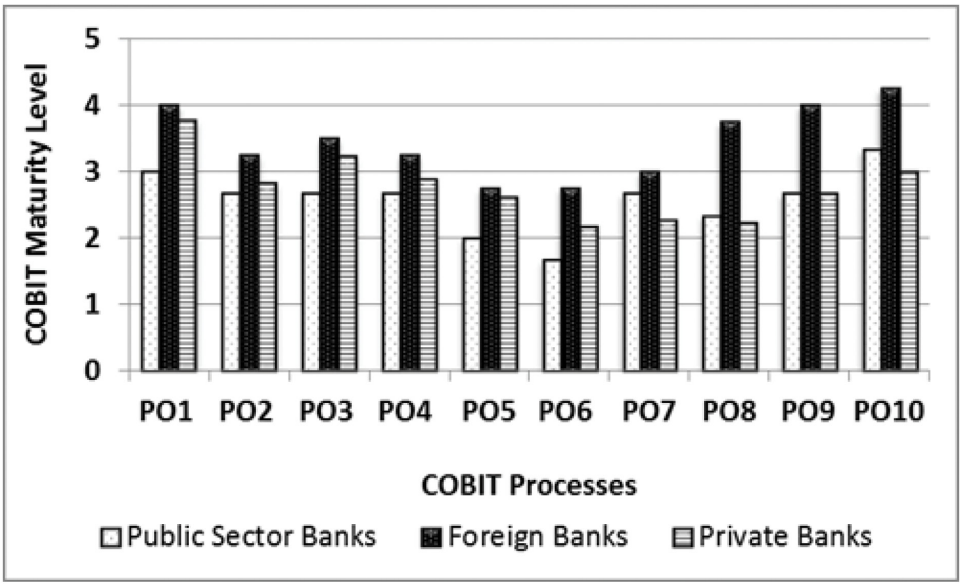


Table 5. Maturity of COBIT high-level processes: Testing the moderating variables

	COBIT High Level Process Name	Bank Type (Kruskal Wallis Test)		Familiarity of IT Governance inside the bank (Mann-Whitney)		Number of IT Employees (Kruskal Wallis Test)	
		X^2	p	W	p	X^2	p
Plan and organize	PO1 Define a Strategic IT Plan	5.182	0.075	150.5	0.149	4.239	0.375
	PO2 Define the Information Architecture	1.891	0.388	153.5	0.286	2.340	0.673
	PO3 Determine Technological Direction	2.450	0.294	123	0.006	2.190	0.701
	PO4 Define the IT Processes, Organisation and Relationships	2.605	0.272	136	0.016	3.879	0.423
	PO5 Manage the IT Investment	1.198	0.549	125.5	0.012	1.809	0.771
	PO6 Communicate Management Aims and Direction	6.296	0.043	139	0.054	1.306	0.860
	PO7 Manage IT Human Resources	1.252	0.535	118	0.003	1.063	0.900
	PO8 Manage Quality	4.070	0.131	129.5	0.025	3.599	0.463
	PO9 Assess and Manage IT Risks	7.307	0.026	119	0.004	2.480	0.648
	PO10 Manage Projects	6.185	0.045	125.5	0.012	1.639	0.802
Acquire and Implement	AI1 Identify Automated Solutions	5.788	0.055	124.5	0.010	3.744	0.442
	AI2 Acquire and Maintain Application Software	2.315	0.314	115.5	0.001	1.757	0.780
	AI3 Acquire and Maintain Technology Infrastructure	3.433	0.180	124	0.005	4.000	0.406
	AI4 Enable Operation and Use	3.531	0.171	132.5	0.031	1.046	0.903
	AI5 Procure IT Resources	1.162	0.559	112.5	0.001	2.635	0.621
	AI6 Manage Changes	4.089	0.129	129	0.022	3.070	0.546
	AI7 Install and Accredit Solutions and Changes	2.333	0.311	139	0.019	4.600	0.331
Deliver and Support	DS1 Define and Manage Service Levels	10.389	0.006	135	0.046	6.426	0.169
	DS2 Manage Third-party Services	5.868	0.053	119.5	0.003	3.239	0.519
	DS3 Manage Performance and Capacity	3.263	0.196	109	0.001	6.475	0.166
	DS4 Ensure Continuous Service	7.470	0.024	132	0.025	2.351	0.671
	DS5 Ensure Systems Security	2.805	0.246	131	0.009	3.669	0.453
	DS6 Identify and Allocate Costs	9.580	0.008	125.5	0.009	4.717	0.318
	DS7 Educate and Train Users	3.072	0.215	121.5	0.005	3.892	0.421
	DS8 Manage Service Desk and Incidents	3.702	0.157	124.5	0.010	5.822	0.213
	DS9 Manage the Configuration	5.102	0.078	137	0.068	2.337	0.674
	DS10 Manage Problems	6.468	0.039	127.5	0.018	5.944	0.203
	DS11 Manage Data	1.833	0.400	157.5	0.327	3.000	0.558
	DS12 Manage the Physical Environment	1.756	0.416	140.5	0.069	4.391	0.356
	DS13 Manage Operations	2.778	0.249	133	0.029	5.940	0.204
Monitor and Evaluate	ME1 Monitor and Evaluate IT Performance	5.032	0.081	122	0.007	4.480	0.345
	ME2 Monitor and Evaluate Internal Control	5.968	0.051	120.5	0.002	4.037	0.401
	ME3 Ensure Compliance With External Requirements	1.802	0.406	133	0.016	3.400	0.493
	ME4 Provide IT Governance	4.420	0.110	104.5	0.000	1.061	0.900

Figure 5. COBIT domains: Plan and organize processes



maturity in two banks. On the average, as shown in Figure 5, all PO processes showed almost the same maturity levels in different bank types with exception to PO8, PO9, and PO10 that showed increase maturity in foreign banks compared to public and private banks.

Defining a strategic IT plan (PO1) was a process that showed high maturity as 80% of banks were in the "Managed" level. This can be reasoned to that fact that this process is highly monitored by the bank board of directors and also by the managerial business levels in the bank, it is the most important link between IT and business from CIO and IT managers perspective, its importance also came from the fact that it the initial stone in planning for future business needs.

PO3 process is more matured in foreign banks compared to private and public mainly because of the existence of IT architecture board, who is responsible for providing architecture guidelines and technology directions for the bank, and the existence of technology infrastructure plan that includes directions for acquisition of technology infrastructure and responsiveness for changes in the competitive environment, in the studied public sector banks, this process was more of the time (66.67%) in the "Defined" level, because of the absence of technology direction in the public sector bank, also the IT department responds very slowly to competitive changes in the environment after taking many procedures and precautions to minimize the investments and the risks, another thing is that there is no preferred technology direction for the public sector bank in general, most of the time these banks are adapting the same successful technology direction in private and foreign banks.

Foreign banks showed more maturity for PO4 compared to private and public sector banks because of the existence of the IT process framework that ensures transparency and control as well as involvement of senior executives and business management, also foreign banks showed that processes, procedures and administrative policies are in place for all functions and especially for control, quality assurance, risk management functions. In addition to this all job descriptions for IT staff are clearly defined and stated, as well as supervision and segregation of duties. Private and public sector banks do have the same process

but in less maturity level due the absence of most of the controls for that process.

Managing quality (PO10) process is highly matured in foreign banks compared with public sector and private banks because of the existence of Quality Management System (QMS) and quality assurance department in foreign banks responsible for ensuring IT is delivering the expected value to business stakeholders without any deviations. In public sector bank, the QMS is still under development and construction

The case was the same for managing project (PO10) that is highly matured in foreign banks compared with public sector and private banks because of the existence of a project management framework that ensures the correct prioritisation and coordination of all projects. All sampled foreign banks have now a project management unit for all IT projects or at least project management function.

Finally, the critical process of assessing and managing IT risks (PO9) is also highly matured in foreign banks compared with public sector and private banks because of the existence of a risk management framework, which is responsible about identifying and mitigating IT risks, many foreign banks have risk management function which is responsible about ensuring the proper working of this process.

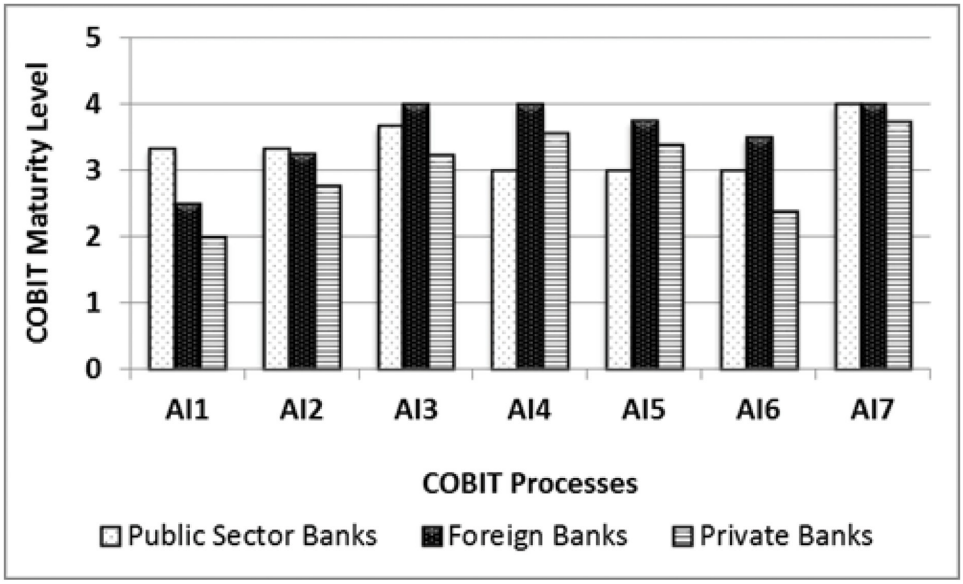
Acquire and Implement

Realizing the IT strategy requires potential IT solutions to be identified, developed or acquired, as well as implemented and integrated into the business process. In addition to these processes, this domain covers areas related to the maintenance of existing systems, management of systems' changes, procurement, operation and use of new and current systems, and verification of installed solutions.

Comparing the maturity of this domain process in the three bank types in Egypt, Figure 6 indicates an even maturity in the range of (4) of almost all process. Unlike the PO domain, public banks outperformed foreign ones in two processes AI 1 and AI2. Foreign banks, however, showed better performance on the following four processes.

Acquire and maintain technology and infrastructure (AI3) is highly matured in foreign banks compared to public sector and private banks

Figure 6. COBIT domains: Acquire and implement processes



because of the existence of processes for acquisition, implementation and upgrade of technology infrastructure. The same

Enable operations and use (AI4) is also highly matured in foreign banks compared to public sector and private banks because of the existence of processes that produces documentation and manuals for users and IT, and provides training for IT and end users.

Deliver and Support

This domain is concerned with the delivery of required services, which includes service delivery, management of security and continuity, service support for users, and management of data and operational facilities. It management issues related to alignment of delivered It services with business priorities, cost optimization, users' capacity, and security.

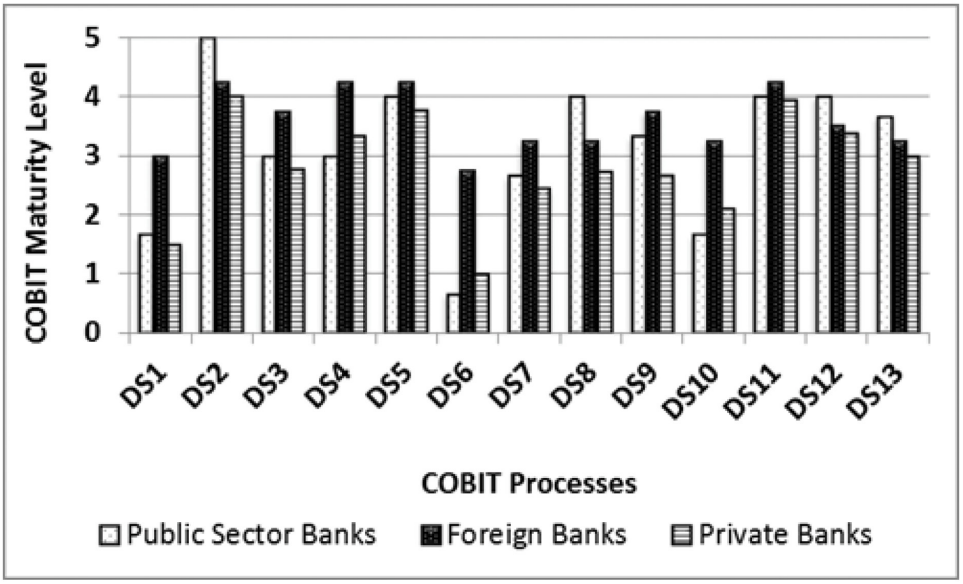
Results of this study showed that public banks had higher maturity than foreign banks in four processes (DS2, DS8, DS12, DS 13) while their maturity in the rest of processes was lower than those of the foreign banks.

Despite the fact that define and manage service level (DS1) is an important process from the IT governance perspective as it links business with IT, this study showed very low maturity level for the examined banks sample, the result was even worse in public and private banks, till now there is no formalized process in these banks which is responsible about measuring service level agreements between business and IT.

With respect to another critical process (DS5), all examined bank in this research showed very high attention to this process importance, all respondent banks reported that they consider this process is the most important IT governance process for their bank, but also because of the criticality of this process, a lot of focus and auditing already exist for this process and that's why this process is at "Managed" maturity level most of the time.

On cost optimization (DS6), foreign banks showed high maturity level compared to private and public sector banks, this is due the existence of operating a system which captures, allocates and reports IT costs to the users of services (see Figure 7).

Figure 7. COBIT domains: Deliver and support processes



Monitor and Evaluate

To guarantee continuous improvement and an effective IT governance practice, all IT processes need to be assessed on regular basis for performance and compliance with control requirements. This domain covers management issues related to performance management, monitoring of internal control, regulatory compliance and governance.

For processes in this domain, foreign banks showed a considerable higher maturity than public banks with respect ME1 and ME4. Despite the fact that performance is required to be evaluate by law, public banks concentrates mainly on workforce performance and do not cover other functional areas such as IT performance (see Figure 8).

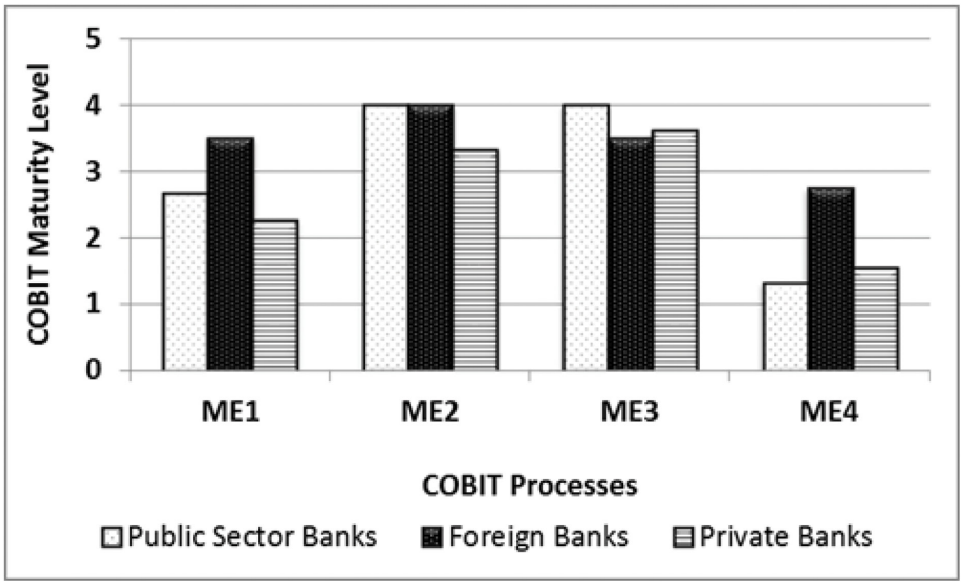
Most of the examined banks showed low maturity level for the provide IT governance (ME4) process, especially private and public sector banks, most of the interviewed CIOs and IT managers from the examined banks especially who reported that their organisations are not familiar with IT governance, see the value of IT governance in implementing some individual COBIT processes and not in the whole entire framework. Also from the interviewed with those CIOs they stated that implementing the IT framework in Egyptian banks will need some supervision and support from the Central Bank of Egypt (CBE).

CONCLUSION

The purpose of this research was to assess the implementation of the Control Objectives for Information and Related Technology (COBIT) domain and high-level processes in Egyptian banking sector, the results of this research will enable Egyptian banks to better understand, evaluate, implement and manage information technology governance for their businesses success. The research provides useful information for executive managers, IT managers, accountants, auditors, and academics to understand the implementation performance of the COBIT processes in Egyptian banks.

Motivation and, thus, importance of this study stems from three sources:

Figure 8. COBIT domains: Monitor and evaluate processes



1. The banking sector is one of the largest sectors in Egypt in terms of contributing to Egypt GDP and in using information technology to support banking business process and requirements (Egypt State Information Service, 2009), this is why implementing a good IT governance framework is needed to align business requirements and information technology in banking sector.
2. Central bank of Egypt is preparing banks for introducing the Basel II regulations. CBE Banking Institute arranged seminars for Egyptian bankers in preparation for Basel II requirements. CBE also informed banks to start building their own internal rating systems in preparation for Basel II (Egyptian Banking Sector Reform Policy: Areas of Future Actions, 2003). This continuous focus from CBE on Basel II implementation will pave the way for implementing the IT governance regulations inside the Egyptian banks, and one of these regulations that will take place is COBIT because of the existing relations between Basel II and COBIT.
3. There was no similar published research work on the practice of IT governance in the Egyptian banking sector or in other developing countries like Egypt.

Presented results answered the four intended objectives of the research:

1. Assessment of how the importance of COBIT high-level processes are perceived.
2. Measuring the extent to which these processes are performed.
3. Examining whether any significant differences among respondent groups regarding their perception of the importance of COBIT high-level processes.
4. Examining whether any significant differences among respondent groups regarding the implementation of these processes.

In general, the study revealed that despite IT governance (COBIT high-level) processes are perceived as important an critical, the practice of these processes – defined in terms of maturity levels – is still in adequate for sector requirements.

Performance of foreign banks operating in Egypt, however, showed better performance compared to public banks on the majority of processes.

On the local level, this study recommends for actions to be taken in order to enhance IT governance practice in the Egyptian banking sector:

1. CBE should sponsor an IT governance awareness program through Federation of Egyptian Banks to raise the awareness and understating of the IT governance concepts and approaches inside the Egyptian banks especially for the management levels.
2. CBE should launch a program to start implementing the IT governance frameworks and standards inside the Egyptian banks with clear roadmap and deadlines.
3. CBE should train internal IT auditors as well as external auditors on different IT governance concepts and standards to start monitoring the IT governance performance inside the Egyptian banks.
4. IT Managers can start implementing COBIT high level processes starting from the most important processes from their organisations perspective and ending with the least.

Finally, future work would include doing the same study in other IT-intensive sectors in Egypt such as Telecommunication and Insurance.

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KEY TERMS AND DEFINITIONS

Basel II: Basel II is the second of the Basel Committee on Bank Supervision's recommendations. It is a set of banking regulations put forth by the Basel Committee on Bank Supervision, which regulates finance and banking internationally.

Chief Information Officer: A job title commonly given to the most senior executive in an enterprise responsible for the information technology and computer systems that support enterprise goals.

Control Objectives for Information and Related Technology (COBIT): A set of best practices (framework) for information (IT) management created initially in 1992 by the Information Systems Audit and Control Association (ISACA), and the IT Governance Institute (ITGI). COBIT is an IT governance control framework that helps organizations meet today's business challenges in the areas of regulatory compliance, risk management and aligning IT strategy with organizational goals.

Information Technology Governance: The capability of organization's senior management to direct, measure and evaluate the use of IT resources to support the achievement of the organization's strategic goals.

Information Technology Maturity: A method of evaluating the organisation, so it can be rated from a maturity level of non-existent (0) to optimised (5). This provides the base for improvement and reaching the appropriate level of management and control over the information infrastructure.

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Chapter 69
Analysis of the Analytical Balance Sheet of Central Bank of Republic of Turkey During 2000 – 2009 Period in Terms of Crises

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Hasan Kalyoncu University, Turkey

ABSTRACT

Today, Central Banks' primary target is to maintain the price stability. In that context, through their monetary policy, they intervene in the money market with different tools. The Analytical Balance Sheet was created upon summing up and offsetting Balance Sheet of the Central Bank of Republic of Turkey (CBRT) in order to represent specific monetary aggregates. By means of that, CBRT aims to make the balance sheet more understandable and simple. In this chapter, firstly the sub items of the Analytical Balance Sheet are explained; secondly, the economic crises of Turkey during 2000-2009 is mentioned; finally, effects of these crises on the CBRT's Analytical Balance Sheet, changes in monetary aggregates which are Currency Issued, Reserve Money, Monetary Base, and Central Bank's Money, and in this context structure of the monetary policy of the CBRT in this period is analyzed.

INTRODUCTION

A commercial bank or a private company's financial statements are important business tools which allow understanding the details about the performance of it. However, the main goal of a central bank is to maintain the price stability not a profit maximization, therefore to interpret accounting records of a central bank is much more complex (Hawkins, 2002: 71).

The balance sheet of a central bank is an important source of information that is shaped by the interaction of monetary policy and the financial system of this country, and also it is crucial for other units of the economy when making decisions (Parasiz, 2000). A central bank is responsible

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for managing monetary policy. A central bank sets targets which are relevant the assets and the liabilities of its own balance sheet and then tries to achieve goals by using the instruments in its hands and by taking into account cyclical developments in economy. That is called monetary policy. Instruments used by a central bank are the emission, reserve requirement ratio, liquidity ratio, open market operations etc. These affect both a central bank's balance sheet and the economic activities. Accordingly, the best analysis of the central bank's monetary policy that is used by the central bank to reach economic targets can be made by observing its balance sheet (Acar, 1999). However, it is very difficult to follow and make comments about central banks' monetary policies and interventions through its balance sheet. So, the Analytical Balance Sheet was created upon summing up and offsetting balance sheet of the Central Bank of Republic of Turkey (CBRT) in order to represent specific monetary aggregates. It makes the balance sheet more understandable and simple. Moreover, the CBRT's foreign exchange and Turkish Lira (TL) movements can be seen in a clear manner in its analytical balance sheet (Ardic, 2004: 209). The assets of the Analytical Balance Sheet exhibit how to provide liquidity of economy, while the liabilities show the form of finance of liquidity which is needed in the economy.

Turkey had 3 economic crises during 2000-2009 period. These are "November of 2000" that was banking crisis, "February 2001" which was currency crisis and lastly "2008" that was global economic crisis. It is important how to read CBRT's Analytical Balance Sheet in terms of these three crises.

In this paper, first of all the CBRT's Analytical Balance Sheet will be explained and then the economic crises of Turkey during 2000-2009 period will be mentioned, briefly. After that, effects of these crises on the Analytical Balance Sheet, changes in monetary aggregates and in this context structure of the monetary policy of the CBRT in this period will be examined. These monetary aggregates are Currency Issued (CI), Reserve Money (RM), Monetary Base (MB), and Central Bank's Money (CBM). The main purpose of this study is to analyse both foreign exchange & TL movements and monetary aggregates in the Analytical Balance Sheet, actions and reactions of the CBRT to these economic crises and its monetary policy strategies during 2000-2009 period.

ANALYTICAL BALANCE SHEET OF THE CBRT

Assets

The CBRT must control the size and the composition of its balance sheet in order to enforce effective monetary policy. In this regard, the CBRT prepares Analytical Balance Sheet, which makes it more simple and straightforward. Analytical Balance Sheet consists of assets and liabilities.

Assets side of the CBRT determines the value of money. If the CBRT wants to affect interest rates and financial magnitudes in the market, the size of its balance sheet should be large enough in proportion to the size of the economy (Fazio, 1991: 127). The Central Bank firstly finds the assets and then it would create the source which finances this assets side (Ardic, 2004, 197). The Assets consist of two main items: The Foreign Assets and the Domestic Assets.

The Foreign Assets (FA) includes foreign currency, gold, foreign credit, temporary debtors and affiliates of the CBRT (Istanbul Univ., 2003: 48). Foreign exchange inflows and foreign exchange purchases due to the use of foreign credit lead to an increase in foreign assets (CBRT, 2009). Accumulation of FA of the CBRT can be evaluated as a function of country's gain of foreign exchange (Iskenderoglu, 1993: 42).

The second part of assets is *Domestic Assets (DA).* The DA involves Cash Operations, Foreign Exchange Revaluation Account and IMF Emergency Assistance Account.

Cash Operations include Treasury Debt, Credit to Banking Sector, Credit to Savings Deposit Insurance Fund (SDIF) and Other Items. Formerly the Treasury could use short-term advances in order to eliminate the state revenue-expense imbalances from the CBRT. In line with the changes in EU norms and international Central Banking practices, a new Central Banking law was enacted on May 5, 2001. The main aim of these amendments was to strengthen the Central Bank's operational independence. In order to sustain independence, the law established that the Bank should not grant advances or extend credit to the Treasury or public establishments and institutions. It was also legislated that the Bank should not purchase debt instruments issued by the Treasury or by public establishments and institutions in the primary market (CBRT, 2001: 113). The second sub-item is Foreign Exchange Revaluation Account which contains the re-evaluation profit or loss of the FA and liabilities when TL depreciates or appreciates against foreign currencies (Istanbul University, 2003: 49). If foreign assets are bigger than foreign liabilities when the foreign currency rises, Revaluation Account decreases, otherwise it increases. In fact, the size of this account is an indicator of the risk of the balance sheet. Growth of the account is a factor restricting the ability of the CBRT to make cash transactions. The third and the last item is IMF Emergency Assistance Account which is reserve position of the Treasury from the IMF.

Liabilities

Liability side of the Analytical Balance Sheet shows the CBRT's total liabilities to the banking and non-banking sector. Foreign exchange and TL are two types of funding source of the CBRT. The first one is the total foreign liabilities and the second one is the Central Bank's Money (CBM).

The Total Foreign Liabilities, which are the financing sources of the CBRT in terms of foreign exchange, include the foreign exchange liabilities to both abroad and domestic side. Liabilities to Non-residents and Liabilities to Residents are two sub-items of Total Foreign Liabilities. The major part of the Liabilities to Non-residents item is the Foreign Exchange Deposit Accounts which belong to the Turkish citizens living abroad. The Liabilities to Residents part includes Foreign Exchange Deposits of Non-Banking Sector and the Foreign exchange Deposits of Banking Sector. The first one mainly reflects the Treasury's foreign currency deposits. The latter one is the amount of foreign currency, which the CBRT will pay the banks on the maturity date of the reserve requirement and free deposits as well as swaps.

The CBM is the total TL liabilities of the Central Bank to all units of economy. The CBM is the largest monetary aggregate created by the CBRT. It is the sum of RM, OMO and TL Deposits of Public Sector (Yardimci, 2006: 164).

RM is an important monetary aggregate because of its power to affect other monetary aggregates. The first sub-item of the RM is "Currency Issued (Emission)" (CI) which is used for demonstration of the difference between banknotes that are put into circulation and withdrawn from circulation (Altunoglu, 2009: 1). The second one is "Deposits of the Banking Sector" which contains the Required Reserves and the Free Deposits. The Required Reserves item is the amount of required reserves of banks in the CBRT. The most significant function of Required Reserves is to be a tool of controlling the money supply. Central Bank can affect the excess reserves of the banks and the expansion of their deposit money by changing required reserve ratios (Parasiz, 2000: 307). By the way, other sub-items of RM are the "Extra Budgetary Fund" and "Deposits of the Non-Banking Sector."

Other Central Bank Money includes OMO and TL Deposits of Public Sector. In the broadest sense; OMO is buying and selling of the financial instruments by the Central Bank in the primary market or secondary market. OMOs can be classified as repurchase agreements, reverse repurchase

agreements, outright purchases and outright sales. These actions expand or contract total reserves of the banking system and so it affects the money supply in the economy. That is to say, the Central Bank uses OMOs as a monetary policy tool to influence the money supply (Akcay, 1997). For example, if monetary authority aims to withdraw currency from circulation or decrease the excess reserve in the banking system, it engages in open market sales and for an expansionary monetary policy it buys bonds from economic agents. When the Central Bank supplies liquidity to the market as a creditor, this item will be minus; when it absorbs the fund from the market as a debtor, this item will change in the positive direction. Moreover, TL Deposits of Public Sector, which are the second item of Other Central Bank's Money, contain total deposits of the public sector, especially the Treasury.

A BRIEF OVERVIEW OF THE CRISES DURING 2000-2009 PERIOD

The November 2000 Crisis

In December 1999, the Turkish government launched an exchange-rate-based stabilization program with the support of the Bretton Woods Institutions in order to bring down inflation and check what looked like an unsustainable process of public debt accumulation. The program appeared to be on course in the subsequent nine months, enjoying wide public confidence and support as well as gaining praise from IMF officials (Akyuz and Boratav). The interest rates, wage rates and prices were released to float in this program, while the foreign exchange was foreseen to be increased in a fixed rate. In the first half of 2000, the program yielded positive results. Inflation fell to the lowest level since the 1980s, the economy experienced a recovery, interest rates declined and structural reforms were applied (Karacor, 387). However, the fast decline in interest rates was a dangerous development in terms of policy of fighting against inflation. The CBRT's inflation program began to suffer, despite the fact that the Treasury's debt burden decreased. It started running into problems in Autumn 2000.

The crisis in the November of 2000 is a banking crisis. The lag between the targeted inflation and the expected inflation was huge. Banks which have open positions faced with liquidity problems and began to sell bonds, then interest rates rose. Consequently, the banks trying to close their positions raised the foreign exchange demand in the market (Coskun & Balatan, 2009: 22-23). The public and the private banks tried to have foreign borrowing (euro) in a flurry and interest rates continued to increase. This rise in interest rates put into trouble some banks. Banks faced huge losses because they were forced to fund the Treasury bills which were in their hands. Because, the CBRT could not fund the markets due to the its monetary policy, the crisis deepened. This situation increased foreign investors' foreign exchange demand; they sold the Treasury bills in their hands and went out from the market. Lastly, the liquidity crisis had occurred. Although the first resistance of the CBRT not to exceed its Net Domestic Asset (NDA) target, eventually it had to provide liquidity to the market through the OMOs (Gaygili, 2007: 150). Accordingly, the Net Domestic Assets (NDA) of the policy was abandoned.

In the CBRT's NDA policy, it had a performance criterion of 1.200 trillion TL. Accordingly, the Central Bank could give the amount of TL creating in return of foreign currency inflows to the market and it could supply the additional liquidity only in this way. As noted above, at the beginning of the crisis, the Central Bank locked on the NDA target, resisted to provide additional liquidity injection to the market. Subsequently, it exceeded the target as mentioned above and provided additional liquidity injection. However, it was too late for the CBRT's this intervention (Egilmez, 2006).

February 2001 Crisis

The banking crisis in November of 2000 turned into foreign exchange crises in February of 2001 and it became a twin-crisis.

The sharp increase in the current account deficit mainly caused the currency crisis in February of 2001. The reasons for these crises in 2000 and 2001 were an overvalued TL, high current account deficit which was over critical limit, the financial sector which was lack of capital, the open position (the bank - the real sector - the public side), public banks' duty losses and as a result of them the rise in the profit and interest rate risk of the financial sector (Karacor, 388).

The IMF program was terminated in February 2001 as the internal debt market collapsed. In February 21, the CBRT did not lend money to the banks who failed to pay their debt at the appropriate time, so this attitude created a negative impact on the economy. In this regard, the overnight interest rates skyrocketed to 5000%. Greatly weakened banking system was faced with a collapse due to the interruption of the interbank payments system. As a result of increasing economic risks, floating exchange rate regime was began to implement instead of fixed exchange rate regime in February of 2001. 1 U.S. dollar rocketed from 685,000 TL to 1,270,000 TL on February 21 (Alic et al, 2009: 12). In the floating exchange rate system, foreign exchange rate is determined by the economic actors in the market and is permitted to fluctuate according to changing economic conditions (Mankiw, 2010: 381). As a result of the crisis, the stock market, employment, production and TL went into a downward spiral and the gross domestic product shrunk by 7.4% over the crisis year, the worst performance since World War II.

The CBRT's foreign assets rose after 2001 because of important change in the exchange rate regime in 2001. Following the crisis, the banking sector and financial sector had been restructured in Turkey. In addition, the structure of the CBRT by law had been changed after the crisis (Yakupoglu, 2011b: 21).

Global Crisis of 2008

2008 crisis was quite different than the previous ones for Turkey because it was a result of world matters. The most important reason for this economic crisis is shifting of capital in recent years from production to finance which is called financialization of capitalism. (Foster, 2008: 45). In other words, it is the change of the center of the gravity of the economy from production (even from growing service sector) to finance and also the real economy had been the victim of financialization. In that respect, global capital, squeezed in the monetary area instead of production, mainly caused the global crisis.

The Federal Reserve reduced the short-term interest rate to 1% at the end of 2002 and the banks gave widespread mortgage credits to consumers. That lies at the roof of the global crisis of 2008 (Alic et al., 2009: 14). In 2006, the crisis started in the form of repayment problems in the American mortgage market. These problems negatively impacted the world economies and it had turned into a global liquidity and credit crisis around the world in 2007 and 2008, due to the fact that the American economy is biggest economy in the world. The trustworthiness in the markets was damaged. Moreover, in 2008 with the bankruptcy of gigantic financial companies there was seen a sharp decline in stock market and increase in foreign exchange rates.

In September of 2008, all countries, particularly developed countries, relax their monetary policies and started to apply expansionary fiscal policy to reduce the contraction in the economy. At the end of 2008, industrial production, employment and foreign trade narrowed in almost all the economies in the world (Yukseler, 2009: 5).

The global crisis has affected Turkey on the real sector side, unlike in the U.S.. This crisis has not affected Turkey from the asset market and financial side especially due to the fact that the domestic financial markets of Turkey were relatively less developed and complex derivative

financial products which were expanding in global markets especially in the last two decades were not trading in Turkey.

There was a sharp contraction in external demand and domestic demand in Turkey. The slowdown in Turkey's economy reduced tax revenues, lowered the rate of capacity utilization, escalated unemployment. Only banks have been protected by the crisis. Banks who were experienced from the crises in 1994 and 2001 have been well supervision and control and also have had Capital Adequacy Ratio of about 18% which was higher than international standards (Erturk, 2010: 416-417).

ANALYSIS OF THE ANALYTICAL BALANCE SHEET OF CBRT DURING 2000 - 2009 PERIOD

Assets

The way of the CBRT's effectiveness on interest rates and monetary and financial magnitudes in the market is dependent on the size of its balance sheet. It should be large enough in proportion to the size of economy (Fazio, 1991: 127). By the means of this, the Central Bank can apply its monetary policy by using its assets and liabilities.

The size of the Analytical Balance Sheet grew 255% in 2001, year on year (Table 1), because of both increase in the FA due to the devaluation in 2001 and the sudden rise in the DA. At the end of 2000s, the increase in international liquidity have resulted in a rise in short term foreign capital coming to Turkey, so it has led to increases in the Central Bank's Foreign Assets (Yakupoglu, 2011b: 43). On the other hand, the reason of the rise in DA is the sharp increase of around 33 billion TL in the Government Domestic Debt Instruments (prior to November 5, 2001).

In 2008, the size of the balance sheet rose by 6.4%, but it shrunk by 3% in 2009 because while the FA ascended in the second half of 2008 due

Table 1. Analytical balance sheet of CBRT during 2000-2009 (million TL)

	2000	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**
A.Assets	16.903	60.090	74.071	76.497	74.673	90.070	104.352	106.625	113.459	110.026
A.1-Foreign Assets	18.004	34.410	50.995	52.892	53.592	72.338	91.465	90.891	114.964	115.415
A.2-Domestic Assets	-1.101	25.680	23.075	23.605	21.081	17.732	12.888	15.734	-1.505	-5.388
A.2.a-Cash Operations	-416	25.664	24.222	22.882	19.048	15.723	12.242	11.023	4.872	-378
A.2.aa-Treasury Dept	1.491	34.403	30.812	28.019	23.237	19.429	18.775	16.888	13.602	8.644
A.2.aa.i-CBRT Portfolio	1.515	34.460	30.919	28.079	23.292	19.470	18.812	16.927	13.654	8.708
A.2.aa.i.a-Gov. Dom. Debt Inst. Period Nov. 5, 2001	1.515	34.301	30.919	28.079	23.292	19.470	18.812	16.927	13.654	8.442
A.2.aa.i.b-Gov. Dom. Debt Inst. Purchased from Sec. Mrkt	-	158	-	-	-	-	-	-	-	266
A.2.aa.ii-Other	-24	-56	-107	-60	-56	-41	-37	-39	-51	-64
A.2.ab-Credits to Banking Sector	-	16	13	7	8	1	1	-	-	486
A.2.ac-Credits to SDIF	500	750	250	-	302	-	-	-	-	-

continued on following page

Table 1. Continued

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
A.2.ad-Other Items	-2.407	-9.505	-6.853	-5.144	-4.498	-3.708	-6.533	-5.865	-8.730	-9.508
A.2.b-FX Revaluation Account	-875	-175	-1.147	723	2.033	2.010	646	4.711	-6.377	-5.010
A.2.c-IMF Emergency Assistance (Treasury)	191	191	-	-	-	-	-	-	-	-
P.Liability	16.903	60.090	74.071	76.497	74.673	90.070	104.353	106.625	113.459	110.026
P.1-Total Foreign Liabilities	15.924	50.221	53.551	52.363	49.929	51.522	62.437	51.834	58.758	59.294
P.1.a-Liabilities to Non-Residents	10.406	36.733	37.369	35.648	30.554	22.858	24.328	19.913	22.128	22.917
P.1.b-Liabilites to Residents	5.518	13.487	16.182	16.715	19.375	28.665	38.109	31.922	36.630	36.377
P.1.ba-FX Deposits of Non-Bank Sector	1.222	3.139	5.463	6.518	6.099	13.874	18.691	12.248	14.928	15.904
P.1.bb-FX Deposits of Banking Sector	4.295	10.348	10.719	10.196	13.276	14.790	19.418	19.673	21.703	20.473
P.2-Central Bank Money	980	9.869	20.519	24.135	24.743	38.548	41.916	54.790	54.701	50.732
P.2.A-Reserve Money	5.949	7.976	410.668	15.010	20.328	32.696	51.398	46.548	62.967	64.723
P.2.Aa-Currency Used	3.772	5.283	7.636	10.676	13.465	19.612	26.815	27.429	31.743	38.340
P.2.Ab-Deposits of Banking Sector	2.015	2.520	2.792	4.191	6.723	12.899	14.420	18.921	30.942	26.179
P.2.Aba-Required Reserves	1.404	1.626	1.672	2.289	3.115	-	-	-	-	-
P.2.Abb-Free Deposits	611	894	1.120	1.903	3.608	12.899	14.420	18.921	30.942	26.179
P.2.Ac-Extrabudgetary Funds	116	104	178	48	24	91	55	92	143	136
P.2.Ad-Deposits of Non-Bank Sector	46	69	63	95	115	95	108	106	139	69
P.2.B-Other Central Bank Money	-4.969	1.893	9.851	9.124	4.415	5.851	517	8.242	-8.266	-13.992
P.2.Ba-Open Market Operations	-5.219	1.244	9.579	8.260	3.622	4.983	-1.098	3.911	-10.126	-18.917
P.2.Bb-TL Deposits of Public Sector	249	649	272	864	793	868	1.616	4.331	1.859	4.926

Source: Analytical Balance Sheet of CBRT (http://evds.tcmb.gov.tr)

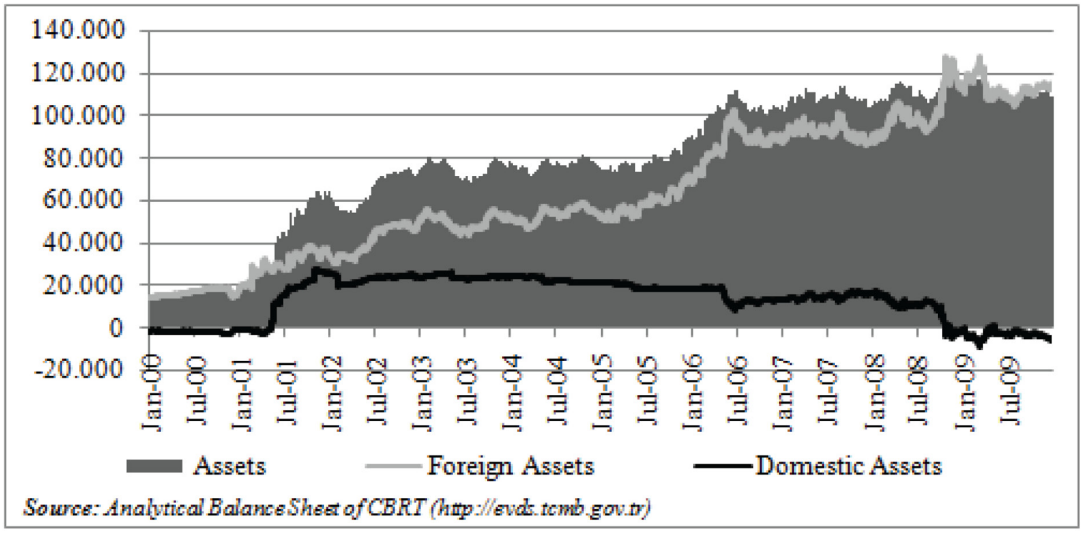
to depreciation of TL, the DA was negative due to decrease of Government Domestic Debt Instruments (prior to November 5, 2001).

In compliance with the floating exchange rate regime, the foreign exchange rate would be determined by the market conditions. However, the CBRT also announced that it could intervene in the foreign exchange market "to prevent excessive volatility." There were interventions in the foreign exchange purchase auctions were carried out to increase the foreign exchange reserves "without affecting the long-term equilibrium value of the foreign exchange rate" (CBRT, 2002, 2003). The CBRT keeps foreign exchange reserve to support monetary and foreign exchange policies, give confidence to the markets, perform government's foreign exchange-denominated debt service to inside and outside and keep necessary foreign exchange liquidity in case of any external shock (CBRT, 2005: 4). The CBRT argued that foreign exchange buying auctions aimed to absorb the excess supply of foreign exchange due to reserve currency substitution. Excluding the 2001 crisis period, the CBRT has mainly bought foreign exchange from the market. The amount it bought 44 billion TL by auctions and 25.5 billion TL by interventions during 2000-2009 period. Thus, the Central Bank has benefited from the abundance of foreign exchange due to the international liquidity by increasing its reserves. As it can be seen from the Figure 1, after the crisis of 2001, FA began to rise and its share in the assets became almost full of the assets in 2009.

If the FA/assets ratio is big, this country has high source which is convertible into money regarding the other central banks and international markets (CBRT, 2009). According to Analytical Balance Sheet of the CBRT, while this ratio was 1.07 in 2000, it declined to 0.57 due the crisis, but later on it has risen gradually above to 1 in 2008 and in 2009 years, because as mentioned above, FA had increased after the crisis of 2001. On the other hand, despite a climb in FA of the CBRT, the ratio of FA to Turkey's Gross Domestic Product (GDP) of Turkey moved in the range of about 10-14% during 2000-2009 period.

The ratio of FA to Total Foreign Liabilities which is called currency risk rate is the most important indicator of the strength of the Central Bank's source which can be convertible to money in international markets and beside the other central banks (Serdengecti, 1997). According to the

Figure 1. The assets of the CBRT during 2000-2009 period (million TL)



CBRT, a developing country who has a healthy balance sheet structure is expected to have bigger than one in developing countries because it is thought that when a country has balance of payments problems it will be more comfortable with higher FA (CBRT, 2006: 51). On the other hand, according to Akguc, the ideal value for this ratio is one. If the ratio is bigger than one, it shows that the balance sheet carries a higher risk (Akguc, 1993: 123).

Because sudden shift in the direction of foreign exchange inflows and capital outflows, FA fell in November of 2000 and the current risk rate also declined from 1,5 to 1 due to the fact that DA did not change. During the second half of 2001, the CBRT's foreign exchange reserves fell because it met the increasing foreign exchange demand of banks after the crisis of November of 2000 and banks' foreign exchange deposits of banks rose after the crisis of February of 2001. Thus, in 2001 the current risk rate decreased to 0.7%. After crises, in line with the Program of Transition to a Strong Economy, that increase in the FA and the foreign exchange deposits slowed down and reserves began to rise again, so the ratio began to ascend again. In the first half of 2002, it has increased due to fall in the CBRT's liabilities because of the repayment of IMF loans in the first half of 2002 and beginning of the process of the reverse currency substitution. The currency risk rate moved in the range of 1-2 during the 2007-2009 period because FA was bigger than Total Foreign Liabilities. It ascended above 2 in 2009, which was important for increasing current account deficit of Turkey.

On the DA side, the share of DA in total assets was highest value in the period of 1980 – 1994 when a large portion of the public finance deficits were met by the CBRT sources. After 1994, the DA began to decline gradually due to the fact that the short-term advances to the Treasury for financing of public deficits began to decrease. In 2000, DA fell below zero in 2000, but after the economic crisis of February of 2001, it skyrocketed and its share in the assets also increased due to the climb in the Government Domestic Debt Instruments (Gogebakan, 2008: 10). After 2001, the Treasury's use of short-term advances in order to eliminate the state revenue-expense imbalances from the CBRT and the CBRT's buying of debt instruments which were issued by the Treasury or public institutions are forbidden by law, so the DA began to decline (CBRT, 2009). Thus, the DA/Assets ratio climbed 43% in 2001, it decreased to 31% in 2002. After 2002, the DA/Assets ratio began to decrease due to the redemption of the Government Domestic Debt Instruments and the CBRT's purchase of foreign exchange from the market. When looking at the year of 2008, the DA began to decline, because of downturn in the Government Domestic Debt Instruments and loss balance in the Foreign Exchange Revaluation Account. At the end of the year, the DA fell below zero at 1.5 billion TL in 2008 and was recorded at minus 5.4 billion TL in 2009.

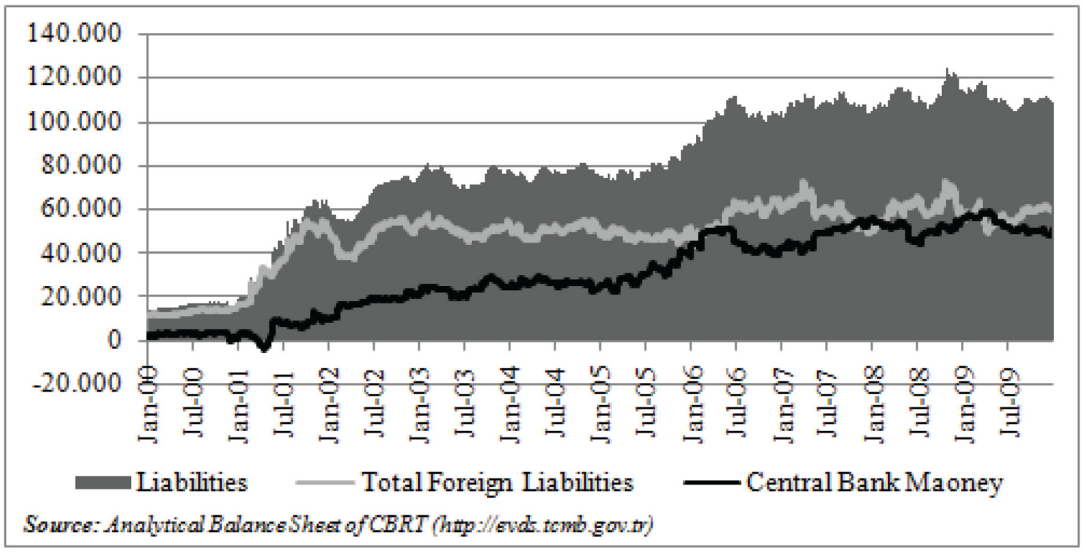
Liabilities

The liabilities show the CBRT's effectiveness on the market. Foreign exchange and TL are two types of funding source of the CBRT. The first one is the total foreign liabilities and the second one is the CBM. Increase in the Total Foreign Liabilities of the CBRT may reduce its strength to direct monetary policy (CBRT, 2009).

Total Foreign Liabilities skyrocketed in 2001 (Figure 2) due to the devaluation and so its monetary policy power has decreased significantly. In other words, in 2000s, Total Foreign Liabilities/Liabilities ratio moved around 80%, but in 2001 crisis it raised to 120%. The share of TL liabilities (CBM) in total liabilities is preferred to be high for low risk.

Total Foreign Liabilities/Liabilities ratio began to fall after the crises of 2000 and 2001. It decreased to around 50% in 2008. On the other hand, the share of the CBM in the balance sheet grew after 2000s because the CBRT supplied liquidity via OMOs and it reached almost 50% in 2008.

Figure 2. Liabilities of the CBRT during 2000-2009 period (million TL)



Monetary Aggregates

CI, RM, MB and CBM are the monetary aggregates in Analytical Balance Sheet (Yakupoglu, 2011a: 25).

Currency Issued (CI)

CI is used for demonstration of the difference between banknotes which are put into circulation and withdrawn from circulation. The CBRT cannot finance the public sector due to its law, so it can be said that the CI is determined by economic units' cash demand (Eroglu, 2008: 120). A Central Bank, who has achieved price stability, is expected to constitute its liabilities on the basis of its currency type. When the majority of these liabilities in a central bank's balance sheet is CI, it is perceived as a positive sign. In short, in the developed countries whose financial structure is strong and inflation is not high, the share of the CBM in total liabilities and also the share of CI which is a sub-item of CBM in total liabilities is generally high.

Central Banks attach importance to the CI item for finance of its balance sheet. Financing of a balance sheet predominantly by the CI is a desired situation because it is directly under the control of the CBRT which reflects its effectiveness of its monetary policy on the economy (Colak, 1996: 19).

The Central Bank regulates the volume of CI in several ways. The CBRT is effective on the money demand and the CI by selling and purchasing of foreign exchange through OMOs, the auctions and direct interventions with the interest rates which are set by the CBRT. Changes in the volume of CI in an economy affect the general price level and total production in the short term depending on the speed of money circulation (CBRT, 2009). Studies show that the main determinants of the volume of CI are consumption expenditures, interest rates and inflation rates. When the movement of the volume of CI in Turkey in the last 20 years is examined, it was moving in a certain range until 2002, but after 2002 it has been skyrocketing. After 2002, consumption expenditures have been increasing in real terms and real interest rates have been declining (Altunoglu, 2009: 45).

The share of the CI in total liabilities rose until the year of 2000 due to increasing foreign exchange reserves, but the ratio began to decline after the

crisis because of the currency substitution and high interest rates. In developing countries such as Turkey, the general condition of the economy causes the currency substitution. This reduces demand for domestic currency, while increases the foreign exchange demand (Erturk, 2004: 249). Accordingly, the ratio of the CI to total liabilities fell around 7-8% in 2001, while it began to ascend after the crisis due to the reverse currency substitution. It was at around 25% in 2006 and reached at the level of 35% in 2009.

Examining the developments in CI during the last two decades, the volume moved within a certain range up to 2002, but it increased very much in real terms after 2002. Moreover, up to 2000, the share of the CI in the balance sheet had increased, but it fell during the 2001 crisis due to the currency substitution and high interest rates. After 2002, this ratio has begun to rise and in 2009 reached to 40% (Figure 3). In this issue, the atmosphere of confidence and optimistic expectations was effective (Gogebakan, 2008: 13).

Reserve Money (RM)

A change in RM in the Analytical Balance Sheet is an important indicator of the CBRT's monetary policy. An increase in RM is perceived as an expansionary monetary policy (Yardimci, 2006: 164). In that context, RM is significant monetary aggregate because an increase in RM raised other monetary aggregates more (Yakupoglu, 2011a: 25). Composition of RM is as follows:

Reserve Money = Currency Issued + Required Reserves + Free Deposits + Extrabudgetary Funds + Deposits of Non-Bank Sector

The ratio of the RM to the balance sheet descended to 13% at the end of 2001 due to shaking of the confidence in TL (Figure 4). Meanwhile the ratio began to rise again after 2002 due to the fact that the confidence in TL and TL instruments increased through the Program of Transition to a Strong Economy (CBRT 2006, 55). In the period of 2007-2009, it fluctuated within the range of 45-60% band because there was not confidence problem to TL.

Figure 3. Currency issued during 2000-2009 period

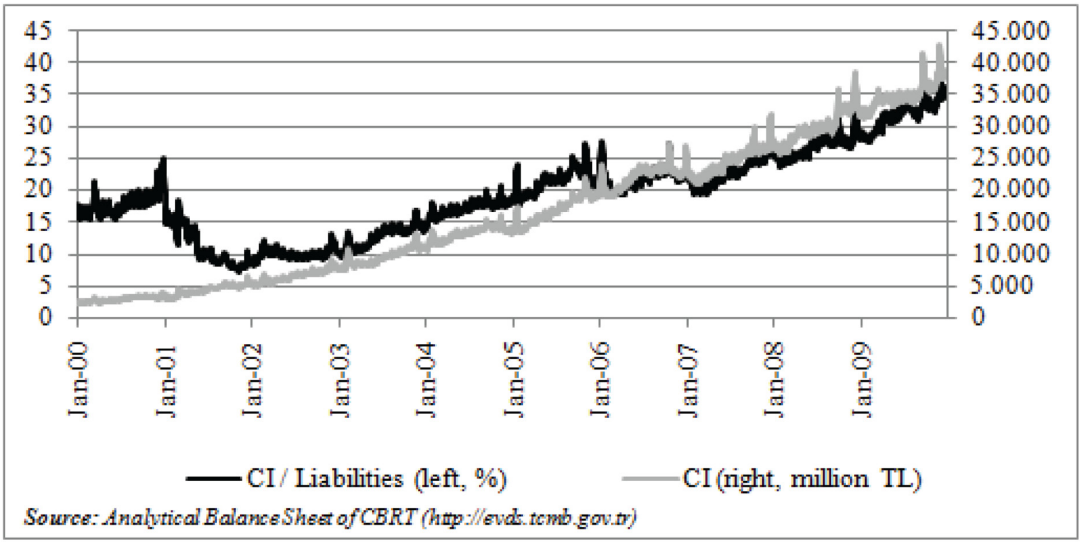
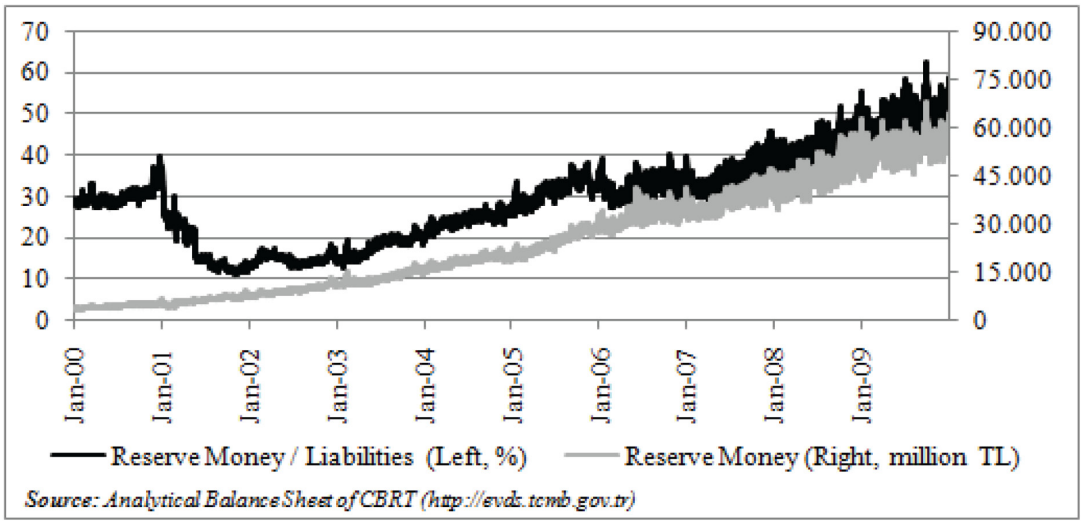


Figure 4. Reserve money during 2000-2009 period



When FA is increasing; if RM remains at the same level, it means TL was taken from the market by using OMO, so OMO item will rise. The same conclusion can also occur if the Treasury raised its deposits on the Central Bank. If there is any of these two transactions, reserve money increases. This process is called sterilization (Yardimci, 2006: 165). In theory the process of sterilization is quite straightforward, but in practice it may be difficult for the monetary authority to fully offset the effects of a change in net foreign assets. In countries with less developed financial markets the ability of sterilization may be constrained by the size and depth of the domestic bond market (Obstfeld, 1982).

Monetary Base (MB)

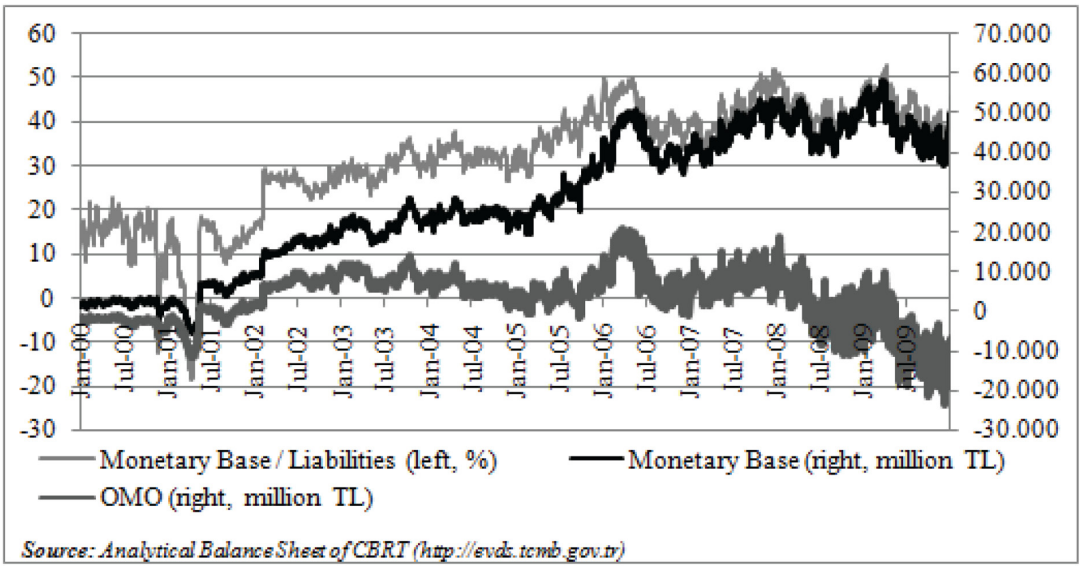
Monetary Base is equal to the sum of RM and OMO which is used to control liquidity in the banking sector by the CBRT.

Monetary Base = Reserve Money + Open Market Operations

The CBRT has been controlling the liquidity of the banking system through OMOs since 1987. The CBRT uses direct purchase, direct sales, repurchase agreement and reverse repurchase agreement transactions as a vehicle in OMOs (Gunal, 2006: 366). If the CBRT supplies liquidity to the market, in other words if it is creditor, OMO changes in the negative way.

The MB moved between 0-5 billion TL in 2000s, but it had a negative value at the end of the first quarter of 2001 due to the February 2001 crisis (Figure 5). The most important reason for this, the CBRT provided liquidity to the market by OMOs. In that context, the OMOs item was negative 5-6 billion TL during the period of November-December of 2000 and it reached negative 11 billion TL in April of 2001 because, the CBRT gave liquidity to the market. Similar movements were observed in 2008 and 2009 years. OMO began to fall below zero in the first half of 2008 and then increased again above zero but fell to negative 23 billion TL in December of 2009. Meanwhile, an upward trend in MB stopped in 2006 and moved around at 40 billion TL during 2007-2009 period.

Figure 5. Monetary base and open market operations during 2000-2009 period



The Central Bank Money (CBM)

The CBM which is total TL liabilities of the Central Bank to all units of economy is the largest monetary aggregate created by the CBRT. The CBM is the sum of RM, OMO and TL Deposits of Public Sector (Yardimci, 2006: 164).

Central Bank Money = Monetary Base + TL Deposits of Public Sector = (Reserve Money + Open Market Operations) + TL Deposits of Public Sector

Central Banks choose and tracks a monetary aggregate in order to control the liquidity in the market. It must pay attention to two points in this selection:

1. There should be a stable relationship between the selected monetary aggregate and money supply and economic activity,
2. The selected item should be affected by all monetary instruments of the CBRT.

This selected item is often the monetary base in foreign countries. In Turkey, the Central Bank used RM until 1989 for these purposes, but after the year 1989 the CBRT has followed CBM (Keyder, 2000: 210).

There are two important points about CBM. Firstly, in foreign exchange transactions, the CBRT's foreign exchange purchase and sale only affect the CBM. Secondly, all sub-items of the CBM have same effects on creating liquidity although they have different mechanisms. Consequently, so as to follow effects of monetary policy implementations over liquidity, the best monetary aggregate is CBM (Serdengecti, 1997: 19).

Analysis of the Analytical Balance Sheet via ratios is important in order to understand effectiveness of the CBRT's operations over the monetary aggregates (Eroglu 2008, 110). Accordingly, in both crises, CI was the primary item that causes an increase of CBM. Especially in 2008 the share of CI in the CBM is much more than in 2001, that means this is the most important factor of increasing the ratio of the CBM to total liabilities.

CBM was just one billion TL in 2000, but it reached 10 billion TL in 2001 because of an upswing of the Other Central Bank Money in 2001 (Figure 6). Moreover, the reason for this rise is that the OMO was negative in between 2000 and May of 2001 due to the fact that the CBRT supplied liquidity to the market after crises, while the OMO item was positive after June of 2001. The CBM fluctuated within the range 20-30 billion TL during 2002-2005 period, began to rise especially after 2005 and ascended above to 50 billion TL in May 2006 due to the CBRT's interventions. At the end of this year it fell to 40 billion TL but after that it began to increase again.

During the global crisis in 2008, the CBM remained at the same level of 55 billion TL according to previous year, because an increase in the free deposits of banking sector compensated the negative OMOs. In addition, the CBM was 50 billion TL in 2009.

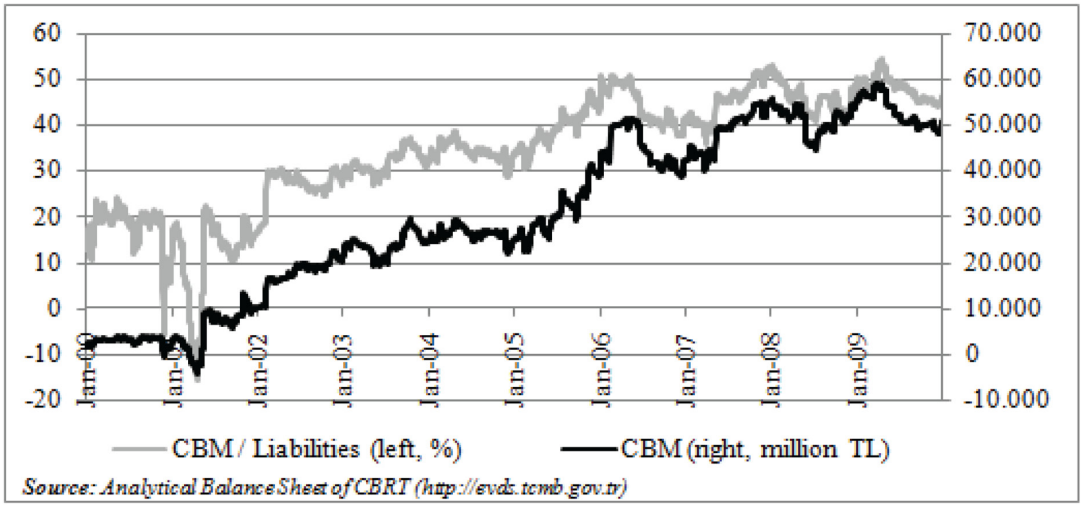
The ratio of the CBM to the liabilities demonstrates whether the CBRT's monetary policy is tight or expansionary (Eroglu, 2008, 110). At the beginning of 2000 while the CBM was 2 billion TL, this ratio was 15%; but at the end of 2001 while it was 10 billion TL, this ratio was 16%. This means, CBRT's power of ability to intervene to the market was low in this crisis period. The CBM reached almost half of total liabilities in 2008 and in 2009, as mentioned above, because especially a regular increase in the CI volume in this period compensated the negative OMOs. Consequently, the Central Bank had more power to intervene to the market in global crisis in 2008 according to the crisis in February of 2001.

CONCLUSION

Nowadays, the primary task of Central Banks is generally to provide and maintain price stability. For this purpose, Central Banks set monetary policies, so they can make changes over the macroeconomic balances. Accordingly, Central Banks use monetary policy tools to control the level of liquidity in the economy. In other words, the Central Bank is the main determinant of the money supply. In that context, the Analytical Balance Sheet of the CBRT is very important especially because it is a main indicator of what kind of a monetary policy that the CBRT follows.

The Central Bank has power to create money in the economy that affects the other economic units in close relationship, so its balance sheet is

Figure 6. The central bank money during 2000-2009 period



very important so as to monitor its effectiveness. Therefore, the changes occurring in the Central Bank's balance sheet are crucial indicators of its monetary policy. Accordingly, the Analytical Balance Sheet was created upon summing up and offsetting balance sheet of the CBRT to represent specific monetary aggregates in order to make the balance sheet more understandable and simple. The assets side of the Analytical Balance Sheet exhibits how to provide liquidity of economy, while the liabilities show the form of finance of liquidity need in the economy.

Turkey had three economic crises during 2000-2009 period. The first crisis was the banking crisis in November of 2000, the second one was the February 2001 crisis, which was currency crisis and last one was the global economic crisis in 2008. The changes in the CBRT's Analytical Balance Sheet in terms of these three crises are as follows:

The size of the Analytical Balance Sheet grew 255% year on year at the end of 2001 because of both an increase in the FA due to the devaluation on February of 2001 and also a rise in the DA. In 2008, its size expanded only 6.4%, year on year, but in 2009, it contracted 3%, year on year. This is because, in spite of the fact that FA climbed in the second half of 2008 due to the depreciation of TL, DA was negative due to decrease of Government Domestic Debt Instruments (prior to November 5, 2001).

The ratio of the FA to total assets of the CBRT entered declining trend after 2000 because of the crisis of 2001, but later on, it began to rise. That is to say that, increasing of the FA/assets means the country's source which is convertible into money regarding the other central banks and international markets is ascending. In addition, the currency risk rate which expresses a similar situation was in a downward trend in the crisis years of 2001 and 2008.

Total Foreign Liabilities escalated in 2001 due to the devaluation, so its monetary policy power has weakened significantly. After 2002, foreign exchange supply increased due to rise in international liquidity and risk appetite. In such an environment, the Central Bank benefited from the abundance of foreign currency in the market by raising its foreign exchange reserves and reducing its foreign liabilities.

In the crises, changes in monetary aggregates which are derived from liabilities of the Central Bank in the Analytical Balance Sheet as follows:

The first monetary aggregate was CI (emission) which is used for the difference between banknotes that are put into circulation and withdrawn from circulation. The share of the CI to total liabilities declined to 7% just after 2001 crises due to the currency substitution and high interest rates, but then it entered in an upward trend until 2009 up to 35%. In this case, the atmosphere of confidence and optimistic expectations that arise from the reverse currency substitution was effective.

The second item was RM which is the sum of CI, Required Reserves, Free Deposits, Extrabudgetary Funds and Deposits of Non-Bank Sector. Because of the fact that the confidence in TL declined due to 2000 and 2001 crises, the share of the RM in balance sheet decreased to 13%. In global crises this ratio moved in the range of 40%-50%.

The third monetary aggregate is the Monetary Base is equal to the sum of RM and OMO which is used to control liquidity in the banking sector by the CBRT. The MB moved between 0-5 billion TL in 2000s, but it had a negative value at the end of the first quarter of 2001 because the CBRT provided liquidity to the market by OMOs in February 2001 crisis. The CBRT uses direct purchase, direct sales, repurchase agreement repurchase agreement and reverse repurchase agreement transactions as a vehicle in OMO. It was at the value of negative 5,2 billion TL at the end of 2000 and negative 11 billion TL on the February 2001 crisis because the CBRT provided liquidity to the market through the OMOs. Similar situation was also observed in the global crisis in 2008. Similar movements were observed in 2008 and 2009 years.

The last monetary aggregate is the CBM which is total TL liabilities of the Central Bank to all units of economy. The CBM is the sum of the monetary base and TL Deposits of Public Sector. In the beginning of 2000 while the CBM was 2 billion TL, the ratio of the CBM to the assets was 15%; but at the end of 2001 while it was 10 billion TL, this ratio was 16%. That means, CBRT's power of ability to intervene to the market was very weak in that period. In addition, the ratio declined also in 2008 but not as much as the other two crises, but then it began to increase again in 2009.

As a result, the Central Bank's most important goal is to maintain price stability and control the creation of money in the economy. In this respect, it uses various monetary policy tools. The Analytical Balance Sheet of the CBRT and the monetary aggregates which are derived from the liabilities of the CBRT are the most important indicators in order to observe whether these tools are effective or not in terms of its monetary policy of the CBRT.

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KEY TERMS AND DEFINITIONS

Analytical Balance Sheet: It is created upon summing up and offsetting Balance Sheet of the Central Bank of Republic of Turkey (CBRT) in order to represent specific monetary aggregates.

Asset: The assets of the Analytical Balance Sheet of the CBRT exhibit how to provide liquidity of economy.

Central Bank: The entity responsible for overseeing the monetary system for a nation. Central banks have a wide range of responsibilities, from overseeing monetary policy to implementing specific goals such as currency stability, low inflation, and full employment.

Central Bank Money: It is total TL liabilities of the Central Bank to all units of economy and indicates the sum of the monetary base and TL Deposits of Public Sector.

Currency Issued: CI (emission) is used for the difference between banknotes that are put into circulation and withdrawn from circulation.

Economic Crises: A situation in which the economy of a country experiences a sudden downturn brought on by a financial crisis. An economy facing an economic crisis will most likely experience a falling GDP, a drying up of liquidity and rising/falling prices due to inflation/deflation.

Liability: The liabilities of the Analytical Balance Sheet of the CBRT show the form of finance of liquidity, which is needed in the economy.

Monetary Base: It is equal to the sum of RM and OMO which is used to control liquidity in the banking sector by the CBRT.

Reserve Money: It is the sum of CI, Required Reserves, Free Deposits, Extrabudgetary Funds and Deposits of Non-Bank Sector.

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Chapter 70
International Portfolio Diversification Benefits among Developed and Emerging Markets within the Context of the Recent Global Financial Crisis

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ABSTRACT

This chapter aims to examine the existence of dynamic linkages among the major emerging stock markets, namely Brazil, Hungary, China, Taiwan, Poland, and Turkey, as well as developed markets, particularly the US, the UK, and Germany during the period 2004-2013. Potential dynamic long-run interdependencies are investigated using Johansen and Juselius (1990) multivariate cointegration test and causal relationship through the Vector Error Correction Model (VECM). Moreover, to capture the impact of the recent global crisis on the cointegrating relationship among the developed and emerging markets, the sample period is divided into pre- and post-crisis sub periods. The empirical findings show that, after the crisis period, the direction of the long-run relationship varies, and furthermore, the stock market interdependence increases, supporting herding behavior of investors during the stock market crash period. Therefore, the increasing dynamic co-movements in the period after the crisis provide direct implications for the international investors due to potential limitation in the international risk diversification and the achievement of greater portfolio returns through global investment.

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INTRODUCTION

Portfolio management, in general sense, is the design of optimal portfolios that match the rational investor's objectives with the future prospects of portfolio manager. Modern portfolio theory states that investors constantly attempt to maximize the expected rate of return through diversification opportunities. The increasing trend in the free capital flows, technological developments in communication and trading systems, thereby, reduction in cost of information and the introduction of new financial products create more diversification opportunities for both individual and institutional investors. Rational investors make their decisions based on their risk aversion rather than maximizing the expected utility. Therefore, international investors have begun to implement international portfolio diversification as a tool for reducing the expected portfolio risk and maximizing the expected rate of return.

One of the main principles of international diversification is the existence of uncorrelated return among markets. When returns from investments in different countries' stock markets are not correlated, the opportunities generated from portfolio diversification are more profitable, according to modern portfolio theory (Elton & Gruber, 1995; Farrell, 1997, Strong, 2000). In recent years, however, globalization, economic and financial integration and assimilation between countries have enhanced the interdependency of global markets and these phenomena seem to affect the decisions of investors in the allocation of financial assets. It is well accepted that integration of financial markets, is primarily linked to economic growth through risk sharing benefits, improvements in allocation efficiency, and reductions in macroeconomic volatility (Pagano, 1993). Since greater integration exists between national stock markets, investors prefer to make an investment in the emerging markets to exploit benefits of international diversification, in the belief that there may be low correlations between developed and emerging markets. In this context, reflecting the trend towards greater integration of stock markets, this chapter explores how application of international portfolio diversification occurs among developed and emerging markets through an assessment of the impact of recent global financial crisis.

The recent global financial crisis is entitled as one of the most severe, because of its global nature. The crisis started in the US and spread through major stock markets all over the world, leading to confusion among policy makers and investment practitioners, and raising many questions relating to the subject of international financial integration. Characterized by turbulent financial markets and widespread economic slowdown across the countries since the middle of 2007, this crisis could be fuelling entirely negative impacts on international financial integration. Given that significant changes have occurred across the world financial markets, it appears timely and interesting to examine whether the relationships among these markets have changed over this crisis period. Therefore, understanding the interaction of global markets across countries interact could provide crucial inputs for policy purposes in dealing with crises spreading from one country to another.

This chapter concentrates on the following questions:

1. What is indicated by any dynamic long-run relationship among emerging and developed stock markets over the period?
2. Have the long-run relationships across stock markets changed since the recent global financial crisis?
3. What are the short-run linkages and causality effects between major developed and emerging stock markets over the period?
4. Are there any specific changes in the short-run and causal relationship among the sample countries after the recent global crisis?

5. How does the recent global crisis affect the integration of emerging and developed stock markets'?
6. What are the key implications of the recent global financial crisis on stock market integration?

Based on the questions above, this chapter investigates possible long-run relationship and short-run dynamic causal linkages between major stock markets in developed countries, particularly the US, the UK and Germany, and those in emerging countries, namely Brazil, Poland, Hungary, Taiwan, China and Turkey, during the period 2004-2013, and also assesses the impact of the recent global financial crisis on the level of financial integration among these markets. This study is of particular importance for both investors and corporate managers, as it considers the influences on international asset allocation and diversification benefits and the cost of capital, which contribute significantly to economic growth.

The contribution of this chapter to the literature is two-fold: First, it utilizes a comprehensive data set that includes daily data for the major stock markets of developed and emerging countries from April, 2004 to March, 2013. Second, it considers whether the recent global financial crisis has resulted in long and short-term structural changes on the co-integrating and lead-lag relationship among the stock markets. To the author's best knowledge, it would appear that a limited number of studies have addressed the issue of how this crisis altered market integration among these countries. By dividing the sample into two sub-periods, it also considers potential differences in terms of international diversification benefits available for both institutional and/or individual investors before and after the recent global financial crisis.

The rest of this chapter is organized as follows. The first part focuses on broad definitions and discussions of the topic within the scope of literature. The second part outlines the econometric methodology, followed by data set. The third part presents the empirical results. Future research directions are discussed in the fourth part. Finally, the chapter concludes with discussion of the overall coverage.

BACKGROUND

The study of Markowizt (1952) is esteemed as first to quantify portfolio diversification, and pioneered the concept of modern portfolio theory. There is always a tradeoff between risk and return in the field of investment. Basically, if an investor invests in an asset with high expected return, the expected risk would be higher for that asset as well. Modern portfolio theory is in the center of this tradeoff, and describes how to select a portfolio that would maximize the expected return through diversification opportunities. Starting from 1970s, liberalization trend in international stock markets led to international investment movements which encouraged international portfolio diversification (Haroon et al., 2012). The primary motivation for international portfolio diversification is to reduce the expected portfolio risk and expand the opportunities for expected portfolio return beyond those available through domestic securities. Investors are assumed to be risk averse in classical portfolio theory, thus they search for an optimal portfolio that maximizes the expected utility (Fama & MacBeth, 1973).

The total risk of any portfolio is composed of two types, systematic, referring to market risk, and unsystematic, referring to individual securities risk. The solution for unsystematic risk is to increase the number of securities in the portfolio (Eiteman et al., 2010). Moreover, investing in different sectors would reduce the company specific and industry specific risks which can be attributed unsystematic risk. However, in each case, systematic risk remains constant unless overall economic conditions change in the country. Therefore, to reduce systematic risk, modern portfolio theory

proposes to diversify the portfolio, by investing in different countries' stock markets which are not perfectly co-integrated or have inverse price patterns (Elton & Gruber, 1995; Coeurdacier & Guibaud, 2011; Haroon et al., 2012).

A growing literature focuses on international portfolio diversification. The majority of previous empirical research has concentrated on diversification opportunities in European stock markets (e.g. Taylor & Tonks, 1989; Corhay et al., 1993; Serletis & King, 1997; Dickinson, 2000; Yang et al., 2003; Demian, 2011), and in Asian and Pacific stock markets (e.g. Hung & Cheung, 1995; Corhay et al., 1995; Janakiramanan & Lamba, 1998; Fan, 2001; Karim et al., 2009; Haroon et al., 2012). Also many studies have examined stock market co-integration across regions (e.g. Hassan & Naka, 1996; Huang et al. 2000; Bessler & Yang, 2003; Kenourgios & Samitas, 2011; Gupta & Guidi, 2012). Moreover, as the correlations between developed markets increased, investors started to seek for new benefits of international diversification, and shifted the direction to emerging markets due to the perception of lower the correlations between developed and emerging markets. Therefore, in the literature, there are also a number of studies that focus on the diversification linkages between emerging markets, and developed markets (e.g. Syriopoulos, 2004; Kenourgios & Samitas, 2011; Yorulmaz, 2011).

Prior literature also provides empirical results for recent global financial crises in the context of portfolio diversification (Hwang, 2012; Meric et al. 2012; Niklewski & Rodgers, 2012; Thao & Daly, 2012). The results demonstrate that events of global importance have significant impacts on the correlation patterns of global stock markets. For instance, Hwang (2012) found no opportunities for global investors to improve their portfolio risk-return performance during 2007 crisis. Also, the study of Meric et al. (2012) demonstrated a considerable decrease in global portfolio diversification during this 2007 crisis. In addition, the effects of 1987 stock market crash on global portfolio diversification were studied by many researchers (Roll, 1988; Malliaris & Urritia, 1992; Arshanapalli & Doukas, 1993; Lee & Kim, 1993; Lau & McInish, 1993; Meric et al. 2001). Similarly, it was found that benefits of global portfolio diversification decreased significantly after the crisis periods. Since the existing studies on this issue are limited, it is crucial to assess whether the recent global crisis has had any effect on the dynamic linkages and interdependencies, as well as the benefits brought by international portfolio diversification, among the major developed and emerging stock markets, as the crisis due to the resulting in structural changes in the financial architecture.

METHODOLOGY

This chapter uses the methodology of cointegration analysis to investigate the issue of likely benefits of diversification through the dynamic comovements and linkages among developed and emerging markets. Interrelations and linkages among the developed and emerging markets are estimated by testing for the presence and number of cointegrating vectors. The cointegrating relationship allows us to determine whether there is stable long-run stationary relationships among the selected variables. To test for the causal dynamic relationship between these stock markets, standard causality test or vector error correction model is conducted.

Unit Root Test

To test for the existence of cointegration, the first step is to analyze each stock index series for the presence of unit roots, which shows whether or not the series are non-stationarity. The order of the integration of all series must be determined, and its equality for all series must be confirmed. Augmented Dickey and Fuller (ADF) (Dickey & Fuller, 1979, 1981) and Philips and Perron (PP)

(Phillips & Perron, 1988) unit root tests were used to check the non-stationarity properties of the series. Additionally, in order to confirm the validity of the ADF and PP unit root test results, Kwiatkowski, Philips, Schmidt and Shin (KPSS) (Kwiatkowski, Philips, Schmidt and Shin, 1992) unit root test was performed. The more general and common ADF test, which includes a drift plus a time trend, is based on the following model:

$$\Delta y_t = \alpha + \mu t + \rho y_{t-1} + \sum\nolimits_{i=1}^{k} \Delta y_{t-i} + \varepsilon_t$$

$$\varepsilon_t \approx i.i.d.(0,\sigma^2) \quad (1)$$

where Δ represents first difference of the series, the term μ indicates a trend variable, and ε_t is the white noise term. ADF test is only valid under the assumption of *i.i.d.* processes. The null hypothesis implies that y_t series contains a unit root when $\rho=0$. The rejection of the null hypothesis implies the stationarity of the series, implying that there is no unit root. The optimal lag length is determined by using the appropriate information criteria, such as Akaike information criterion (AIC) or the Schwarz information criterion (SIC).

PP test is a generalization of the Dickey-Fuller test and described as follows:

$$y_t = \alpha_0 + \alpha y_{t-1} + u_t \quad (2)$$

where u_t is the white noise term. Philips and Perron (1988) modified the ADF test by allowing the error disturbances to be weakly dependent and heterogeneously distributed, since the ADF test assumes that errors are statistically independent and have constant variance. This test tends to be more robust to a wide range of serial correlations and time-dependent heteroscedasticity.

Unlike the ADF and PP unit root tests, KPSS assumes the stationarity of the series as the null hypothesis and the rejection of the null hypothesis indicates a non-stationary time series. The KPSS test uses a frequency zero spectrum estimation of the residuals in:

$$y_t = \alpha_0 + \beta t + \varepsilon_t \quad (3)$$

The KPSS test is one-sided Lagrange Multiplier (LM) test and is described as follow:

$$LM = \sum\nolimits_{t=1}^{T} \frac{\left(\sum_{r=1}^{t} \varepsilon_t\right)^2}{T^2 f_0} \quad (4)$$

where f_0 is the estimator of the residual spectrum at frequency zero.

Cointegrating Vectors

If two or more variables are cointegrated, there may exist stationary linear combinations of these variables. In absence of a cointegrating relationship among the variables, the variables have no long-run interdependence and can drift arbitrarily from each other (e.g. Engle & Granger, 1987; Johansen; 1988). Johansen's methodology (Johansen, 1988; Johansen & Juselius; 1990) is applied to determine whether stock prices of developed and emerging markets move together over the long run.

Johansen cointegration approach, which takes its starting point in the vector autoregressive (VAR) analysis, utilizes maximum likelihood estimates to test for the number of cointegrating relationships in the multivariate system[1]. This approach relies on the relationship between the rank of a matrix and its characteristic roots (eigenvalues). Consider a VAR of order *p*:

$$z_t = A_1 z_{t-1} + A_2 z_{t-2} + \ldots + A_p z_{t-p} + \mu_t \quad (5)$$

where z_t is an n x 1 vector of variables, each of A_i represents a n x n matrix of parameters and μ_t is a zero mean white noise vector process. The VAR representation is also re-written as follows:

$$\Delta z_t = c + \prod z_{t-1} + \sum\nolimits_{i=1}^{p-1} \Gamma \Delta z_t + \mu_t \quad (6)$$

where

$$\prod = \sum_{i=1}^{p} A_i - I \quad \text{and} \quad \Gamma_i = -\sum_{j=i+1}^{p} A_j$$

If the coefficient matrix Π has reduced rank $r<n$, then there exist n x r matrices α and β each with rank r such that $\Pi = \alpha\beta'$ and $\beta' z_t$ is stationary. r represents the number of the cointegrating relationship (cointegrating rank), the elements α are known as the adjustment parameters in the vector autoregressive model and each column of β is the cointegrating vector. The Johansen approach provides the estimates of Π matrix, that is, α and β, using the 'reduced rank regression" procedure and tests whether the restrictions implied by the reduced rank of Π matrix can be rejected (Harris, 1995).

In order to determine the rank of matrix Π (that is, the number of cointegrating vectors), the characteristic roots or eigenvalues, λ of Π are estimated. Based on Johansen cointegration approach, two types of test statistics can be used for the hypothesis of the existence of r cointegrating vectors, maximum likelihood-based trace test (λ_{trace}) and maximum eigenvalue test (λ_{max}), which are computed by using the following formulas:

$$\lambda_{trace}\left(r\right) = -T\sum_{j=r+1}^{k} \ln(1 - \hat{\lambda}_j) \tag{7}$$

$$\lambda_{\max}\left(r, r+1\right) = -T\ln(1 - \hat{\lambda}_{r+1}) \tag{8}$$

where T is the sample size, $\hat{\lambda}_j$ and $\hat{\lambda}_{r+1}$ equal the estimated values of the characteristic roots (eigenvalues) obtained from the Π matrix, r is the number of cointegrating vectors. The trace test evaluates the null hypothesis of the existence of at most r distinct cointegrating vectors against the alternative hypothesis of n cointegtaing vectors, whereas the maximum eigenvalue tests the null hypothesis of r cointegrating vectors against the alternative hypothesis of $r+1$ cointegrating vectors. If the computed values of λ_{trace} and λ_{max} are less than the critical value provided by Osterwald-Lenum (1992), then the null hypothesis cannot be rejected. The optimal lag structure of vector autoregression model is determined by using Akaike Information Criterion (AIC) and Schwarz Bayesian Criterion (SBC).

On the basis of Johansen approach, two alternative models were conducted to compare and contrast the linkages among the stock markets in the multivariate system; *model 1,* a model with no trend and *model 2,* a model with a linear trend in the cointegrating vector.

Error Correction and Granger Causality

The direction of the relationship between the variables was investigated by employing the causality test based on Granger's approach (Granger, 1969). The linear Granger causality approach stated a testable definition of causality in terms of predictability in a set of non-cointegrated variables. In the presence of cointegration, standard Granger causality test is misspecified and a vector error correction model (VECM) can be formulated that captures both the long-run relationship and the short-run dynamics of the variables. The VECM depicts the feedback process and adjustment speed of short-run deviations towards the long-run equilibrium path. For two cointegrated series, x_t and y_t, the error correction mechanism can take the following forms:

$$\Delta y_t = \alpha_1 + \sum_{i=1}^{m1} \beta_{1i} \Delta x_{t-i} + \sum_{i=1}^{m2} \beta_{2i} \Delta y_{t-i} + y_1 z_{t-1} + u_{1t} \tag{9a}$$

$$\Delta x_t = \alpha_2 + \sum_{i=1}^{m3} \beta_{3i} \Delta x_{t-i} + \sum_{i=1}^{m4} \beta_{4i} \Delta y_{t-i} + y_2 z_{t-1} + u_{2t} \tag{9b}$$

where y_1 and y_2 are the error correction terms. The magnitude of the coefficients of these error correction terms represents the speed of adjustment back to the long-run equilibrium after the market shock. In the case of large coefficients, reversion to the long-run equilibrium will be rapid and z will be highly stationary.

DATA

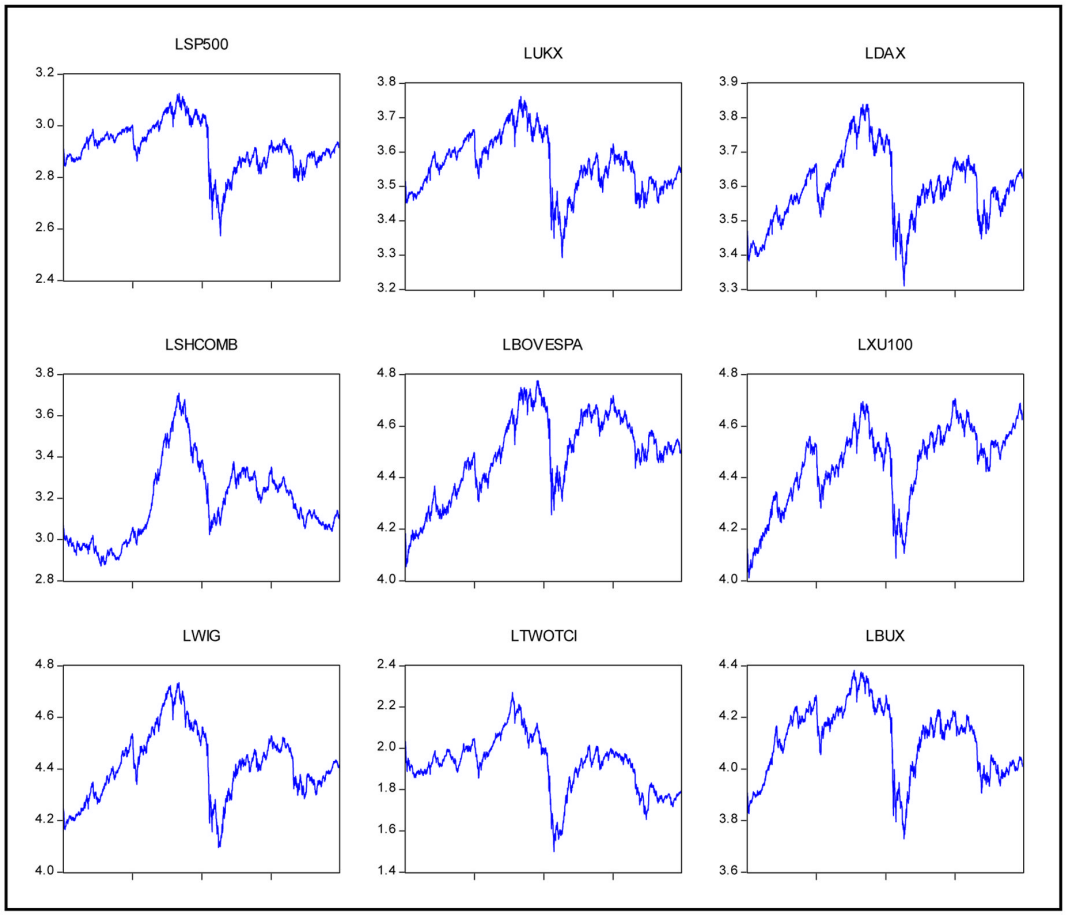
The dataset is comprised of the daily stock index closing prices from the sample markets from April 26, 2004 through March 8, 2013, obtained from Matriks Database. While the US, the UK and Germany were selected as representative for developed countries, the stock market indices of Brazil, Hungary, China, Taiwan, Poland and Turkey represented emerging stock markets (selected on the basis of their representativeness of emerging stock markets). Each stock price indices is denominated in US dollars. Any observations affected by national or other holidays are removed from the sample. Following the removal of these non trading days, 1991 observations were remained. As a means of conducting the impact of the global crisis on stock markets, the sample period was divided into two sub-periods. The beginning of August 2007 is chosen as the moment when the global financial crisis began to demonstrate its full manifestations on international stock markets. The first sub-period covers from April, 26 2004 to July, 31 2007. The second sub-period is from August, 1, 2007 to March, 8, 2013 corresponding to the post-crisis period.

The Lehman Brothers' collapse in September 2008 is used by many researchers as the event which reflects the beginning of the crisis on international financial markets. However, a more thorough investigation demonstrates manifestations of the crisis in the second half of 2007, and spreading across economies, and engulfing developed and emerging economies, as shown in Figure 1.

The descriptive statistics of the return structure for the sample stock markets are represented in Table 1. The mean excess return is lower in the developed stock markets (SP500 and UKX) whereas the mean return is found to be higher for Brazil (BOVESPA) and Turkey (XU100). As anticipated, the emerging stock markets exhibit higher volatility, as indicated by larger standard deviation values with the exception of China, Taiwan and Poland. The results for skewness point to all stock indices being skewed to the left. The presence of high value of kurtosis for each index demonstrates leptokurtic distribution. The results for skewness and kurtosis statistics also signify the non-normality of returns, supported by Jarque-Bera statistics suggesting that any of the return series are not normally distributed.

The unconditional contemporaneous correlation matrix of the developed and emerging stock market indices providing important information for the subsequent Granger causality tests is reported in Table 2. Partitioning the period into two sub-periods, it is observed that there is an increase in the pairwise correlations among all developed and emerging stock markets, and all stock markets interconnections were strengthened after the crisis period, except those between Poland-Taiwan and Turkey-Taiwan. This result is accompanied by increases in the standard deviations of market returns and a reflection of the wider worldwide trend of greater global financial integration. The stock indices of the US, the UK and Germany indicate high and positive correlations, averaged between 80% and 95%, suggesting weak portfolio diversification benefits among the developed markets before and after the crisis period. The correlation coefficients report that developed markets are highly integrated with the emerging markets, namely Brazil, Poland, Hungary and Turkey, in the short run. These finding may be associated to closer economic ties, geographic proximity and EU union accession process. Surprisingly, the relatively isolated markets of China and Taiwan exhibit low correlations with the all

Figure 1. Stock markets (log) plots



Note: *LSP500, LUKX LDAX, LSHCOMB, LBOVESPA, LXU100, LWIG, LTWOTCI, and LBUX* stand for the natural logarithm of stock prices in the US, the UK, Germany, China, Brazil, Turkey, Poland, Korea, and Hungary, respectively.

Table 1. Descriptive statistics

Variables	Index	Mean	Std. Dev.	Max.	Min.	Kurt.	Skew.	JB
USA	*SP500*	0.000028	0.021537	0.163582	-0.250623	19.92590	-1.104741	24159.26
UK	*UKX*	0.000046	0.020292	0.141071	-0.215918	15.56678	-0.951582	13394.87
Germany	*DAX*	0.000202	0.021966	0.167980	-0.230938	14.99537	-0.753375	12119.02
China	*SHCOMB*	0.000047	0.021753	0.107980	-0.166398	7.446637	-0.467735	1712.037
Brazil	*BOVESPA*	0.000380	0.026484	0.187099	-0.300137	17.12214	-0.978196	16853.83
Turkey	*XU100*	0.000626	0.025292	0.141483	-0.259147	11.62690	-0.840471	6405.232
Poland	*WIG*	0.000196	0.020806	0.107434	-0.211730	12.61403	-0.983965	7985.066
Taiwan	*TWOTCI*	-0.000275	0.020134	0.098440	-0.154339	9.076587	-1.005101	3396.750
Hungary	*BUX*	0.000135	0.024268	0.152027	-0.204375	11.80804	-0.471713	6506.609

Note: Std. Dev. indicates standard deviation. Jarque-Bera (JB) normality test statistic has a chi-square distribution with 2 degrees of freedom.

Table 2. Unconditional correlation matrix

	Variables	SP500	UKX	DAX	BOVESPA	BUX	SHCOMB	TWOTCI	WIG	XU100
Before Crisis	**SP500**	1.00000								
	UKX	0.80992	1.00000							
	DAX	0.79741	0.93994	1.00000						
	BOVESPA	0.81315	0.71708	0.69305	1.00000					
	BUX	0.58674	0.72372	0.68581	0.55849	1.00000				
	SHCOMB	0.48699	0.48081	0.45204	0.46589	0.37862	1.00000			
	TWOTCI	0.55105	0.61206	0.60165	0.47717	0.52212	0.41078	1.00000		
	WIG	0.70315	0.81717	0.77882	0.64361	0.79815	0.48646	0.61242	1.00000	
	XU100	0.62375	0.73652	0.71054	0.58207	0.70175	0.42166	0.60282	0.73332	1.00000
After Crisis	**SP500**	1.00000								
	UKX	0.83663	1.00000							
	DAX	0.85376	0.93826	1.00000						
	BOVESPA	0.85513	0.82484	0.81753	1.00000					
	BUX	0.72547	0.79711	0.80002	0.72207	1.0000				
	SHCOMB	0.48614	0.54682	0.53415	0.54745	0.49915	1.00000			
	TWOTCI	0.56774	0.63697	0.61822	0.59737	0.56667	0.55563	1.00000		
	WIG	0.76539	0.85331	0.84827	0.76711	0.79856	0.54921	0.61561	1.00000	
	XU100	0.72672	0.82083	0.80307	0.72768	0.73525	0.52871	0.61881	0.82251	1.00000

developed markets. Further investigation through cointegration techniques whether the short-term correlations among the developed and emerging markets support the existence of international diversification benefits for the long-term investment will be discussed in the next section.

EMPIRICAL RESULTS

Results of the Unit Root Test

To test for the presence of stochastic non-stationarity in the data, the integration order of the each stock index series is investigated using standard unit root tests. The ADF, PP and KPSS unit root tests are applied both with and without trend on the levels, and first differences of each series and the results are reported in Table 3. The null hypothesis of a unit root test is not rejected at the 1% significance level by both ADF and PP tests for any stock indices in the log levels. Hence, the first differences series reject the null hypothesis, indicating that they are integrated of order one, I (1). These findings are also supported by the KPSS test. The next step is to check whether the stock markets are cointegrated in the long-run.

Cointegration and Causality Analysis

Having established the unit root characteristics of the stock market indices, multivariate models can be conducted to allow examination of the presence or absence of cointegrating relationships among the emerging and developed markets. Johansen's approach, which requires the estimation of VAR (p), is employed to analyze whether developed and emerging stock market indices are jointly integrated. The optimal number of lag (p) of the VAR is determined based on Akaike Information

Table 3. Unit root tests

			ADF		PP		KPSS	
		Level/First Difference	**No Trend**	**Trend**	**No Trend**	**Trend**	**No Trend**	**Trend**
Before Crisis	**SP500**	Level	-0.912888	-2.407005	-0.964511	-2.460582	2.175871*	0.251923*
		First Diff.	-26.78615*	-26.78068*	-26.77105	-2676491	0.079112	0.048940
	UKX	Level	-0.894895	-2.550933	-0.885729	-2.718559	2.704174*	0.306638*
		First Diff.	-29.29536*	-29.28038*	-29.27603*	-29.26124*	0.051895	0.047289
	DAX	Level	-0.044479	-2.750244	-0.029821	-2.750244	3.000597*	0.188509**
		First Diff.	-28.72627*	-28.74211*	-28.71673*	-28.73591*	0.128175	0.056770
	BOVESPA	Level	-0.282233	-2.718028	-0.323188	-2.809058	3.060504*	0.159367**
		First Diff.	-27.16540*	-27.16174*	-27.15515*	-2.715515*	0.069166	0.038772
	BUX	Level	-1.077205	-1.985628	-0.994449	-2.003609	2.664819*	0.559949*
		First Diff.	-17.86755*	-17.85637*	-26.28736*	-26.27153*	0.068792	0.068611
	SHCOMB	Level	2.605255	-0.376504	2.532590	-0.488841	2.151006*	0.767245*
		First Diff.	-29.56490*	-30.10609*	-29.53252*	-30.12250*	1.480166*	0.043579
	TWOTCI	Level	0.716924	-2.127234	0.627430	-2.345925	2.257821*	0.320716*
		First Diff.	-25.26770*	-25.49099*	-25.29669*	-25.48461*	0.598559**	0.087796
	WIG	Level	0.341360	-3.226443***	0.229546	-3.393609***	3.250448*	0.210547**
		First Diff.	-18.03036*	-18.05672*	-27.84568*	-27.86570*	0.129527	0.032317
	XU100	Level	-0.903574	-2.121018	-0.799365	-2.093131	2.779769*	0.416620*
		First Diff.	-26.08118*	-26.06466*	-26.05255*	-26.03574*	0.061412	0.064951
After Crisis	**SP500**	Level	-2.202141	-2.023264	-2.033968	-1.803011	0.841325*	0.536699*
		First Diff.	-6.953302*	-7.008950*	-38.04734*	-38.07735*	0.165527	0.055397
	UKX	Level	-2.216877	-2.165856	-2.170975	-2.115511	1.103529*	0.414235*
		First Diff.	-7.140590*	-7.166269*	-35.41577	-35.41865	0.103598	0.047970
	DAX	Level	-2.166148	-2.040914	-2.143726	-1.967271	0.839947*	0.442236*
		First Diff.	-7.367854*	-7.401755*	-35.04438*	-35.05363*	0.133411	0.052715
	BOVESPA	Level	-2.255436	-2.485370	-1.999167	-2.224254	0.706801**	0.260344*
		First Diff.	-6.671278*	-6.670470*	-35.51938*	-35.50367*	0.056757	0.056087
	BUX	Level	-2.183812	-2.255926	-2.047045	-1.964740	1.100577*	0.330741*
		First Diff.	-6.542570*	-6.552310*	-32.38393*	-32.39456*	0.119021	0.083896
	SHCOMB	Level	-1.621405	-1.760921	-1.538913	-1.719635	2.462739*	0.347828*
		First Diff.	-32.09488*	-32.09187*	-32.09564*	-32.09257*	0.110324	0.079123
	TWOTCİ	Level	-2.117293	-2.074556	-2.270862	-1.957332	1.184502*	0.340903*
		First Diff.	-6.780843	-6.807140	-29.04153	-29.08944	0.239533	0.139857***
	WIG	Level	-2.085591	-1.884309	-2.171979	-1.872130	0.880924*	0.425195*
		First Diff.	-10.56787*	-10.60466*	-31.58764*	-31.65005*	0.216596	0.091486
	XU100	Level	-1.934897	-2.177374	-1.480473	-1.833652	0.801141*	0.345696*
		First Diff.	-6.592990*	-6.614105*	-32.99722*	-33.00757*	0.164509	0.084370

Note: *SP500, UKX, DAX, BOVESPA*, *BUX, SHCOMB, TWOTCI, WIG and XU100* represent natural logarithm of stock price index.

ADF: Optimum lag is selected according to the AIC, critical values are based on MacKinnon (1991); critical values are -3.43 (99%), -2.86 (95%), -2.56 (90%) and -3.96 (99%), -3.41 (95%), -3.13 (90%) with no trend and with trend, respectively. **PP:** Optimum lag is selected according to the AIC, critical values are based on MacKinnon (1991); critical values are -3.43 (99%), -2.86 (95%), -2.56 (90%) and -3.96 (99%), -3.41 (95%), -3.13 (90%) with no trend and with trend, respectively. **KPSS:** Optimum lag is selected according to Schwert (1989); critical values are 0.216, 0.146, and 0.119 for the model with trend; 0.739, 0.463, 0.347 for the model without trend and for 1, 5, and 10% respectively (KPSS, 1992).

*, ** and *** denote rejection of null hypothesis at 1, 5 and 10%, respectively

Criterion (AIC). The determination of the order of the stock market indices in the VAR model depends upon the market capitalization value of each series. As mentioned above, two alternative models, a model without trend (model 1) and a model with a linear trend in the cointegrating equation (model 2), are employed to compare whether the inclusion of trend in the cointegrating vector alters the critical values of the test statistics. Table 4 and Table 5 present the results of the λ_{trace} and λ_{max} tests, respectively. In the case of λ_{trace} test, the empirical findings of both models indicate that there are at most two cointegrating vectors for the pre- and post-crisis period, since H_0 of $r \leq 2$ is not rejected at the 5% significance level. The presence of a long run relationship is an evidence of financial integration among these markets, which will accelerate the adjustment process from the short run to the long run. However, the empirical findings of λ_{max} test reveal the presence of one cointegrating vector only for the post-crisis period in both versions of the model. Since the tests for cointegration utilizing both the λ_{trace} and λ_{max} statistics represent different results, λ_{trace} test is more preferable than λ_{max} test (Johansen & Juselius, 1990)[2].

Since cointegration tests carried out for the developed and emerging stock markets show a long run relationship, the coefficients in the cointegrating vector inform us the extent of the stock

Table 4. Tests for the presence of cointegrating vectors

	Null	Eigenvalues		Critical Values at 95%	
		Model 1	Model 2	Model 1	Model 2
Before Crisis	$r=0$	0.066967	0.073483	197.3709	228.2979
	$r\leq1$	0.058310	0.058320	159.5297	187.4701
	$r\leq2$	0.048784	0.048821	125.6154	150.5585
	$r\leq3$	0.035751	0.040572	95.75366	117.7082
	$r\leq4$	0.029238	0.034702	69.81889	88.80380
	$r\leq5$	0.020225	0.028011	47.85613	63.87610
	$r\leq6$	0.012821	0.019247	29.79707	42.91525
	$r\leq7$	0.006984	0.010552	15.49471	25.87211
	$r\leq8$	0.000100	0.005252	3.841466	12.51798
After Crisis	$r=0$	0.049245	0.058079	197.3709	228.2979
	$r\leq1$	0.036437	0.036719	159.5297	187.4701
	$r\leq2$	0.029414	0.032977	125.6154	150.5585
	$r\leq3$	0.024117	0.029395	95.75366	117.7082
	$r\leq4$	0.015519	0.018378	69.81889	88.80380
	$r\leq5$	0.013235	0.013546	47.85613	63.87610
	$r\leq6$	0.008345	0.013020	29.79707	42.91525
	$r\leq7$	0.005440	0.008332	15.49471	25.87211
	$r\leq8$	0.000335	0.005422	3.841466	12.51798

Notes: $H_1(r)$ against $H_1(n)$.

Model 1: Model without trend.

Model 2: Model with a linear trend in the cointegrating equation; critical values from Ostenwald-Lenum (1992).

Table 5. Tests for the number of cointegrating vectors

	Null	λm_{ax} Test		Critical Values at 95%	
		Model 1	Model 2	Model 1	Model 2
Before Crisis	$r=0$	53.71892	59.15063	58.43354	62.75215
	$r=1$	46.56136	46.56956	52.36261	56.70519
	$r=2$	38.76086	38.79100	46.23142	50.59985
	$r=3$	28.21457	32.09882	40.07757	44.49720
	$r=4$	22.99769	27.37151	33.87687	38.33101
	$r=5$	15.83479	22.01867	27.58434	32.11832
	$r=6$	10.00041	15.06163	21.13162	25.82321
	$r=7$	5.431379	8.221358	14.26460	19.38704
	$r=8$	0.077887	4.081154	3.841466	12.51798
After Crisis	$r=0$	61.05371*	72.33945*	58.43354	62.75215
	$r=1$	44.87433	45.22830	52.36261	56.70519
	$r=2$	36.09549	40.54127	46.23142	50.59985
	$r=3$	29.51455	36.07129	40.07757	44.49720
	$r=4$	18.91000	22.42549	33.87687	38.33101
	$r=5$	16.10795	16.48920	27.58434	32.11832
	$r=6$	10.13128	15.84435	21.13162	25.82321
	$r=7$	6.595037	10.11552	14.26460	19.38704
	$r=8$	0.405462	6.573618	3.841466	12.51798

Notes: $H_1(r)$ against $H_1(r+1)$.

Model 1: Model without trend.

Model 2: Model with a linear trend in the cointegrating equation; critical values from Ostenwald-Lenum (1992).

market integration in the long run. With respect to the reported two cointegrated vectors according to the λ_{trace} test, the influence of two developed markets (the US and the UK) on emerging equity markets was investigated. Table 6 reports the normalized cointegration vector from the two versions of the model for the pre- and post-crisis period. The relative size of the coefficient of the cointegrating vector provides considerable information about the role of the individual stock markets in the group.

The empirical findings of model *1* and model *2* indicate that the US stock market has a positive long run impact on Brazil, Poland and Taiwan, whereas a negative long run impact on Germany, China, Turkey and Hungary in the pre-crisis period. In the post-crisis period, the direction of the relationship between developed (the US) and emerging markets remains the same, except for Brazil in model *1*, and Brazil and Turkey in model 2. Surprisingly, the prevailing significant relationship disappears between the US and two emerging markets, namely Poland and Taiwan, in model *2*. The results indicate that these two pair-wise countries have relatively less financial importance in comparison with the other emerging countries in our sample. As noted by Forbes and Chinn, 2004, after the divergence of economic and industrial structures of countries, the degree of financial integration between the stock markets may also differ. Given the primary role of the US, the UK and Germany, in terms of trading volume, market capitalization, depth and liquidity, these findings are reasonable and consistent with the results of previous studies (Ratanapakorn & Sharma, 2002; Syriopoulos, 2006, 2007 and 2011). Overall, the findings reveal that the global crisis results both in changes in the direction of the long-run relationship among some markets, and causes striking increases in the relative size of the coefficients of all markets in the cointegrating vector. The increase in the magnitude of the interrelationship and dynamic linkages has in the post-crisis period among the developed and emerging markets is due to the herding behavior of the investors throughout the financial crisis period, and growing inflow and outflow of portfolio investments across developed and emerging markets.

The co-movements and linkages among these stock markets may be attributed to international financial globalization, and integration as well as, to the common path of their economies. The global crisis, as an external shock to the domestic markets, affected all emerging markets, leading to a long-run equilibrium path. Therefore, the presence of cointegrating relationship between developed and emerging markets reveals that the latter have become increasingly integrated with the former after crisis period, implying that long-run international investors who seek to diversify their portfolios across the emerging and developed markets should expect only modest long-term portfolio benefits. These findings are in line with the previous empirical findings (Meric et al., 2012). From such an investment allocation, it has become more difficult to reduce the portfolio risk because the diversification benefit is less effective across the cointegrated stock markets.

Error Correction and Causality

In the presence of cointegrating vectors across the developed and emerging markets under study, the possible short-run (uni-or bi-directional) Granger causal relationship among the stock markets is investigated through the VECM estimations. In addition to the short run causalities, the VECM captures both speed of adjustment through the long-run equilibrium path and lead-lag relationships between developed and emerging markets. Hence, it is possible to draw conclusions from these results for the international investment allocation.

In the VEC model, there are two approaches to estimating the causal relationship between the stock markets; one is through the error correction term, which estimates the response of the dependent variable to departure from equilibrium and

Table 6. Normalized cointegrated vector

		SP500	UKX	DAX	SHCOMB	BOVESPA	XU100	WIG	TWOTCI	BUX	TREND
Before Crisis	Model 1	1.000000	0.000000	-1.150426	-0.306973	0.446308	-0.245183	0.755045	0.212052	-0.228625	
				(0.28847)*	(0.07409)*	(0.19827)*	(0.14171)*	(0.15443)*	(0.12785)*	(0.10520)*	
		0.000000	1.000000	-0.359098	-0.149727	0.532754	-0.399494	0.074280	0.042423	-0.236702	
				(0.18345)*	(0.04712)*	(0.12609)*	(0.09012)*	(0.09821)	(0.08131)	(0.06690)*	
	Model 2	1.000000	0.000000	-1.139904	-0.286467	0.403493	-0.194982	0.651367	0.233705	-0.236428	0.0000901
				(0.26879)*	(0.06932)*	(0.18682)*	(0.13383)*	(0.23007)*	(0.13679)*	(0.09884)*	(0.00015)
		0.000000	1.000000	-0.334597	-0.098142	0.422576	-0.271080	-0.182737	0.096735	-0.257140	0.000225
				(0.13761)*	(0.03549)*	(0.09565)*	(0.06852)*	(0.11779)*	(0.07004)*	(0.05060)*	(0.00008)
After Crisis	Model 1	1.000000	0.000000	-5.666269	-1.089680	-2.721908	-1.325693	6.292273	-2.027003	4.056465	
				(1.51641)*	(0.53950)*	(0.96110)*	(0.52047)*	(2.03669)*	(0.91890)*	(1.23371)*	
		0.000000	1.000000	-1.065456	-0.241672	-1.028.004	-0.140186	0.515923	-0.143847	0.938914	
				(0.34209)*	(0.12171)*	(0.21682)*	(0.11742)*	(0.45947)*	(0.20730)	(0.27832)*	
	Model 2	1.000000	0.000000	-1.317942	-0.627204	-0.802583	0.913134	0.055026	0.090113	0.347244	-0.000884
				(0.32282)*	(0.14848)*	(0.20416)*	(0.26473)*	(0.43076)	(0.19443)	(0.30707)*	(0.00021)
		0.000000	1.000000	-0.183784	-0.141405	-0.642539	0.275978	-0.736741	0.293097	0.206779	-0.000148
				(0.14275)*	(0.06566)*	(0.09028)*	(0.11706)*	(0.19048)*	(0.08598)*	(0.13579)*	(0.00009)

Notes: Figures in () are standard errors.

Model 1: Model without trend.

Model 2: Model with a linear trend in the cointegrating equation. * indicates 1% significant level.

the other one is through the lagged differences of variables. The results of Granger causality tests through VECM between the stock markets are reported in Tables 7 and 8. The optimal lag length for the VECM is selected based on the Akaike Information Criterion (AIC) for each sub-period.

In order to investigate the speed of adjustment to restoring long-run equilibrium in the dynamic model, the error correction terms are estimated, and the results are reported in Tables 7and 8, Panel A. In the pre-crisis period, the ECT is found to be statistically insignificant in all developed markets except for the UK. In the post-crisis period, however, the UK ECT coefficient turned out to be insignificant. This may be explained by the fact that these developed markets appear statistically exogenous to the system and they determine the trends/paths that the other emerging markets will follow in the long-run, which is in line with the previous studies (Syriopoulos, 2007, 2011). For the

Table 7. VECM estimated for before crisis period

Panel A. Error Correction Term Estimates									
Variables	**SP500**	**UKX**	**DAX**	**SHCOMB**	**BOVESPA**	**XU100**	**WIG**	**TWOTCI**	**BUX**
ECT	0.019227	0.028382**	0.022253	0.007154	0.052440*	0.002008	-0.016508	-0.035720**	-0.021450
	(0.01246)	(0.01269)	(0.01448)	(0.01926)	(0.02043)	(0.02117)	(0.01616)	(0.01567)	(0.01726)
	[1.54313]	[2.23663]	[1.53667]	[0.37150]	[2.56709]	[0.09487]	[-1.02125]	[-2.27941]	[-1.24296]

Panel B. Granger Causality Test			
	F Statistic		**F Statistic**
SP500→UKX	25.5556*	BOVESPA→XU100	26.6222*
SP500→DAX	21.7645*	BOVESPA→WIG	18.5774*
SP500→SHCOMB	3.20090**	BOVESPA→TWOTCI	13.2294*
SP500→BOVESPA	0.44459	BOVESPA→BUX	21.5436*
SP500→XU100	23.7682*	XU100→SP500	0.37008
SP500→WIG	13.9952*	XU100→UKX	2.96367***
SP500→TWOTCI	11.5537*	XU100→DAX	0.41666
SP500→BUX	13.2930*	XU100→SHCOMB	3.48315**
UKX→SP500	0.62927	XU100→BOVESPA	0.37259
UKX→DAX	0.44849	XU100→WIG	0.54658
UKX→SHCOMB	2.51235***	XU100→TWOTCI	2.70534***
UKX→BOVESPA	0.93512	XU100→BUX	0.39053
UKX→XU100	2.52575***	WIG→SP500	2.82542***
UKX→WIG	0.25023	WIG→UKX	0.74780
UKX→TWOTCI	4.85384*	WIG→DAX	1.88422
UKX→BUX	1.61886	WIG→SHCOMB	3.75743**
DAX→SP500	1.19981	WIG→BOVESPA	4.92078*
DAX→UKX	0.83568	WIG→XU100	0.80587
DAX→SHCOMB	3.10944**	WIG→TWOTCI	7.88343*
DAX→BOVESPA	2.63092***	WIG→BUX	0.38887
DAX→XU100	3.62695**	TWOTCI→SP500	0.73428

continued on following page

Table 7. Continued

DAX→WIG	0.45320	TWOTCI→UKX	1.27798
DAX→TWOTCI	7.31959*	TWOTCI→DAX	2.43938***
DAX→BUX	1.49686	TWOTCI→SHCOMB	2.02329
SHCOMB→SP500	3.35566**	TWOTCI→BOVESPA	0.56392
SHCOMB→UKX	0.52000	TWOTCI→XU100	1.91855
SHCOMB→DAX	0.36999	TWOTCI→WIG	2.16633
SHCOMB→BOVESPA	4.30560**	TWOTCI→BUX	0.00516
SHCOMB→XU100	0.79256	BUX→SP500	0.51066
SHCOMB→WIG	1.26152	BUX→UKX	1.26181
SHCOMB→TWOTCI	2.17713	BUX→DAX	0.04942
SHCOMB→BUX	0.62341	BUX→SHCOMB	3.28051**
BOVESPA→SP500	0.86576	BUX→XU100	0.87568
BOVESPA→UKX	20.5822*	BUX→BOVESPA	0.22040
BOVESPA→DAX	13.4738*	BUX→WIG	0.88558
BOVESPA→SHCOMB	6.43574*	BUX→TWOTCI	3.11197**

Notes: Figures in (), [ ] are standard errors and t-statistics, respectively. *,**,*** indicate 1%, 5% and 10% significant level, respectively.

Table 8. VECM estimated for after crisis period

Panel A. Error Correction Term Estimates									
Variables	**SP500**	**UKX**	**DAX**	**SHCOMB**	**BOVESPA**	**XU100**	**WIG**	**TWOTCI**	**BUX**
ECT	-0.000805	0.004990	0.003542	-0.001695	0.001856	0.000769	-0.008811**	-0.000449	-0.008218***
	(0.00437)	(0.00395)	(0.00429)	(0.00389)	(0.00501)	(0.00458)	(0.00387)	(0.00372)	(0.00458)
	[-0.18399]	[1.26242]	[0.82517]	[-0.43579]	[0.37008]	[0.16774]	[-2.27685]	[-0.12058]	[-1.79480]

Panel B. Granger Causality test			
	F Statistic		**F Statistic**
SP500→UKX	18.1776*	BOVESPA→XU100	2.10407***
SP500→DAX	10.1389*	BOVESPA→WIG	0.41388
SP500→SHCOMB	10.2290*	BOVESPA→TWOTCI	4.99398*
SP500→BOVESPA	6.35331*	BOVESPA→BUX	4.73304*
SP500→XU100	5.74039*	XU100→SP500	2.04324
SP500→WIG	3.51748**	XU100→UKX	1.81410
SP500→TWOTCI	7.71023*	XU100→DAX	1.49023
SP500→BUX	8.65956*	XU100→SHCOMB	7.84621*
UKX→SP500	2.6.316**	XU100→BOVESPA	1.65225
UKX→DAX	0.18178	XU100→WIG	1.53655
UKX→SHCOMB	11.5630*	XU100→TWOTCI	4.33206*
UKX→BOVESPA	2.46581***	XU100→BUX	5.39618*
UKX→XU100	2.05937	WIG→SP500	5.26514*

continued on following page

Table 8. Continued

UKX→WIG	2.75126**	WIG→UKX	6.51636*
UKX→TWOTCI	4.27446*	WIG→DAX	6.29729*
UKX→BUX	2.00898	WIG→SHCOMB	10.6575*
DAX→SP500	1.15596	WIG→BOVESPA	4.57119*
DAX→UKX	0.06568	WIG→XU100	2.07568
DAX→SHCOMB	8.51174*	WIG→TWOTCI	6.42116*
DAX→BOVESPA	1.80968	WIG→BUX	7.42057*
DAX→XU100	1.64853	TWOTCI→SP500	3.10044**
DAX→WIG	2.15398***	TWOTCI→UKX	4.27735*
DAX→TWOTCI	5.02095*	TWOTCI→DAX	2.74514**
DAX→BUX	1.43772	TWOTCI→SHCOMB	4.33019*
SHCOMB→SP500	1.33218	TWOTCI→BOVESPA	5.83655*
SHCOMB→UKX	1.60980	TWOTCI→XU100	0.70372
SHCOMB→DAX	0.69820	TWOTCI→WIG	3.84063*
SHCOMB→BOVESPA	3.75617**	TWOTCI→BUX	1.04021*
SHCOMB→XU100	0.20826	BUX→SP500	0.50687
SHCOMB→WIG	1.49505	BUX→UKX	1.17614
SHCOMB→TWOTCI	0.54385	BUX→DAX	0.50896
SHCOMB→BUX	2.60136**	BUX→SHCOMB	5.71579*
BOVESPA→SP500	0.58076	BUX→BOVESPA	0.42239
BOVESPA→UKX	3.51280**	BUX→XU100	0.94132
BOVESPA→DAX	0.87162	BUX→WIG	1.11205
BOVESPA→SHCOMB	8.25508*	BUX→TWOTCI	2.50297***

Notes: Figures in (), [ ] are standard errors and t-statistics, respectively. *,**,*** indicate 1%, 5% and 10% significant level, respectively.

emerging markets, ECT is found to be statistically significant for Brazil and Taiwan pre-crisis period, whereas the post-crisis coefficient estimates for the ECT are found to be statistically significant mainly in cases of Poland and Hungary. These results imply that these emerging markets seem to be potentially influenced by short-run shocks in the developed markets. The larger ECT coefficients for Brazil stock market before the crisis period and Poland and Hungary stock markets after the crisis period state that a deviation from the long-run equilibrium following a short-run shock is adjusted more rapidly compared to the other stock markets. This may be linked to the fact that these emerging markets, namely Brazil, Poland and Hungary, are more closely integrated with the developed markets.

The results of the direction of the causal relationship and lead-lag effects between each pair of markets in our dataset for the two sub-periods are summarized in Tables 7 and 8, Panel B. The empirical results from the causality test support the international leading role of the US and German markets, implying that these markets have a strong impact on all other stock markets in both sub-periods, which is consistent with the previous studies (Massih & Massih, 1997; Ratanapakorn & Sharma, 2002). These findings appear to be reasonable because of

their market capitalization as well as foreign direct capital inflows and investors' stock investments in the emerging markets (Hanousek & Filer, 2000). Of all the emerging markets under study, the one that seems to have the most influence of the US market is China, due to the geographic proximity, robust trade and financial transactions and the highest market capitalization. As expected, the pre-crisis causal relationship between the US and China is found to be bi-directional, while Chinese stock market is not seen to exert any significant impact on the other developed countries, Germany and the UK. The global financial crisis that started in the US caused a slowdown of the growth in China. Hence, after the crisis period, the influence of China on the US stock market has totally disappeared. As a consequence, the recent worldwide financial crisis has proved that Chinese stock market remains isolated from the external shocks which originating from developed stock markets, especially, the US.

Surprisingly, for the pair-wise setting, only Poland and Taiwan represent bi-directional causal relationship among the developed and emerging markets after the crisis period, as in the case of unilateral causal effects of Poland on the US, China and Brazil; and Taiwan on Germany. During this recent crisis, the contagion originating in the US spread quickly to the other countries around the world. The episodic evidence of results confirms the possible short-run granger causal relationship among the stock markets post-crisis. On the other hand, taking the results of the tests for the Hungarian stock market into consideration, it seems that there was no change in the nature of the causal relationship over the time period. It is worth pointing out that no causal bi-directional relationship is detected between the US and Brazil for either sub-periods, despite the strength of trade, the geographical proximity, cultural factors and portfolio fund flows between the two economics. In the pair-wise setting of Turkey and the UK, it is noted that the initial evidence of causal relationship disappears in the post-crisis.

FUTURE RESEARCH DIRECTIONS

The dynamic co-movements and causal relationship among the developed and emerging markets under study studied in this chapter provides a guide for future research. In order to further understand the stock market interdependencies, in addition to conventional cointegration tests, regime-shifting cointegration models will be studied since they allow structural changes in the cointegrating vectors. Moreover, future research at these nodes will include variance decomposition and impulse response analysis. Variance decomposition analysis, which provides a quantitative measure of the linkages among the stock markets, explains the degree of a movement in a stock market through other markets, in regard to the percentage of forecast error variance of that market. Impulse response analysis, as a further investigation of the short-term relationship among stock markets, maps out the responsiveness of a particular stock market to the shocks emerging from other stock markets, and examines whether the impact of an unexpected shock is permanent or transitory in each stock market.

Additionally, future research at these nodes will capture the impact of the recent global crisis on the time-varying correlation dynamics by employing GARCH models. If stock returns exhibit GARCH effects, it is reasonable to expect that the cointegrating relationship among markets could be affected by the presence of time-varying volatility. Hence, the future research adopts the modified cointegration tests with time-varying volatility effects.

CONCLUSION

This chapter investigates short and long-run dynamic linkages and causal effects among stock markets of developed countries, particularly the

US, the UK and Germany, and emerging countries namely Brazil, Poland, Hungary, Taiwan, China and Turkey over the period 2004-2013, and examines whether the developed and emerging stock markets have been affected by the recent global financial crisis. The time period is considered long enough for stock markets to show the effects of the global crisis; therefore, the empirical findings have direct implications for the assessment of risk and return characteristics and will be helpful in understanding the short and long-run diversification benefits for international investors.

The multivariate cointegration test results demonstrate that the global crisis changes the direction of the long-run relationship between the US-Brazil, the US-Hungary, the UK-Brazil and the UK-Hungary stock market pairs for two alternative models. However, only, the integration of the US and the UK with Turkey becomes positive for one of the cointegration model after the crisis period although it is negative before the crisis period. The magnitude of the coefficients of the cointegrating vector increases after the crisis period among the developed and emerging markets which is informative on the respective role of the each market. The presence of high degree of correlations across emerging and developed countries can be attributed to an increase in economic and financial integration among these countries, and in fact, there is a growing inflow and outflow of portfolio investments across developed and emerging markets, which is a result of herding behavior of investors throughout the crisis period. The results of the Granger causality tests clearly reveal that the interdependencies among stock markets are generally greater in the post-crisis period. The US stock market has the greatest impact on all emerging markets in either sub-period, supporting the leading influential role of the US.

As expected, all empirical analyses confirm the strong interrelations between the stock markets after the crisis period, which, in turn, implies that the benefits of international portfolio diversification disappear after financial turmoil. These findings indicate that investors who try to diversify their portfolios among emerging markets as well as developed countries may expect rather short-run portfolio gains, since investment risk cannot be reduced, and market shocks can affect the portfolio returns. These results are in line with the findings of Grubel and Fadner (1971), Ripley (1973), and Panton et al. (1976) who point out that the benefits from international diversification will be reduced in the long run, because long-run interrelationship between stock markets are higher than those in the short run.

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KEY TERMS AND DEFINITIONS

Causality: If a time series is said to cause, or lead, another time series in the short run, or vice versa, there exists a causal relationship among the series, meaning that these time series affect each other in the short run.

Cointegration: If two or more than two series have a linear combination with each other at the same time period, then these series are said to be cointegrated, implying some underlying long-term equilibrium relationship.

Correlation: When two or more than two series are statistically related with each other involving dependency, then these series are said to be correlated.

Global Financial Crisis: Known as the "subprime mortgage crisis," started in the US in 2007 and resulted in a bankruptcy of many financial institutions, stock market crashes, and decline in economic activities all around the world.

International Portfolio Diversification: By making an investment in a variety of assets from foreign stock markets, investors can reduce

portfolio risk as much as possible by holding international assets that are negatively correlated.

International Stock Market: This market allows companies to raise a larger amount of capital than a single market and investors to hold stocks in a number of different countries simultaneously.

Vector Error Correction Model: A dynamical system that forecasts both the impact of one variable on another by directly indicating the speed of adjustments of one variable to restore equilibrium after the change in another variable.

ENDNOTES

1 The comparative advantage Johansen's approach is that it provides independent estimates of the multiple cointegration vectors.

2 The trace test provides more powerful result than the maximum eigenvalue test when the eigenvalues are evenly distributed (Kasa 1992). Moreover, according to Cheung and Lai (1993), the trace test indicates more robustness to both skewness and excess kurtosis in the residuals than the maximum eigenvalue test.

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Section 6
Emerging Trends

This section focuses on the new technologies and investment strategies that have become a prevalent part of Banking, Finance, and Accounting in the wake of the recent global economic crisis. In business, to stagnate is to perish, so business leaders in particular are constantly looking to the future. Recent developments discussed in this section include international banking operations, pervasive and social computing tools, and online and mobile investment portfolios. The final 12 chapters of this extensive three-volume reference conclude with a detailed look at emerging trends in the field of Banking, Finance, and Accounting.

Chapter 71
The Impact of Internet Adoption on the International Marketing of the Jordanian Banking Sector: Some Emerging Practices

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ABSTRACT

The research aims are to explore the extent of the banking sector's adoption of Internet applications in Jordan for marketing products and to identify the impact of such adoption on developing international markets. This study also aims to determine the major obstacles restraining banks marketing their products internationally through the Internet and to make recommendations conducive to an effective and optimal implementation of Internet applications for marketing bank products locally and internationally. The statistical software package SPSS was used to analyse data and test hypotheses and from the findings a series of recommendations were formulated for upgrading the banking industry in Jordan. A population frame included banking organisations in Jordan and a research sample of 19 banks was used involving an inclusive field survey. For the unit of analysis, the study analysed information and data gathered through the questionnaire which was distributed to managers and other personnel involved in marketing at banks. Statistical methods used to analyse data and test hypotheses were frequency rates and percentages relevant to the questionnaire, standard deviations and means, and multiple regression analysis. The key results from the statistical analysis have shown that the Jordanian banking sector's adoption of the Internet has had an impact on the international clients' commitment towards the banks.

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INTRODUCTION

This chapter considers the impact of adopting the Internet on the international marketing of the Jordanian Banking sector in terms of emerging practices. The main function of the marketing of business organisations is to make the important connection between the introduction of appropriate products that satisfy customers' needs and contributing to achieving the goals of the organisation. In the second half of the 1990's a number of academic articles asserted that the use of the Internet would transform the way firms and companies carry out their international marketing activities. Although the adoption of the Internet for marketing activities in the field of banking in developing countries is taking place at a fast rate, and the theoretical application of such technology is effective, little attention has been paid in the extant literature to emerging practices.

Information and Communication Technology (ICT) has brought about fundamental changes to many sectors in developing countries and the sectors in these countries have benefited considerably from the enormous and rapid changes taking place in the field of Information Technology (IT). Obviously, the banking sector in developing countries has a large financial potential, which can be used to invest in IT. Additionally, growing competition between banks at national and global levels has required significant expansion of their IT operations. This has been in concert with the sweeping wave of financial innovations which have been launched in recent years leading to fundamental changes in the processes of investing money and creating many new financial products and services.

This study has used quantitative research and descriptive statistical analysis involving the distribution of a questionnaire to branches of banks in Jordan. The statistical software package SPSS has been used to analyse the data and test the hypotheses and from the findings a series of recommendations have been formulated for the upgrading of the banking industry in Jordan.

The key results from the statistical analysis show that the Jordanian banking sector's adoption of the Internet has an impact on the international clients' commitment towards the banks and the international banking services have differed according to the size of the banks. Also, it has been found that the quality of the international banking services have differed according to the banks' experiences. Overall the Internet applications for the marketing of banking services have been undertaken in an efficient manner. The main obstacle facing the Jordanian banking sector's adoption of the Internet for marketing its services internationally is the lack of legislation with regard to the regulation and control of e-transactions.

In order to study the impact of Internet adoption on the international marketing of the Jordanian banking sector (Al-Fayoumi & Abuzayed, 2009) this chapter initially investigates Internet banking in Jordan which is one form of electronic banking (e-banking) in the country. E-banking is defined as "the use of electronic channels to communicate and transact business with both domestic and international customers, primarily through the use of the Internet and the World Wide Web" (McDowell, 2002, p. 40). Currently, there are three basic kinds of Internet banking that are employed in the market place and these are information, communication and transaction (Pereummal & Shanmugan, 2004, pp. 80-90). Wang et al. (2003) conducted a study based on a sample of 123 users in Taiwan, which aimed to identify the factors that determine acceptance of Internet banking by users. Perceived ease of use, usefulness and credibility were found to be significant antecedents of the intention to use an Internet banking system. The individual difference variable (i.e. computer self-efficacy) was found to be an important determinant of perceived ease of use, usefulness and credibility of Internet banking. People with higher computer self-efficacy were more readily prepared to use Internet banking services. Rotchanakitumnuai and Speece (2003) conducted a qualitative study to explore the barriers to Internet banking adoption

based on qualitative interviews with Thai firms. It was found that trust in the Internet was a critical issue inhibiting adoption, including worries about security of the system, low reliability of transactions, and distrust of the service provider. Those already using Internet banking seemed to have more confidence that the system was reliable, whereas non-users were much more service conscious, and did not trust financial transactions made via Internet channels. For non-Internet banking users the management of negative attitudes towards adoption, lack of management commitment, reducing IT resources and lack of motivation to use the Internet were major barriers to Internet banking adoption. Legal support was also a major barrier for corporate customers. Sathye (1999) conducted a study to quantify the factors affecting the adoption of Internet banking by Australian consumers. It was found that 75% of the total respondents had security concerns, 68% were not clear about the benefits or added value, 40% ascribed difficulty in use and 55% considered that an unreasonable price prevented adoption. June and Cai (2001) conducted a study to identify key quality attributes of Internet banking products and services by analysing Internet banking customers' comments on their banking experiences. The most frequently mentioned dimensions, as the main sources of satisfaction or dissatisfaction, were reliability, responsiveness, access and accuracy. Bradley and Stewart (2002) conducted a study to investigate the drivers and inhibitors of the adoption of Internet banking and the future level of adoption. The external factors were the most important drivers in the overall decision to adopt, the key inhibitors were the most important drivers in the overall decision to adopt, and future World adoption of Internet banking was expected to be 85% of retail banks by 2011. Guru et al. (2003) conducted a study based on a sample of 37 banks which evaluated Internet banking sites in Islamic countries and levels of banks' adoption of Internet banking. It was found that the range and quality of Internet banking varied widely from country to country, Islamic banking institutions were fast catching up, they had been successful in the introductory phase of Web banking, some of the banks in the Middle East had well-developed Internet banking web sites, and Islamic banking had gained momentum over the years. Finally, Rexha et al. (2003) conducted a study based on a survey of bank corporate clients in Singapore. It was found that trust was the key factor influencing the adoption of electronic banking, perceived customer satisfaction with the bank only impacted indirectly on the adoption of electronic banking, and customer satisfaction, trust, and the use of electronic banking were found to have a positive impact on the corporate clients' commitment towards their bank.

In Jordan, the banking sector has endeavoured to keep pace with global developments, and has shown considerable interest in modern technical applications especially in the field of communication networks. The banking industry has, therefore, sought to carry out the automation of processes linking branches and providing benefit through technological advancement in terms of automated services. Due to limited research into the adoption of the Internet for the international marketing of the banking sector in Jordan the chapter seeks to explore the impact of such adoption on the marketing of banking sector's products at an international level and the emerging practices that are evident. The study also seeks to determine the major obstacles limiting the banking sector in terms of the marketing of its products internationally through the Internet. The chapter provides recommendations conducive to an effective and optimal implementation of Internet applications for the international marketing of the banking sector in Jordan.

BACKGROUND

The presentation of the literature review below on the impact of Internet adoption on the international marketing of the Jordanian banking sector has

been linked and the relationships between different levels of the literature illustrated according to the following sections: "Marketing Jordanian Banking Services," "The Banking Sector in Jordan," and "E-Banking Transactions and Services in Jordan."

Marketing Jordanian Banking Services

In the Kingdom of Jordan the real implementation of marketing within banking organisations has taken place only very recently compared to other sectors within the country. In fact, the marketing of banking was not known in the early 1950s but has since become well defined. The marketing of banking services in terms of its concept and objectives does not differ greatly from those of marketing generally. The concept of banking services marketing represents a series of activities intended to provide the beneficiary with banking services according to demand and the standards required. It is a process of harmonisation based on objectives and capabilities through which the banking organisation can provide a marketing mix that meets the beneficiaries' requirements (Sumaidaie, 2001, p. 89). Banking marketing represents the process of satisfying beneficiaries' needs by delivering banking services at the right time and place in return for appropriate marketing costs through accepting deposits, delivering loans and undertaking credit and investment according to a well integrated system which takes into account the objectives of the beneficiaries, banks and the state within the context of an effective marketing mix (Naji, 1995; 2003).

The Jordanian banking industry today is in the middle of an information technology (IT) revolution involving technology changes which have created greater competition among the banks and this has led to increasing banking automation. Traditional branch-based banking remains the most widespread method for conducting banking transactions as evidenced in other countries. However, the considerable advances in technology, deregulations, globalisation, and liberalisation measures have resulted in a completely new operating environment for banks. Services and products like tele-banking, Internet banking (Baraghani, 2007; Celik, 2008; Hernandez et al., 2007; Sattabusaya et al., 2007; Zheng, 2010), Web banking (Casalo et al., 2008), e-banking, online banking (Han, 2008), etc., have become buzzwords with the banks endeavouring to cope with competition by offering innovative and attractive packaged technology based services to their customers (Akram & Asghar, 2012; Musiime & Ramadhan, 2011; Sorournejad & Monadjemi, 2011).

The Banking Sector in Jordan

The banking sector in Jordan consists of the Central Bank of Jordan (CBJ), private banks, special –credit institutions and money-exchange companies. Banks operating in the Kingdom are distributed according to sixteen national banks including two banks working according to Islamic Sharri'a, two Arab banks and three foreign banks. These banks practice their activities through 449 branches and 154 offices. However, there were 139 bank branches and representation offices for the Jordanian banks operating abroad by the end of 2008 including 58 branches in Palestine (Central Bank of Jordan, 2008).

In Jordan the majority of banks have moved steadily towards Internet banking and these banks have tried to introduce Internet-based e-banking systems (Casalo et al., 2008; Riyadh, 2009) to improve their operations, reduce costs and meet customers' demand and to deal with increased competition. Banks started Internet banking initially with simple functions such as information gathering about interest rates, checking account balances and computing loan eligibility. Services were then extended to online bill payment, transfer of funds between accounts and cash management services for corporations. Following this banks have facilitated payment for e-commerce transactions by directly debiting bank accounts or through credit cards.

Financial and banking services offered by the Jordanian banks, which are marketed and sold on the Internet through e-commerce channels, include sophisticated financial and banking services. Banks' Web sites on the Internet contain promotional information and pictures intended to facilitate and consolidate contacts with customers and identify their views and needs. Such information includes introducing the bank's achievements, a description of the bank's activities and the overall services marketed by the bank (Mash'al & Abbas, 2002, p. 77-88). These services include opening different types of accounts, enquiries about the source, transfer from one account to another, paying invoices for household and commercial services, loans services, buying and selling foreign currencies, issuing different credit cards, buying and selling traveller's cheques, financial brokerage services, executing purchase orders and selling shares, along with trade financing operations and guarantees.

It has been found that Jordanian banks have been successful in the introductory phase of Web banking at a basic level including institutional and promotional information, but they have not fully utilised the concepts and applications of Web banking at intermediate and advanced levels compared to developments in international markets. Some of the commercial banks in Jordan offer e-banking services (Casalo et al., 2008; Riyadh, 2009).

For this study, a sample of banks has been randomly chosen which provide a sample of services offered and how these are related to e-commerce has been investigated. These banks include the Arab Bank (AB), Jordan Kuwait Bank (JKB), Jordan National Bank (JNB) and the Citi Bank (CB) (Royal Jordanian Society, 2002). The Arab Bank is the Amman-based Arab Bank, Jordan's first institution in the private sector in the Arab world. The Arab Bank is ranked as one of the largest global financial institutions as listed by Fitch (A-), Standard and Poor (A-) and Moody (A3). The capital base of the Arab Bank is US $6.9 billion in total assets of $38.3 billion and income before tax of 1001.1 million dollars in 2007. A sample of electronic services offered by the Arab Bank includes Internet banking (the Arab bank was the first to launch Internet banking services in the country), Internet shopping card (ISC), mobile bank and WAP banking.

The Jordan Kuwait Bank was established in 1976 in Amman as a Jordanian joint investment between Jordanian and Kuwaiti investors and investors from other Arab countries. The group of investors had the idea of attracting capital from Kuwait to invest in Jordan which was known for its efficiency and the development of its workforce. The investment and development opportunities offered by Jordan were based on certainty of success and the Jordan Kuwait Bank is one of the few projects that have been established and through joint Arab contributions it has been able to continue successfully. The Jordan Kuwait Bank offers electronic services including on-line stock trading and the bank offers this service in collaboration with its affiliate organisation the United Financial Investment Company (UFICO). The service allows JKB customers to trade in Amman through UFICO's Web site and settle the value of shares traded through JFK's Internet banking service directly from their accounts with the bank. Other services include Net Banker for performing banking transactions and Cyber branch which is a comprehensive electronic bank providing services directly to clients on a 24 hour basis.

The Jordan National Bank Plc was one of the earliest national banks to be established in Jordan in 1955. It operates 54 branches and offices in Jordan, 35 of which are in the Greater Amman area including Al Ahli International Bank, a subsidiary 85.5% owned by the Jordan National Bank, the international banking unit in Limassol-Cyprus, and 5 branches in the West Bank. The bank's principal activities include retail and corporate banking services, such as deposits and all principal foreign currencies, lending, trade finance,

foreign exchange and credit cards. The Jordan National Bank is regarded as a retail bank with a strong market position and customer base and it offers central banking services such an E-com card which is a pre-paid electronic card, which allows purchase of the World Wide Web, the phone and mail order.

The Citibank N.A. ('Citi') was first established in Jordan in 1974 and it is now a fully licensed commercial bank with two branches located in the capital city, Amman. They have approximately 70 employees based in Jordan, which are responsible for Citi's business in Jordan, Syria and the Palestine National Authority, and they are presently the only commercial US bank in the country and the only global foreign bank with senior local management. A sample of electronic services offered by Citi Bank include on-line bank statements (the customer can access online bank statements on time), online bill payments (the bank offers two services: a safety check and checking plus), and wireless alert (the customer can use Citi Bank's free wireless alerts to receive information on their text-enabled digital cell phone at any e-mail address).

According to Mash'al and Abbas (2002, pp 77-88) banking transactions in Jordan have progressed through four phases. The first phase began with communication through the Internet only using e-mail and browsing the Internet. The second phase took the form of a Web site for promoting the bank. The third phase proceeded making an advanced step through linking the website with other websites and exchanging information either with foreign or internal systems. Finally, the fourth phase involved making full banking transactions.

E-Banking Transactions and Services in Jordan

Many Jordanian commercial banks have shown an interest in e-banking and have invested a considerable part of their public expenditure for providing sophisticated electronic financial and banking services (e-banking). This tendency has led to reducing the cost of banking operations and promoting the local banking market. A system has been introduced connecting the ATM systems of licensed banks through a joint network (JONET) which enables customers to receive banking services at any time. Jordanian banks have been linked to the international payment systems such as VISA and Master Card where holders of such cards can use them to pay for purchases directly out of their accounts through points of sales outside the Kingdom. They have also been able to provide banking services through a number of e-channels including home banks and the phone and mobile banks. Other banks have provided banking and financial services through a number of call centres, automated banks and Internet banking. Since Jordan has assumed a leading role for countries in the Middle East, with rapid growth rates in the use of Visa credit cards, it is expected that the Kingdom will have considerable growth in banking services.

There have been a number of drivers for Internet banking in the Jordanian banking systems involving increased investments in e-communications technology with greater access to e-commerce through the Internet. There has been reduction in the cost of banking operations by providing banking services on an ongoing basis without need for human involvement which has reduced the cost of banking service procedures. This has reduced the operational costs and other administrative expenses. By coping with regional and international competition the Jordanian banking sector is expected to face strong competition following international agreements and arrangements. In the light of these the Jordanian market will be open to regional and international competition. This means that there will be strong competition with foreign banks wanting to operate in Jordan. In order to face up to competitive international banks in terms of investing in, and adopting, banking technology,

improving transactions using financial and monetary instruments, and upgrading Web sites on the Internet, the Jordanian banks will have to access and develop financial and monetary services and products which depend on international automated technologies like the Internet. By doing this the Jordanian banks will be able to retain a reasonable share of banking services.

Many customers prefer to process their banking transactions from their offices or homes at any time of the day without having to stand in long queues to obtain a particular banking service. Most businessmen prefer to carry out their banking transactions including the opening of documentary credits and financial brokerage works on the Internet while they are at work whereby they can reduce the costs and time involved. The banking sector in Jordan has for the past few years realised the importance of the developments in the field of communications technology and its impact on international banking business. Jordanian banks are undertaking to understand and apply technology to the services they provide. However, it is apparent that despite these banks' awareness of the importance underlying the need to provide financial and banking services, through the Internet and e-commerce to reach a new and wider customer base, the steps made have been slow. Jordanian banks with websites have tended to use these in the past only for promoting their services and not for using services on the part of customers for completing their transactions.

According to the Jordan Kuwait Bank (2008), banking services cannot be produced in advance or stored and are intangible. The bank, branch or employee cannot produce samples that will be put on-show to clients before selling. The banking service is provided once the client's needs, requirements and capacities have been ascertained and it is produced and delivered (sold) simultaneously. The product quality can often be verified by the clients after sale through a feedback process intended to ascertain the extent to which the service satisfies customer needs.

The Internet has made fundamental changes to the basic principles of transacting business. The implications and effects of these developments on business marketing might be even more significant. What is clear about these developments is that some of the basic tenets of marketing are being called into question. This part of the study sheds light on the application of the Internet in bank marketing and the impacts of such applications on the marketing mix elements. It can be argued that the traditional concept of marketing is no longer adequate to meet the increased demands of customers and the ever-changing competitive business environment. Therefore, it is necessary for banks to adopt new strategies to achieve competitive advantage (Al-Rousan & Qawasmeh, 2009) by integrating customer relationships and developing interactive marketing.

RESEARCH METHODOLOGY

The research aims are to explore the extent of the banking sector's adoption of Internet applications in Jordan for marketing products and to identify the impact of such adoption on developing international markets. This study also aims to determine the major obstacles restraining banks marketing their products internationally through the Internet and to make recommendations conducive to an effective and optimal implementation of Internet applications for marketing bank products locally and internationally. The main research problem is the absence of a clear and comprehensive understanding of the banking sector's adoption of the Internet in Jordan to market products and services and the impact of such adoption on marketing products. Arising from this the research question is – does the adoption of Internet applications by the Jordanian banking sector affect the marketing of products at an international level? This study used a quantitative analytical research method and descriptive statistical analysis involving the distribution of a questionnaire to branches of

banks in Jordan. The statistical software package SPSS was used to analyse data and test hypotheses and from the findings a series of recommendations were formulated for upgrading the banking industry in Jordan. A population frame included banking organisations in Jordan and a research sample of 19 banks was used involving an inclusive field survey. For the unit of analysis the study analysed information and data gathered through the questionnaire which was distributed to managers and other personnel involved in marketing at banks. Questionnaire forms were submitted to managers, officers and other personnel involved in marketing on the Internet regardless of their job titles in the departments of marketing and sales, public relations, finance, computing, information technology and information systems, electronic services, research and development. The three types of variables were independent, dependent and moderating variables. The independent variable was the adoption of the Internet by banks in Jordan. The variable was measured according to developing services' quality, pricing, distribution and promotion. The dependent variable was international marketing and the moderating variables were size (assets), experience (number of years) and the presence of branches abroad. SPSS was used to analyse the data and test the hypotheses. Statistical methods used to analyse data and test hypotheses were frequency rates and percentages relevant to the questionnaire, standard deviations and means, and multiple regression analysis.

The null and the alternative hypotheses investigated in this study are:

Hypothesis 1:

Ho: The banking sector's adoption of Internet applications in Jordan does not affect the international banking services' quality, prices, distribution and promotion.

Ha: The banking sector's adoption of Internet applications in Jordan affects the international banking services' quality, prices, distribution and promotion.

Hypothesis 2:

Ho: The banking sector's adoption of Internet applications in Jordan has no impact on the international clients' commitment towards the bank.

Ha: The banking sector's adoption of Internet applications in Jordan has an impact on the international clients' commitment towards the bank.

The results of the analysis of the data and the testing of the hypotheses are reported in the findings.

FINDINGS

The findings of the study are reported according to the adoption of Internet applications, the impact of the Internet and obstacles facing the banking sector's adoption of the Internet in Jordan and the marketing of services internationally. In order to determine whether the banks had, or had not, been adopting Internet applications within the elements of the marketing mix this was investigated for service development, pricing, distribution and promotion of banking services.

Internet Applications

As evidenced in the findings, 63.2% of banks adopted Internet applications to develop their *services* in an efficient manner. These banks provided up-to-date and developed information on the Internet about the diversified services marketed by them. Also, these banks simplified procedures and steps which the client goes through to obtain services via the Internet, and provided new banking services corresponding to the clients' different needs and desires, expanded and diversified online banking services already offered commensurate with the surrounding environment and responding to various proposals and views submitted by clients about online banking services. Further-

more, these banks continuously kept improving their electronic systems and the technology used in delivering online banking services.

Some two thirds of banks adopted Internet applications according to *pricing*, but this adoption was not at the required level. This became clear in the responses of banks with regard to whether they publish their statements of fees and charges relating to the use of their Internet banking services. Banks appeared to co-ordinate their pricing decision with other marketing elements taking into consideration economic conditions and competitor banks' prices and the cost along with the profit margin in determining the process of their online services.

Twelve out of the nineteen banks (63.2%) adopted Internet applications in distributing their banking services efficiently. The results indicated that these banks drew up a clear plan for *distribution* of their online banking services and took into consideration designing a website adapted to the clients' different needs, desires and cultures. Moreover, these banks maintained and developed their websites to secure continued service delivery and coverage of targeted markets. Also, the websites of these banks contained instructions about the way to obtain services and to pay for them.

Sixteen out of the nineteen banks (84.2%) adopted Internet applications efficiently in promoting their banking services. It was found that the banking sector's adoption of Internet applications in promoting its services was the major adoption among other elements in the marketing mix (84.5%), which reflected the importance of promotional activities on the Internet for banks in marketing their services. This finding is consistent with the study of Awamleh et al. (2003), which found that most Jordanian banks present institutional and promotional information in their websites.

These banks drew up a clear plan for promoting banking services on the Internet, advertised on the Internet, retained contact and interaction with their clients before and after delivering services and published information and news about their bank's services in the form of news items through the Internet. Furthermore, they sought to establish and consolidate relations with their audience through the Internet. However, sales promotion as an element of the promotional mix was not adopted efficiently by banks for promoting online banking services. This was clear in the responses of the banks which measured whether the banks provide rewards for promoting online banking services marketed via the Internet.

Impact of the Internet

In order to shed light on the impact of the banking sector's adoption of the Internet analysis was undertaken on international banking service quality, price, distribution, promotion, and the international clients' commitment towards the bank. The banking sector's adoption of the Internet had an impact on the international banking services quality of 12 out of the 19 banks (63.2%). These impacts become clear in the light of the findings, which indicated that the adoption of the Internet enabled these banks to offer their international clients reliable, accurate, secure, improved and immediate banking services via the Internet to meet their expectations. Furthermore, the accessibility and ease to contact international online banking services and ATM networks have also been indicated.

The adoption of the Internet affected service prices for two thirds of the banks. This became clear in the light of the results, which indicated that the adoption of the Internet by these banks contributed to increase price competition and standardisation of prices of online banking services across borders, and reduced prices as a result of international baking competition. Furthermore, attracting market share beyond geographical borders and promoting banks' competitive advantage through the prices of banking services were delivered via the Internet.

Twelve out of nineteen banks' (63.2%) adoption of the Internet affected their international banking services distribution. This impact became clear in terms of delivering banking services to the largest possible clients beyond geographical borders according to proper time and place and achieving a continuing contact with them on a 24 hour basis. Furthermore, reducing the distribution cost and creating policy changes in distributing banking services in international markets have also been clarified.

Internet applications affected the international banking services promotion of 18 out of 19 banks (94.7%). This result shows that the highest impact of the banking sector's adoption of the Internet was the impact on promoting its services internationally. This impact became clear in the light of the findings, which illustrated the important role of promotional activities on the Internet in informing current or prospective clients in international markets by virtue of the variety of banking services, invoking clients' interest beyond geographical borders and persuading them to deal with the bank and bolstering ties and relations with them. Furthermore, reducing the promotion costs of banking services through the Internet in international markets has been demonstrated compared to the traditional promotion methods, creating policy changes in terms of promoting banking in international markets and the remarkable improvement in the process of market intelligence at an international level.

The banking sector's adoption of the Internet affected the international clients' commitment towards 12 of the 19 banks (63.2%). This impact became clear in terms of meeting international clients' satisfaction and enhancing their trust in banks. Furthermore, this was consolidated in international clients' loyalty to the banks and their frequent use of their Internet banking services. This finding is closely related to the study of Rexha et al. (2003), where it was found that customer satisfaction, trust, and the use of electronic banking were found to have a positive impact on the corporate clients' commitment towards their bank. Also, this finding is consistent with the survey of ForeSee Results and Forbes.com (2003), in which it was found that customers using online bill payment are more satisfied with their banks than customers not utilising online bill payment. Moreover, online bill payment has a significant direct impact on adoption, loyalty and will also increase the frequency of use of online banking.

Obstacles Facing the Banking Sector's Adoption of the Internet for Marketing its Services Internationally

The major obstacle facing the banking sector's adoption of the Internet, and for marketing its services internationally and ranked first, was lack of legislation that regulates and controls e-transactions (100% of respondent banks). This finding is consistent with other studies, for example, the existing legacy system became an inhibitor for the adoption of Internet banking (Bradley & Stewart, 2002). Jordan is still suffering from a lack of basic requirements for implementing the Internet as a result of a deficiency related to the absence of rules for implementation for legal and financial aspects (The Royal Scientific Society, 2003), and legal support is also a major barrier to Internet banking adoption for corporate customers (Rotchanakitumnuai & Speece, 2003). The obstacles that were ranked second (94.7%) were increasing computer crimes, fraud and piracy on the Internet, concerns related to the privacy and security of transactions delivered via the Internet. This finding is consistent with those from other studies, for example, privacy and security concerns was a major reason for not currently using online banking (ForeSee Results & Forbes.com, 2003), security concerns affecting the adoption of Internet banking by Australian consumers (Sathye, 1999) and security was the prime issue for those not banking online (Singh, 2004). Also, other obstacles ranked second were lack of an efficient strategy for marketing banking services

internationally on the Internet and the low level of clients' trust in e-transactions. This finding is consistent with those found in other studies, for example, trust in the Internet is one of the most critical issues inhibiting adoption, including worries about security of the system, low reliability of transactions, and distrust in the service provider (Rotchanakitumnuai & Speece, 2003). A major obstacle facing implementation at an international level was the poor rate of trust in the payment process (The Royal Scientific Society, 2003). Obstacles also included poor demand for banking services marketed by the bank via the Internet outside geographical borders, which ranked third (89.5% of respondent banks), followed by lack of safety in e-payments and e-money on the Internet, inability to compete in international markets, and lack of a homogenous mixture of technical expertise, information technology knowledge and marketing skills, which ranked fourth (78.9% of respondent banks). This finding is consistent with the study of Awamleh et al. (2003), which found that non-availability of information technologies, packages, solutions and human resources was one of the major challenges facing further development of Web banking in Jordan.

The null (Ho) and the alternative (Ha) hypotheses investigated in this study were:

Hypothesis 1:

Ho: The banking sector's adoption of Internet applications in Jordan does not affect the international banking services' quality, prices, distribution and promotion.

Ha: The banking sector's adoption of Internet applications in Jordan affects the international banking services' quality, prices, distribution and promotion.

Multiple regression analysis was used to test the hypothesis and it was found that the calculated F value was greater than the tabulated F value. According to the decision rule accept Ho if the calculated value (F) is less than the tabulated value (R) and reject Ho if the calculated value (F) is greater than the tabulated value (R). Since the calculated value (F) was greater than the tabulated value (R) Ho was rejected and Ha was accepted. Thus, the banking sector's adoption of Internet applications in Jordan affects the marketing of its banking services at an international level in terms of quality, process, distribution and promotion.

Hypothesis 2:

Ho: The banking sector's adoption of Internet applications in Jordan has no impact on the international clients' commitment towards the bank.

Ha: The banking sector's adoption of Internet applications in Jordan has an impact on the international clients' commitment towards the bank.

Again, multiple regression analysis was used to test the hypothesis and it was found that the calculated F value was greater than the tabulated F value. Thus, the banking sector's adoption of Internet applications in Jordan has an impact on the international clients' commitment towards the bank.

CONCLUSION

In the light of the statistical findings there are a number of significant conclusions and recommendations. The banking sector's adoption of Internet applications in Jordan has had an impact on the international clients' commitment towards the banks. This impact has become clear in terms of meeting international clients' satisfaction and enhancing their trust in the banks. Furthermore, this has consolidated international clients' loyalty to the banks and their frequent usage of their Internet banking services (Sorournejad & Monadjemi, 2011). The influence of the banking sector's adoption in Jordan of Internet applications on international banking services quality

differs according to the different size of banks. Meanwhile, the impact of such adoption on international banking services' prices, distribution, promotion, and international clients' commitment towards the bank does not differ according to the different sizes of banks. The effect of the banking sector's adoption in Jordan of Internet applications on international banking services' quality differs according to different banks' experiences. Meanwhile, the impact of such adoption on international banking services' prices, distribution, promotion, and the international clients' commitment towards the bank does not differ according to the different banks' experiences. The bearing of the banking sector's adoption in Jordan of Internet applications on marketing its services internationally does not differ insofar as banks have branches abroad. It appears that the banking sector in Jordan adopts Internet applications for marketing its banking services in an efficient manner. Banks adopted Internet applications in developing, distributing, and promoting their banking services (Sorournejad & Monadjemi, 2011) efficiently. But in terms of pricing adoption was not to the required level. The major obstacle facing the banking sector's adoption of the Internet for marketing its services internationally was lack of legislation to regulate and control e-transactions.

Further to the conclusions some approaches are recommended for emerging practices to enhance the process of improving the efficiency of adopting Internet applications for marketing banking services in Jordan locally and internationally. Banks have to continuously improve their online security (Rotchanakitumnuai & Speece, 2003; ForeSee Results & Forbes.com, 2003) in order to increase consumer confidence. Since the Internet is an open network, Internet banking customers appear to be much more concerned with security of their banking transactions and the privacy of their personal information than do traditional banking customers. Therefore, the Internet banks should do their best to ensure security of their customers' personal information and banking transactions. Banks should also advertise and publicise their security innovations, as this will play a role in improving consumer confidence in their service. If customers are aware of what is on offer, they will soon want to use it (Akram & Asghar, 2012; Musiime & Ramadhan, 2011).

Banks should implement appropriate public awareness programmes and train their customers to use their online facilities in order to grow their Internet service usage (Casalo et al., 2008). Training can be conducted through the banks' regional training centres. Institutions and personnel such as universities and technicians have the infrastructure available, and sessions could be held for bank customers using either the banks' trainers or lecturers who have been trained as trainers. Training should not be restricted to current customers. Banks need to educate the potential market. Therefore, banks could try and capture final year students by providing them with free Internet banking training. Banks should pay more attention to sales promotion, the important element in the promotional mix. It was found that 21.1% of banks only provided rewards or lower prices for promoting online banking (Han, 2008) services. Banks could allocate a portion of the savings they enjoy from customers using Internet banking and reward them with incentives. The rewards that could be given to Internet bankers are limited only by the imagination of the banks. Some ideas that could be used include double airline miles, points that could be redeemed for products, entry into a competition that carries a large financial prize, incentives for introducing new online bankers, customers who pay water and electricity bills online could receive a month's free electricity.

The banks are required to keep increasing the speed of online systems' responses to customers' input, upgrading the websites' navigational functions, and improving the compatibility of their online systems with customers' application software as well as hardware. It is necessary to take into consideration that these websites do not target solely clients inside Jordan, but are also of

a universal nature, and their design should reflect cultural, linguistic and technological differences. There is a need to formulate and implement integrated educational and training plans that aim to prepare a qualified technical workforce capable of developing and managing Internet applications to World standards. Prior to engagement in cross-border e-banking (Casalo et al., 2008; Riyadh et al., 2009) activities, a banking institution should conduct an appropriate risk assessment (Alrawashdeh et al., 2011) and due diligence. It needs to establish an effective risk management programme for these activities. International harmonisation of electronic banking regulations must be a top priority. This means intensifying cross-border co-operation between supervisors and co-ordinating laws and regulatory practices internationally and domestically across different regulatory agencies. There is a need to provide insurance for hardware appliances, software, information networks, and employees of information technology departments against damage, error, cheating, robbery and fraud. It is necessary to draw up effective strategies for enhancing e-banks' works in Jordan and marketing their banking services both locally and internationally on the Internet in order to cope with challenges posed by international competition vis-à-vis the banking industry.

Research Limitations

There are three research limitations to this study of the impact of Internet adoption on the international marketing of the Jordanian banking sector. First, there is limited consideration of the updating and improvement of laws and legislation related to banking work. Second, computer fraud and crime have not been investigated in depth. Third, the attention paid by banks to the issue related to the supply and demand of Internet banking services (Sorournejad & Monadjemi, 2011) at the time of pricing the services has only received cursory attention.

Future Research Directions

In response to the research limitations future research needs to investigate how to update and improve laws and legislation related to banks' work in conformity with requirements, developing a legal framework warranting confidentiality of transactions (Hayale & Khadra, 2006) between clients and banks and tackling all issues related to e-business (Alawneh & Hattab, 2009) such as digital signatures, digital identity, tax treatment and consumer protection, etc. Laws for computer fraud and crimes should also be investigated and put in place to protect those using online banking to give them a sense of trust and security. Such law should be harmonised with international law since computer crimes are international in nature. It is necessary for banks to pay greater attention to the issue related to the supply and demand of Internet banking services at the time of pricing these services and to publish their statement of fees and charges relating to the use of their Internet banking services (Sorournejad & Monadjemi, 2011) as an emerging practice.

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KEY TERMS AND DEFINITIONS

E-Banking: Electronic, Internet, and WWW channels of communication to transact bank business for customers domestically and internationally.

E-Business: Internet used to sell, buy, or exchange services or products.

E-Commerce: Buying and selling goods and services over the Internet.

E-Market Place: An electronic market place that allows buyers and sellers to communicate online.

Information and Communication Technology (ICT): The use of computer based information systems (ISs) and communication systems (CSs) to process, transmit, and store information and data.

International Marketing: Marketing undertaken by organizations across national boundaries or overseas.

Internet: The worldwide network of networks that use the TCP/IP communications protocol.

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Chapter 72
XBRL:
A New Global Paradigm for Business Financial Reporting

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ABSTRACT

Ranked as one of top ten technologies for accounting and auditing professionals, eXtensible Business Reporting Language (XBRL) is a freely available, open, and global standard language for exchanging business financial information digitally. XBRL holds the greatest promise for building a global standard that is pledged to enhance the accuracy, reliability, efficiency, accessibility and availability of electronic communication of business financial data. This paper sets out to provide a review of literature to lend insights into our understanding of XBRL adoption, implementation, and value realization assessment. A comprehensive review uncovers four sub-themes of research in XBRL adoption: perceived benefits of XBRL adoption; organizational readiness; external pressure; and XBRL adoption. Research challenges for future research are highlighted.

INTRODUCTION

The persistent rise of high profile corporate accounting scandals in recent years highlights the urgency for more effective corporate financial reporting that is informative, credible, and readily accessible to regulators, investors, and other stakeholders (Lester, 2007). As an evolving information technology for web-based financial reporting (Doolin & Troshani, 2007), eXtensible Business Reporting Language (XBRL) holds the greatest promise for building a global standard that is pledged to enhance the accuracy, reliability, efficiency, accessibility and availability of electronic communication of business financial data (Baldwin *et al*, 2006; Lester, 2007; Stantial, 2007; Vasarhelyi et al., 2012; Willis, 2005; Yoon *et al*, 2011). Initiated in 1998 by the AICPA, and now administered by a global consortium, XBRL streamlines the preparation of financial statements both internally and externally (Taylor & Dzuranin, 2010). XBRL is considered an important enabler of corporate transparency (Apostolou & Nanopoulos, 2009; Bonsón et al., 2010; Debreceny et al.,

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2011; Ionescu, 2011; Roohani et al., 2009) and an example of breakthrough value adding accounting information technology (Alles et al., 2008).

XBRL is an information technology that provides an identifying tag for business information such as total sales to create an unambiguous way to identify and compare information of one company to another (Hoitash *et al*, 2006). Self-describing markups or tags provide notations to contents of a document and thus allow the search and extraction of desired information by purpose-built computer programs without downloading an entire document (Jones & Willis, 2003; Vasarhelyi et al., 2012). XBRL tags are defined and organized using a systematic classification scheme called a taxonomy that defines financial reporting concepts and their relationships as per specific legislation or standards (Deshmukh, 2004; Lester, 2007; Strader, 2007). Files with tagged financial information are called XBRL instance documents (Janvrin & Mascha, 2010). XBRL tags can be applied to financial statements after they are generated or implemented directly into an accounting information system (Vasarhelyi et al., 2012). By separating content from format, XBRL benefits all members of the financial information supply chain by making information exchangeable between different applications and systems and easy to extract, search, and reuse by users (Jensen & Xiao, 2001). The computer readable and searchable XBRL-tagged document will lead to a fundamental revolution in financial reporting as users like investors and analysts can download not only the traditional financial report but also consistent representations of the data that were combined and aggregated to create that report (Hannon, 2002; Plumlee & Plumlee, 2008). It's also perceived as a useful IT productivity tool by auditors (Chironna & Zwikker, 2011; Janvrin et al., 2008). The American Institute of Certified Public Accountants has ranked XBRL as one of top ten technologies for accounting and auditing professionals (Peng & Chang, 2010).

XBRL facilitates the automated production and consumption of large volumes of business performance information by combining the immediacy and reach of the Web with the ability of information consumers to incorporate corporate information directly into their data warehouses and decision models (Debreceny et al. 2010). Because of such expected benefits (Bovee et al., 2005), XBRL is quickly becoming the reporting standard for financial information worldwide (Taylor & Dzuranin, 2010). Many countries such as Australia, Chile, China, Denmark, Germany, India, Israel, Italy, Japan, Luxemburg, Singapore, Spain, South Korea, the United Kingdom, and the United States have started mandating XBRL adoption (O'Kelly 2010; Srivastava & Kogan 2010; Yoon et al. 2011). Regulators in many jurisdictions such as Canadian Securities Administrators are still assessing the costs and benefits from XBRL adoption.

Given the rising interest in XBRL assessment and implementation among academics, financial statement preparers and regulators (Janvrin & Mascha, 2010), this article reviews extent research into XBRL technology to reveal key theories, key findings and key challenges. This paper is organized as follows. The next section presents a brief overview of our research methodology in conducting this review. It's followed by a review of literature that includes XBRL as a central variable in the study. The paper concludes with a summary of findings and highlights unresolved challenges for future research.

RESEARCH METHODOLOGY

A search of the key word "XBRL" is conducted with ABI/Inform, Business Source Premier, and Science Direct (Elsevier) databases. The bibliographies of key articles are further checked to ensure that other articles are not overlooked. Finally, every issue of leading journals in information systems and accounting information systems is searched

since 1998 for appropriate literature. The search is limited by choosing articles from peer-reviewed academic journals. Articles that merely mention XBRL as a recent technology are removed from the sample.

LITERATURE REVIEW

137 articles from 57 peer-reviewed academic journals have been reviewed. Three major themes are observed: XBRL adoption, implementation, and value realization assessment. XBRL adoption research theme is broken into four sub-themes as per the Iacovou et al. (1995) model: perceived benefits; organizational readiness; external pressure; and XBRL adoption. The literature review is provided next. Then, challenges for future research will be discussed.

Major Theme 1: XBRL Adoption

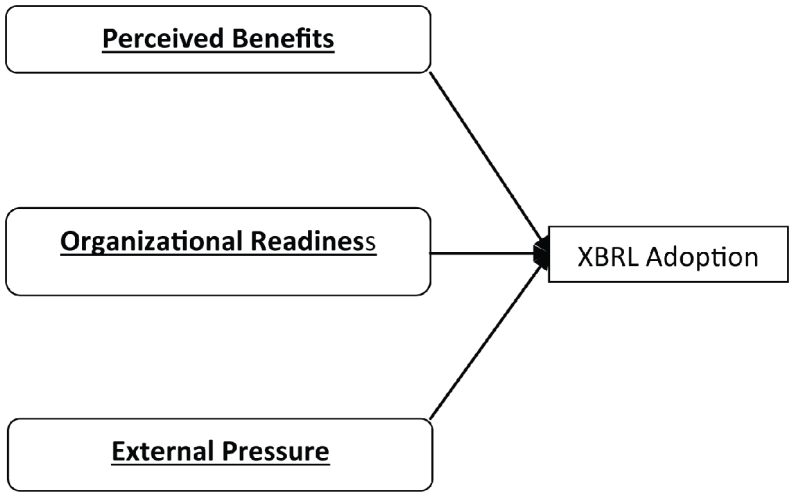
The adoption of innovations such as XBRL often results from a mixture of pull and push influences (Warren, 2004). Many theories have tried to identify drivers in the decision to adopt a new technology. Theory of reasoned action (TRA) (Fishbein & Ajzen, 1975) asserts that individual behavior such as technology adoption is driven by intentions, which are a function of an individual's attitude. Based on TRA, technology acceptance model (TAM), an information systems theory, proposes that users' attitude toward adopting a new technology is influenced by the perceived usefulness and perceived ease-of-use of the technology (Davis et al., 1989). Theory of planned behavior (TPB) (Ajzen, 1991) extends TRA and posits that the immediate antecedent of a given behavior is the intent to perform it and that the intent can be predicted by three conceptually independent determinants of intention: attitude, subjective norms, and perceived behavioral control. Decomposed TPB incorporates perceived usefulness and ease of use from TAM as mediating variables for the attitude construct in TPB (Taylor & Todd, 1995). In addition to these models at the individual level, models have been developed for understanding IT adoption at the firm level. For example, the technology, organization, and environment (TOE) framework (Tornatzky & Fleischer, 1990) identifies technological, organizational, and environment contexts as influential in a firm's adoption of an IT. Iacovou et al. (1995) combine technological and organizational context factors to reflect organizational readiness and add perceived benefits as an additional critical factor (Oliveira & Martins, 2011). As per the Iacovou et al. (1995) model, XBRL adoption research theme is broken into four sub-themes: perceived benefits; organizational readiness; external pressure; and XBRL adoption as depicted in Figure 1.

Sub-Theme 1: Perceived Benefits

Common to TRA, TAM, TPB, and the Iacovou et al. (1995) model is the belief that perceived benefit or usefulness of a technology contributes to attitude formation toward the adoption of a technology. In face of the growing interest in online business reporting and XBRL, research tends to have a means/ends focus which tells us what the technology can do and the potential benefits that will be derived (Williams et al., 2006).

XBRL is expected to improve digital financial information quality and prevent the financial chicanery present in accounting scandals (Seetharaman et al., 2005). Researchers (Apostolou & Nanopoulos, 2009; Bonsón et al. (2010); Debreceny et al., 2011; Florescu & Tudor, 2009; Graziano, 2002; Ionescu, 2011; Roohani et al., 2009) believe that XBRL will provide financial executives with the critical ability to provide the transparency required by recent governance regulation. Bizarro and Garcia (2010) think that XBRL can improve internal control as the machine-readable XBRL eliminates manual intervention such as rekeying of data or manipulation via a spread sheet with associated labor costs and possibility for error.

Figure 1. XBRL adoption research themes as per the Iacovou et al. (1995) model



Uniquely identifying each line item on the financial statement and tagging the method of accounting used, XBRL standardizes current financial reporting data to resolve comparability issues resulted from different naming conventions, accounting policies, or account aggregation levels (Vasarhelyi et al., 2012).

XBRL is expected to benefit the preparer of financial information. XBRL is expected to facilitate real-time reporting, continuous auditing, and rapid and versatile preparation of business information to facilitate reliable and accurate data reporting (Cunningham, 2005; Dye, 2010; Estebanez et al., 2010; Gray & Miller, 2009; McGuire et al., 2006; Pitre, 2007; Rezaee et al., 2001; Rezaee & Turner, 2005; Roohani, 2003; Toshani, 2007; Vasarhelyi et al., 2010; Willis, 2005). Internal incentives to voluntarily file financial statements in the XBRL format include reduced costs of compiling and reporting financial information due to streamline reporting process, reduced disparities between firms in disclosure level and content to gain easier access to capital markets, reduced cost of capital, improved corporate governance, and reduced cost for tax filing (Gray et al., 1995; Hannon, 2006; Hodgson et al., 2011; Malhotra & Garritt 2004; Matherne & Coffin, 2001; Premuros & Bhattacharya, 2008). Thomson and Iyer (2011) believe in XBRL's ability to improve risk management and sustainability reporting. In addition, XBRL can be a significant tool in the move towards the adoption of International Financial Reporting Standards (Alley & James, 2005; Liu, 2011; Liu et al., 2011b). Result demonstrability is another perceived benefit of XBRL adoption. Signaling good or improved firm performance is often a major motivation for firm voluntary disclosures (Dye, 1985; Lang & Lundholm, 1993; Miller, 2002; Verrecchia, 2001). Researchers (Callaghan & Nehmer, 2009; Hodge et al., 2004; Premuros & Bhattacharya, 2008) find significant relation between corporate governance level and firms' decision to voluntarily adopt XBRL for signaling purpose. Early adopters of XBRL filing expect to be rewarded for their efforts in increased transparency through an increased share price and market capitalization by differentiating themselves from late movers (Sledgianowski et al., 2010) and improving credit agency rating evaluations (Premuros & Bhattacharya, 2008).

Besides probable benefits to firms filing with XBRL technology, XBRL is also expected to benefit information users such as investors, auditors, analysts, and regulators. Bartlett (2010) states that

XBRL has the potential to increase the speed and usability of financial information by minimizing transcription costs and logistic challenges related to real-time evaluation of firms' periodic filings. Wallace (2001) thinks that by reducing the time spent on data gathering which can now be automated with data in XBRL format, lenders can price and monitor their risks more effectively. As XBRL tags make searching through financial statements easier than ever (Baldwin & Trinkle, 2011; Hunton & McEwen, 1997; Rezaee et al., 2001; Teo et al., 2003), Quinlan (2010) says that XBRL will make it easier for analysts to identify the best-performing stocks, for executives to monitor competitors, and for regulators to identify potential problems in a company's financial data. Weber (2003) believes that XBRL reduces the costs associated with getting and analyzing information from businesses by eliminating incompatible reporting formats. Ball (2007) and Kull et al. (2007) indicate that XBRL can also be relevant to federal financial management in reconciling intra-governmental activities and balances between federal agencies, improving consolidated financial statements, and improving business-to-government reporting. Moreover, advanced technology like XBRL preserves the ability of the taxing jurisdictions to achieve economic objectives and to address the unique circumstances of the state and local government through the use of a flexible sales tax system (Wells, 2009). Therefore, proponents believe that XBRL benefits all members of the financial information supply chain (Jensen & Xiao, 2001). Pinsker and Wheeler (2009)'s survey of 61 MBA students as proxies for nonprofessional investors reveals a generally positive perceptions of net benefits from using XBRL.

Sub-Theme 2: Organizational Readiness

Organizational readiness measures the level of resources necessary for realizing the perceived benefits of a technology (Iacovou et al., 1995). Organizational readiness or capability behaves both as a source of competitive advantage and as a constraint of changes (Liu et al., 2008). Organizational-capability theorists and resource-based-view theorists believe that innovations are adopted when they help the organization to utilize its unique capabilities and resources to realize value (Liu et al., 2008).

Financial resources are important for organizational readiness. The U.S. SEC estimates that the direct costs to a company submitting its first interactive data financial statements with XBRL with block-text footnotes and schedules could average $40,510 with an upper bound of $82,220 while the costs for subsequent block-text filings could average $13,450 with an upper bound of $21,340 (Sledgianowski et al., 2010). The level of cost and resources necessary to prepare XBRL filings vary significantly, from several thousand dollars at smaller companies to $500,000 at largest filers (Malonza, 2011).

In addition to budget constraint, Teo et al. (2006) reveal that unresolved technical issues and lack of IT expertise can inhibit a firm's readiness for an IT. High degree of change and difficulties associated with XBRL generate uncertainty and risk (Doolin & Troshani 2010; Li & Pinsker 2005). Recent studies of early XBRL adoption reveal that XBRL, as an unproven technology, has yet to be fine-tuned (Liu & Yao, 2012). XBRL specification is being developed by a global non-profit consortium and still going through changes which necessitate costly redevelopments and disrupt normal reporting process (Doolin & Troshani, 2007; Nicolaou et al., 2003). Locke and Lowe (2007) point out that the governance of the XBRL consortium such as the requirement for paid membership and a focus on transacting business at physical conferences and meetings may create a barrier to participation for XBRL to fully benefit from the open source model. Researchers have contributed to uncovering design issues in XBRL specifications. The empirical study by Cong (2008) shows that a company's inherent

characteristics such as industry, sales and inventory position play significant roles in the selection of financial statement formats and henceforth certain degree of flexibility should be allowed for the choice of financial statement formats in the XBRL design. Such flexibility decreases comparability of documents for information processing and evaluation and increases search cost (Boritz & No 2008; Debreceny et al. 2005). In addition, the XBRL community is trying to overcome information integration barrier resulted from XBRL data taxonomies presented in a format that is not readily transferable to or integral with standard data warehousing schemata through XBRL for General Ledger (Cohen, 2009; Haseqawa et al., 2004; Spies, 2010). Because raw XBRL data are not intended for human consumption, the ease of use associated with XBRL must be derived from XBRL-enabled analysis and parsing software (Vasarhelyi et al., 2012). Many XBRL software packages are difficult and time-consuming to use and demand high level of XBRL and accounting knowledge (Janvrin & No, 2012). Easy-to-use applications must be developed for mainstream users to benefit from XBRL (Vasarhelyi et al., 2012).

Besides unresolved technical issues, lack of expertise can inhibit a firm's readiness for XBRL adoption. Surveys of accountants, auditors, and financial executives reveal a significant lack of XBRL knowledge (Abdullah et al. 2008; Aguilar, 2008; Bizarro & Garcia, 2010; Bonsón 2001; Cuneo, 2002; Filipek, 2007; Hannon, 2004; Pinsker, 2003; Said, 2011). Debreceny et al. (2011) analyze extensions made in a subset of XBRL filings made to the SEC between April 2009 and June 2010 to find forty percent of extensions to be unnecessary due to the availability of semantically equivalent elements in U.S. Generally Accepted Accounting Principles (GAAP) taxonomy. They also find twenty one percent of extensions to be aggregated or disaggregated existing elements and thirty percent of extensions for new concepts to be variants of existing elements. A better understanding of XBRL taxonomy could have reduced the need for such unnecessary extensions and improved the comparability of reported information tremendously. Lack of XBRL knowledge/expertise limits self-efficacy and perceived behavioral control among accountants and hinders many organizations from considering XBRL adoption (Alles & Gray, 2012).

XBRL is among the least frequently covered topics in accounting programs' curricula (Badua, 2008; Rezaee et al., 2006). In response to this challenge, cases, exercises, and illustrations have been developed to train students and practitioners on XBRL (Capozzoli & Farewell, 2010; Debreceny & Farewell, 2010a, 2010b; Naumann, 2004; Peng & Chang, 2010; Phillips et al., 2008; Taylor & Dzuranin, 2010; Tribunella & Tribunella, 2010; White Jr., 2010b). Bartley et al. (2011) reveal that the use of a voluntary filing program (VFP) such as the U.S. VFP offers an effective learning experience to identify and solve unanticipated issues because a reduction in errors in XBRL documents over time is identified in the U.S. VFP. Therefore, more XBRL training and practice through programs such as VFP may be necessary to improve knowledge readiness among firms.

Both unresolved technical issues and lack of expertise can inhibit a firm's readiness because they increase the risk of errors in creating XBRL documents (Debreceny et al., 2005; Bartley et al., 2010). Bovee et al. (2002) reveal significant variations of quality across financial statements and industries among firms using the year 2000 version of XBRL taxonomy. Boritz and No (2008) find two-thirds of the XBRL instance documents in the SEC's Voluntary Filing Program to contain inconsistencies and errors. Boritz and No (2009) find several problem areas such as redundant elements, inconsistent labels, missing totals, and misspellings in XBRL-rendered documents. Debreceny et al. (2010) examine SEC XBRL filings up to 1 September 2009 to uncover an average of 1.8 errors per filing in a U.S. XBRL

filing sample, which has median error of $9.1 million per filing with the maximum exceeding $7 billion. Bartley et al. (2011) examine errors in the XBRL Form 10-K documents in the U.S. Voluntary Filing Program (VFP) for fiscal 2006 and 2008 to find a reduction in errors in XBRL documents over time but a persistence of errors in the third year of VFP.

Despite evidence of errors in XBRL implementation, no requirement has been set up for independent assurance of the XBRL version of financial statements in any regulatory filings around the world (Boritz & No, 2009; Gray & Miller, 2009; Plumlee & Plumlee, 2008; White Jr., 2010a). Attestation on the financial statements does not currently apply to the process of creating XBRL documents, so it is unclear what criteria would be used in an XBRL environment by auditors or others as they provide assurance (Plumlee & Plumlee, 2008). Current XBRL guidelines require only a match of the XBRL-based documents to the paper filing and may not be effective in the paradigm shift from a paper-centric to a data-centric focus resulted from XBRL adoption (Plumlee & Plumlee, 2008). Where legal protection of outside investors is weak, the uncertainty and errors associated with XBRL adoption can be especially salient without requirement for independent assurance (Li & Pinsker, 2005). XBRL statements must be made less error-prone before information preparers and organizations can have stronger readiness for XBRL adoption (Vasarhelyi et al., 2012).

Sub-Theme 3: External Pressure

External pressure refers to influences from the organizational environment (Iacovou et al., 1995). Institutional theory posits that organizations are subject to external influences such as institutional pressures or promotions that cause them to be similar to others in their environment to gain legitimacy, which allows them to secure resources and support for survival (Liu et al., 2008). Institutional pressures may arise from three major sources: coercive (pressures exerted on organizations by other organizations upon which they are dependent for scarce and important resources), mimetic (the pressures to imitate similar other organizations that are successful), and normative pressures (pressures from professionalization) (Liu et al., 2008).

Novel technologies are more likely to be adopted when they are adopted by other organizations (Haveman, 1993). Mimetic pressure is found to play a role in voluntary adoption of XBRL as firms voluntarily submit information in XBRL to acquire a company image as being among pioneers in technology (Ponte et al., 2009). However, the rate of voluntary adoption is sometimes considered to be disappointing when compared with the early predictions made for XBRL's success (Keeling & Domingo, 2004; Topazio, 2008). For example, in Australia, a critical mass of both XBRL adopters and suppliers of is lacking (Troshani & Rao, 2007). Such a lack of salience among local XBRL stakeholders highlights the importance of normative pressures for XBRL diffusion (Troshani & Doolin, 2007).

Normative pressures and promotions have played an important role in XBRL diffusion to date. Many accountants and researchers have contributed to promoting XBRL. Researhers (Barnabė, 2003; Garthwaite, 2000; Jones & Willis, 2003) introduce XBRL as an eXtensible Markup Language (XML) based language for business reporting which is platform independent and software independent. Lester (2007) promotes XBRL technology as "the business reporting equivalent of bar coding." Research on perceived benefits of XBRL mentioned in sub-theme 1 demonstrates a collective effort of members of the accounting profession to define and promote XBRL so that legitimacy for occupational autonomy can be strengthened with improved corporate financial reporting that is informative, credible, and readily accessible to regulators, investors, and other stakeholders.

In addition to mimetic and normative pressures, coercive pressures have played a key role in XBRL adoption. Charles Hoffman, the founding father of XBRL, recognizes that a lot of the use of XBRL has been regulator driven (Wenger et al., 2011) due to the clear benefits for regulators and governments in allowing data to be filed once and used and shared in many ways by multiple agencies (Fisher, 2008). Many countries have mandated XBRL as the format for reporting financial information (Taylor & Dzuranin, 2010). Most respondents in the study of Janvrin and No (2010) report the primary motivation for XBRL implementation in the U.S. to be the Securities and Exchange Commission (SEC) mandate. Besides institutional pressures from governmental mandate and regulations, institutional promotions also play a key role in XBRL diffusion. For example, Standard Business Reporting (SBR) program, an Australian Government initiative to reduce the business-to-government reporting burden, has been a key actor providing a specific social setting for the emerging XBRL standard in Australia (Troshani & Lymer, 2010).

Sub-Theme 4: XBRL Adoption

Because of limited organizational readiness due to unresolved technical issues and lack of knowledge/expertise, a lot of the use of XBRL has been regulator driven (Wenger et al., 2011). Due to the perceived benefits of XBRL, many XBRL jurisdictions have indicated an intention to allow voluntary business financial information filing with XBRL while XBRL jurisdictions such as Belgium, Chile, China, Denmark, Germany, India, Israel, Japan, Luxembourg, Singapore, South Korea, Spain, United Kingdom and United States have solidified their adoption intention by mandating XBRL adoption. Bartley et al. (2011), Coffin (2001b), Cohen et al. (2005), Deshmukh (2004), and Rezaee *et al.* (2001) provide a timeline for XBRL adoption.

Major Theme 2: XBRL Implementation

Janvrin and No (2012) suggest four major phases for XBRL implementation: planning; tagging financial items and creating taxonomy extensions; validating, reviewing and rendering XBRL-related documents; and auditing and issuing XBRL documents. At the planning phase, after knowledge about XBRL and regulatory requirements is obtained, an implementation team is set up to develop an implementation plan. The interviews conducted by Williams et al. (2006) indicate that making sense of, and implementing emerging XBRL metadata standards for business reporting are challenging for organizations. Approximately three months are needed to learn XBRL and the related software among voluntary adopters surveyed in a recent study (Choi et al., 2008). Proper XBRL training and learning are critical for proper XBRL implementation and compliance to XBRL taxonomies (Debreceny et al., 2005; Williams et al., 2006). Support from top management is also critical as it has been found to be the most crucial factor in information technology implementation (Wang & Chen, 2006). Interviews with accountants responsible for XBRL implementation in U.S. reveal that top management commitment is necessary to align XBRL with the existing financial reporting process, to allocate appropriate resources, to align incentives, and to monitor progress (Janvrin & No, 2012; Sharma & Yetton, 2003). At the second phase, the firm chooses the appropriate standard taxonomy based on XBRL knowledge, maps financial items to tags in the taxonomy or creates a new tag by extending the taxonomy, and generates an instance document. At the third phase, validation tests and other internal control mechanisms are conducted to ensure the compliance of XBRL documents to XBRL specifications and regulatory requirements. In an ideal situation, the firm requests its auditor to provide assurance on XBRL documents at the last phase.

Unfortunately, independent audit assurance for XBRL documents is not yet required.

Gianluca Garbellotto (2009), current chair of XBRL global ledger working group, suggests that organizations can consider the following three implementation options for tagging items: a bolt-on option by tagging financial statements at the end of the reporting process to convert the statements to XBRL format; a built-in option by integrating XBRL mapping capability within accounting information systems across the firm's value chain as part of the reporting process with the help of a conversion software; or an embedded option by standardizing the internal reporting process by embedding it in ERP applications and ledgers. A survey of voluntary adopters of XBRL in U.S. reveals that some early adopters purchase XBRL financial statement conversion software while others outsource the XBRL project with their vendors performing the conversion (Choi et al, 2008). Creating XBRL documents through either XBRL financial statement conversion software or outsourcing at the end of the accounting cycle does not utilize the full potential of XBRL within a company (Wenger et al., 2011). Such implementation methods are expected to evolve so that XBRL tags are incorporated into accounting software and ERP systems to become part of the process of creating financial reports in the beginning of the accounting cycle (Plumlee & Plumlee, 2008). A recent survey reveals that many companies that previously outsourced their XBRL conversion have begun to bring the process in-house by integrating XBRL into their normal reporting processes (Howell, 2012; Sinnett, 2011). Major software vendors have started to embed XBRL into ERP applications (Mascha et al., 2009). Effort is also made to use XBRL to supplement internal control procedures (Argyrou & Andreev, 2011).

In addition, Chang and Jarvenpaa (2005) highlight the importance of broad collaborations across groups of stakeholders in the financial reporting supply chain in the development and implementation of XBRL. Fahy et al (2009)'s case study of an XBRL-enabled inter-organizational system concludes that the co-operative approach to inter-organizational systems (IOS) is likely to be more suited to the implementation of XBRL-enabled systems for financial information supply chains than the "hub and spoke" model characteristic of IOS in other industries (Montazemi & Irani, 2009).

Global implementation of XBRL is also affected by national cultural values. Accounting is contingent on national culture (Alexander, 2011; Ionascu et al., 2011). Information is interpreted through cultural lenses (Bhagat et al., 2002). Research (Downing et al., 2003; Katz & Townsend, 2000; Sia et al., 2011) demonstrates that cultural differences impact firm operations and IT use. Liu et al. (2011b) illustrate that national cultural dimensions matter in XBRL implementation. Take Hofstede's (1980, 1983, & 2001) cultural dimensions for instance. Hofstede's cultural dimensions are one of the most widely studied cultural frameworks (Lim, Leung, Sia, & Lee, 2004). This framework depicts culture along the dimensions of power distance (the extent to which a culture accepts unequal power distribution), uncertainty avoidance (the extent to which people feel threatened by uncertain situations), individualism-collectivism (the extent of ties people hold beyond those of the nuclear family and the degree to which a culture supports individual or collective achievement), masculinity-femininity (the extent to which people are tough and concerned about material success), and long-or short-term-orientation (the extent of orientation toward future vs. past and present). Potential influences of such national cultural value dimensions on successful implementation of XBRL are provided in Table 1.

Major Theme 3: XBRL Value Realization Assessment

Coffin (2001a) believes that XBRL implementation can ultimately impact 90% of what accountants do. Brown and Willis (2003) argue that XBRL

Table 1. Examples of national cultural dimensions and their potential influences

Cultural Dimensions	XBRL Key Success Factors	Potential Influences
Power distance	Collaboration (Chang & Jarvenpaa, 2005; Fahy et al., 2009)	Mejias et al. (1996) and Tan et al. (1998) find a positive association between high power distance and group consensus and collaboration.
Uncertainty avoidance	Effort to learn XBRL (Williams et al., 2006)	Hwang (2005) reveals that uncertainty avoidance encourages firms to provide training that enhances perceived ease of use..
Individualism	Compliance with XBRL taxonomies (Debreceny et al., 2005)	Milberg et al. (1995) find that countries rated higher in individualism tend to have less government involvement in regulation and thus higher level of resistance to regulatory mandate.
Masculinity	Collaboration (Chang & Jarvenpaa, 2005; Fahy et al., 2009)	Quaddus and Tung (2002) show that people with high masculinity tend to generate more conflict than collaboration.
Long-term orientation	Effort to learn XBRL (Williams et al., 2006)	Hofstede and Bond (1988) posit that people of long-term time orientation are more comfortable with sacrificing now such as spending time to learn a new technology.

systems will revolutionize the corporate reporting supply chain. Notwithstanding the anticipated impact of XBRL, its actual value realization is yet to be assessed. A weak link between information technology (IT) and value, an 'IT productivity paradox', has been identified in previous IT value realization research (Hitt & Brynjolfsson, 1996; Sircar et al., 2000). Further investigations (Im et al., 2001; Kivijarvi & Saarinen, 1995; Yao et al., 2010) into such a paradox find that investment in information systems such as XBRL may take some time before its value can be fully realized. The need for XBRL value realization assessment has been identified (Richards & Tower, 2004) because economic justification for XBRL disclosure is an important issue to regulators, the investing community, and participating companies (Debreceny et al., 2005).

Positive impact has been identified among preparers of XBRL documents. Pinsker and Li (2008)'s interview reveals that XBRL can lead to a reduction of 30% of bookkeeping staff in some companies and reduce the time needed to generate financial statements tremendously. John Stantial, assistant controller at United Technologies Corp. reports that XBRL usage reduces the cost and time of external reporting processes by more than 20 percent (Willis & Sinnett, 2008).

Positive impact has also been revealed among users of XBRL documents. Fahy *et al* (2009)'s case study reveals that XBRL-enabled systems can significantly reduce the burden of data discovery and processing for regulated firms, facilitate new forms of value creating activity such as returning benchmarking data to the market, and shape new regulatory policies by facilitating higher levels of process transparency. Hodge et al. (2004) find that XBRL helps nonprofessional financial statement users to acquire and integrate related financial statement and footnote information in making investment decisions. Hunton and McEwen (1997) find that directive information search strategy enabled by XBRL is associated with accurate analysts forecast. Yoon et al. (2011) find a significant negative association between XBRL adoption and information asymmetry in the Korean stock market, implying that XBRL adoption may lead to the reduction of information asymmetry in South Korea. Kim et al. (2012) show that that XBRL disclosure under the SEC mandate increases information efficiency and decreases return volatility.

Nevertheless, contingency theory entails that accounting information systems and technologies are an important part of the fabric of organizational life and need to be evaluated in their wider environmental context (Cheung & Burn, 1994; Otley, 1980). Assessment of value realization of a technology, hence, depends on the fit between technology integration and contingent factors (Nicolaou, 2000). According to Karimi and Konsynski (1991), differences in business environments, availability of resources, technological and regulatory environments must be taken into consideration as soon as a technology crosses national boundaries. Though an empirical examination of firms listed in U.S. reveals that the mandatory XBRL adoption has led to a significant improvement to both the quantity and quality of information, as measured by analyst following and forecast accuracy (Liu et al., in press), Liu and Yao (2011) and Liu et al. (2013) disclose that the uncertainty related to XBRL, such as information errors, has decreased analysts' forecast accuracy and increased cost of capital among Chinese firms in an economy with weak public information on listed firms. Though Yoon et al. (2011) find a significant negative association between XBRL adoption and information asymmetry in the Korean stock market, Blankespoor et al. (2012) find a significant positive relation between XBRL adoption and information asymmetry in the U.S. Such empirical evidence of differences in value realization from XBRL adoption in different nations implies that contextual differences across nations such as cultural differences (Liu et al., 2011a) play an important role as influential contingent factors. Potential influences and challenges from global contextual factors are summarized in Table 2. These factors should be considered when assessing value realization from XBRL across nations.

CONCLUDING COMMENTS

Based on the number and variety of articles dealing with some aspects of XBRL, there appears to be strong interest in XBRL, the technology believed to bring forth a new paradigm of business financial reporting. Key themes covered in extant literature

Table 2. Potential challenges to value realization from XBRL as a global standard

Contextual Differences	Potential Challenges
Different accounting standards	The proliferation of a multitude of accounting principles and standards across nations necessitates the need for flexibility in creating taxonomy extensions (Bonsón et al., 2009; Piechocki et al., 2009). The development and diffusion of global accounting standards as a unique foundation for XBRL taxonomies are essential to achieve global standardization and comparability (Bonsón et al., 2009).
Different XBRL regulations	Different speed of XBRL mandate across nations (Srivastava & Kogan 2010) undermines its value realization in terms of financial statement comparability of firms from different countries.
Different auditing practices	Despite evidence of errors in XBRL documents, no requirement has been set up for independent assurance of the XBRL version of financial statements in any regulatory filings around the world (Gray & Miller, 2009). Different auditing practices across nations leave the reliability and accuracy of XBRL documents of different countries in the dark. A solution is yet to be sought for a unified standard for assurance of XBRL documents.
Different financial regulatory environments	Financial regulatory structure affects accounting information quality (Han et al., 2010; Leuz et al., 2003). The uncertainty associated with XBRL is especially salient for firms in economies with weak public information on listed firms (Li & Pinsker, 2005).
Different national cultures	Different cultural values can contribute to remarkably different usage of information and communication technology in various nations of the world (Bagchi & Kirs, 2009) because cultural differences among nations may result in different views of the relevance, applicability and value of XBRL (Liu et al. 2011b).

include perceived benefits; organizational readiness; external pressure; XBRL adoption; XBRL implementation; and value realization assessment as depicted in Figure 2.

Much research has contributed to a better understanding of XBRL adoption. Research analyzing the costs and benefits of XBRL filing is important to both potential preparers and users of XBRL (Debreceny et al., 2005). Many believe that benefits will outweigh the cost to convert (Bonsón, 2001). Perceived benefits include improved transparency due to streamline reporting process, improved corporate governance and internal control, reduced cost of capital, improved credit agency rating evaluations to adopting firms, improved search and analysis by business information users, and improved business-to-government reporting process. Though the perceived benefits contribute to positive attitude toward XBRL adoption, organizational readiness is relatively weak due to unresolved technical issues, unresolved assurance and security issues, varying speeds of adoption across countries and industries, and lack of internal organizational resources such as XBRL knowledge among accountants and financial experts. Much of XBRL adoption is regulator driven through external pressure.

XBRL implementation can take four major phases with three options for tagging items. Top management support, financial resources, XBRL expertise, and collaborations are among key success factors for XBRL implementation. In addition, national cultural values can play an important role in global implementation of XBRL.

Though XBRL diffusion is at an early stage, some impact has been identified by empirical studies. XBRL-enabled systems are found to significantly reduce the burden of data discovery, processing, and integration for decision making purposes. Significant relation has been identified between XBRL and information asymmetry, analyst forecast accuracy and cost of capital. Some contradictory findings highlight the importance of evaluating XBRL impact in light of contingent factors such as cultural accounting, auditing, and financial regulatory contexts.

As Table 3 indicates, the majority of extant research is based on conceptual and qualitative analysis. Quantitative analyses are conducted less than thirty percent in the reviewed literature. As the availability of archival data increases with broader adoption of XBRL, more quantitative analyses may be conducted to shed light on the impact, implementation, and value realization assessment of XBRL diffusion.

Figure 2. Overview of XBRL research

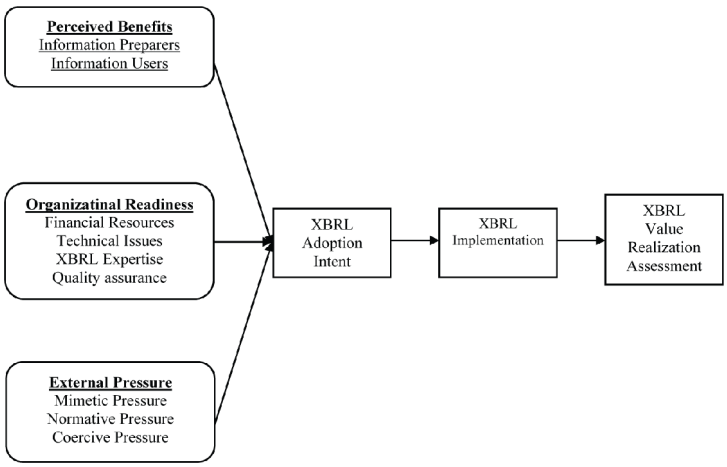


Table 3. A summary of XBRL research method

Methodology	Usage
Archival Data Analysis	20%
Case Study	4%
Experiment	3%
Interview	6%
Qualitative Analysis	65%
Survey	2%

SUGGESTIONS FOR FUTURE RESEARCH

Our conclusion reveals that the investigation of XBRL is still at an early stage. Further research is necessary to unravel the full potential of XBRL. Debreceny and Gray (2001) lay out potential areas of research incorporating: new taxonomies; XBRL front end to database accounting; XBRL-based financial statement assurance; intelligent agents; human/computer interface for XBRL reports; standard development process, adoption incentives, global adoption; and formal ontologies. Though progress has been made in these areas of research, much is still unexplored. For example, development of a suite of new taxonomies incorporating current XBRL standard taxonomies is needed to reduce the need for taxonomy extensions, to improve comparability of tagged information, and to better meet the need for business reporting and tax reporting (Brands, 2011; Monterio, 2011). The development and diffusion of global accounting standards as a unique foundation for XBRL taxonomies are essential to achieve global standardization and comparability (Bonsón et al., 2009). Research is yet to overcome information integration barrier to embed XBRL in ERP systems and the management control systems (Grabski et al., 2011). Further research is necessary to set up appropriate assurance policies on XBRL-based reporting (Srivastava & Kogan, 2010; Wright et al., 2008). The future prospects of XBRL-based reporting precipitate an entirely new set of needs for assurance at the account level (Alles et al., 2002) to allow investment analysts to disaggregate financial statements more easily (Elliott, 2002). Since available tools and systems are inadequate to identify errors in the XBRL filing (Malonza, 2011), reliable tools need to be developed to review the XBRL files effectively (Boritz & No, 2005; Bovee et al., 2005). Developing XBRL as a global standard calls for the development of interoperable XBRL taxonomies under various GAAPs and a better understanding of the role environmental factors such as national cultures and financial regulatory environments play in XBRL diffusion. More research is imperative in establishing effective ways to incorporate XBRL in the accounting curriculum and to train accounting professionals and financial experts. Additional research is necessary to reveal contingent factors such as organizational, cultural, or financial regulatory factors influencing value realization from XBRL adoption and to uncover a better picture of real impact of XBRL on information preparers and users.

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Chapter 73
Innovation in Business Models of Banks in Europe:
Towards a Methodological Approach

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ABSTRACT

Since the end of the 1990s, the introduction of Internet technology to the mainstream technologies used in businesses led to the expectation of pure Internet enterprises that might eliminate physical presence to one or more points in the value chain. A sequence of failures managed to resize those expectations and led most firms to just expose routine back end systems transactions through the Internet without a clear focus on relationship building or an integrated cross-channel sales approach. Despite the structural changes to the business level strategy that the Internet may have brought to firms in many industries, business practices in banking have not really evolved. This is because banks perceived Internet-based innovation as an investment opportunity that could raise spatial and temporal constraints much like ATMs had done in the past, without actually changing the value proposition of the business model or the strategic options of financial institutions. This chapter argues that the degree to which financial institutions have actually infused innovation into their traditional business model has been negligible and aims to set out a scene for the study of the evolution of strategy and business models of banks in the Internet era.

INTRODUCTION

The introduction of internet technology to the mainstream technologies used in businesses, led to the expectation of pure internet enterprises that might eliminate physical presence to one or more points in the value chain. Especially in the cases of non-tangible goods or in cases where parts of the value chain could become dematerialized - like money transactions, telecommunications spectrum, software or music - expectations were really high and in some cases business plans were justified based on these expectations in order to support such e-businesses (for example, pure e-

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bank entities like Egg[1]). A sequence of failures managed to resize those expectations and led most firms to just expose routine back end systems transactions through the internet without a clear focus on relationship building or an integrated cross-channel sales approach. This resizing of expectations[2] led in certain cases to a mismatch between the initial decision for an additional revenue stream that would result from shifting business online, and the actual multi-channel approach that was finally adopted. In the banking sector, in particular, this was especially obvious in cases where e-business was implemented through an additional channel and not as a pure e-bank entity.

Although in certain industries (ICT, retail commerce etc.) internet technology has led to a differentiation in the business level strategy and business models, in the bulk of the traditional banking sector business practices have not really evolved. Despite the structural changes (to business level strategy or business model) that internet may have caused to firms in most industries, the banking sector seems the least affected. Most banking institutions perceived Internet-based innovation as an investment opportunity and funded businesses that based their business models on these technologies. However, as this chapter argues the degree to which these institutions have actually infused innovation into their business models has been so far negligible. This initial perception has been our primary stimulus for an in-depth investigation into the ways in which the strategy and the business models of banking institutions appear to have evolved in the Internet era.

Our starting hypothesis in this chapter is that, in this changing environment, incumbent banks opted to push their existing business models to the extreme - underestimating in many cases lending risk (Nellis, McCaffery, & Hutchinson, 2000) – than to investigate the opportunities offered in the provision of higher value products and services. The latter stem out of the observable deconstruction of banks' traditional value-chain activities and the revision of their current approach in conducting business. This chapter aims to function as a provocative first attempt to explore the validity of the aforementioned hypothesis. To do so, it develops an analytical framework that allows for an in-depth investigation into the evolution of business models surrounding the operation of commercial banks in Europe over the last decade.

The chapter does not aspire to unfold a fully-fleshed theoretical framework regarding the complexity of the dynamics shaping the banking industry in the Internet era. Rather, drawing upon observed industry trends, it uses a methodological approach that allows for the measurement of the "behavior" of an organization, that is the initiatives stemming from its business plan, the processes, and the performance metrics used to plan and realize its business model. To this end, the aim here is to go one step further and develop an operational tool that can guide future work in the identification of innovation in the business models and business level strategy of commercial banks during the first years of the Internet era.

The structure of the chapter is as follows: the following Section Two summarizes briefly the main arguments found in the literature regarding the impact of Information Technology (IT), and of the Internet in particular, on the banking industry and the subsequent emergence of new business models in the banking sector. Section Three presents the theoretical elements upon which a conceptual framework is built for the study of the behavior of incumbent banks in the networked era. This conceptual framework guides the empirical investigation in the subsequent Section Four of the main hypothesis stated at the beginning of the chapter. The Concluding Section summarizes the main arguments posed and proposes directions for further research.

INFORMATION TECHNOLOGY AND THE INTERNET IN BANKING: A REVIEW AND SOME PENDING ISSUES

In the current electronic environment, Information Technology (IT) has been seen as a dominant element in organizations' competitiveness and growth. In the banking industry, in particular, IT has been the backbone of all multilateral Business-to-Business (B2B) and Business–to-Customer (B2C) financial transactions. Banking institutions have been pioneers in the adoption of IT-based innovations, such as electronic markets, clearing-houses, and multilateral trading facilities. Banks also use IT and the Internet as a strategic weapon to face competition in the consumer markets by developing services such as e-banking, that offer them the possibility to enhance their relationships with customers (Marinč, 2013).

Several studies discuss IT in banking in terms of strategy- technology alignment that can potentially lead to organizational growth and development. For example, previous studies have focused on several strategic issues such as the internal and external factors (e.g. government regulation, costs, technology platforms, competition, etc) that influence the development of e-banking strategies (Smith, 2006); the strategies for the successful implementation and development of multichannel banking services (Gurău, 2005); the assessment of the level of banks' readiness for providing e-banking services (Huang, Huang, Zhao, & Huang, 2004); the role of technological aspects and IT employees' capabilities in creating value for banking firms (Lin, 2007); and the internal organizational critical success factors in e-banking adoption by banking institutions (Shah & Siddiqui, 2006). Another strand in the literature has been looking at consumers' perspective, their acceptance of e-banking technologies and the factors that seem to affect their evaluation of e-banking trustworthiness and their subsequent adoption behavior (Tan & Teo, 2000; Yap, Wong, Loh, & Bak, 2010). For example, studies in this area address the issue of trust and the confidence that can be cultivated among customers about the security and integrity of their transactions as a particularly influential factor. Last, but not least, the measurement of the impact of e-banking in terms of business value creation has been also attracted researchers' attention over the last decade (Stamoulis, Panagiotis, & Drakoulis, 2002).

Still, amidst these technologically deterministic approaches of IT research in banking, there are other approaches that take a longer and more strategic perspective (Li, 2001; Alt & Puschmann, 2012; Marinč, 2013). These approaches seek to assess the extent to which, and the particular ways in which, the adoption of IT and the Internet shake the mere foundations of the banking industry causing a major disruption in the operation of the traditional business model of banks, which has been based on process integration, service bundling, scale economies, and the monopolization of distribution channels (Li, 2001).

Initially, the deployment of the Internet by banking institutions in their routine procedures and practices was more seen as a cost-cutting and distribution-extending mechanism, which could further enhance the existing vertically integrated and consolidated banking model. It could do so, as the cost of processing a transaction over the Internet was significantly lower than the cost of handling it over the counter, whereas the convenience of having Internet banking available anytime and anywhere allowed banks to extend their distribution network using cheaper and more convenient solutions. In parallel, another trend made its appearance: that of the unbundling of the banking services and the re-intermediation of the traditional value chain of banking activities by third party, non-bank-related newcomers, who specialize on specific niche activities (Li, 2001). As a first example of this unbundling of the value chain, one could refer to the new actors that entered the market, such as Pay Pal and VeriSign, which started their businesses by offering

payment transaction and security management facilities between business and consumers. More recent examples of similar nature and scope include services such the collaboration of Google, Citibank and Mastercard to establish a mobile payment system, Vodafone's plan to provide a banking infrastructure for Africa and Facebook's engangement into developing "Facebook Credits" (Alt & Puschmann 2012).

Over a decade ago, Li (2001) made a first attempt to conceptualize the complex picture in Internet banking in the UK by identifying eight such prevalent models. These ranged from more conservative ones, which treated the Internet as merely a "new distribution channel," to more revolutionary ones like those of "brand-stretching," where non-bank players with established brand name were using the Internet to serve banking services to selected customers; and "pure-play new entrants," which have been experimenting with entirely new business models. Li concluded that:

…if [incumbent] banks do not proactively reinvent the industry by adopting new strategies, new entrants will increasingly take away profitable businesses from them by leveraging the potential of the Internet and other new technologies. By then, not only will strategic opportunities have been lost, but many existing banks may have no choice but to change or die (Li, 2001:320).

A decade later, a similar observation is made by Marinč (2013). He sees IT developments interfering in the traditional business model of banks pushing them to choose between what he calls "transaction banking" and "relationship banking."[3] The former relates more to the banks' traditional business model of reaping the benefits of scale and scope in standardized operations, whereas the latter places an emphasis on the redesign of business processes and on the exploitation and strengthening of relationships with customers. In this respect, his analysis concludes that:

…the future structure of the banking industry is blurred. On the one hand, large universal banks would focus on IT-driven economies of scale and scope in transaction banking activities. On the other hand, small, customer-focused banks should use IT developments to further cultivate relationship ties with their customers (p.93).

This chapter argues that the degree to which incumbent banks have actually got accustomed to these new opportunities and challenges by infusing innovation into their traditional business model has been negligible. The value proposition of the business model of most incumbent banking institutions has not changed much and is still based on what they know to do best: reaping the benefits of process integration and service bundling. A typical example of the extent to which the business practices of incumbent banks have remained unchanged comes from the U.S. There, the biggest retailers Wal-Mart and Home Depot have applied for banking licenses. Also major players in the auto making industry (VW, BMW) have already completed this process[4]. These new actors enter the banking market with new IT-based business models. This is not surprising since banking is essentially an information intensive sector which trades information-based products and services that can be accessed from a variety of Internet-enabled devices. It is obvious that financial institutions themselves could provide "white label" products and services to these organizations but have either decided not to do so or keep postponing such a shift in their business model. Beyond that, banks have not yet started to offer as a service the skill set that they have seen enterprises from other industries developing internally. Skills like capital management, transaction platform design deployment and management[5] are examples of core competencies that financial institutions could provide as white label services. Although certain brands from non-banking industries may have had the gravity to

develop this know how internally, there are others that either do not have the capacity to follow the same approach or choose to focus on developing their core competences, i.e. the production and distribution of goods and services.

The changes in the financial payments landscape with the implementation of the Single European Payments Area (SEPA)[6], provide an additional basis that will further enhance the opportunities for new non-banking organizations to provide payment services intercepting this commission generating activity that until now has been carried out exclusively by banks. This interception, beyond the obvious reduction of operating income, will deprive banks from data related to the transactional behavior of their clients, as well as from opportunities for cross-selling and up-selling. Almost in parallel, regulatory changes in the financial sector like the implementation of the single market programme[7] has further boosted cross border competition.

In the banking literature, (and especially the part that refers to commercial banks), the evolution of banking operations has often been examined through a series of events like crisis, rescues, mergers and regulation. Evolution has been observed in relation to economic growth through capital mobilization and credit creation. This chapter looks at the evolution in banking from a different perspective: that of *business model innovation*. The key role of business models in the evolutions linked to ICTs and the corresponding innovative strategies (Chesbrough, 2006; Teece, 2009) was pointed out in the literature a few years ago (Mahadevan, 2000) and has been gradually defined and refined from a strategic perspective (Zott and Amitt, 2008). Of particular interest is the application of this concept to the evolution of incumbent commercial banks. The next sections propose a framework for identifying business model innovation in traditional banks.

TOWARDS A CONCEPTUAL FRAMEWORK FOR IDENTIFYING BUSINESS MODEL INNOVATION IN BANKING

Defining a Business Model

Strategy is a broad term. In the context of this chapter, we use it to denote the process of selecting the environment within which a company is positioned, as well as the process of selecting the company's long term goals and the way to achieve them within this environment. In particular we refer to the content of strategy at the business level (De Wit and Meyer, 2010). That is the level where functional units of the firm (sales, marketing etc.) aggregate to an autonomous entity and cater for specific products or services. Beyond the business level, firms may aggregate to groups that operate within a corporate level strategy. At a higher level, network level strategy guides the course of a firm within the value network that it operates in.

In order for a firm to meet its objectives in the strategically selected business environment, a value proposition must be formed using the available resources to address the needs of selected customer segments. This subset of business level strategy that focuses upon the value the firm delivers to its customers using its resources is of core importance as it is the system that implements strategy. This system has been named "Business System" (De Wit and Meyer, 2010, pp.168) or "Business Model" (Johnson, Christensen, and Kagermann, 2008). A more transaction-oriented definition of the business model concept is the following: "The business model can be defined as 'the structure, content, and governance of transactions' between the focal firm and its exchange partners"(Amit and Zott, 2001, pp. 511). Alternatively, a value-oriented definition of the concept of business model is the following (Osterwalder

and Pigneur, 2010, pp.14) "A business model describes the rationale of how an organization creates, delivers and captures value." Internet technology facilitated multiplication of options regarding resources, partners, customer segments, value propositions, therefore the significance of the business model construct increased to the point of it being considered as an autonomous concept.

Johnson, Christensen, and Kagermann (2008) provide a structural perspective to the business model definition. They identify the concept as consisting of the following key elements:

1. **The Customer Value Proposition:** A suitable product-service combination to address a real need of selected customer segments.
2. **The Profit Generation Model:** A monetary view of the value creation mechanism considering the revenue generation concept, the cost structure (direct, overheads, economies of scale), etc.
3. **Key Resources:** People, know how, partners, marketing and corporate communication, channels etc. Whatever is needed to deliver the Customer Value Proposition.
4. **Key Processes:** The processes that -using the key resources available- will deliver the Customer Value Proposition in a measureable, scalable, and manageable way.

This approach regarding the structure of the business model, enriched with rules and metrics as the connecting tissue for the system to work, is depicted in Figure 1 (Johnson, 2010).

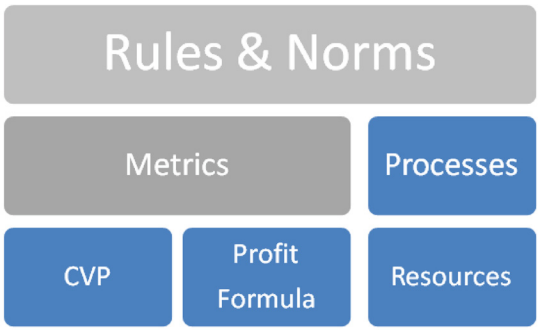
Business Model Innovation

The concept of Innovation covers a wide range of activities from discovery and invention to development and commercialization. Innovation is usually perceived as the end offering (the final form of product or service) and as being tightly coupled with some sort of technological novelty. Innovation in the business model is defined after Conway and Steward (2009, pp. 14) as "novelty in the drivers of an organization's activities or strategy." For the purpose of analysis in this chapter, we seek to identify elements that prompt either to architectural or to component level innovation at the business model or the business level strategy of commercial retail banks during the last 15 years.

As an example of business model evolution within the banking domain one could consider the way the scope of banks has changed over time. Capital mobilization has been the initial value proposition of financial institutions since ancient and medieval times. Main resources were own funds -and in time deposits-, processes and rules handling operational and credit risk. Profit was generated by interest on loans. Currency exchange and fund transfers reformed the value proposition allowing for regional specialization in production of goods. This additional value proposition allowed for additional commissions reforming the traditional revenue scheme and adding operational risk which then affected the cost scheme.(Grossman, 2010).

In this vein, one may consider whether the regulatory obligation of financial institutions to reserve capital constitutes an evolution of their business model. This is because it definitely affects their cost structure both directly and indirectly in the form of opportunity cost as the reserved capital cannot be used for investments or for funding loans. The approach adopted in this chapter is that whatever

Figure 1. The Four Boxes business model framework
Adapted from Johnson (2010, pp.24)



does not affect the value proposition of banking institutions towards their customers and business partners will not be considered as innovation in their business model evolution.

Operationalising Strategy: The Delta Model

The attempt to study evolution of strategy and business models of financial institutions involves a number of challenges. Strategy frameworks (at least the dominant ones like M. Porter's Competitive Advantage or the Resource Based View of the firm) are conceptually useful when used to define the competitive positioning of an organization but difficult to be applied in practice. More than often, the process of identifying the strategy of a particular organization ends up as an intuitive exercise. What is more, the term "business model" is often broadly defined making the boundaries with the concept of strategy quite obscure.

In most cases, the strategy and business models of organizations are not explicitly documented beyond a mission statement. Of course there are a number of reasons that justify the lack of a complete strategy statement. Evolution of business as a series of reactions to environmental changes gives the impression of a preconceived strategy (Andrews, 1987). However even if strategy is not clearly articulated it can be deducted from the "behavior" of the organization, where "behavior" refers to the initiatives stemming from the business plan, the processes, and the performance metrics used to plan and realize its business model.

The review of the various strategic frameworks that could be more useful in identify business level strategy paved the way to the Delta Model (Hax & Wilde, 2001), a recent framework developed as a complement to existing ones. The main characteristic of this framework is that beyond the new elements at the conceptual level, it ties the strategic positioning at the business strategy level with the business model through which this positioning is realized. It also uses metrics as sensors to monitor the alignment of strategy to its implementation. The Delta Model provides a framework that allows an organization to position its business level strategy on a hypothetical triangle according to where its focus lays on regarding its products, its customers, and its complementors (firms that deliver products and services that enhance the organization's product and service portfolio) within its business environment.

As already indicated, this framework was developed in order to complement existing strategy frameworks that relied more on the mechanism of competition, whereas the Delta Model puts an emphasis on bonding with customers and complementors. The framework has three major components which are the following:

- The "Triangle," which is a comprehensive representation of three distinct strategic options at the level of business strategy, namely:
  - **Best Product:** This refers to the traditional strategic options for most companies that pursue success either by offering low cost products or services, or by seeking product differentiation strategies. Examples of companies seeking to achieve product differentiation are Google Inc. which seeks to offer distinct features to its products, and BMW, which has a hard to establish corporate image.
  - **Total Customer Solutions:** This is an option that can be realized either by offering a complete spectrum of products and services that satisfy customer needs through integration beyond discount bundling (e.g. Amazon), or by adding value to the daily routine of customer operations (e.g. GE, Xerox) or by redefining customer experience in a way that encompasses the timeline from customer acquisition till the end of life of

the purchased product or service (e.g. General Motors, Saturn).
    - **System Lock In:** This option can be achieved either through the use of proprietary standards (as Intel and Oracle do), or as an exchange after achieving a critical mass of customers (e.g. eBay), or by raising barriers to entry to competitors (e.g. Coca Cola, and WalMart through its opt for rural locations).
- The business model structure, which in the context of this framework is comprised of the initiatives and the processes needed to realize the selected strategic positioning. These initiatives are grouped in the term *Strategic Agenda* and the processes in the term *Adaptive Processes* and cover the areas of :
    - Defining and offering a Customer Value Proposition called *Customer Targeting* in the context of the framework.
    - Defining and operating the cost infrastructure called *Operational Effectiveness* in the context of the framework.
    - Defining and operating the revenue infrastructure called *Innovation* in the context of the framework.
- Metrics, which monitor the alignment of the selected strategic positioning with its implementation through the Strategic Agenda and the Adaptive Processes. The framework stresses the inefficiency of using averages as the main aggregate metric and the need to use more elaborate aggregate metrics as well as the need for granular metrics.

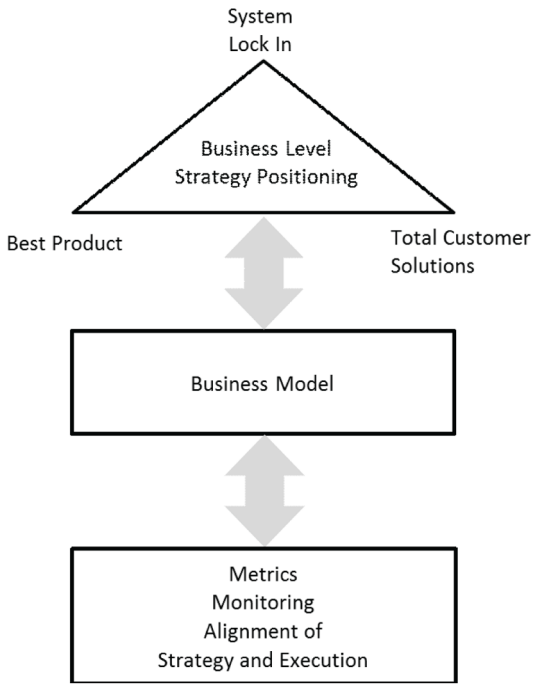
A conceptual representation of the Delta Model is presented in Figure 2.

The Delta model provides a way to map the strategic positioning of a firm on the triangle and identify its evolution over time. Moreover, through the use of metrics it supports the relation between the business level strategy and its realization at the level of the business model. Therefore it supports the identification and mapping on the triangle of the strategy actually executed, which may or may not match to the initially selected strategic positioning.

From Static to Dynamic Approach in Strategy Evolution: The Business Model Canvas

Identifying the strategy and the business model of an organization over specific periods of time is one thing. The ability to identify its evolution *over* time is another. Throughout the description of the Delta Model by Hax and Wilde (2001), the term business model is used interchangeably with the term strategic option. It implies the

Figure 2. Conceptual representation of the Delta model
Adapted from Hax and Wilde (2001)



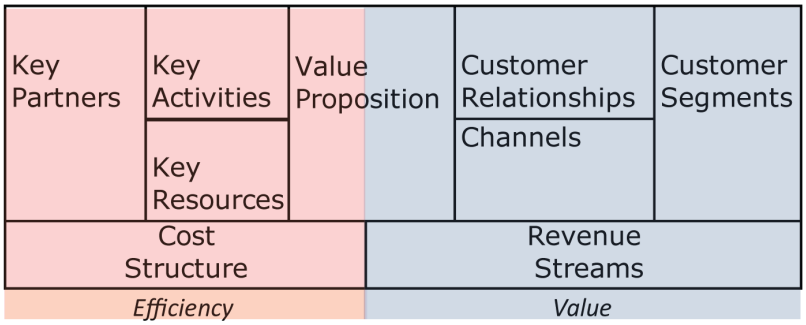
group of processes that span across a company's Operational Effectiveness, Customer Targeting and Innovation. This approach, although fits the purpose of the Delta Model framework, is not suitable for studying how a business model evolves over time. In order to identify evolution in the design and content of the business model (the 'what' question) and not just in its application to the operation of the organization through the processes adopted, (the 'how' question), another two-dimensional representation of the concept would be more appropriate. The in-depth review of the literature over measures that could be used for the operationalisation of business model evolution over time led us to the concept of the "business model canvas" as defined by Osterwalder & Pigneur (2010).

In this concept, the business model construct is broken down into nine elements altogether, namely:

1. The key partners of the company,
2. The key activities,
3. The key resources used for the realisation of activities,
4. The company's value proposition,
5. The relationships with its customers,
6. The channels through which it establishes presence in the market,
7. The customer segments it serves,
8. Its cost structure, and finally
9. Its revenues streams.

Being a more granular approach to the Four Boxes Business Model Framework discussed above, it is more suitable for the identification of innovation in certain elements of the business model. The concept of business model canvas is built on the assumption that the goal of an organization is to serve specific customer segments through value propositions designed to identify and solve problems as well as to address the needs of these segments. In order to achieve this goal, relationships have to be developed with customer segments and partnerships with external contractors have to be established. In this context, resources are utilized to perform the necessary activities in order to deliver the value proposition to the customer segments through selected channels. All the phases prior to the delivery of the value proposition result in costs and the delivery phase produces revenues. It depends on the business level strategic positioning and the related business model design what the financial goal of the bottom line (net profit, break even etc.) eventually is. This description is depicted in Figure 3.

Figure 3. The main elements of the business model canvas
Business Model Generation, ©Osterwalder & Pigneur (2010). This material is reproduced with permission of John Wiley and Sons, Inc.



Putting it All Together

In order to identify a business model's evolution *over* time a hybrid approach is adopted which utilizes components from both the aforementioned frameworks. In particular, the business model construct included in the Delta Model is replaced by the more analytical Business Model Canvas. This hybrid framework, will be fed with actual metrics used over time by banking organizations that correspond to the elements of the business model canvas. Depending on the emphasis put on distinct parts of the canvas and on the relationship between the parts, innovation at the level of business model and subsequently at the business level strategy is identified. This is all portrayed in Figure 4. Apart from relying on two complementary frameworks, the novelty of this approach is its inverted direction: the down-arrow figure suggests that using the metrics and allocating them to the appropriate modules of the business model canvas one can characterize the actual behavior of a firm and identify the business model used as well as its business level strategy, as defined by the Delta Model..

APPLYING THE FRAMEWORK TO TEST BUSINESS MODEL EVOLUTION IN THE BANKING SECTOR

The approach described above has been operationalised in a real case in order to test its validity. The metrics used to feed the model assess the performance of the retail network of a Greek bank at three distinct points in time (2003, 2005 and 2011). It is important to stress that the actual figures do not matter in the context of this paper. It is the nature of the metrics that characterizes the business model and business level strategy actually implemented.

In addition to the metrics provided by the retail network MIS team of a major Greek bank, two interviews with experts were conducted which sought for the opinions of interviewees about the elements of the business model canvas. During these interviews, the retail network business plans were reviewed in order to extract information not directly evident through the metrics. Table 1 presents the metrics collected by the banking

Figure 4. The down arrow approach

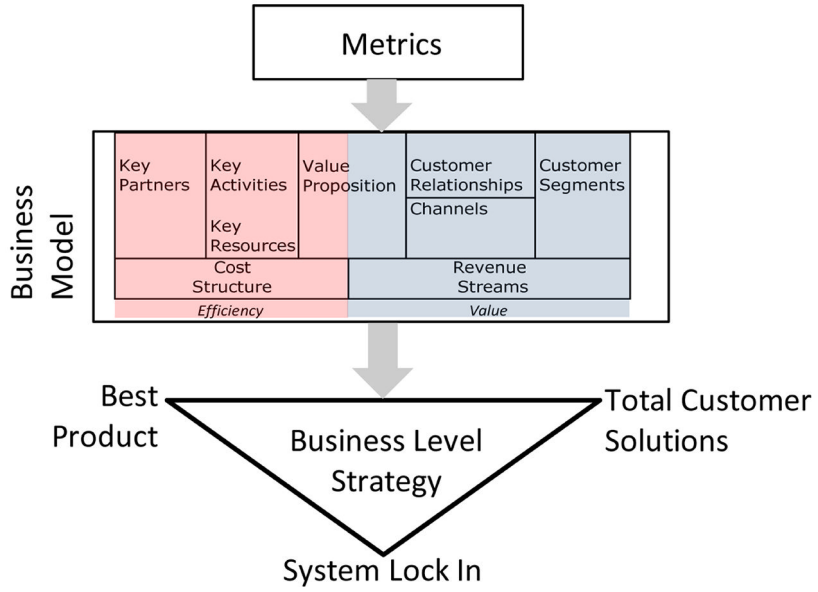


Table 1. Mapping of 2003 performance metrics to the business model canvas elements

Value Proposition	As it is obvious from the performance metrics the value proposition is the provision of credit and funds management. Bancassurance offering is emerging. Performance assessment is 100% product based. [8]
Revenue	
Customer Segments	Professionals running their own business.
	Affluent customers with over a 100.000€ funds under management.
	Employees.
Customer Relationships	Cross Selling Ratio.
Channels	Own channels such as branch network sales force and Open24 sales force. Phone and internet for commission producing transactions.
	Retailers (car, appliances, etc.) providing credit.
Revenue Streams	Interest margin, transaction commissions and insurance premiums.
Cost	
Key Partners	Retailers as additional credit delivery channels.
Key Activities	Provide credit aiming at market growth and streamline operations
Key Resources	Branch network, unified IT infrastructure, capital from funds under management.
Cost Structure	All retail network operating costs are allocated to branches and combined with the revenues per branch form the branch profitability.

institution which can be mapped into the Business Model Canvas components.

From a business level strategy standpoint, the metrics used to assess the company's performance in 2003 as well as the interviews held with experts led to an assessment of the company's strategic focus as being on the Best Product positioning (see Figure 5).

During the interviews, the concept of credit risk mitigation seemed to emerge in the 2005 business plans. Customer service and customer satisfaction concepts also surfaced. However the emphasis, as it appears in the metrics used to assess performance was still on volumes and on how to mitigate the saturation at the credit market. The mapping of the 2005 metrics to the Business Model canvas is shown in Table 2.

From a business level strategy standpoint the assessment leads again to a Best Product strategic positioning (see Figure 6).

In the specific bank selected for the case study, a strategic initiative had taken place in 2009 in order to refocus the organization towards a customer centric approach. With the support of a strategy consulting firm the financial institution was aiming to change its structure from pure product oriented, replacing the product oriented business units with customer segment oriented business. Still, despite this effort, the metrics used in 2011, 2 years after this initiative, were still product-oriented although the emphasis was on controlling the costs than on generating profits. Table 3 maps the 2011 performance metrics to the Business Model Canvas.

Figure 5. Strategic positioning of the Greek bank in 2003

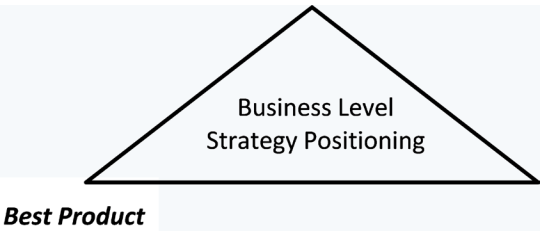
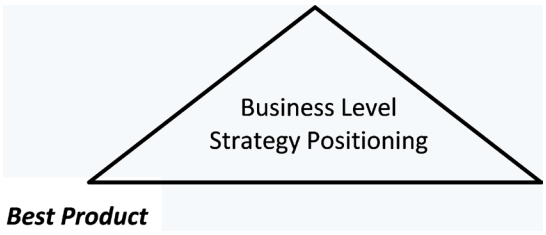


Table 2. Mapping of 2005 performance metrics to the business model canvas elements

Value Proposition	As in 2003, the value proposition is provision of credit and funds management. Bank assurance volume is important as well. Performance assessment is still 100% product based.
Revenue	
Customer Segments	Small Businesses have replaced the initial Professionals segment extending the concept of those running their own business
	Affluent customers with over a 100.000€ funds under management remain a core segment.
	Mass retail has extended the Employees segment of 2003
Customer Relationships	The only metric is still Cross Selling Ratio
Channels	Same as in 2003. Own channels such as branch network sales force and Open24 sales force. Phone and internet for commission producing transactions.
	Retailers (car, appliances, etc.) providing credit
Revenue Streams	Interest margin, transaction commissions and insurance premiums remain the sources of revenue
Cost	
Key Partners	As retail credit remains the main pillar of the value proposition still retailers act as additional credit delivery channels
Key Activities	As the credit market becomes saturated the main activities shift to customer attraction, up selling, cross selling and anti attrition
Key Resources	Extension of branch network, customer service training and tools for operational efficiency
Cost Structure	No change in this element. Still all retail network operating costs are allocated to branches and combined with the revenues per branch, form the branch profitability

Figure 6. Strategic positioning of the Greek bank in 2005



It is obvious that the bank was trying to conform to changes occurring in the external environment. The disengagement between the metrics and the customer-centric business redesign is obvious, confirming the Delta Model's attempt to mitigate and align strategy to its execution. Still, in the business model theme, the shift from provision of credit to the defensive position of restructuring credit does not constitute innovation in the value proposition. Therefore in this particular case although there are changes in the elements of the business model as a reaction to the environmental changes, the main theme of delivering value to the customers has not changed.

From a business level strategy standpoint neither the business plans nor the metrics used, could prove a shift of the strategic positioning of the company from Best Product to Total Customer Solutions or to System Lock-In. In the span of 8 years for the particular case the strategic positioning remained Best Product (see Figure 7).

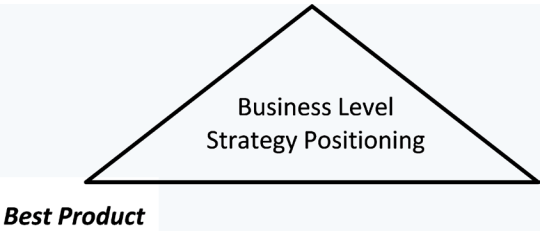
CONCLUDING REMARKS

Starting with an overview of the basics of IT research in the banking industry, and in the light of the increasing use of IT and the Internet by both established actors and newcomers in the sector, this chapter dealt specifically with business model

Table 3. Mapping of 2011 performance metrics to the business model canvas elements

Value Proposition	Credit restructuring. Performance assessment is still 100% product based.
Revenue	
Customer Segments	Small Business has replaced the initial Professionals segment extending the concept of those running their own business
	Affluent customers with over a 100.000€ funds under management remain a core segment.
	Mass retail has extended the Employees segment of 2003
Customer Relationships	The only metric is still Cross Selling Ratio
Channels	Open 24 is out of the picture. Branch network is resized. Phone and internet remain sources for commission producing transactions. Retailers still provide credit but pre-credit control is tighter.
	Retailers (car, appliances, etc.) providing credit
Revenue Streams	As credit risk increases and funds are insufficient, emphasis shifts on insurance premiums and transaction commissions still contribute to revenue
Cost	
Key Partners	As retail credit recedes, the role of retailers as additional credit delivery channels is not as important
Key Activities	Credit restructuring and securing outstanding balances
Key Resources	Branch staff
Cost Structure	Loan provisions heavily affect the profitability of the branches

Figure 7. Strategic positioning of the Greek bank in 2011



innovation in traditional banks. A framework was built which could support the monitoring of evolution of incumbent firms' business models through the use of metrics collected at the business level. To put the framework to the test, it was fed with metrics used to monitor the performance of a retail bank network over the last 8 years. This made possible the examination of the evolution of the customer value proposition (the core business model element) as well as of the strategic positioning of the bank. The empirical application of methodology indicated that, at this level, no significant changes to the business model were identified.

As this is an ongoing research, the conceptual framework presented can be further fine-tuned. Future research could produce a more extensive list of parameters that could include explicit as well as implicit metrics that go beyond the retail branch network domain to the rest of the commercial bank activities. Additionally, further research could enhance our understanding as to the ways in which banks view innovations like Peer-to-Peer lending and financial management platforms that have developed outside of the banking industry. Last but not least, the validity of this framework depends to a significant extent upon the proper design of information systems that bear the collection and processing of metrics and, as a result can support the short- and long-term operation of banking institutions. In this regard, information systems' design and performance represents a necessary condition for the further testing and use of this framework.

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KEY TERMS AND DEFINITIONS

Business Model: A concept that describes the general approach an organization has adopted to go about and organise its business in order to create value for its customers and generate revenue.

Business Model Canvas: A conceptual framework that operationalises the *business model* concept by breaking it down into nine distinct areas, each of which deals with specific aspects of an organization's internal and external resources and activities.

Business Model Innovation: A radical or incremental change in the operation, organization, or product offering of an organization that affects the value proposition to its customers and business partners.

Delta Model: A conceptual framework in the field of strategy that links the business level strategy of an organization to a set of initiatives and processes used to realize its strategic positioning and proposes metrics to monitor the alignment of strategy with its implementation.

ENDNOTES

1 www.egg.com founded 1998 out of Prudential's banking arm and survived the dot.com burst (unlike other efforts like First-e) due to its flexible low cost infrastructure and low cost credit card offering. Today owned by Citibank, it still remains a pure e-bank which means it is only possible to operate an Egg account over the internet, or via their call center.

2 In the case of the banking industry, this is exemplified by the following statement from a Datamonitor report published in April 20 2001 "The mass desertion from traditional banks to online players that was so hyped just a year ago has failed to materialize. Instead, the traditional banks have realized that online is the way to go - as part of a multi-channel distribution strategy," available at http://www.datamonitor.com/store/News/barclays_a_big_bank_and_a_big_ebank?productid=FA7222E3-9BB9-48E7-8C54-88817B822F53 (last accessed March 2013).

3 By transaction banking, Marinč refers to activities with a one-time focus on a single customer which are scalable and can easily be replicated for transactions with many customers. Relationship banking, on the other hand, is defined "as bank activities that rely on often proprietary, customer-specific information, obtained through multiple in-

teractions with the same customer over time and/or across products. Such information is predominantly soft in nature (i.e., difficult to quantify) and therefore proprietary to the bank, reusable, and costly to produce" (Marinč, 2013, pp. 73).

4 Forrester July 10 2006 "Retailers Get Into Banking; So What for banks?"

5 Transaction platforms: systems and processes used for payments, billing, customer service, credit and debit card issuing and management as well as other streamlined and commoditized assets

6 http://www.ecb.int/paym/pol/sepa/html/index.en.html

7 The Second Banking Directive effective from January 1st 1993, established the mechanisms of home-country control, single licence and mutual recognition in order to create a European financial area with the free provision of financial services.

8 The term Bancassurance denotes the provision of banking and insurance products and services through the same distribution channel to the same customer segment.

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Chapter 74
The Role of Social Media Strategies in Competitive Banking Operations Worldwide

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ABSTRACT

Social media has rapidly taken its place among the important phenomenons of today. It has an important role in institutionalization and companies' financial effectivness in many fields. This chapter discusses concept, development of social media, investigations about social media in different continents, its relation with institutionalization, and its role in the banking sector in the process of globalisation. In this study, social media strategies of a global bank on different continents are empirically analysed. Obtained data sheds light on the relationship between the social and economic capital in today's world in an interdisciplinary platform.

INTRODUCTION

A study conducted in USA puts forward various findings indicating a positive relationship between brain health of the elderly and social interaction. According to the same study, on- line social networks also support brain health of the elderly although it is realized in virtual environment (Ristau, 2011). What are the institutional and financial influences of these virtual formations which we define as new media? Can differences be seen between countries or continents? This study is based on such a problematique.

Being one of the social media accountant is very favourable nowadays and is a sign of being updated and instancy in the digital age. It is a must and vital for enterprenuers, who are rivals in the age of digital speedity on the social media. We have already known that the world is nothing than a small village anymore thanks to digital social

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media. The first popular social media is Facebook, where a news or a photo or an opinion or a suggession for action is shared once, then almost hundres or more see it, like it or hate it instantly. By the time, people, in pursuit of earning more, discovered how fruitful social media is and how earnings would be duplicated via advertisements on the social media pages. Many enterpreneurs in various fields have already attempted to take their places on the social media. However, banking business was not the first to involve with the social media. ING Bank is one of the assertive Banks, with its registered quality in the field of global banking.

ING Bank has many offices around the world; four of them are Australia, Canada, India and Turkey. The objective of the research is to investigate how ING Global Banking manages social media affairs and how it gets into contact with its customers and what kind of strategies it developed on Facebook. This is an emprical study in which discourse and semiological analyses and the significance of the subject matter is that ING Bank was awarded as "the most successful effective banking management" in Eastern Europe in 2012, with the products and services it provided to global customers. This investigation relates to the ways it deals with its global customers on social media and from that point it worths investigation. The research is limited to three months December 2012, January 2013, and February 2013.

Through a quick investigation on the social media, it can simply be recognised that ING banking is one of those whose global banking affairs expanded from America to Australia; Asia to Europe in the world. ING Banking seems well updated itself with Facebook and has taken its place among Facebook accountants, which is very popular for instant communication among people and private organizations for public announcements or civil public institutions especially governmental or political propagandas all around the world just like an epidemic. Beforehand, it would be beneficiary to learn more about some terms or concepts like globalism, social media, Facebook and the relationship among them.

VIRTUAL STRUCTURES OF COMPANIES AND CORPORATE COMMUNICATIONS

This part of the study investigates virtual structure types of companies. Virtual structures will be evaluated in the context of corporate communications. As known, internet has arisen with computer network constituted by Pentagon in 1969 for sharing data of Advanced Research Projects Agency (ARPA). Excghanging messages have also been enabled beside data through this network and expanded towards community and became World Wide Web (www) today. The concept of syber space formed as the result of this structure defines the interaction space in which global computer network which constitutes internet is formed (Giddens, 2000:418-420). Today, syber space not only forms a part of our reality but also has become a place which significantly reforms it. However there is no doubt about the presence of this place but also it becomes impossible to mention about its presence. So the concept 'virtual' is used to define that type of a reality. Virtual means something that is not actually present but seems as present. Virtual reality emphasizes the virtuality of reality by referring to a similar definition. This reality also reflects to corporate communication field and activities done by companies in syber space are integrated in the structure of reality (Koçel, 2001:361).

This new extent which is effective in formation of reality has begun to pull the business enterprises towards itself. It emerges as a quite effective tool particularly in public relations studies beside all activities of enterprises. Public relations activity which follows a way from institutionalization to nationalization constitutes

an institution image through institutionalization and works on a plane which targets to control the institution perception of the target group (Yılmaz & Ertike, 2011:132-134). The concept of corporate communication is used in order to refer to communication field within this system. Concept is used to discriminate marketing-based public relations and esteem-based public relations. The concept of corporate communication may be defined as " a social process which enables continuous data and idea exchange between both varius departments and elements of the enterprise and, enterprise and environment or constitution of required relationships between departments" (Akat, Budak, & Budak, 1994:272). Corporate communication transfers the effectiveness of corporate behaviours to all marketing fields and stakeholders (Steidl & Emery,1999:77). It refers to the communication between various target groups with this aspect. Communication channels gradually gain importance when communication is taken into consideration. Communication in virtual environment extremely gains importance as social media is one of the most important communication channels today.

Emergence of communication in virtual environment is possible through formers of communication. This formation requires a team work. Virtual team at that point is defined as "a group of people which works independently from time, place and group borders using technology in order to reach a common goal" (Akdoğan & Oflazer, 2002:827). Conducting this team work is enabled by virtual offices. Virtual work and workplace is used to determine "offices which are supported by information and communication technologies and which do not need dependence to a certain physical environment, and work trough a web site used commonly by a group of virtual workers" (Tutar, 2002).

Virtuality may be tool which is used to communicate and also sometimes the enterprise itself is seen to become virtual. Virtul companies which are defined as " independent company groups boud to each other with information technology in order to share skills, costs and market access" (Li & Xiao, 2006). Products or services may also become virtual as virtual companies. Virtual products or services mean " the products or services which are produced, distributed and sold in computer networks" and we usually see them today (Skyrme, 2012).

Companies which become completely virtual or use virtual environment as a tool are obliged to some type of network place. These formations which are named as virtual web are defined as "the open-ended clusters in which the companies are included which can contribute to any projects before the establishment of virtual organizations and of which properties are accepted by others as a result of a preliminary assessment," (Franke, 2012). Organizations constituted with these webs are named as virtual organizations and defined as " a group of companies which behave as a temporal and a single enterprise through joining to each other" (Wang, 2000). Maintainability of that type of enterprises depends on the continuity of supply and demand relationship.

A final concept is the concept of telework which refers to work from home. Telework is an expanded form of telecommunicating which is used to enable to work from home in order to reduce the time to go between home and workplace. The concept telework emphasizes the telecommunicating's converting the work to holism (Ölçer, 2004).

Working structure which is tried to describe under the light of basic concepts refers to the companies which maintain some part of their presence in virtual environment beside the companies which completely work with a virtual structure. These formations may reach houses of people through computer hardwares and enable an intense mind contact. Mind contact manifests in in-house and external dimensions.Corporate culture and institutional commitment may develop and it also contributes to relationships with media which are indirect public relations tools. Virtual reality forms a significant domain of corporate

communication also during crisis (Sayımer, 2008; Uzunoğlu et al., 2009).

Social network which is out of the enterprise and thereby not controlled by the enterprise but also enables access may be used as market based and for corporate communication purposes. Especially the messages in facebook and twitter may be used for promotion and announcement of corporate activities. The present study is focused on announement types in different continents. Although data will be discussed in 'Results' part, usage of social networking site must also be discussed. The following part mentions about this issue.

AN OVERVIEW OF SOCIAL MEDIA STUDIES IN DIFFERENT CONTINENTS

While value is focused in America, it is seen that on- line networks and influences of them on social life are focued in other parts of the world. However, while it is tried to analyse whether on-line life has a negative effect on off-line social life in Europe, it is questioned whether social media has a positive effect in Asia. The research has indicated that only a trend difference is present in studies investigating the same research object however the principle of the universality of science is preserved. The main factor which determines the trends is the closed gaps by level of knowledges produced by countries. Mental concerns become specific as information gaps are closed. Another factor which determines trends is the traditional cultures in which scientists grew and the effect of presence of sub-cultures composed of academies as a group. So, while value is in the foreground in USA which is a more individualist and cosmopolitan community, destructive aspect of social media on daily relationships is the deterministic factor of the examination plane in European countries in which traditional culture is strong and positive aspects of social media on socialization is emphasized in Asian countries in which community culture is dominant. However we must state that specific characteristcs of the studies are at leve of nuance. Particularly, if we may state that social structures become similar in globalisation process and the world which gradually becomes a global village produces individuals who have similar conscious structure, it may also be possible to mention about the similarity of conscious structures and awaraness levels of scientists. Universality of science becomes closer to its real meaning. It may be useful to emphasize that the abovementioned differences would not localize them.Given that there is only a trend difference between studies, it would be possible to state that scientific studies are global in fact and each trend gives a different color and dimension to common global efforts (Stefanone, Lackaff, & Rosen, 2011; Gosling et al., 2011; Gonzales & Hancock, 2011; Junghyun & Lee, 2011; Kalpidou, Costin, & Morris, 2011; Thomas, Robert, & Dunbar, 2011; Hsu, Wang, & Tai, 2011).

GLOBALISM, SOCIAL MEDIA, AND BANKING SECTOR

Ino Rossi points out the increasing and deepening interaction among different cultures and traditional conflicts. To him, globalism is a process manifested within the social layers of a society itself. These conflicts are motivated by social interest in a society. Gradually, it is accompanied by multi cultural affairs and information technology as well (Ceylan, 2011: 37).What bears a major significance here is its strict observation over intercultural behaviours of people. Countries are in hard rivalry to acquire the capital, which is a principal element of production, on their side. Thanks to ICT developments and globalism, economical and social substratum have to face a radical change (Soros, 2003: 2).

One of the crucial points with the globalization is some critical thoughts about its eliminating of

traditional values. It is an inevitable process which can be denied conversely. Globalism establishes a threat against cultural values and identities (Stiglitz, 2006: 273). Functionally, globalism is established upon hard competing which enables setting its own values separately. It means that traditional culture substantially might get injured.

Some researchers evaluate globalism prior to its political cultural and ideological aspects (Ertürk, 2010: 25). One of the factors of its fast expansion lies in the developments of Information Communication Technologies (ICT). Data improvements and ICT developments especially on the internet phenomena affected financial markets directly and inevitably (Ceylan, 2011: 52). The undeniable impact of ICT during 1980's, almost extinguished the concept of "distance" on earth. Within its ideological respect, globalism exists on a dialectical base (Ertürk, 2010: 26-27). Expansion of globalism is not estimated as limited only with the developments of technology and ideology, but also economically. Globalism has an active role on the global integration of expansion and improvement of economical, political, and social systems of countries (Ertürk, 2010: 28).

The internet has become an ubiquitous tool for users ranging from professional careers to casual housewives and being online has prompted curiosity and speculation about the interaction between this technology and individual person variables (Mitchell et al., 2011). Therefore, the equilibrium between the counterparts are highly considerable. On Facebook, there is a heterogenious population on each social level, some are disguised, some fake, some not. Institutions with a good image and profound vision for the future have to be on good terms with online social media users.

According to Marshall, social media means one or more people connected each other with social activities (Marshall, 1999: 4). Thanks to ICT and globalisation, today we have a different sort of media which is called "networking society." Today individuals are surrounded with nets which provide them immense facilities. On the other side, users, doomed to computer screen only, lead an unsocial life. Social net works can be defined as individual web pages that enable people sharing some fruitful information around and making socialization possible for those who would like to have interactive relationships (Özmen et al., 2011). Contents are bound to people and can be determined independently. In other words, social media eliminates time and space boundaries and develops a kind of commuınicational system in which mobile sharing based on "discussion." Social media platforms are mainly established on the basis of "communication and "sharing" (Erkul, 2009: 8).

Facebook is a networking system which provides people interactions and sharings, join other groups, write about a subject and express his opinion on open access platforms online (Gonzales, 2010). Facebook was created by a Havardian student Mark Zuckerberg to keep in touch with other Havard students over the Internet and get to know each other better. By the time, Facebook became so popular that is was soon opened to other colleges. By the end of the following year it was also open to high schools. The year after that, it was opened to the general Internet public. According to the statistics, Facebook has reached 1 bilion users in the world and day by day it is getting incresed. At present, most instutions, companies have Facebook accounts and make their business via online transactions. As a conclusion, explosive innovation thanks to the growth of ICT, particularly the provision of welfare services, largely unchanged. Where socialising, commerce, information finding, entertainment and travel have all undergone profound structural transformations (Shah, 2012).

Another aspect of this new world set on a technological basis emerges in the increase of cross- border activities of financial sector. Global ownership and global activities have already come into prominence and the expansion of ICT at top speed also caused the increase of cross- border capital flows. Besides the removal of exchange

questioning, major reasons of globalism are easy accessibility of foreign securities thanks to technological revolutions and the rapid increasing importance of institutional investors in addition to the diversification of the portfolio (Şener, 2012). Along with the technology, financial sector has been expandad all around and brougt facilities to some daily business. People have alreday achieved the facilities of banking transactions online at desk, which exposed globalisation of banking systems as well.

Internet users are now broadly representative of large swathes of the population, with far fewer groups remaining unconnected to the Internet – the elderly, low-educated and disabled being the main examples. From the point of view of public service delivery, it is of course highly important to encourage these groups to get online, to ensure equality of access to the opportunities available there (Shah, 2012).

People, as a must of information society, should be provided technological conveniences by govenmental subsidaries as a need of cross-border relations.

Establishing groups in the social media are closely related with social capital idea which is defined as people's social networks and mutual trust that they can draw upon in order to solve common problems. Social capital is very important for improving group social participation (e.g. perceived membership and influence (Tsai et al., 2012).

Social media consists of tools that enable open online exchange of information through conversation and interaction. Unlike traditional Internet and communication technologies (ICTs), social media manage the content of the conversation or interaction as an information artifact in the online environment (Yates & Paquette, 2011).

Banking hosts seem quite beneficiary part here as costumers are ready to interact online from social capital point of view.

What social media online system exposed on banking institutions generally is integration of some new units. Additionally, it also provided standardization of information flow system, improvement of efficiency, recurrence of the same transactions and more work in less time.

Moreover, it provided a decrease in manager employment, less cost and distribution of management responsibilties and globalization, as well (Işın, 2006).

These days' computers, mobile phones and the Internet serve as central means of communication, social interaction and entertainment, and the popularity of new technology has played a prominent role in the rise of different online networks (Näsi et al., 2011) Among the social media sites, Facebook is the first and the most prevalent one. On networking, people have the opportunity of expressing themselves in louder voices. Therefore being instant and have an account on the social media is one of the musts of information society. Social networks gained much respect for many institutions as a source of information and feedback for social networksa re environments where most people react negatively or positively but independently. Similarly, Facebook users actively use and follow online banking occasions or ask questions, like or dislikes about transactions or bank officials, in the trendy way of the digital age.

Investigations demonstrate 44% of global customers use social networks in order to get individual banking information. Türkiye is categorized one of the leading countries. Generally, 78% of customers use social media with the purpose of banking products and services and 53% as feedback they experienced (Elhadef & Hatipoglu, 2012: 7). Facebook, as the most preferred social site in Türkiye provides an environment on which users

evaluate products, experiences, feedbacks, services, opinions or actions, etc. as likes or dislikes independently. As a conclusion of globalisation, Facebook gained a huge number of banking hosts as new accountants and their customers as well. ING Bank is one of them participated and establised a remarkable position among counterparts.

On examining four web pages of ING Bank Global Offices on Facebook, an apparent similarity about the visual frame is remarkable. The orange colour at the background and the lion image on it toghether are the components of official ING Bank logo. Each Facebook Time Tunnel page of ING Bank includes many themes under different titles within Time tunnel windows. According to their contents these windows can be classified into seven sections;

- Contents relating to ING Bank advertisements, announcements and campaigns and videos relating to products and services.
- Customers' Questions &ING Bank Answers; Customers' feedbacks (positive and negative.)
- Contents relating to ING social (responsibility) activities.
- Surveys and contests relating to product and services.

It can be submitted that contents are mosty focused on advertisements, announcements, campaigns and feedbacks.

AMPRICAL ANALYSIS

ING Bank Australia on Facebook

ING AUSTRALIA began operating in Australia in 1999 and joined Facebok in 2010. By doing business online, over the phone and through intermediaries, they keep overheads low and pass the savings onto customers in the form of competitive rates. Today, ING DIRECT has $23 billion in deposits, more than $37 billion in loans and around 1.4 million customers. The page has 4872 likes.(March 9th, 2013, GMT 16.15)

Facebook Time Tunnel Contents 2012 Dec. ING Bank Australia

Contents Relating to Advertisements, Announcements, Videos, and Campaigns, Services, and Products

1. Make a list, check it twice (and more tips to make your money go further this Christmas). http://bit.ly/INGxmasSavingTips.
2. Only a few hours to go! What are your resolutions for the new year?
3. We've just announced that we'll be decreasing interest rates on ING DIRECT variable residential home loans by 0.25% per annum, effective Monday 24 December. ING IRECT's Mortgage Simplifier will be 5.72% per annum.
4. Are you Super savvy?
5. All sorted for gift buying, or are you a last-minute shopper?
6. Do you splash out, or save over the holidays? BBQ or Banquet?
7. Please look what Ing Direct do for italian market:http://www.youtube.com/watch?v=vB6cFsAgkbw
8. They stole the dream of many generation, why they do that?
9. Is terrible realy no soul, no respect.

Customer's Questions, Answers, and Feedbacks

1. Thank you, but why is it it taking so long to pass on the rates cuts?
2. Hi. Is it possible to add my fiancee to my current everyday account so she can get a card and access it? Or would we have to open a new joint account together?
3. Hi, I just wanted to find out that whether your fixed rate for home loan will reduce sooner or not? Thank you.

4. Hey! I was just looking up everyday accounts and came across your Orange Everyday account... I want to know how ATM withdrawal fees work. Do we pay them first, then get reimbursed for them once I withdraw $200?
5. I have a savings maximiser account and I was wondering how I can go about requesting a statement for a specific time period which I need for an application. It needs to be a standard bank statement so the export function available isn't going to help. Thanks! P.s. a 1300 or 1800 number would be great! I can't call the 133 number without getting charged on either my landline or mobile.
6. Yay. The Reserve Bank have lowered interest rates by 25%. Come on ING. Pass on the WHOLE cut! (u sure raise it by the full amount when interest rates go up)
7. Come on ING Direct the RBA just cut rates by 0.25% it's time to pass that cut on in FULL to your customers
8. Well Done guys, the big 4 need someone here to create some competition... I'm Glad I'm with ING - Leading the way once again...
9. Thanks for passing on the full rate cut, love your work! Show the big 4 up ING!
10. Why three weeks to get a rate cut? Surely it doesn't take that long to change a number on a computer? An increase is almost instantaneous on our loans. I don't understand. I am happy or the cut, but it seems like you are taking what you can for three weeks.
11. Bravo ING Direct on passing on the full rate cut! Thank you for leading the way!
12. Well done ING! The full 25 points. Corporate creed set aside!
13. Yay for passing on the rate cut!
14. ING Without a doubt best bank, but considering you are purely Online based only, you would think your Android App would be semi usable. Huge let down in that department. Other than that, I am Happy.
15. Thanks for passing on the full interest rate cut ING - You guys Rock!
16. Hi, New ING Direct customer here, signed up a few days ago and my accounts were activated this morning; just waiting for my debit card to arrive:) Just a suggestion,maybe you could point your improvements team to have a look at the mobile banking apps from ANZ and Commonwealth. I just switched from anz and the login process on their app is much easier, a once off registration of your mobile device... then just a 4 digit pin next time you log on- which saves time. ING's current app is okay. But trying to find your client number to log on takes up time, Also aesthetically. if ING Directs new app looks like these or compared quality wise, everything would be perfect.http://www.gomoney.anz.com/http://www.commbank.com.au/mobile/commbank-kaching/what-is-kaching.html
17. After years of international travel, which unfortunately yet rather inevitably results in occasional fraudulent bank account activity while abroad, I haven't had an Australian banking institution to sort it out so consumately, quickly and quietly as ING! Thanks team for restoring some faith!
18. Best. Everyday. Account. Ever. ♥ u ING Direct.
19. I had a really bad customer service experience today & decided to close down all my accounts from ING (although started to a build my little savings for future home). No matter how good they offer to attract the potential clients. One of the customer service officers unable to explain & provide the written form of the policy that she asked me for a simple enquire and they call it SECURITY purpose! Finally I would like to score them below 5 out of 10 & I quit. Thanks to social networking so that we can express our satisfaction.
20. Will you consider matching your interest rate in saving maximiser with what others are at, such as Rabo? Im a long time customer

but I partly moved towards rabo due to the better rates, every little cent counts!
21. I am really unhappy with the online banking system. It constantly times out and I am having to log in multiple times in the space of a few minutes!
22. LOVE your customer service! Painless, friendly and efficient. TOPS!:D
23. Hey! Absolutely love you guys!! My one year old sons have accounts with Commonwealth and I'm already horribly dissatisfied. Do you have any accounts that are more directed to children? Or any benefits to a child joining? Also, can a child join?? If so, I'd really love to sign them up with you guys and make my life easier! Thanks, Amanda
24. I know not many people can say this but - I love my bank!

Surveys and Contests

1. Are you spent up already, or do you manage your pay-cycle budget with your savings?
2. Got any sneaky savings secrets?
3. How will you be spending Boxing Day?

Social (Responsibility) Activities

(None for this month)

Facebook Time Tunnel Contents 2013 Jan. ING Bank Australia

Contents Relating to Advertising, Announcements, Videos, and Campaigns, Services, and Products

1. Happy New Year, everyone! If you're back in the office today like us, ease in to it, and spend your first 2013 working day well.
2. We're happy to announce this week's winners of our Year of the Saver prize draw. They have won $2013 by opening a Savings Maximiser. You could too! Find out more at ingdirect.com.au/2013. Promoter ING Bank (Australia) Limited. Authorised under NSW Permit No. LTPS/12/11332, Victorian Permit No. 12/3404, ACT TP12/05079, SA Licence No. T12/2636.

Customer's Questions, Answers, and Feedbacks

1. ING you disappoint me! Your customer service if by far the worst I have ever had to deal with. You were absolutely no help at all when my account was drained overseas and with the 'glitch' that you admitted to has brought my account into overdraw. Your customer service people don't seem to know how to perform simple tasks when asked a question. I can't wait to close my account with you. It has been nothing but problems. I am now in debt over $150 out of my own pocket just in phone calls because not one of you can give me a straight answer!

Survey and Contests

1. Are you plugged-in to the news? Do you need to know what's happening in the world 24/7? We're wondering; where do you get your news from?

Social (Responsibility) Activities

(None for this month)

Facebook Time Tunnel Contents 2013 Feb. ING Bank Australia

Contents Relating to Advertisements, Announcements, Videos, and Campaigns, Services, and Products

1. 2013 is the Year of the Saver! To celebrate we are rewarding 10,000 of our existing Savings Maximiser customers. Terms and conditions apply.Visit http://ingdirect.com.au/saverrewards, check if you are eligible and tell us what you're saving for.
2. Want cash back? Here's how video!

Customer's Customer's Questions, Answers, and Feedbacks

1. Hi, is it possible to have a secondary orange everyday visa debit card for my partner to use overseas?
2. Hi Alain, we have 2 cards on my account and my husband used his overseas. Just let ING know he's travelling so they don't think overseas transactions are suspicious/ potentially fraudulent!
3. Thanks Jo. do both cards have the same number and security digits on the back Jo?
4. **ING DIRECT Australia:** Hi Alain, is your partner an Australian resident? To open a new account with ING DIRECT you must be an Australian resident. If they meet these criteria they can certainly apply and have a card issued in their name. There are some fees associated with using the VISA Debit Card internationally, you can view the information on our website under 'Everyday' - 'Where are the fees?' Cheers, Tash
5. If not am I able to change my solo account to a joint account for a secondary card?
6. **ING DIRECT Australia:** Hi Alain, a single account will only be issued with one card for the account holder. If you wish to apply for a second joint account you certainly can and each account holder is issued with a card, but you must meet the criteria to open an account. Thanks, Tash
7. Hi, how long does it take to transfer Funds from Commonwealth to ING Direct orange everyday account?
8. Does ING offer any sort of savings accounts for children?
9. How do i stop all this annoying crap coming up on my page?
10. My husband and I recently took out our first home loan with ING Direct. As expected we were very excited to be joint home owners for the first time. When I arrived home there was a parcel waiting for him at the post office. I went and picked it up and left it for him to open. However I was extremely disappointed to discover the parcel my husband received was in fact a house warming pack from ING direct which had excluded me completely. I was not referred to in the whole welcome letter.....disgraceful ING to discriminate against the joint home owner. I'm equally involved in this home loan, I share the debt & the home loan repayment responsibilities yet you send the welcome pack to only one of us - how can you justify that? I'm offended. I called the support line & nothing. The least you could do is apologize and send the other home owner their welcome pack. I'll be waiting for mine in the mail. We are planning to refinance in a year and if I am not equally acknowledged we'll be finding other lenders.
11. **ING DIRECT Australia:** Hi Michelle, we are sorry to hear that the experience of receiving your welcome pack has left you with a feeling of disappointment. As I am sure you are aware you have not been excluded on purpose. The pack itself is sent only with the intention of congratulations. Our apologises again. Cilla
12. **ING DIRECT Australia:** Hi Michelle, I have investigated your enquiry and have attempted to call you today. Are you able to confirm a good time to call back and have a chat over the phone? Looking forward to your reply. Regards Kayla.
13. Thanks Kayla, I much appreciated your call this afternoon. Thank you for your response to my concern. I'm glad to hear you are changing your procedures going forward & I thank you in advance for my house warming gift. Well done ING!
14. **ING DIRECT Australia:** Hi Michelle, I'm so happy to hear this has been resolved and you're happy with the outcome. It was lovley speaking with you. Congratulations

again of your new home and hope you and your partner are enjoying all the little treats in your housewarming gift. Cheers, Kayla

15. Time to update your iphone app I think. Use the ANZ app as inspiration:)
16. I received this email today:

Hi Peter,

This is just a short note to say thanks for banking with ING DIRECT and being a loyal customer. We value your business and we want tothank you for banking with us. If there's anything you need, or if you have some feedback you'd like to share, we always want to hear from you so call us anytime, 24/7 on 133 464.

Thanks again, Brett Morgan, Executive Director, Customers ING DIRECT. Feedback is always welcomed in my business (good or bad) and on this occassion I'm happy to say its all GOOD for your bank. I spruke ING everywhere. Banks rarely receive feedback of that nature. The only issue I have is attempting to forward my feedback, might I suggest an email requesting feedback with a reply email address. I tried the 133464 number but refuse to go through the whole prompt system, other than that congratulations on a job well done to date... Regards Peter

17. I wish the interest rates would go up my investments arnt growing very fast.

Surveys and Contests

1. How do you plan to spend your Valentine's Day well?
2. Got a favourite to win? What's your pick for the Best Picture?Oscars night!
3. How would you caption these pictures of Guy Sebastian? Caption one today and you could win a VIP Backstage Double Pass to one of his Get Along 2013 Tour concerts. More info on how to enter here:http://bit.ly/GetAlongWithGuy
4. We've got over 200 tickets to Guy Sebastian's next tour to give away, including VIP Backstage Double Passes. Enter to win:http://bit.ly/GetAlongWithGuy
5. Guy Sebastian fans, this is your last chance to win tickets to his upcoming tour. We've got over 200 tickets including VIP Backstage Double Passes to give away. Don't miss out. Enter before the competition closes:http://bit.ly/GetAlongWithGuy!

Social (Responsibility) Activities

1. Do some good Australia – rain or shine! Today is clean up australia day! So get outside and lend a hand!

ING Direct Canada on Facebook

ING DIRECT is Canada's leading direct bank with over 1.8 million Clients and close to $40 billion in total assets. ING DIRECT has been operating in Canada since 1997, and paid more than $5 billion in interest to clients. ING DIRECT is open for banking 24 hours a day, 7 days a week, at ingdirect.ca, on mobile devices at m.ingdirect.ca The mission is to help Canadians live better lives through changing the conversation about money. Welcome to Forward Banking. ING Bank Canada joined Facebook in 2009. 23.030 people liked the page (9th March, GMT 16.14).

Facebook Time Tunnel Contents 2012 Dec. ING Direct Canada

Contents Relating to Advertising, Announcements, Videos, and Campaigns, Services, and Products

1. Happy Holidays from everyone at ING DIRECT Canada!
2. Time to double the rewards! We've doubled our Refer A Friend Bonus to $50 and you have until December 31st 2012 to participate. Refer friends with your Orange Key

and you are both rewarded with $50! Rules and restrictions here:http://www.ingdirect.ca/referafriend/To help you spread the word we've created these handy Orange Key cards. Print them out, cut them and start referring all your friends.

Customer's Questions, Answers, and Feedbacks

(None for this month)

Surveys and Contests

(None for this month)

Social (Responsibility) Activities

1. The month of "Movember" is officially in the books. To do our part in helping change the face of men's health, we assembled a team of ING DIRECT's finest Mo Bros and Mo Sistas to raise money and awareness for prostate cancer and male mental health initiatives. Our team, The MOward Bankers, raised $6,500 for this worthy cause – which ranked us #685 out of 23,664 teams in Canada. To learn more about our team and the Movember initiative, visit our official Movember page:http://ca.movember.com/team/581653

Facebook Time Tunnel Contents 2013 Jan. ING Direct Canada

Contents Relating to Advertisements, Announcements, Videos, and Campaigns, Services, and Products

1. Millions of Canadians suffer from TFSA everyday... Get fast acting TFSA (Tax-Free Savings Account)relief now. Treat TFSA with great rates, no fees and no minimums. Get fast- acting TFSA relief now. http://www.ingdirect.ca/en/landingpage/tfsarelief/index.html
2. Start 2013 on the right fiscal foot:http://ow.ly/guvGO
3. Suffering from TFSA confusion? Here's a great source from the Canada Revenue Agency to help clear the fog! http://ow.ly/gxygB
4. Regardless of what side of the fence you sit on with the return of pro hockey, it's nice to read that the players wanted to improve the structure of their pension. Now, it has become a defined benefit and players are also able to contribute some of their own money to improve their pension package. Yes, we're talking about the 1%, but it's nice to see that they're planning for their futures, too.http://ow.ly/gCovy
5. T.F.S... A? Have you given any thought to your Tax Free Saving Account? This year the contribution limit is $5,500 - sweet!
6. Get fast-acting TFSA relief.
7. No minimums, no service charges. It's tax-free and the rate is great. In just one dose you'll be feeling better. http://ow.ly/gI9Fy
8. Ideally, we prefer more economical modes of transportation (public transit, two feet and a heartbeat), but the ongoing discussion of whether it's best fix-up, buy, or lease a new vehicle continues to challenge many drivers. Included in this article is the idea that '$4K in annual repairs is about the break-even point financially'.For those that drive, which side of the argument do you fall on? http://ow.ly/gO2iK
9. The ability to send money via text is apparently headed to Britain by Spring 2014. Would you feel comfortable sending your money by sharing only a phone number? http://ow.ly/gQjK5
10. For some of us, an #RSP account can seem like a blur, @Moneyville has got 10 facts that can get you focused:http://ow.ly/h6sRv
11. Confused & disoriented about the difference between an RSP and a TFSA? The Globe

and Mail helps shed some light:http://ow.ly/h6ro5

12. Spending problem? Blame it on your brain. The Financial Post has got some great tips on how your mind can work for you:http://ow.ly/h6sTl
13. Think you're too young for RSPs? Think again! The Globe and Mail has got pointers for every generation. http://ow.ly/h6sSy
14. Need relief from RSP Season? Moneyville's got some quick pointers when it comes to your yearly contributions:http://ow.ly/h6sUO
15. What better time to check on your financial health than a Thursday morning? http://ow.ly/hijwI
16. Happy New Year Savers! May all your savings goals be achieved in 2013!
17. "I will only spend money on what I need." We've learned our lesson after the holidays!
18. It's RSP season and which means it's the perfect time to check your financial health. Hop on over to our RSP Check-up app and see how you're doing: http://ow.ly/h41N0 How do you feel about saving during RSP season?
19. It's RSP season again. Time to get out your tissues, aroma therapy candles, and RSP remedies. http://ow.ly/h4FqX
20. It's cold, flu, and RSP season. Time to make sure your financial health is just as strong as your physical: http://ow.ly/h7PL9
21. Does size matter? If you're feeling overwhelmed about how big your #RSP contribution should be Globe and Mail can help:http://ow.ly/h6qV0
22. Think you're too young for RSPs? Think again! The Globe and Mail has got pointers for every generation. http://ow.ly/h6sSy
23. One of our Orange Ambassadors - Chris Vollick (aka @Canadian88 on Twitter) - has shared the '52 Week Money Challenge' chart that has been making its rounds online, and has plegged to save north of $1,300 this year. Who's going to join Chris? Have you set a savings goal for 2013? To read more about the challenge itself, read Chris' blog post here: http://ow.ly/gRw0q

Customer's Questions, Answers, and Feedbacks

(None for this month)

Surveys and Contests

1. Let's talk about budgets! How much do you usually spend on a night out with friends?
2. Who has been the most influential person in helping you take care of your personal finances?
3. Let's pretend your magic money tree grew a new $100 bill for the weekend. What fun would you plan to make the most of it? Spend it wisely...
4. We're looking for some good reads this lazy Sunday. Who has a good book or article suggestion for us?
5. It's TFSA season! Let's start the week off with a little quiz. What year did the Government of Canada introduce the Tax Free Savings Account (TFSA) as a savings vehicle for Canadians?
6. Our TFSA quiz week continues! The NEW annual contribution limit for 2013 has increased to….
7. Happy Wednesday, let's keep this #TFSA quiz week rolling. TRUE or FALSE: Having a TFSA has an impact on federal benefits and credits?
8. Need a cure to the mid-week blues? Maclean's Magazine shared a list of '99 stupid things the government did with your money'.http://www2.macleans.ca/2013/01/07/99-stupid-things-the-government-did-with-your-money-part-i/

9. Sunday mornings are best for which of the following? a) Brunch b) RSP planning c) Sleeping in
10. Interesting idea from the Financial Post today - would you rather pay down debt or make contributions to your RRSP? http://business.financialpost.com/2013/01/16/have-we-given-up-on-retirement-saving/
11. Following yesterday's RSP question, how much do you plan on contributing to your RSP this year?
12. When someone mentions 'money', the first thing that comes to mind is _____?
13. We'd like to thank all of our Clients and followers for their feedback. While it was never our intention to make light of any health concerns related to mental illness, we have heard you loud and clear. We have decided to remove our RSP (Retirement Savings Plan)) commercial from TV. It may take a few days for it to come off air, but the process is in motion. Please accept our apologies if you were offended by our commercial.
14. We're in the heart of RSP (Retirement Savings Plan) season, and we thought there is no better way to keep the momentum going than to start an RSP quiz week. Besides saving for your retirement, one of the main advantages of contributing to an RSP is that it helps to reduce your taxable income for the year. Question 1: what is the deadline to contribute to your RSP for 2013?
15. RSP Quiz time! True or false. Can you borrow money to contribute to your RSP?
16. Happiness is _____.
17. True or False: Canadians who plan their finances are happier.http://ow.ly/he1c3
18. What's the best retirement advice you've heard?

Social (Responsibility) Activities

(None for this month)

Facebook Time Tunnel Contents 2013 Feb. ING Direct Canada

Contents Relating to Advertising, Announcements, Videos, and Campaigns, Services, and Products

1. There's just a month till the 2012 #RSP deadline! Are you a procrastinator? Money Sense Mag has some tips for you:http://ow.ly/hiN1i
2. Are you in your 20s and trying to figure out how to start saving up for your RSP? Money Sense has some advice for you:http://ow.ly/hiSoU
3. The past two days we've posted Retirement advice for people in their 20s and 30s. Don't worry, we've got tips for those of you in your 40s too! Have a look.
4. This Valentine's Day, I'm being a smart saver by.
5. With Valentine's Day around the corner, here are 6 ways to save money! http://ow.ly/hEVMU
6. If a relative gives me American money, do I deposit it in the same way as I would deposit an American cheque? By sending it to ING Direct via snail mail in Toronto? I don't get USD very often, but it would be nice to know what I have to do to deposit it. Can I put it in one of the Exchange Network ABM's?
7. The Psychology of Smart Savings via savings.com
8. Thinking about applying for a mortgage soon? Here are some pointers from The Star that could help you clean up any errors on your credit score first. http://ow.ly/hRrgk
9. Don't you think you deserve a vacation? Financial Post has got some great ideas to help you start saving up for a trip, plus they've got some tips on how to travel on a budget.http://ow.ly/hTjrY
10. Think you know everything about mortgages? Here are 5 things you most likely didn't

know about the Canadian mortgage market via Rate Hub. Link to image:http://www.ratehub.ca/images/infographics/mortgage-market-statistics.jpg

11. Your future self wants to thank your present self for stashing away some of those hard-earned dollars
12. "The person who doesn't know where his next dollar is coming from usually doesn't know where his last dollar went." Anonymous
13. In a few days we say goodbye to pennies! How do you feel about that? Hoard all the pennies!
14. Different generations have different needs and priorities, we get that! So to help you guys out, next week we'll be posting some Money Sense articles that will help shed some light on how each age group can invest in their Retirement. Check in everyday at 9am ET starting tomorrow!
15. Did you know that today is the day that our Canadian pennies are phased out?! So now what? Check out Royal Canadian Mint's website for some answers on what happens next.http://ow.ly/hj6Ek
16. For those of you in your 30s, we know things can be tough financially as you try to balance family, debts, and savings. Need a bit of help when it comes to retirement savings? Here's some RSP advice for you from Money Sense: http://ow.ly/hiT3y
17. THRILLED & honoured to be teaching a series of by donation yoga classes at ING DIRECT Canada's Orange Cafe in Toronto all March long, in support of Power of Movement! (also excited to be volunteering at the event March 3rd w/YogaFit Canada) http://www.powerofmovement.ca/
18. Hey Savers! The price of gas has gone up yet again. Here are a few tips to help you save in these kinds of circumstances:
    a. Try to keep your car as light as possible by removing excess weight. With less to pull, your car will use less fuel!
    b. Consider commuting. You will be doing your wallet and the environment a big favor!
    c. Keep your tires properly inflated. Believe it or not, this will make a big difference in your gas mileage!
    d. Turn off your car if you are idling. It costs less fuel to restart your car than to keep it on when you're not moving.
    e. Drive at the speed limit! Constantly accelerating only wastes gas. Besides, a speeding ticket is much more expensive.
19. If you're in your 50s and 60s, you're most likely thinking pretty seriously about your retirement plans.Read this Money Sense article for some insight on how to use your RSPs to reach your goals: http://ow.ly/hiVcy
20. Ever wish you could deposit a cheque just by snapping a picture of it? Well, it's on the way. http://ow.ly/hC87i
21. Do you know the top 10 financial mistakes made by Generation Y, according to the Financial Post? Take a look at this article which also gives some great tips on how to avoid these mistakes in the future! http://ow.ly/hQVgP
22. Get Rich Slowly shares 10 tips on how to make extra cash. Turning a hobby into a business sounds good to us! Some of these you can do while having a full-time job as well! Can you think of more ways that aren't mentioned?http://ow.ly/hvQ10
23. On March 1st, don't forget to RSP. Everybody's (hopefully) doing it. If you want to join the cool kids, RSP here: http://www.ingdirect.ca/en/save-invest/rsps/index.html
24. Here's a fun little infographic from mint.ca on the History of the Penny. Since it was re-moved from circulation just over a week ago, we're wondering - do you miss the Penny? http://www.mint.ca/store/mint/learn/infographic-history-of-the-penny-7200012

Customer's Questions, Answers, and Feedbacks

1. Does ING do RESP's? I need to move the one for my toddler, and since I'm moving all other accounts to ING, I'd like to bring the RESP over too.
2. Do you have locations with tellers? or just sign up locations?
3. So did the Capital One buyout only impact ING Direct in the USA?
4. Hello, how do I delete my account with ING and remove my details from your system? Please let me know what is the procedure for that. Thanks!
5. From a recent mail I got from you, under the "stuff your lawyers make you say" (cute), I saw that you've been acquired by The Bank of Nova Scotia. Can you please let me know what changes will happen and how it will affect your customers? Thank you.
6. I am wondering what the fees are to transfer RSPs from ING to another institution... (don't panic!! i am not saying i will do it, but curious to know anyway)
7. **ING DIRECT Canada:** Hi Kyle and Dogger, While we know that credit cards are a hot topic, we don't have an update as to when an ING DIRECT credit card will be offered. Keep your eyes open for updates here and on our website!
8. ING used to have the best USD exchange rates, now it is not!
9. How long until our 2012 RRSP and TFSA receipts are available online?
10. **ING DIRECT Canada:** Hi Rae, 2012 RSP Receipts were mailed out starting the week of January 9, 2013 and e-Receipts were made available at the same time. Receipts are not issued for your TFSA as that account is just that - tax-free! No need to claim interest earned on Tax-Free accounts. Be sure to check your tax receipt preferences online to see if you're set for "Electronic" e-Receipts. If you are and don't see your RSP receipts, call us at 1-888-464-3232. We're here 24/7
11. Dear ING, please come back to America. It was a poor choice to sell out to Capital One, but I know your fans will easily forgive you. Just come back and we will come back as loyal customers.
12. C'est la fin de ING pour ma famille. Le fait que ING ne permette pas les paiement de factures à la SAAQ vient de nous couter un beau $35.00 de frais de chèque sans fond. Erreur d'institution.
13. In your ads, you shouldn't make fun of people with illnesses and diseases.
14. I was offended to see the ING ad pop on my screen today while surfing.....I thought they had pulled the ad or was that just pulled from CTV.
15. After outcry, you pulled your TV ads but I see your pop up ads on websites continue with the same mocking tone. Are you just not getting it? Forward banking??? How about forward THINKING??? The shame continues...ridiculous.
16. Please, please, PLEASE roll this out for all clients quickly. This would instantly become the single most convenient feature of my chequing account. No more trudging to the ATM in -20 just to make a deposit. Seriously, please make this available for all of us very, very soon.
17. David Green How secure is this with programs like photoshop etc???
18. **ING DIRECT Canada:** Great comments, keep them coming. It's good to keep in mind this feature is still a pilot-project and we're testing it out to see what works. While our goal is to go paperless, for now, we still require the original cheque be mailed or dropped off to us. There isn't actual legislation in place just yet for features like this and until that happens, we're unable to be rid of the paper portion.

19. Buying with credit online and paying $25 for delivery.
20. Forgetting the chocolate and gifts and going to dinner at a restaurant; instead going to a local "wild game night" dinner with venison and other game for the low price of $15pp.
21. Me and my significant other wait until the 15th or 16th to buy each other chocolate. It always gets marked way down after Valentine's Day has passed by. Still the same chocolate, and the day isn't significant to us.
22. Credit cards? How much longer do we have to wait!
23. I asked the same question a few weeks ago and did not get a direct answer. Perhaps now that they are part of BNS those plans are being scrapped.
24. But you would think the opposite. they should offer a mastercard or visa at 9.99%
25. What happened the Apple Gift Cards for switching our payroll to ING? It was promised to be sent 30 days after - my payroll was transfered in October 2012. We're going on 100+ days late...
26. My roommate switched payroll on jan3 and got his a week ago.
27. February 26, 2013 and still nothing.
28. Yours - 0.988, interchangefinancial - 0.998!
29. You're complaining about 0.010%? Dont get me wrong I'd want my money as well but when you look at how "off" Ing directs TFSA compared to other online banks measuring in full percentages is, you'd have more of a shoebox to stand on.
30. I joined ths banking 1 thing thy dont tell ya you will not get ur pin number untill u have urselves idea notorized whch comes out of ur pockets.first u join then send a cheque they deposit in ur account u have set up on line.u awit for ur banking
31. **ING DIRECT Canada:** Hi Vwd Garcia, While we aim to make your banking experience as easy as possible, sometimes we require extra identification. Normally, by cashing your cheque and doing a soft credit check, we have everything we need to get you started. In some cases, there isn't enough credit history, and we ask for your help. This is where the form and your ID come in. Once verified, you have full access to your account and you'll have your new bank card before you know it! If you'd like some help completing the form, call 1-888-464-3232 anytime! If you live close to a Café, we can even help ID you instead. Check here for a location near you: http://www.ingdirect.ca/en/aboutus/contactus/index.html
32. No family day HERE!
33. Cool! Actually felt good after reading this yay Canada
34. Some good news here.
35. This graph is only true if your house already is n great shape. If I am buying a home and I will need to remodel it after I buy, I will take 5 - 15% off what the house would be worth after remodeling (depending how much work i will have to put in). If the seller did a really good job with remodeling I and I don't want to do the work myself of course I would pay a premium because remodeling can be a huge headache and i just saved on a headache!
36. Well I must say this is a heated topic. No wonder, the banks have been telling us for years to invest in rrsp But if you go into a bank and ask a teller to explain how it works, most can't. It has never been in the banks interest to teach people how their money works. They make money from people who trust them. If you have your investments with a bank you are not richer than you think. It is time people woke up and realized there is a better way. Ask me.
37. If there were a branch here I would. I have an autoimmune disorder and would like to see an answer more than your immune system attacked you but we don't know why. Good luck!!

38. **ING DIRECT Canada:** Thanks for your support, Debra! There are teams all over Canada not just in the Cafe cities. You can still participate at a location closer to you. Here's a list of locations:http://powerof-movement.ca/Register.aspx. Bring friends and start your own team!
39. I heard from the news, once you retire/withdraw your money, your tax will be 70% in total. My goodness. RSP is good for now, but they will bite you at the end.
40. Unhappy cat is unhappy about the low 1.35% savings account rate.
41. Sometimes People don't like when savings account fee is $5 plus and the bank pays interests less than 2%.
42. **ING DIRECT Canada:** Prosperity Good thing we don't charge fees on our Savings Account
43. Unhappy that you could at least match Canadian Tire Financial at 1.5%!
44. Here's one 20 year old planning for retirement.
45. Paid off my credit cards with my tax refund. Now my payments that I would have made to them are going to my savings account!
46. Paying myself first and not buying junk I don't need!

Survey and Contests

1. RSP Quiz time! To regulate your RSP contribution, there is a limit to how much you can contribute. What is that limit?
2. How are you finding ways to save this week?

Social (Responsibility) Activities

1. Happy Valentine's Day! Let's all join together and share some love for the Penny.
2. It's time to start hating debt again.
3. http://www.youtube.com/watch?v=XMo1dRiezaA&feature=youtu.be
4. Happy Family Day! For those that are enjoying a long weekend today, how are you making the most of your Monday?
5. If you're thinking about starting a family, or have a baby on the way, Money Sense has an article that can help you prepare financially for that little bundle of joy. http://ow.ly/hVaHp
6. Admit it - there are many who eat out regularly and this winds up costing more than if you prepared our own meals. Luckily, US News has an article that can help us save some money when we dine out. http://ow.ly/hVlUX
7. "The question isn't at what age I want to retire, it's at what income." - George Foreman
8. Now's the time to contribute to your RSP as the deadline is literally just around the corner (*cough* tomorrow *cough*). Don't be late!
9. Your future self thanks you for saving your green, to get you on the green.

ING Direct India (VysyaBank) on Facebook

ING Vysya Bank Ltd is a premier private sector bank with retail, private and wholesale banking platforms that serve over two million customers. With 80 years of history in India and leveraging ING's global financial expertise, the bank offers a broad range of innovative and established products and services, across its 526 branches. ING Vysya Bank was ranked among top 5 Most Trusted Brands among private sector banks in India in the Economic Times Brand Equity – Neilsen Survey 2011.

The ING bank was incorporated at Banglore city of India in 1930 and has been a Facebook accountant since 2012. People liking the page: 7.031 (9th March 2013GMT:16.16)

Facebook Time Tunnel Contents 2012 Dec. ING (Vysabank) India

Contents Relating to Advertisements, Announcements, Videos, and Campaigns, Services, and Products

1. First day, first shows burning a hole in your pocket? Not anymore! Get great discounts while you book your movie tickets online with ING edeals. Visit www.ingvysyabank.com/edeals We would love to hear your take on the movies you watch. Post them here.
2. Only time when 12+12+12 = 62 is right! Wishing Super star Rajinikanth a happy 62nd birthday!
3. May this Christmas bring you all the love and luck in the World. Merry Christmas!
4. Wishing you a Happy New Year! 2013!
5. Dr Priya Sequeira from Mumbai is all set to go places; Europe to be precise!3 more tickets up for grabs. Would you want to be next? Drop in @ www.ingvysyabank.com/europe
6. ING Swipe and Win a Trip to Europe. Our third winner is Jeebak Dasgupta. Jeebak has won a 'Trip to Europe' for the fortnight 16th – 30th Nov. There are 2 more 'Trips to Europe' up for grabs. Visit www.ingvysyabank.com/europe to know more. Winners of the Gift Vouchers will be informed separately by mail.

Customer's Questions, Answers, and Feedbacks

(None for this month)

Surveys and Contests

1. "In our endeavor to learn from you – innovate and improve our services, we request you to spare a few minutes and participate in ING's Annual 'Money and your child' survey by clicking the link below" www.surveymonkey.com/s/MoneyAndYourChildSurvey
2. Do you budget for your festive spending?
3. Share your New Year resolution with us. Come back after a week and tell us how it is going.
4. All of us know the best combination to unleash on the field. Give us your pick from India's finest. The 1st correct answer will win a special gift. Send your entries before 7am, December 5. Calling all the Super-Selectors!

Social (Responsibility) Activities

1. Christmas is around the corner and Santa is making his list. Was your child Naughty or Nice? Share photos of your child, tell us how they've been nice and if Santa is impressed, he might just come over with a gift The nicest kids watch out, Santa is gonna come home with a gift. Remember due to Santa's busy schedule, he'll only visit a selected few.
2. NAUGHTY or NICE? (159 pics) Here is a glimpse at all the kids who are NAUGHTY or NICE! Think your kid fits in here? Upload HIS or HER photo on the page!
3. It's time to deliver the presents! Santa is already preparing his list of the nicest kids to visit on Christmas. So hurry, send in your entries latest by 2 PM tomorrow (19th Dec). Remember, Santa has a long list and would only be visiting a selected few.
4. Santa visited some very nice kids this Sunday.

Facebook Time Tunnel Contents 2013 Jan. ING (Vysabank) India

Contents Relating to Advertisements, Announcements, Videos, and Campaigns, Services, and Products

1. Great Savings while you shop online with ING e-deals. Find out more @ http://bit.ly/11DK1tJ Maximum shopping, Maximum savings.
2. Traveling this weekend? Check out exclusive travel deals at ING e-deals. Find out more:

http://bit.ly/11DK1tJ Exotic holidays, exciting Discounts. Get great Discounts on Travel. Book online with ING edeals.

3. Non-CTS cheques will not be valid after 31st March, so order your CTS cheque now! More info: http://bit.ly/YFJ3gd
4. Wishing everyone happiness and prosperity on the occasion of Milad un Nabi.
5. Let's pledge to take our country to new heights! Happy Republic day!
6. ING Swipe and Win a Trip to Europe. Our Fourth winner is Akshay Wagh. Akshay has won a 'Trip to Europe' for the fortnight 1st – 15th Dec.
7. Get exciting offers on Shoes & Clothing. Read more: http://bit.ly/11DK1tJ Jabong.com. Get 20% off. Offer valid till 31 th March 2013.
8. We have the final winner for the "Swipe and Win" Contest. Congratulations Rajesh Rathi ! Find all winners @ http://bit.ly/XHbe7E

Customer's Questions, Answers, and Feedbacks

1. **ING Vysya Bank:** Dear Aesha Gupta Kapoor, as per your discussion with Ms Simrat from our Delhi Team, we are processing your request for the Foreclosure and the List of Documents. A copy of the same will be couriered as well.
2. **ING Vysya Bank:** Hello Ankit, We are quite sorry to hear about your disappointment. Our Team would be getting in touch with you soon.
3. I have a similar fate.. I have been following up for a month to get the Foreclosure letter and each time I get a response that it will be provided in 15 days. Can you please let me know who to escalate and how to take it forward.
4. how to purchage rail tickets through net banking ? (irctc.co.in > net banking option)
5. **ING Vysya Bank:** Hello, We are already working on this and ING Vysya bank would be listed in IRCTC shortly. We will keep you updated.
6. Wat will u do ??? By giving adds on media u spend so much.. But u have free space for display board.. Its been wasted....
7. **ING Vysya Bank:** Hello Prabhjot, Thanks for brining this to our notice. We will surely look into this.
8. **ING Vysya Bank:** Hello Vamshi, This is the Debit Card Annual Maintenance Fee that is levied on the 14th day from Account Activation for ING Orange Savings Accounts.
9. **ING Vysya Bank:** Hello Rajkumar, Apologies for the inconvenience. please PM us your contact number and also the branch with which you have your OD account.
10. **ING Vysya Bank:** Hello Santhi, We are already working on this and ING Vysya bank would be listed in IRCTC shortly. We will keep you updated and thank you for choosing ING Vysy
11. **ING Vysya Bank** Hello Ankit, Hope the issue is resolved and you have received the courier.
12. Is there a cut in Floating interest rate because of the recent RBI announcement?
13. **ING Vysya Bank:** Hello Dharmik, please find the winners list at the following url: http://bit.ly/XHbe7E
14. I have account at Ahmedabad and now I am in London. I was able login to my account but now it is not working and I have written them a letter but nobody is worried I think. Please help.
15. Yes, this is right way to expose them, how they serve the customer. Good idea.
16. **ING Vysya Bank:** Hello Ajit Parekh, please use the message option available in the page to send us your contact number.

17. **ING Vysya Bank:** Apologies for the inconvenience. Please PM your contact number.
18. **ING Vysya Bank:** Hello CA Yogeshwar Bajaj, Could you please confirm the receipt?
19. **ING Vysya Bank:** Hello Matlapudi Seshu Prabhakar, we are sorry for the inconvenience. Please PM your contact number.
20. I want a credit card... pls. guide me
21. Good bank.
22. Phew...got my offer letter after a long long time... today I can say m employed....thank u each and everyone for ur support and special thanx to ING Vysya Bank.....
23. Nice Bank with encouraging features.... Friendly staff.....quick service..lot many attractive features.
24. I feel very Good Performance.....
25. I found it is very easy & Comfortable to work with ING Vysya Bank Net Banking. They are faster to send the report/stmnt as compare to other bank. There customer care executive are also good to resolve the problem instantly. In a single line i can say Jiyo easy.(Good Banking System)
26. I am also acustomer of ing..... its true.....
27. ING bank very good to anther bank.
28. I am salary account holder, staff in this bank are very friendly & helpful.
29. Worst Bank.. frustrating experience.. have no work ethics... make customer suffer till death. Home loan division is pathetic. In today's world I am paying 14% as ROI and the bank ensures that I cannot foreclose my account.
30. (Ankit Lakhera) Why complaints are getting closed even that are not addressed by ING redressalfgrievances?? and No response on the query after that??????????? Now I have no choice left but to go to RBI and file a complaint against ING.
31. And the frustration continues! Finally after so much of escalations and follow ups I got the documents which I believe are the simplest kind of documents for a International standard Bank can provide! Those are merely List of documents and the Foreclosure letter! Now inspite of the delay from the bank, ING has charged me with the late fees and the broken period interest! what is that? The bank delays on such small things and is charging customers for that! Such things is certainly not acceptable.. I suggest the customers of the bank to make a note of the sufferings which the bank offers to their loyal customers! BIG DISAPPOINTMENT !- I have decided not to have any kind of association with the bank even I am making a loss!
32. Horrible service with no care attitude for its customers.
33. Absolutely ridiculous customer satisfaction...it jst seems they want customers but dnt care about after services.
34. I think the Bank would surely take an action on this & close it your satisfaction and avoid any social media viral image & rbi ombudsmen action.
35. I think u should refer this mattter to Bnaking Ombuds man.....u will get the information abt that from RBI site.
36. First go to ING ombudsman if they are of no help approach RBI ombudsman.
37. Very Bad experience with ING Vysya bank... certainly not acceptable.
38. That's truly disappointing! They're going to lose huge amount of customer base if this kind of service continues.
39. Hi Aesha. Hard to see one more bearer of the same pain. Well in addition to the social networking site I have escalated to Ing ombudsman. But I must tell you that the bank will charge you for the delays from their side and you will get this response.'This is a system generated report and we cannot do anything' so be ready for the same however I will not let it go like this after all this is about the hard money that we earn.

40. Guys be careful in opening ING -ORANGE account. ING welcomes you by debiting 225 Rs.
41. My account is 745044032948.I have OD account and i was charged O D renew charges some 11000+ and when i issued a cheque of Rs. 1,53,189 it bounced, on 11 aug 2012 and when i asked the bank about this, i got a reply that my O.D account is not renewed. When i told its already renewed and the account has been debited too, I was asked to contact to consult Mr Krishna Kishore. He said sorry and promised to pay me by cash the chq. returned charges. Later on i went to the bank, new manager promised me that the money will be returned to you if the account was not renewed. Kindly do the needful. I had other very serious problems too and that was a police case but as the bank employees are good, i did not inform to the police.
42. I am new customer to the bank and when i tried to use the Internet banking platform for booking my train ticket through IRCTC, ING was not there. It has almost all the Banks where there in IRCTC except ING VYSYA. what is the use of ING Online Bnaking then even if we cannot use it for a smal transaction like booking a train Ticket.
43. Worst ever experience with the bank services. Even after charging highest interest rates the services that the bank provide is pathetic. Its hard to say but INGVYSYA is not upto the mark to meet at least the basic standards.
44. Extremely regret to write that in spite of all good about the bank the bank have not able to deliver my ATM card in 9 months. My account was debited in April 2012 and couriered the card to my residence address and since we were travelling the card went back to the bank and after that i have requested to send it again and till now i yet to receive the card. pathetic people in call center, no responsibility on anybody to address the issue. Thanks to the system and procedures bank follow to run the operation where a customer grievances not addressed for such a long time. In case it reaches to ING my account no. is 550010002377. Thanks and best regards.
45. How r u Vinay. Tired of their call center no response and hence posted this. The bank is having relationship of 15 years and i m astonished by the service standard. You know in their TV commercial they r showing a man running behind the customer to hand over ATM card before expiry and here its just opposite i m running behind them to get my card. The spending on tv commercial is not justified by the service standard.
46. I am Good. Thanks! Good one. their tiger is sitting since inception-lazy (logo).Hahaha.
47. I agree with CA Yogeshwar Bajaj. I had similar experience since 2007 and gave up. I've few accounts in the bank but did not had Internet Login (Mi-B@nk). When asked at the branch, I was asked to contact call center for the password to be mailed to me. I contacted the call center and the lady verified my details and told me that the login id and password would be mailed. I contacted the call center again only to be given the EMS speedpost number. However, it never came. Now, I want close my accounts and open a new one since past few months but nothing moved. Their accounts dept come with bizzaire questions while opening a new account even for an existing customer. Still trying the worst bank to bank with in India! bunch of thugs and thieves looting the regular customer! I have closed by accounts with you'll and will encourage everyone to do so! CHOR CHOR.
48. I am really feeling very bad while writing this post on facebook about my very bad and awkward experience with ing vysya indore branch and team - Abhishek kukreti - BM. He is very unprofessional guy and not respond to customer. at the time of account opening

he committed a lot and now the condition is he is not picking phone. He has made the branch local kirana shop. He is not committed for the word vikas jain – 93003887911.

49. Robert Varda. SONIA GANDHI daughter Prinanka's Gandhi husband he is the most corrupted man in India he has became one ofthe most richest man and business icon of India.he has earned millions and billions of dollars in very short period.RAHUL GANDHI...he has been arrested by US police once.Because he was carrying suitcase full of $ 2million dollars with his girl friend who is a daughter of Columbian drug dealer.Police and media is not doing any thing against them because they have got power, they will kill people who will say any word against them and they have already done this before.
50. This is what I received from ING Vysya: Dear Customer This is in response to your mail/letter dated: 16-12-2012 with regard to updation of Mobile no and refund of policy amount posted in Blog. In reply we inform as under: As per the request your Mobile no is already updated in the account. The reversal of your policy amount will be credited into your SB a/c with in friday as confirmed to you by our concerned officer from the branch dated 08/01/2012. Hence treating your complaint as resolved and closed. MY ANSWER: Dear ####, From what you mention in your email, it appears that the matter is closed. You fail to mention in your email that it took me 2 visits to the bank branch and even then the cell no. never got updated. Then I had to raise the issue with the customer care and thereafter the no. was updated. What was done to ensure that it does not repeat in future? You just mention that the no. has been updated. Was it updated in time? Was it update in a manner that should have been? Also, my policy has been freelooked and I have received money in my account today. However ~200 Rs have been deducted from the 25000 Rs. Why were these deducted? Its not a matter of 200 Rs. But, first I am fradulently sold a policy by Aparna Kumar. And then I have to wait, visit the branch 3 times and then get money deducted and for what? My question is if it should have been freelooked or some other action had to be taken?`Was there any action taken against Aparna Kumar? Does the bank authorities know of this case? Or was it reported to be a case of simple freelook? Please note that I need an answer to my queries within 72 hours. I will then lodge a complaint with IRDA and Banking Ombudusman. Also, I am posting this conversation on the ING FB page so that others can read it and be cautioned. Abhiram Mishra.

Survey and Contests

1. Have you set a Financial Resolution for 2013?

Social (Responsibility) Activities

(None for this month)

Facebook Time Tunnel Contents 2013 Feb. ING (Vysyabank) India

Contents Relating to Advertisements, Announcements, Videos, and Campaigns, Services, and Products

1. **Zovi.com:** Get Flat 15% discount on all products with ING Net Banking. More info: http://bit.ly/11DK1tJ Flat %15 discount on Zovi.com. Offer valid till 30 th June 2013.
2. Get 10% off next time you book bus tickets online with redBus. More about this deal @ http://bit.ly/XHbe7E
3. **Valentines Day Exclusive:** Get flat 18% off on flowers only at Ferns N Petals with ING Debit Card and ING Net Banking. More info: http://bit.ly/11DK1tJ

4. **Valentines Day Exclusive:** Shop from Jewelskart.com and get Rs 500 off*. More info: http://bit.ly/11DK1tJ
5. **ING eDeals:** Get 20% off on shoes, accessories and much more only at Bestylish.com. More info: http://bit.ly/11DK1tJ
6. **ING edeals:** Get 6% off on over 10 million products at eBay India with ING Netbanking, Debit and Credit Cards. More info: http://bit.ly/11DK1tJ
7. **ING edeals:** Get 15% off on exciting range of apparel, accessories and footwear at inkfruit.com with ING debit cards and ING Net banking. More info: http://bit.ly/11DK1tJ
8. **ING edeals:** Get Rs. 200 to Rs. 500 off across categories on Tradus.com with ING Debit Card and ING Net Banking. More info: http://bit.ly/11DK1tJ
9. **ING edeals:** Get Get 8% off on mobiles, laptops and much more at shopping.indiatimes.com with ING Net Banking and ING Debit cards. More info: http://bit.ly/11DK1tJ
10. **ING edeals:** Get up to Rs 5000 off on international and domestic air tickets and up to 10% off on Hotel at VIA.com with ING Net Banking. More info: http://bit.ly/11DK1tJ
11. Wishing everyone a Happy rose day! Buy flowers from Ferns N Petals and get flat 18% off. More info: http://bit.ly/11DK1tJ
12. **Today is Propose Day:** Gift your loved one jewellery from Jewelskart and get Rs 500 off* with ING Net banking and Debit card. More info: http://bit.ly/11DK1tJ
13. **Valentines Day Special ING edeal:** Get up to 50% off on photo books, photo mugs and calendars at Zoomin.com with ING Debit cards. More info: http://bit.ly/11DK1tJ
14. With ING FD+ get the best rates and enjoy freedom to withdraw your money when you need it with No Penalty!. Find out more: http://bit.ly/WDNrtF Earn higest interest on your savings! 9.25% no penalties!
15. **ING edeals:** Get 6% cash back on your recharge at mobikwik.com. Offer valid for ING Net-Banking and ING Debit Card customers only. More info: http://bit.ly/11DK1tJ
16. This Valentines Day, let your gifts speak. Shop Online with ING eDeals and enjoy special deals & discounts. More info: http://bit.ly/11DK1tJ
17. With ING FD+ earn higher interest rates on your savings and enjoy freedom to withdraw your money when you need it with No Penalty!. Find out more: http://bit.ly/WDNrtF
18. No Pre-payment penalties with ING FD+. Now withdraw your fixed deposit anytime without any penalties. Find out more: http://bit.ly/WDNrtF
19. **ING e-deals:** redBus - 10% off. http://bit.ly/XHbe7E. Get 10% off next time you book bus tickets online with redBus.
20. **Indiatimes Shopping @ ING edeals:** Get 8% off on mobiles, laptops and much more with ING Net Banking and ING Debit cards. More info: http://bit.ly/11DK1tJ
21. Now get up to 9.25% on your FD with ING. Find out more: http://bit.ly/WDNrtF
22. **ING e-Deals:** Get Rs. 200 off on minimum purchase of Rs. 1000 @ Hoopos.com with ING Debit Card and Net-banking. More info: http://bit.ly/11DK1tJ
23. Get more from your savings with ING FD+. Try the Calculator to find out. More info: http://bit.ly/WDNrtF
24. **ING eDeals for your KID:** Get Rs. 100 off on minimum billing of Rs. 500 at SkoolShop.com. More info: http://bit.ly/11DK1tJ Let everyday be Children's Day! SkoolShop.com
25. **ING eDeals:** Get 5% discount on your bookings for a minimum transaction value of Rs. 1000 at Savaari.com. Offer applicable for ING Net Banking customers only. More info: http://bit.ly/11DK1tJ SAVAARI car Rentals.
26. **ING FD+:** Enjoy zero pre-closure charges with ING FD+. Now withdraw your fixed

deposit anytime without any penalties. More info: http://bit.ly/WDNrtF. Withdraw your Money when you need it with no penalty.

27. **Introducing ING Dining Deals:** Get up to 25% discount when you eat out and pay using ING Debit Card. Know more: http://bit.ly/WkTUff.
28. **ING Dining Deals:** Save more when u dine in Bangalore using ING Debit card. Know more: http://bit.ly/WkTUff
29. Non-CTS cheques will not be valid after 31st March, so order your CTS cheque now!. More info: http://bit.ly/YFJ3gd The OLD has to make way for the NEW!
30. The Best thing to hold onto in life is Each other. Happy Valentines Day! Check out the exclusive Valentines Day Offers: http://bit.ly/XDu17V
31. Wishing everyone a Happy rose day! Buy flowers from Ferns N Petals and get flat 18% off. More info: http://bit.ly/11DK1tJ
32. **VIDEO:** The Oscar for best chase sequence goes to……The chaser becomes the chased. A fantastic chase sequence on foot with a twist in the tale in the end. - ING Vysya Bank. Quick replacement of lost Debit Card

Customer's Questions, Answers, and Feedbacks

1. ING Vysya offered a forex rate of INR 54.01 on Jan 03, 2013. The IBR rate on the day is INR 54.34. The executive promised 5 paisa less than IBR rate. With rate of INR 54.29 (5 paisa less), the total amount of money will be INR 81,43,500 while it is just INR 81,00,960. A total loss of around INR 43k. Is this right? Please comment.
2. With regard your bad experience, you can drag them to consumer court!
3. Citibank did the same. The difference was Rs 1.65/Euro
4. This is for the current account. It's for an amount $150k. Their executive already promised 5 paisa less than the IBR rate. So guess this is not right.
5. They gave 50 paisa less. So we loss 43k INR.
6. If 5paisa less then for 150k dollars se u will be losing 7.5k Indian rupees!
7. Damn this bank. Somebody needs to do the dirty job of dragging them to consumer forum.
8. Surely bhaiya...this is not right...you should write back to them first...and plan for the next step after their revert...because once you get the clarifications/justifications from their end, you can then base your case on that as well as on the email confirmation sent by them earlier...
9. Yes Shilpa. They have agreed to revert the money. There are couples of other complaints for which I have written to them. Also engaged www.akosha.com to give it more formal process.
10. ing.no.1
11. (Victor Samson) A VERY VERY FRIENDLY AND FEEL FREE BANK FOR A COMMON MAN.
12. (Ankit Lakhera) Worst ever experience with the bank services..Even after charging highest interest rates the services that the bank provide is pathetic. Its hard to say but INGVYSYA is not upto the mark to meet at least the basic standards.
13. **ING Vysya Bank:** Hello Ankit, we are really sorry for the experience you had. Please private message your mobile number and the brief of your problem. ((ING Vysya Bank) Hello Ankit, Hope the issue is resolved and you have received the courier.
14. (Santhi Krishna) i am new customer to the bank and when i tried to use the Internet banking platform for booking my train ticket through IRCTC, ING was not there. It has almost all the Banks where there in IRCTC except ING VYSYA. what is the use of ING Online Bnaking then even if we cannot use

it for a smal transaction like booking a train Ticket.

15. **ING Vysya Bank:** Hello Santhi, We are already working on this and ING Vysya bank would be listed in IRCTC shortly. We will keep you updated and thank you for choosing ING Vysya.

Survey and Contests

1. What do you think was the most striking announcement of Budget 2013?

Social (Responsibility) Activities

(None for this month)

ING Bank Türkiye on Facebook

Ing Bank Türkiye was established in 2008. ING is one of the leading financial service institutions that provides people in the fields of banking business, assurance, assesment and loyality managementand expanded services and products in individual and institutional areas for almost five years in Türkiye. It has been expanded from Asia to America, Europe to Australia, having 85 million customers with 125.000 officers over 50 countries. ING Bank, originated from Holland, is awarded on the 81 st grade among Interbrand's the best 100 brands of 2007. ING Bank is successfully placed on the 7th grade among the biggest 500 company list of Fortune Global. ING Bank Türkiye has joined the Facebook in 2009 and 98.328 people liked this (9th March 2013 GMT 16.16).

Facebook Time Tunnel Contents 2012 Dec. ING Bank Türkiye

Contents Relating to Advertisements, Announcements, Videos, and Campaigns, Services, and Products

1. Big support to minors! Savings seminars! We cordially thank our "volunteer personnel" who gave "Savings Seminars" at schools within our Project.
2. "Access notifications on time" and click "Show it" buttons and chase after ING Bank campaigns and occasions for you!

Customer's Questions, Answers, and Feedbacks

1. I was also one of the vounteers, it was a real experience and a matter of pride.
2. First you sent a platinum card then cancelled it; then I investigated you asked for name and surname with the promise of calling back but its all silence! When will you be calling back me, I really wonder!
3. Aha ah…very good picture!

Survey and Contests

1. Secondhand selling and buying are highly favourable in smart phones and motor cars. Have you ever tried this kind of business when your budget is insufficient?

Social (Responsibility) Activities

1. General Manager of ING Türkiye Pınar Abay has been awarded as "The best woman leader" by Bosphorus University, Engineering Club.(6 photos)
2. We wish you an endless happiness and many realizations of your dreams in the new year!

Facebook Time Tunnel Contents 2013 Jan. ING Bank Türkiye

Contents Relating to Advertisements, Announcements, Videos, and Campaigns, Services, and Products

1. Credit for land (within 2/B project) property for %0,94 interest! Submission to http://bit.ly/WeckYf-
2. Access your bank via online banking (mobile or ipad) and get your e reader from reeder.

com.tr % 35 less. Last day January the 31th. For details; http://bit.ly/UmfHfK

3. All your expectations is here! Open a savings account with provision and get the advantage of tax reduce! For details and submission: http://bit.ly/UDbaYh
4. This offer is a real occasion! Access your bank via online banking, mobile or ipad till Feb.15 th, and try your chance for packing up for London, Arsenal- Manchester United home match! http://bit.ly/VIgGdM
5. Everybody Save!! No expiry date! In order to start saving with % 8 welcome interest; http://bit.ly/VMwlsE
6. Pay Tax on Motor Vehicles with your Bonus Card in 6 installments!! Grab the opportunity! Deadline; January 31th!! click for the details ;http://bit.ly/UUli2K
7. ING Bank purpose loan for 10,000 YTL, without cost, special to Şehrikeyif', for submission refer to http://bit.ly/ZOaIqh
8. According to the "Financial resolutions Survey," 2013 will be the "Year of Savings." In the survey, among the new year wishes are mostly "more saving" and " less spending." %49 of Turkish people wished to start the new year with the previlege of better investments http://bit.ly/XeSu5w
9. "ING International Savings Investigations 2013 Survey" showed that last year most cut down was on entertainment and recreation. People who claim no cutting down on expenses rated %28 in Türkiye.Details of the investigation ;http://bit.ly/V73kbe
10. Send an SMS to 2205 "mobile" and access your bank on your mobile! Log in instantly with your user code; for details; http://bit.ly/ViAWji
11. ING Bank Bills and Bonds are being offered to the public! Demand for lucrative investment opportunity in this collection! Final date January 9th! For more information;http://bit.ly/11f6eOF
12. ING Bank is supporting entrepreneurship in Turkey now! The European Investment Bank (EIB) provides employment and financial growth to Turkish SMEs with 100 million Euro credit via ING Bank in Türkiye! http://bit.ly/Wmzihq
13. In the "Case Management Achivement List" organised by Şikayetvar.com, we had the most successful Bank rate in the field of "Private Banks and Banking"in 2012!
14. Your ID Card is your Credit! For Public Officials Only!! Do not miss the credit without cost, with %1,09 interest;http://bit.ly/V6l6Rt
15. Do you need motivation for saving? ING's Senior Economist Ian Bright advises you to set a goal achievible by the end of the year and suggests to put aside a small amount on a monthly basis: http://bit.ly/XeSu5w
16. "Future is mine" Practica Camp submissions! the ultimate day!! Join with the Camp to give a direction to your career; http://bit.ly/V6nj7p
17. Searching for branch office managers of the future! Candidates for Retail, SME, Commercial Banking or sales executive positions!! come on! Applications must be submitted; http://bit.ly/14qrjol

Survey and Contests

1. According to a one-year data analysis "Saving Trends Survey in Türkiye" prepared by ING Bank Türkiye shows that Working Women tend to save more than men; but men tend to save less, in case she is a housewife.
2. On the very early days of the new year what's your major reason for savings?
3. In the ING Group Survey, the most popular answer to the question "What's your major reason for saving at the moment" is "my children and family." For whom or what are you saving ?http://bit.ly/Ztm3kL

Customers' Questions/Customers' Feedback

1. Will you need more personnel?
2. I wish I could….
3. Why don't you have a housing loan configuration?
4. **ING Bank Türkiye:** Hi Mr. Hüseyin, in order to contact with you, could you kindly send your communication information to our address at http://on.fb.me/QHkA1K Thank you.
5. We are not satisfied with your dealing with credit system; may be the problem is with the personnel. Early deposited installments are not paid in due time. Are we allowed to move our credit to another bank?
6. I have tried all cahnnels of communication to configure my housing loan but all are in vain! No reply for 15 days! Having customers follow the bank personnel is not pleasant! In case I were obliged to pay an high interest rate again, I would give a petition to Consumer's Court!
7. **ING Bank Türkiye:** Hi, in order to contact with you, could you kindly send your communication information to our address at http://on.fb.me/QHkA1K. Thank you.
8. What's the afterwards interest rate of welcome campaign,and what is the net interest does 1000 YTL bear?
9. **ING Bank Türkiye:** Hello Mr. Yiğit, in order to get detailed information about Orange Account and interest calculations please visit our page at http://www.ingbank.com.tr/turuncuhesap/vadeliyekarsi.asp Thank you for your interest.
10. How can I close my flexible account?
11. My retiring pension is deposited in your bank, shall I have the Orange Account as well or should I apply for it?
12. **ING Bank Türkiye:** Hello, Mr. Mustafa you could submit your application online at http://www.ingbank.com.tr/turuncuhesap/ozellikler.asp or via telephone banking 0850 222 0 600.Thank you for your interest.
13. Wanna 5000 YTL consumer loan.
14. How much is the interest rate, what are the required docs?
15. I applied 3 days ago for the credit, but nobody called me back negatively or positively! It seems quite utopic!
16. Are we supposed to pay any filing fee?
17. Hi, I made four installments on Nov 11th, 2012 with my credit card and the refund was made by the company to concerned bank on Dec 31st, 2012, but the bank reflected this process as nine installments on my extract. Customer service seems unable to find a solution for my problem.What kind of banking you are dealing with?? You keep my money for five months more and there is no collocutor and no explanation! I am the victim here! ING Bank should compensate this error immediately!
18. I love ING Bank!
19. Very good campaign! Congratulations!
20. When we arrive at the bank, you won't speak like that!
21. I applied for a "without cost loan" and had to pay 60 YTL for filing fee and had no reply yet!! Quit such tricks ING Bank!!
22. Here is Banking, I call
23. Hi here! I am a student. Can I get a consumer's loan for 2500 YTL? Thank you!
24. **ING Bank Türkiye:** Hello Mr. Ozgur.We are sorry to tell you that we are unable to give you more details about the evaluating criteria. You are kindly asked to visit our offices. Nearest Office addresses and phone nubers are available at http://www.ingbank.com.tr/subeler.asp Thanks for your interest.
25. **ING Bank Türkiye:** Hello Mr.Orhan, you can fill in the job application form at https://ik.ingbank.com.tr/You will be contacted when a positionis vacant, appropiate with your qualifications.Thank you for your interest.

26. I went to ING Bank Antalya Office, Manavgat Branch, which I have an account beforehand. I would tend to change it an Orange Account but I was almost scolded on my question, and couldn't even get a reply to my question! I am through with ING Bank!!
27. **ING Bank Türkiye:** Hello Mr. Ali, Hi, in order to contact with you, could you please send your communication information to our address at http://on.fb.me/QHkA1K. Thank you.
28. I failed to get any contact by telephone to your Ankara, Cankaya Office. So many times I have tried to call Cankaya Office, which is a vain struggle! Right now your number 0 312 441 84 27 is inaccessable! Could Mr. Ozturk examine his e post address and reply me back soon, please? Note: As a conclusion of my victimization, I will be changing my bank as soon as I land onTürkiye.
29. In addition to my vain efforts, International Fax Service Staples has already failed to send any docs to fax number given by ING Bank. I also failed to transmit my credit card debit interaction, therefore please do regard the petition I signed and scanned to you. I have been struggling with it for a week. For the information of authorities concerned, best regards.
30. **ING Bank Türkiye:** Hello Mrs Pınar, in order to investigate the issue you happened to meet, could you please share your phone number with us at https://www.facebook.com/messages/ingbankturkiye. Thank you.
31. I am an ING customer who has a stable salary but they refuse to loan me some credit! What's the problem?
32. We are the followers! I love INGBank! Thanks!
33. Great Bank!
34. Congratulations! You are very good at the business!
35. Congratualtions! By the way, I would like to take your attention to customer's service to reply faster.
36. Congratulations! Good job!
37. I am surprised! In fact, it is not!
38. I am beyond being surprised!
39. At the bottom of being surprised I am!
40. **ING Bank Türkiye:** Hello, Mr. Kemal, we would like to inform you that your opinions are highly appreciated for us and they will absolutely be evaluated on the way to upgrade our service quality. Thank you for your concern.
41. When I called up your customer's service for a transaction, he asked my ID number; I refused and ask for an another way to do the transaction. He was so rude and priggish! It is not surprising your rank in the list! You must have plenty of complaints at şikayetvar.com!
42. I am also shocked that you're awarded on the first rank!

Facebook Time Tunnel Contents 2013 Feb. ING Bank Türkiye

Contents Relating to Advertising, Announcements, Videos, and Campaigns, Services, and Products

1. Save 300 YTL a year!! Account management or Daily Banking transactions for free!; http://bit.ly/Y7mmBl
2. Private Credit from ING to Facebook accountants!! Apply fort he credit without cost up to 10.000 YTL!! Submit http://bit.ly/SplpBa
3. With ING Orange Account, Now saving is much more possible! For further details; http://bit.ly/XX6zyH
4. Now St Valentine Day's about to come ! Do your interactions online branches and get a 100 YTL off at Modagram.com, Trendyol's fashion site for her unique gift. Get discounts

on your purchases over 100 YTL! http://bit.ly/14HLVZq

5. Feel the experience of "Premier League" on the stands! Try your chance for one of the three couples!; http://bit.ly/VIgGdM
6. Meet ING Bank Orange Account today and start saving!! For further details and submission: http://bit.ly/VKdgrr
7. **VIDEO:** When applying for Available Credit, you won't need any recognisance at ING Bank! http://bit.ly/YBq3d3
8. If you think you wont need any recognisance when applying for Available Credit please click http://bit.ly/YBq3d3
9. Hi there, I do not like to save Turkish Lira but gold. Is it ok? We are not supposed to save only cash?
10. They had online interactions and had their ipad 2! here is the name list; http://bit.ly/VzyytW
11. Lucky three couple to watch the Arsenal-M.U match will have the pleasures of five o'clock tea at Ritz Carlton and "Panthom of the Opera" on the stage (8 pics).Just take the opportunity of this gorgeous weekend!! Get the opportunity and be one of the three couples!! Use internet banking, mobile banking and ipad banking.:http://bit.ly/VIgGdM
12. Have you revised your expenses before you started savings? According to ING Group Survey we mostly cut off from entertainment and clothing expenses.
13. Installments from 99 YTL, total 7.000 YTL consumer's loan click for submission; http://bit.ly/YBq3d3

Customer's Questions, Answers, and Feedbacks

1. **ING Bank Türkiye:** Hello Mr. Emir ING Orange Account is a TL checking account, (demand deposit), therefore you can withdraw or invest your Money any time without prior notice. Thanks for your concern.
2. As far as I am informed, most fruitful interest is here. I dont wanna credit card. How much interest does 5000 YTL make for 4 month? I will save 200 YTL every week; How much is the welcome rate? I won't withdraw for 4 months.
3. I**NG Bank Türkiye:** Hello Mr.Tolga, you can evaluate your savings in Orange Account. Welcome interest rate is 8.25% and you can calculate it at https://www.ingbank.com.tr/turuncuhesap/vadeliyekarsi.asp.Thanks for your concern.
4. Good evening, could you please tell me about the calculation of overdraft deposit account interest?
5. **ING Bank Türkiye:** Hello, Mr.Halil. ING Bank Holland and ING Bank Türkiye have different banking systems that's why you should apply to ING Bank Türkiye in order to have an account in Türkiye. Thanks for your concern.
6. When do the job applications start?
7. You can train people when they're younger. One should teach his children about money management. Do ING Bank have such a Project?
8. **ING Bank Türkiye:** Mrs Bahar, unfortunately we havent such kind of Project yet. your opinions are highly appreciated for us and absolutely be evaluated on the way to upgrade our service quality. Thank you for your concern.
9. Do we have to have a credit card in advance before we apply for a loan to ING Bank?
10. We are unable to join your contest "The Time comes," because somethin wrong with the system and refuses applications. For your infomation, sincerely Author Journalist Muharrem Akduman
11. I am a customer of another ban and I am in need of 18.000 YTL. Am I supposed to lend credit from your bank?
12. **ING Bank Türkiye;** Hello Mr. Berat, there is no obligation of having a credit card to get

a loan. You could apply for loan at https://www.ingbank.com.tr/sizinicin-kredibasvuru2.asp.Thanks for your concern.

13. **ING Bank Türkiye:** Hi Mr. Can, unfortunately we are unable to give information about the terms of credit card ownership. You could have a meeting at your nearest ING Bank Office.Here is the list of nearest offices and telephone numbers: http://www.ingbank.com.tr/subeler.asp. Thanks.
14. **ING Bank Türkiye:** Hi Muharrem Bey, in order to contact with you about the problem you faced, could you please send your communication information to our address at http://on.fb.me/QHkA1K
15. What are the terms of credit card ownership?
16. I loaned vehicle credit on 60 months installations from this bank but they didnot provide me any convenience. I will never deal my business with this bank at all!!
17. **ING Bank Türkiye:** Hi Mr. Ercan, You could have a meeting with the office to configure of your credit. Please kindly find addresses and phone numbers of the nearest ING Offices at http://www.ingbank.com.tr/subeler.aspThanks for your concern.
18. I am so satisfied with the credits I loaned from ING Bank. I would like to loan again.
19. Let him die who hates you!
20. Great Bank for me!
21. Better than Finance Bank!
22. I will, If had the chance of meeting Ronoy!
23. I think you'd better to train your personnel be on time first! Give up searching "the manager for the future"! Employ more personnel who are punctual and respectful as well!
24. (Zehra) You are great ING Bank!! There is no any other alikeeeee!! I sincerely celebrate St Valentine's Day of all ING personnell, primarily administartive board and the rest and wishing never ending success and smiling faces.. with loveee, thanks a lot for your kindnessss
25. (Rafi Tuere) Zehra works for ING Bank! Gee!
26. They are liars! They won't give you any credits!
27. We live abroad, we applied for housing loan, but you refused! you externalized us, you didnot hold us esteemed! We are Turkish citizens, as well!
28. Can anybody help me? Tell me how can I get into contact with this bank! I sent a message but nobody's back!
29. Bravo!
30. Congratualtions! We wish you establish one in Erzincan, too.
31. YOUR MONEY IS PRECIOUS HERE!
32. Thank you very much indeed! We have to g oto Türkiye to open an account! Good job! That's very kind of you!
33. ING Bank! In November I faxed the doc related with the filing fees. Last week, you WOULD FAX TO ESKİŞEHİR BRANCH, BUT STILL YOU DIDN'T! WE HAD FEEDBACKS FROM ALL BANKS EXCEPT YOU!!
34. Smart boys! Managers of the future! May God save you all!
35. Dear sirs; since yesterday I have had some unpleasant situations with ING Bank İzmir Karşıyaka Office. I withdraw some Money from ATM at Karşıyaka and the machine payment was missing. ATM was broken therefore other people and me were in a helpless situation, we had payments but we couldnt get the rest of the amount in the machine!! We gave a petition to the Office related but nothing changed! I really wonder, If I were obliged to overpay because of this situation, would ING Bank compensate my penalty? Yesterday was the expiry date of my credit card. The problem is clear, total amount is clear why all these process take so much time? Be reasonable!
36. **ING Bank Türkiye:** Hi Mrs. Nevbahar, in order to contact with you, could you please

send your communication information to our address at http://on.fb.me/QHkA1K. Thank you.

37. The Bank whose number-0850 222 0 600-has always been inaccessable! Since last night I couldnot have a contact, so funny the situation!
38. **ING Bank Türkiye:** Hi Mr.Murat, in order to contact with you about the problem you faced, could you please send your communication information to our address at http://on.fb.me/QHkA1K. Thank you.

Survey and Contests

1. Guess, who wins, Arsenal or Manchester United ? Get chance of Premier League experience in London and be one of the lucky three couples! The opportunity is on your mobile, iPad or the internet!; http://bit.ly/VIgGdM
2. As a matter of buying a house, we very often take loans from "parent's bank." According to a survey of ING Group, Türkiye is on the second rank among twelve European countries where people mostly barrowed loans from their families or friends when they are about to buy a house. http://www.ingbank.com.tr/ingbank-basinbultenleri_25_10_2012.asp
3. Personal Finance Professionals recommends some accumulation of 3-6 months income for emergencies. In Türkiye, in case of a fall people who have a 3 month's subsistence is 52%. How much can you save from your income? http://bit.ly/V73kbe
4. Would you like to learn your probablity of saving ?; http://bit.ly/Z5j6a7
5. Special to birliktealalım.com users !! Customer's credit for %0,99 interest, without cost! http://bit.ly/WZ39z5
6. We are searching for the "manager of the future"!;http://bit.ly/14qrjol
7. Happy Valantine's Day! It could be a good idea for a unique gift and making your partner happy by writing notes, cooking some special food or forming a collage work of your pics! What do you think?
8. When applying for Available Credit, you won't need any recognisance at ING Bank! Installments starting from 99 YTL, totally 7.000 YTL consumer's credit: http://bit.ly/YBq3d3
9. ING Bank was awarded as "the most successful effective banking management" in Eastern Europe in 2012, with the products and services it provided to global customers.
10. What's your most important savings goal right now? Accoprding toING Group Survey we save mosty for "children and families": http://bit.ly/Ztm3kL

Social (Responsibility) Activities

1. By June 2013, we will have built an "Operation Centre"which will be employing 500 people in Kahramanmaraş. We will both contribute to employment business and carry the quality of our service one step further at the same time:http://bit.ly/XOJWMS

EVALUATION AND CONCLUSION

On a three month's observation, pages seem to include vernacular events as well as banking business affairs in accompaniment with pictures in attractive colours. Administators of pages seem supporting the famous PR approach. "think globally, act locally" for pages include various kind of announcements, photos, advertisements relating to credit card campaigns, local and universal activities, news, videos, customers' feedbacks, surveys or contests, etc. Before the argument, it would be fruitful for customers categorized into two: really involved with finance affairs or probably have plans for the future visit the page just for fun. A recent research shows kinds of using social media for functional benefits, social benefits, psychological and hedonic benfits and it also reveals that the "use of social media is both pleasing and fun for

them; Individuals who participate in collaborative environments by expressing opinions and sharing tourist experiences are proud of doing so" (Parra-López et al., 2010)

Finally, four offices on four different continents seem applying the same strategies for the social media Facebook users. Let's have a look how they manage to realise this.

Contents of advertising videos or written announcements are naturally composed of the advertisements everyday watched or met on the media. They are nothing but just repetitions; sometimes there are temporary ones like Valentine's Day Celebration or Austraian Cleaning up Day. Facebook pages can be assumed as the smartest way to keep such archives at hand. On the other side, most people who have enough time, are affected readily by means of some enticing tricks such as surveys, contests or awards. These are highly attractive means for social media accountants. The bank could easily attract people and they read or watch almost evething on the page including complaints, appraisals or any news they would like to hear or read or see. There are also people really involved with the banking business, as well. Major target here is to attract people to the events as much as possible and persuade them to submit a credit card or housing loan application form and reach the customer via Facebook events or emphatic pictures or cute images of lion "the logo."There are also nice pictures from real life, working or saluting personnel or contest winners. Today, where advertising has had a major impact on consumers, companies do their best to go ahead. One of the advertising starategies in this way is employing a celebrity in the advertising film. ING Bank Global seems to neglect about it; there is only a Turkish celebrity, Acun Ilıcalı performs with the puppet lion in ING Bank Türkiye advertising films and videos on Facebook page. There is no any other celebrity performing in the Bank's videos or films during these three months.

As come to feedbacks, Banking personnel charged with finding solutions for the problems written by the customers on Facebook page are almost rightful. If they had reviewed the page once, they would have got all the answers and wouldnt be in need of asking the same question again and again On the page sufficient information is given mostly. Sometimes people complain of getting no reply soon. What most complaints revealed here is related with primarily Customer's service's rudeness or being late for the replies. Secondly comes about the banking processes and interactions and procedures. When people write up with a rightful tone, ING personnel replies in a "copy –paste" structure, only the names change! They kindly direct them to another link on which the customer could give his ID or problem details, which they seem as if they could provide a solution. A few of them seem to achieve the happy ending.

Some customers are not satisfied enough with the service they have so that they get so much surprised at ING Bank's being awarded a prize of "the most successful effective banking management" in Eastern Europe in 2012. They even supported each other online. "Online social support plays a critical role in a virtual group, which is inherently regarded as an innovative form of a social network linking people, organizations, and knowledge" (Tsai, et al., 2012)

Another strategy ING Bank applies to online customers especially who are aggresive and rude aginst the banking proceedings is no replying at all. Especially messages including accuses or insults they do not reply. Sometimes customers are right and the Bank is not fair all the time. They often have errors during interactions or transactions or they are late in doing some transactins or replying or compensating soon; so this causes some financial penaties by the INGBank. However, they might not know what the missing thing is or they are too confused and overloaded the whle day. On the other hand, the Bank employs many young people for the future and provides employment resources. However, this situation might have been caused by lack of experience. Replying customers' questions on a fixed format might sometimes

cause misinformation and change the course of dialogue in a wrong way, as well. Customers should be treated as do gooders.

Treating an organization's publics well goes far beyond the tactical and behavioral decisions made when incorporating reciprocity, responsibility, and reporting into the public relations programming. The final stewardship strategy– relationship nurturing – requires that organizations engage in extra efforts to ensure that these relationships are nurtured carefully and consistently. It is vital that practitioners let stakeholders know on a regular basis that they are important to organizations, that organizations respect and care about them, and they appreciate their involvement (Waters, 2011).

On the other side, there are many people supporting and following the events or activities taken over by ING Bank. Besides, there are ING personnel who cordially support their employer.

Surveys are striking points for customers, but not all the time. That's why percentage of participation is lower than others. ING Bank should search for or create more attractive contests, concerts or events appealing different classes of society. Major reason of this low participation must be correlated with the products of the Bank. Unless having a credit card or having an online interaction via smart media, such as mobiles or ipads, nobody seems to acquire the opportunity of joining a contest, which is not fair on one hand, whereas pure commercial on the other.

This reaseach also reveals how far interested a global Bank in social activities. It is clear that they pay much attention to social event s like Mother's Day, New Year, Republic Days, Celebrity Birthdays beyond themselves. Turkish, Indian, Canadian and Australian ING Facebook pages are good examples for this phenomenon. They provide not only their services and products but involve with local and universal events as well. On ING Direct Australia Facebook page "Australian Clean up Day" is induced with a nice scenery of people cleaning up around, which recalls "Think global, act local" approach again which is one of the most successively applied approaches in Public Relations Field. India is an hetereogenious country from religion point of view but prevalent belief is Islam. By this respect ING VysaBank celebrates the sacred day of Islam on its Facebopok page, whereas the other ING Bank Facebook pages do not. ING VysaBank Facebook page directly appeals to Islamic customers in order to make them feel at home, as his own Islamic Bank.Other pages also celebrate and participate universal events like New Year and X-mas but, it is inexcusable for ING VysaBank neglecting to celebrate a universal day like Christmas!

As a conclusion, it can be assumed that ING Bank social media management strategies are almost the same with each other in different continents. It also implies institutional identity and institutional unity of ING Bank wordwide. Here it deserves being voted for the most successful Bank rate in the field of "Private Banks and Banking"in 2012.

In the age of digital convergency, social media will lead societies for further steps to learn and teach each other gradually on the way to all kind of literacies via commercial enterprises like banking business, which has been vital for everyone, anytime, anywhere in the world. Consequently, as a whole, ING Bank is a good candidate for social media global leadership and could be the best anytime, in case it recovers the deficiencies pointed out on Facebook pages by its customers.

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Chapter 75
Banking Online:
Design for a New Credibility

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ABSTRACT

The authors present the first results of a communicability evaluation of a set of online banking systems aimed at the new credibility of those institutions. They evaluate the strategies of interactive design, focusing on the presentation of the information on the interface. Finally, the first group of human factors is established which has affected negatively the veracity of banking information in Southern Europe in the last five years.

INTRODUCTION

One of the key elements of the institutional image of the banking bodies has been trust factor towards intangible services related to money and finances (Karat, Brodie & Karat, 2006). Now this flux of information must be available electronically to its clients, 24/7 in every day of the week. Allegedly it is a premise that is guaranteed from the banking publicity to the clientele, but in reality it is not so. The financial institutions have information processes in real time and others in batch processing – in execution of a series of programmes (also called "jobs") on a computer without manual intervention. This is a widespread reality in this kind of institutions, since the mid 20th century. The public in general doesn't know this reality, which is a source of constant complaints (previous to the global financial crisis), whether it is with the remote services or in the banking seats themselves. Consequently, there are processes which are carried out immediately such as the data consultation of the banking headquarters, such as the IBAN code (International Bank Account Number), SWIFT (Society for Worldwide Interbank Financial Telecommunication), etc., and others which require a whole series of previous verifications such as the transfer of currency inside and outside a state. From the point of view of communicability we can establish two kinds of factors, underlying and apparent. The underlying ones are the characteristics intrinsic to the informa-

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tion system, such as the information in real time or in batch, whereas the apparent are those which obey to the design factors of the computer programmes (Cipolla-Ficarra, 2005). For instance, it is not normal that an experienced or inexperienced user must resort to the Google or Yahoo searcher to find quickly the IBAN or SWIFT code of the banking institution he/she is member.

The issues related to the way of operating from the computer science point of view have joined a myriad human factors of the banking staff towards their clients. The latter have practically lost their trust towards these institutions, without distinguishing whether the problems stem from the computer systems or the human factors (Cipolla-Ficarra, et al., 2011). When we talk about human factors we mean those excellent clients who have never had red numbers in their accounts and who operated in the banking offices or electronically. These clients interrelated with these institutions without any kind of inconveniences, but who have been swindled by the disingenuous publicity of the banking institutions, that is, the lack of clarity in the marketing information. In our group of adult and inexperienced users in computer science, that knowledge of the banking staff has been termed as sadism in 97% of the analyzed cases.

The current work is structured in the following way: state of the art and strategies followed for the selection of the universe of study and the users, elaboration of the instruments for the measurement of communicability, veracity and credibility of the banking information, interaction with the banking systems, compiling of the results, learned lessons, future lines of work and conclusions. The examples that are commented in the current work over the banking experiences refer to the period 2008-2012 are truthful 100% belong to cities of Southern Europe, and have been extracted from our universe of study. These have been included to contextualize the data and the presented conclusions.

THE UNIVERSE OF STUDY: BANKS AND CLIENTS

Our universe of study is made up by adult people, whose ages oscillate between 40-60 years, clients of banking institutions in Southern Europe. All of them have 15 years of seniority of having bank accounts in the same institution. Some of them have access to the online banking systems, but their knowledge of computer science is elementary. They use the computer for the search of information in Google, Yahoo, etc. and the reception/emission of messages mainly. The analyzed banking institutions have their local headquarters in Catalonia and Lombardy mainly although some of the examples that we will address belong to international financial groups. With these institutions our group of users interact virtually from the workplace and/or the home and in the daily life. The emotional aspects deriving from scarcely transparent business practices have been quantified through the use of techniques stemming from the social sciences and statistics (Cipolla-Ficarra, et al., 2011). Some examples of these emotional variables are the result of financial prosperity and the deceitful publicity to get the excellent clients into debt are: the former Caixa in Barcelona, now CaixaBank, in the face of the closure of a small firm due to the global financial crisis does not allow the quick transformation of the debt into a personal debt. In contrast, they have chosen to demand the whole payment of the debt, increasing in 50% the overall amount of the debt, to end after several months of disputes in a personal credit to be paid back in several years. Another example is a Lombardian institution that dedicates itself to issuing double personal loans, which are managed externally from the bank, with pensioners who cash € 600 per month and whose monthly fees surpass 50% of their revenue due to the double charge of interests in the amount of the loan. In the face of these two small examples, the credibility towards those

banks and the rest of the financial system is equal to zero for those customers. If we add to this the technological issues of not-functioning, such as the typical phrases in Latin America before making a payment with cards in a shop, hotel or even inside the banks themselves, "there is no system," we can find even worse situations in Europe, as it can be seen in the following example of the Figure 1, where the operations with the Iberian Peninsula are thwarted and the message of "non-existent" nation appears, as is the case of Spain inside the German banking circuit. Obviously, the "there is no system," is a lesser evil as compared to the "non-existent nation."

The example of "non-existent nation" with which not only it is not possible to make Internet banking operations from the south of the Mediterranean, makes apparent once again the real prejudices towards the clients, who must make the operations on the bank counter, pay fees and see how the batch process slows down the financial operations. Oddly enough, the call center does not inform over the exact date in which the service will be reactivated, nor are there dysfunction messages in the website. That is, that the credibility and the communicability of the online banking information is equal to zero. Of course the banking institutions between 2008-2012 in Southern Europe have carried out a series of make-up operations in their real or virtual structures, such as placing statues of the "angel" at the entrance (Figure 2), similar to victory or freedom by many sculptors, organizing paintings exhibits, theoretically aiding the disabled, fostering museums of the sciences, etc. of course the opinion gathered in our universe of study indicates that some of these institutions are parochial, antiglobalization, uncouth, among other variables related to the human and/or social factors (Cipolla-Ficarra, et al., 2011).

Figure 1. Message of non-existent nation "Spain" (*) from an online service in Italy

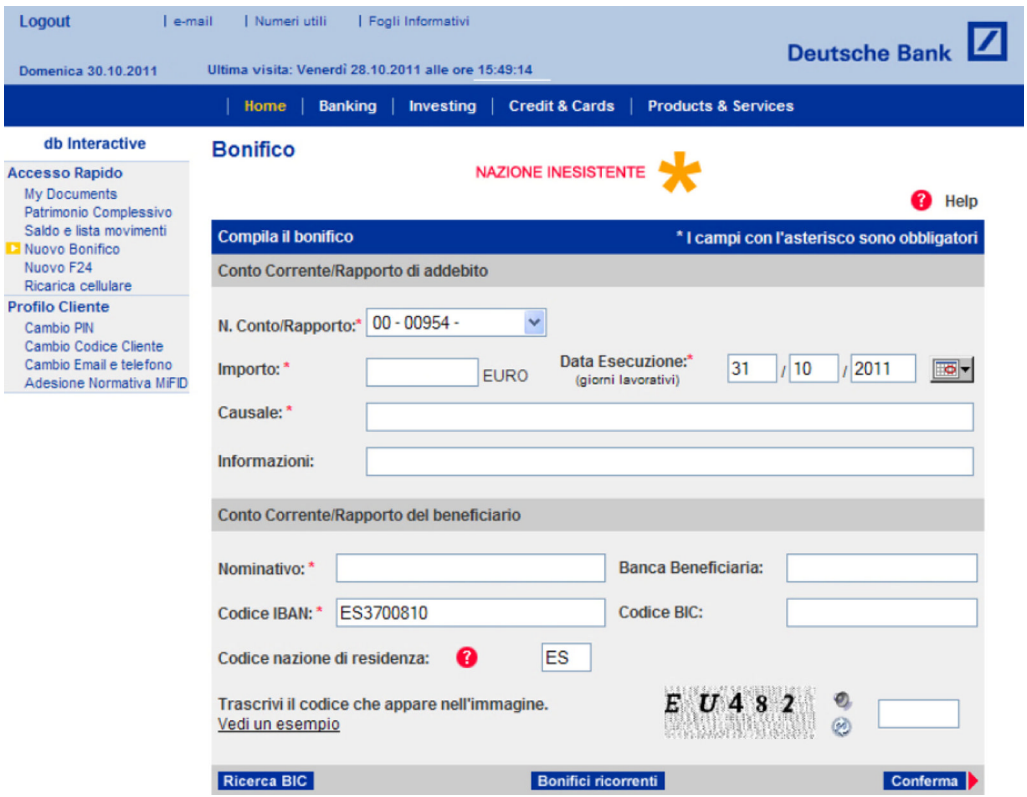


Figure 2. Digital newspaper: L'eco di Bergamo, 03.25.2012 (www.ecodibergamo.it)

These real values will be downplayed to the utmost through the publicity rhetoric of the banking and/or financial institutions. These are persuasive publicity campaigns, which have taken avail of almost every media of both digital and analogical communication in order to foster consumerism. Where they practically forced their clients to run into debt with personal credits, mortgages for cars, houses, etc. All of this happened in the period 2000-2007 in countries like Spain and Portugal. Since the 90 down to the early 21st century has had one of the widest ATMs networks on the European continent, with which the phenomenon of wild consumerism in an exponential way.

ANALOGICAL AND DIGITAL INSTITUTIONAL COMMUNICABILITY

The analogical institutional communicability of the financial institutions right now only admits a single way of evaluation; the quality of the paper they use in their brochures, postcards, catalogues of artistic samples, calendars, notebooks, etc. Products produced in Asian countries but designed in Europe make apparent that the bridge between average and small clients with the great, middle-size and small credit institutions has been destroyed. From a linguistic point of view, these institutions try to get back or keep their customers with notions such as "partner," "members of the same group," "safety," "future," etc., that is, as elements which belong to a same set who must work for the sake of the future. However, these are obsolete communicational forms in view of the human factors, backed by the computer systems, for instance, the reduction of the limits in the credit cards or the increase of the control mechanisms to carry out long distance operations through the use of the internet.

Examining the home pages of the banking and financial systems through a set of quality attributes and metrics developed in the mid 90s and perfected in the current millennium, such as isomorphism, richness and accesibility (Cipolla-Ficarra, 1997), which the interested reader can look up in the following bibliographical references (Cipolla-Ficarra, 1998; Cipolla-Ficarra, 2012). In our first work we will focus on two of the categories of interactive design such as are the presentation of the information and the content, applying the following table which was the basis of the set of quality attributes and metrics (Cipolla-Ficarra, 1998; Cipolla-Ficarra & Cipolla-Ficarra, 2008). The analyzed websites belong to the following banking institutions: Banca di Roma (Italy), Banca Nazionale del Lavoro (Italy), Banca Popolare (Italy), Banco Bilbao-Viscaya (Spain), Bankinter (Spain), CaixaBank (Spain), Citibank (Spain), Lloyds Bank (Italy), Sabadell-Atlantico (Spain), and Unicredit (Italy). All of them with headquarters in Spain and Italy. Evidently the visual factor of the websites (Alison et al., 1995; Gage, 2000; Brown, et al., 2002) of the Figures 3 and 4 makes apparent the existence of isotopy lines through the following colors: primary (red, blue, yellow), secondary (light blue, orange) and neuter (black and white). However, inside them can be seen the strengthening of the phenomenon called Argentinization of the colors and which are presented in the following flag with their matching values.

Figure 3. The Argentinization of the design: Logo and banner in digital newspaper (www.elpais.es, www.elmundo.es, and www.lavanguardia.es, for example)

Figure 4. Argentinization of the design (www.bancsabadell.com)

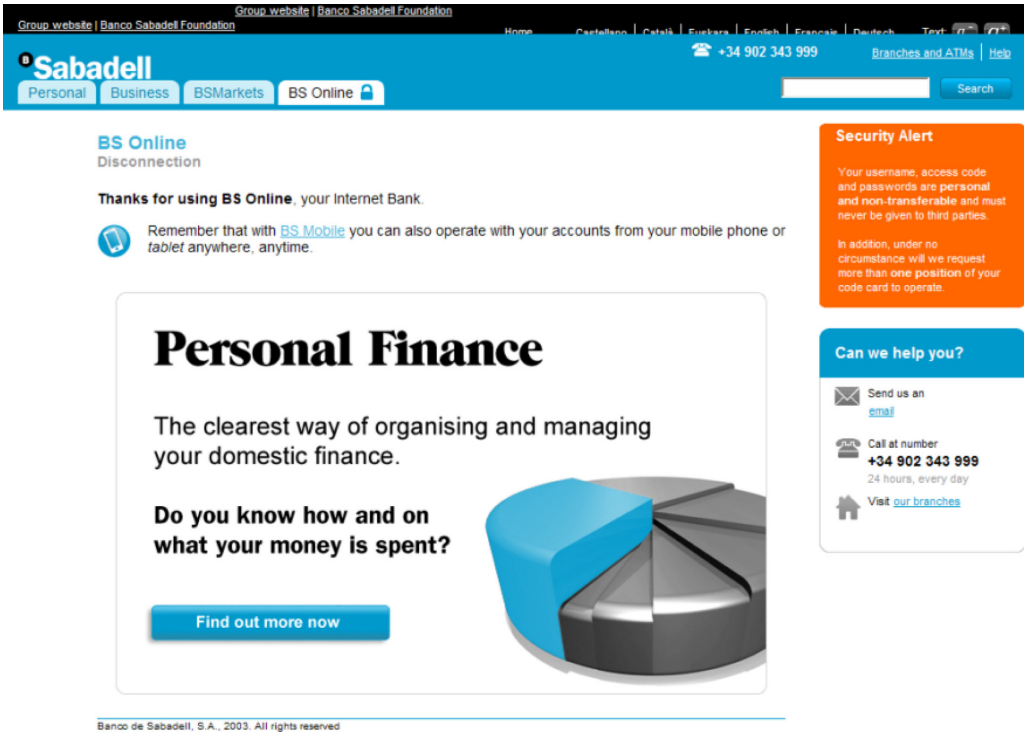
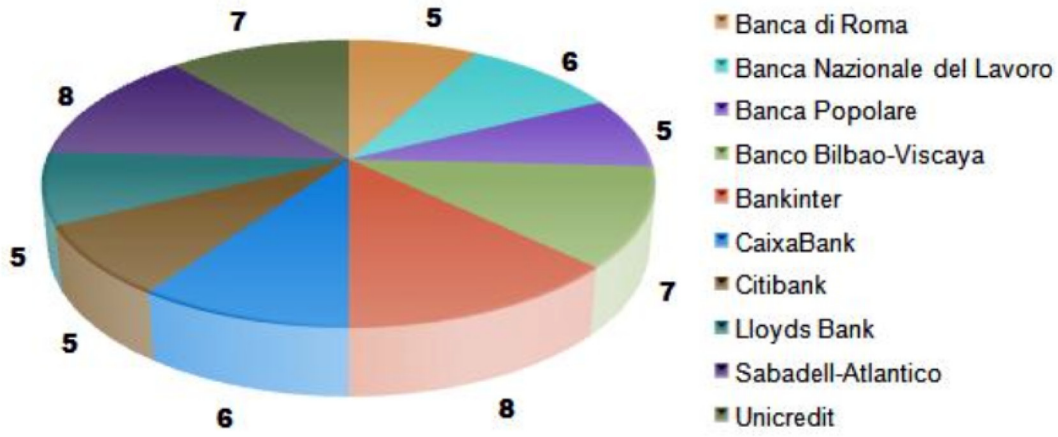


Figure 5. Flag of Argentina: Colours and the different codes used in regard to the support that is used. The colors of this flag in a direct or indirect way are present in the banking websites.

Computer				
RGB:	252-191-73	132-53-17	117-170-219	255-255-255
Hexadecimal:	FCBF49	843511	75AADB	FFFFFF
Textile	14-1064TC	18-1441TC	16-4132TC	
Graphics	1235C ó 11U6	1685C ó 1675U	284C ó 284U	
Plastic	Q03021	Q12024	Q30041	

Although in a portal we have a drawing made by Joan Mirò such as the star of the current CaixaBank (Figure 3), the three colors are not so present in the intranet environments for the customers. In that environment it can be seen how the red is used few times, compared with the light blue, white and yellow. The former colours, light blue with white background of the websites, are currently fashionable even in the Spanish digital press such as can be the portals of El País (www.elpais.es) El mundo (www.elmundo.es), La Vanguardia (www.lavanguardia.es) that is, they have also chosen the Argentinization of their portals. In some way the portals of the banking institutions also try to establish chromatic links with the daily information of the digital press. Next the results of the communicability from the point of view of presentation and the contents of the online information (minimum value 0, maximum value 10).

Figure 6. Results of the main components of the free access online interfaces



SAFETY AND DESIGN

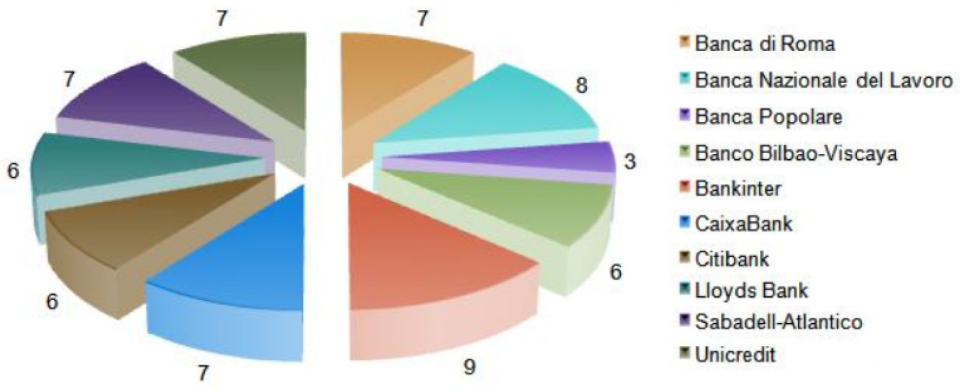
Without any doubt, this is an environment where the safety issue occupies a first place. Aside from all the mechanisms of computer safety applied to the current financial services and that they can be improved to avoid fraud, we focus on the ease of access the users have in our universe of study, without resorting to avant-garde technologies such as can be voice recognition, the iris of the eye, fingerprints, etc. As a rule, for the customers there are two or three keys before having access to their confidential information, such as can be the bank balances and/on movements of their bank accounts or credit cards. Now whereas in Spain with only four digits one can have access to the bank account through an ATM, in Italy it is necessary to type five digits to access the bank account. Here we have a first lack of uniformity of criteria of the banking systems inside a same European region, which have a common currency. This lack of uniformity does not respond to technical issues, but are rather political. Now these criteria create certain habits among the potential users who when they reach certain ages and/or certain educational levels do not grasp easily the logic of these differences. Nor is it easy to them the fact of having to introduce the components of a password in the shape of bidirectional coordinates (x e y), for instance, the firsr component of the key and below the second component. Next the result of the analysis made on the communicability for the ease of access to the online banking information of credit cards of the group that made up our universe of study (minimum value 0, maximum value 10).

Of course here the dichotomous discussion between online safety and interactive design opens. However, the ideal thing is that this dichotomy could merge in a single reality where safety, communicability, usability and accessibility were present.

From a topological point of view in the access websites to the confidential information we can claim that 100% of the cases are to be found in the upper/central area of the interface. Evidently it is a cultural issue of the Western world, and it obeys to the principles of the "divine or perfect proportion," in which the spectator focuses her vision on a rectangular or square figure and which Leonardo Da Vinci already used in his paintings.

The chronological factor also affects these two components that we are analyzing (safety and design), especially at the moment of finding out the movements of the bank accounts in the matching detail of the made operations. Whereas in some online systems it is possible to have access to the

Figure 7. The financial institution best valued by the users is Bankinter. The worst valued is Banca Populare.



historical information in others it isn't, since there is a calendar which sets a limit towards the past, for instance, 30, 60, 90, 180, etc. days. Besides, the detail of the operation may be presented in the shape of an enclosed file of the pdf kind or a.txt file with synthetized information.

Once again we are in the face of a reality where from the technological point of view it is feasible to offer the maximum possible information to the online user, that is, the remote customer. However, said alternative is not active in all the banks. This operation is not provided in some financial institutions because it is a way to generate additional revenue, for instance, by cashing a commission for asking all the movements of the account in a year.

Although these institutions do not take into account the waste of time that it means for the customer, who is forced to visit the banking office, since they are personal requests and are made in the counter of the bank. Here is another real situation which accumulates to the human factors as source of possible conflicts, especially for the users experienced in the use of computer systems but who are forced to go to the banks.

In the evaluation with users (20 in all) we have established a series of tasks to be carried out by them once they have reached the reserved or confidential areas. Some of these operations were doable and others not. In an affirmative case, the number of options that were chosen to reach the goal were counted (keyboard and mouse pulses). The same happened with those actions impossible to do in some websites. The tasks and their matching codifications are the following:

T1 = Knowing the balance;
T2 = The last 20 movements;
T3 = Having access to the detail to each one of those movements;
T4 = Having access to a banking movement from 180 days back;
T5 = Having access to the information linked to a movement of 6 months back;
T6 = having access to the IBAN of the account.

The names of the banking institutions have been eliminated in the following graphic of results (confidential reasons).

The degree of difficulty to access wanted information is very high in the area of study that is made, if we compare the average of the results obtained by the evaluator who has carried out the set of tasks that the users had to perform.

T 1= 3 options (here is calculated the total, that is, those made both from the keyboard and the mouse which are equivalent to an input or an enter or a click).
T 2= 2 steps.
T 5= In the cases when it is feasible to reach the average is 5, in other financial websites this task is impossible to make.
T 7= it is not possible to carry out that operation.

Figure 8. Total of operations carried out from the keyboard or with the mouse to have access to confidential information in the online service of some financial institutions which operate in Southern Europe

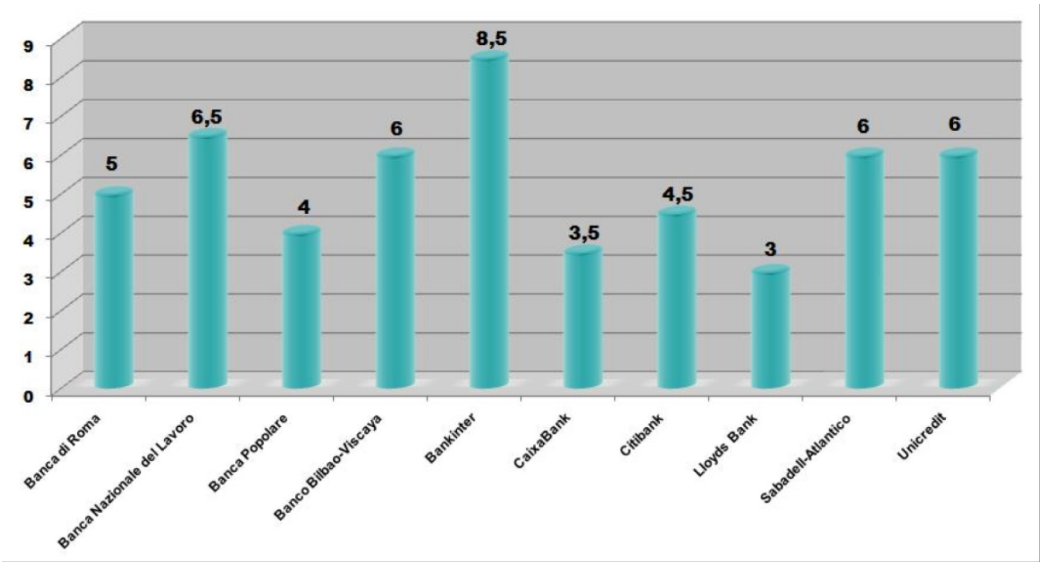
RESULTS, LESSONS LEARNED, AND FUTURE WORKS

Next the evaluation of the users accessing = confidential information is presented, that is, both the banking intranet, extranet and Internet information. This evaluation has been grouped in relation to the analyzed banking institutions:

- Banca di Roma (Italy)
- Banca Nazionale del Lavoro (Italy)
- Banca Popolare (Italy)
- Banco Bilbao-Viscaya (Spain)
- Bankinter (Spain)
- CaixaBank (Spain)
- Citibank (Spain)
- Lloyds Bank (Italy)
- Sabadell-Atlantico (Spain)
- Unicredit (Italy)

The lessons learned from the current work can be summed up in three large areas. In the first place, the results obtained make apparent that the interactive design of the online systems for banking institutions will not be able to give back the confidence and credibility of the information from those institutions to their clients or Internet users in all countries and regions south of Europe. Besides, the make-up operations which some financial institutions have made such as the change of name, linked to the pseudo interest towards the art, the sciences, the social assistance, grants, etc., can do little or nothing to solve the communicability problem between their websites and the references towards the real world, whether in relation to emulation or simulation situations of the reality of some interactive services of a high level of safety but of little informative transparency towards the clients or inexperienced users in the use of computers. Second, from the point of view of the online communicability of the banks there is a process to emulate the digital newspapers. This statement stems from the studies of the design categories belonging to the presentation of data in the interfaces as well as the way to distribute the contents on the screens of computers or mobile phones. However, the banks and the digital newspapers have plumped for the Argentinization

Figure 9. The loss of credibility of the information and trust in the computerized services of the banking and/or financial institutions: Minimum value 0; maximum value 10



of the interactive design, starting by the use of colours, and the topological distribution of the contents on the homepage, comparing them with the portals of banks and newspapers in France, for instance. Finally the human factors linked to the global economic context from 2008 to 2012 slow down the technological advances in the issue of safety which could be implemented in the online banking transactions. Besides, there is a rejection towards those institutions with which the digital gap between clients and banking services will increase in the next years. A way of cutting it down would be to increase the operations in real time and reducing those which are made in the batch modality. In future works we will enhance the number of users in the experiments in keeping with the goal that the clients have at the moment of having access to the banking services and inserting motley categories of users, for instance, trade clerks, industrial workers, university students, freelance professionals, researchers. We will also include banking entities from the north of Europe to contrast them with the south of Europe.

CONCLUSION

The negative human/social factors should be radically eliminated in the banks. Instead of carrying out operations of institutional make-up such as the sudden interest towards culture, nature, education, which do not help to restore a truthful and reliable interrelation between users and financial interactive systems. The institutional image of many financial entities with the global crisis has been totally destroyed in the credibility of millions of small and middle customers in the south of Europe. This is an image that was based on the absolute trust of the excellent clients or inexperienced users in computers. However, many of them have been swindled by the institutional communication. For instance, through the deceitful publicity design which has circulated in both a digital and an analog format. Those responsible for that mess have not reacted to the global crisis and keep on making portals where the "copy and paste" of foreign models prevails. See as an example the Argentinization factor of design. Perhaps the use of that fashion of the interactive design responds to the fact that the scandals occur always very far from where the banking institutions are located for which the interfaces for the computer systems are created. In the Spanish ATMs we have so far seen a minimalist design to facilitate the operations to millions of users for decades but little or nothing remains from that quality from the point of view of communicability in the current online systems. The online banking portals today not only have communicability errors, but also usability errors. Theoretically the usability problems in the interactive design should be overcome in the current era of communicability expansion.

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Chapter 76
Emerging Technologies for User-Friendly Mobile Payment Applications

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ABSTRACT

The advancement and the evolution of mobile communications and mobile device technology have led to a remarkable growth and tremendous requirement for mobile applications that are carried on mobile phones. These technologies have lead to the deployment of business, communications, and mobile services, and hence, gave rise to mobile payments. The mobile payments are considered as the killer applications and are real-time cashless payments. Mobile payments take place with the help of mobile telephony and communications where maintaining security solutions becomes an important factor. This chapter describes the different emerging technologies carried out between a resource-limited mobile device and a resource-rich computer server over wireless networks.

1. INTRODUCTION

The essence of mobile technology revolves around the idea of reaching customers, suppliers, and employees regardless of where they are located. Mobile technologies are about delivering the right information to the right place at the right time. It gives users the ability to access the Internet from any location at any time, the capability to pinpoint an individual mobile terminal user's location, the functionality to access information at the point of need, and a need-based data/information update capability. A mobile technology is not just evolution of communication technologies but combines the advantages of mobile communications with existing electronic communications services. There are some specific attributes of mobile technology, such as mobility, reachability etc. Mobile technology is a broad category that includes all devices, protocols and infrastructures that allow one to communicate, interact and exchange data with an individual or system anywhere and anytime. Examples include mobile phones, PDAs (Personal Digital Assistants). For mobile technology, the major characteristics are mobility and reachability. Mobility implies that users can carry cell phones or other mobile devices to transact from anywhere in mobile network area. Reachability of the wire-

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less devices makes it possible for people to be contacted anytime and anywhere and provides users with the choice to limit their reachability to particular persons or times. Mobile commerce has features not available to traditional e-commerce. In addition to reachability and mobility others feature are described as follows:

1. **Ubiquity:** It is the primary advantage of mobile telephony. Users can get any information that they are interested in, whenever they want regardless of their location, through Internet-enabled mobile devices. In mobile applications, users may be engaged in activities, such as meeting people or travelling, while conducting transactions or receiving information. In this sense, mobile communications makes a service or an application available wherever and whenever such a need arises.
2. **Localization:** The knowledge of the user's physical location at a particular moment also adds significant value to mobile commerce. With location information available, many location-based applications can be provided. For example, with the knowledge of the user's location, the mobile service will quickly alert him/her when his or her friend or colleague is nearby. It will also help the user locate the nearest restaurant or ATM. Positioning technologies, such as the Global Positioning System (GPS), allow companies to offer goods and services to the user specific to his current location. Location based services can be, thus, offered to meet consumers' needs and wishes for localised content and services.
3. **Personalization:** An enormous number of information, services, and applications are currently available on the Internet, and the relevance of information users receive is of great importance. Since owners of mobile devices often require different sets of applications and services, mobile applications can be personalized to represent information or provide services in ways appropriate to a specific user.
4. **Dissemination:** Some wireless infrastructures support simultaneous delivery of data to all mobile users within a specific geographical region. This functionality offers an efficient means to disseminate information to a large consumer population.
5. **Flexibility:** Users of mobile devices should be able to engage in activities such as, receiving information, and conducting transactions with ease.
6. **Immediacy:** Closely related to the feature of ubiquity is the possibility of real time availability of services. This feature is particularly attractive for services that are time-critical and demand a fast reaction, e.g. stock market information for a broker. Additionally, the consumer can buy goods and services, as and when he feels the need. The immediacy of transaction helps to capture consumers at the moment of intention so that sales are not lost in the discrepancy between the point of intention and that of the actual purchase.
7. **Instant Connectivity**: With the introduction of the General Packet Radio Service (GPRS) mobile devices are constantly online, i.e. in touch with the network. This feature brings convenience to the user, as time-consuming dial-up or boot processes are not necessary.
8. **Pro-Active Functionality:** A mobile application opens, by the virtue of its ability to be immediate, local and personal, new avenues for push-marketing, such as content and product offers. Services like Opt in advertising can be offered, so that a user may choose the products, services and companies, which he wants to be kept informed about. The Short Message Service (SMS) can be used to send brief text messages to consumers informing them of relevant local offerings that best suit their needs. This feature ensures that the relevant information can be provided to the

user at the right place, at the right time. The user too does not have to fear missing some potentially crucial information or getting it too late.

9. **Simple Authentication Procedure:** Mobile telecommunication devices function with an electronic chip called Subscriber Identity Module (SIM). The SIM is registered with the network operator and the owner is thus unambiguously identifiable. The clear identification of the user in combination with an individual Personal Identification Number (PIN) makes any further time-consuming, complicated and potentially inefficient authentication process redundant.

2. BACKGROUND

Fourati et al. (2002) proposed an approach combining the SET protocol with the TLS/WTLS protocols in order to enforce the security services over the WAP 1.X for the payment in the m-commerce. The authors implemented the additional services of the SET protocol as the confidentiality of the payment information between the buyer and the payment gateway and the data integrity. In the proposed approach WTLS certificates are used instead of SET certificates. This allows avoiding the SET certification heaviness. Moreover, this approach eliminates the WAP gap since the payment information would not be decrypted within the WAP gateway or within the seller side. Long and et al. (2003) discussed the unique challenges of securing the financial Services and suggest several technologies that can meet these technologies. The Internet has changed the way many people trade stocks by bringing up-to-date market information and do it yourself trading to average investors. Wireless connectivity and Web services play essential roles in meetings such demands, offering financial traders unprecedented convenience, choices and speed in accessing the dynamic financial information they need to make real time decisions. These improvements benefit the whole market by increasing liquidity and reducing information asymmetry, a condition when critical information is known only to some traders, rather than to all participants in the stock market. Ondrus (2003) has suggested and identified different types of mobile payments considering the type of transaction and the location of POS and the number of entities involved in it. Berger et al. (2003) expanded the notion that mobile devices can both offer and consume Web Services. They discussed some classes of applications that can be enabled when mobile devices can host Web Services. This is the powerful model for facilitating automatic interaction between resource constrained mobile devices, time starved users and pervasive infrastructure. To implement a scenario they explored the issues that arise due to the mobility of devices hosting Web Services such as service discovery, device disambiguation, software footprints and security requirements. The authors implemented a retail shopping scenario where mobile device offers wallet services to an electronic check-out kiosk. This demonstration is housed at IBM industry Solutions Lab and has been operational. Zheng and Chen (2003) developed a mobile Payment System and are operating in Digital Fujian Province of China. Chen and Adams (2004) examine several available short range wireless technologies for mobile payment systems and the ways in which short-range wireless technologies support these mobile payment systems. Also, the issues, advantages along with the future developments of mobile payments and wireless technologies associated with mobile payment industry have also been discussed.

3. WIRELESS APPLICATION PROTOCOL (WAP)

The Wireless Application Protocol (WAP) is an effort to make Internet available to mobile phones

and similar devices, which are communicating over a wireless network. It is designed to use as much as possible of existing technologies, with the World Wide Web as the main component. Other important factors in the protocol design are the differences between desktop computers and handheld devices. Examples of such differences are the limited power, display and input capabilities. Since WAP is using the Web, the service providers do not need to buy new servers or any other hardware devices at all. Instead the company's existing Web server is fully capable of delivering WAP contents after some minor configuration of the Web server software. Wireless Application Protocol (WAP) is a specification for a set of communication protocols to standardize the way that wireless devices, such as cellular telephones and radio transceivers, can be used for Internet access, including e-mail, the World Wide Web, newsgroups, and instant messaging. Before the introduction of WAP, mobile services were limited and the opportunities to offer interactive data services were minimum. It needed interactivity to support Internet and Web applications. WAP is the convergence of three evolving network technologies wireless data, telephony and the Internet. WAP was designed to meet all the requirements that a mobile device provides in terms of advanced services in a useable and attractive way in order to promote increased usage of the mobile network services. WAP is an open standard, developed by the WAP Forum. Nokia, Ericsson and Motorola, plus the US software company, Phone.com (formerly Unwired Planet) took the initiative to create a standard for development of services for the wireless community on June 26 1997. At the end of the year WAP Forum was created and the first release of the WAP specification was released in February 1998. The goal of WAP Forum is to develop a license-free standard for bringing information and services to wireless devices. The name "Wireless Application Protocol" (WAP) is misleading. WAP is not actually a protocol at all. In fact, WAP involves multiple protocols and complete network architecture for delivery of wireless content. A WAP browser is a Web browser for mobile devices that uses the protocol.

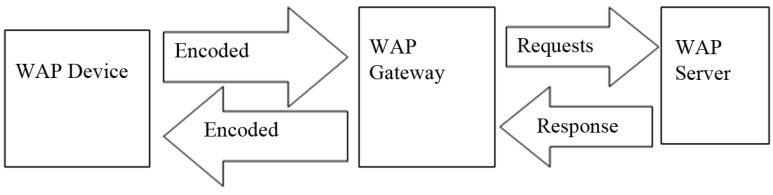
3.1. WAP Architecture

The WAP protocol is designed to use as much of existing technologies and standards as possible. There are three major parts of a WAP enabled system (Figure 1):

- WAP Gateway
- HTTP Web Server
- WAP Device

A browser in the WAP device communicates with a WAP gateway (or proxy) connected to the Internet. The gateway translates requests from the WAP protocol stack to the WWW protocol stack (HTTP and TCP/IP) and vice versa. Since all communication between the gateway and the WAP client is binary encoded to reduce network traffic, the gateway also encodes and decodes all messages respectively. When the browser sends a request the gateway decodes it to plain text and then forwards the request to the Web-server containing the desired content. In this way a content provider

Figure 1. WAP model



only needs to add a few content types to the Web server to enable WAP services to be developed since the user of the WAP device is always connected to the same gateway. This leads to the fact that WAP uses the same naming model as Web applications to point out content on remote servers by using URLs. The standard content formats used by WAP applications is based on WWW technology including a Markup language called Wireless Markup Language (WML), calendar information, a scripting language by the name WMLScript and so forth.

When a server replies, the desired content is sent to the gateway. The gateway encodes the information into the binary form of WML it uses for the communication with the WAP device. The binary encoding compresses the tags and the header information of the WML document. Each tag in the document is replaced by a two-byte value, i.e. no more data than a single character. The textual content is not compressed but all unnecessary spaces and line breaks are removed. This saves both bandwidth on the communication channel and power on the client. WAP Applications reside on the Web Server so no software has to be installed on the mobile device. Encryption and authentication are provided through Wireless Transport Layer Security (WTLS). This security is based on Transport Layer Security and SSL. The encryption options are DES and 3DES. The overall architecture of WAP is layered, and is shown in next section.

3.2. WAP Protocol Stack

WAP is designed in a layered fashion so that it can be extensible, flexible, and scalable. The WAP protocol stack is divided into five layers:

- Application Layer (WAE)
- Session Layer (WSP)
- Transaction Layer (WTP)
- Security Layer (WTLS)
- Transport Layer (WDP)

3.2.1. Wireless Application Environment (WAE)

The Wireless Application Environment (WAE) is the uppermost layer in the WAP protocol stack. It combines World Wide Web and mobile telephony technologies and the effort is to provide a common environment for operators and service providers. The WAE is divided in two logical layers, one for user agents and one for services and formats. The first layer is for user agents, e.g. browsers, phonebooks and message editors. In the second layer, there are different elements available such as WML, WMLScript, image formats, card and calendar formats and so forth. Those services and formats are accessible to and used by the different user agents.

3.2.2. Session Layer: Wireless Session Protocol (WSP)

The session layer offers two interfaces for the WAE. A connection-oriented service operates above the transaction layer protocol and a connectionless service that operates above a secure or non secure datagram service. The connection-oriented service provides a session between the client and a WAP gateway or proxy. It handles capability negotiation and communication interrupts, such as change of bearer. There is support for asynchronous requests and answers can be handled unordered. The connectionless service is basically a thin layer used by the WAE when there is no need for a reliable transaction of data. WSP is optimized for low bandwidth bearer networks. The wireless session protocols currently consist of services suited for browsing applications named WSP/B. WSP/B is designed to allow a WAP proxy to connect a WAP client to a standard HTTP server and provides HTTP/1.1 functionality and semantics in a compact over the- air encoding. The service is assumed to be a long-lived session that can be suspended and resumed at a later time without any need for a new capability negotiation, which

results in less traffic. With the release of WAP/1.2 a function for both reliable and unreliable data push is fully included in the protocol.

3.2.3. Transaction Layer: Wireless Transaction Protocol (WTP)

WTP runs on top of a datagram service and provides a lightweight transaction-oriented protocol that is suitable for mobile phones. It operates over secure or non secure wireless datagram networks and is a reliable way of communication with the ability to retransmit lost messages and avoid duplication. The communication sequence is only alive during the exchange of an individual message and therefore there is no relation between different messages.

3.2.4. Security Layer: Wireless Transport Layer Security (WTLS)

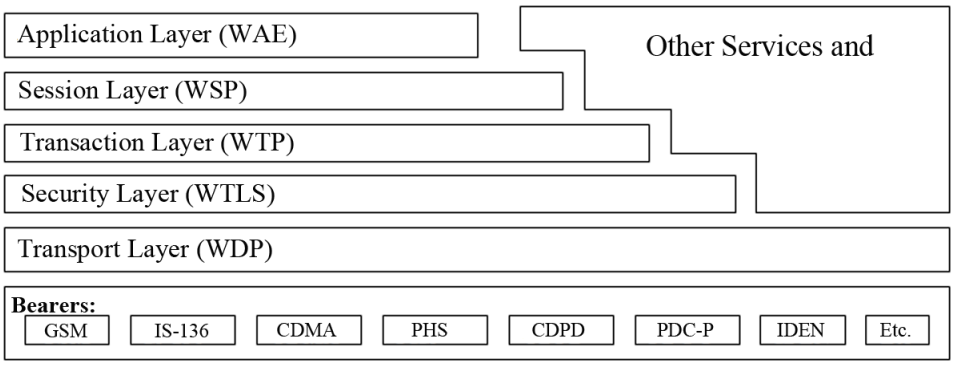
WTLS provides a transport layer security between the WAP client and the WAP Gateway/Proxy. It is based upon the industry standard Transport Layer Security (TLS) protocol, formerly known as Secure Socket Layer (SSL). WTLS is optimized for use over narrowband communication channels and each application can selectively enable security features. The security layer provides data integrity to ensure that the data is unchanged and uncorrupted. It grants privacy and ensures that any intermediate parties intercepting the data stream cannot understand the data. Authentication and a protection against Denial-of-service attacks are also parts of WTLS.

Wireless transactions, such as those between a user and their bank, require stringent authentication and encryption to ensure security to protect the communication from attack during data transmission. Because mobile networks do not provide end-to-end security, TLS had to be modified to address the special needs of wireless users. Designed to support datagram's in a high latency, low bandwidth environment, WTLS provides an optimized handshake through dynamic key refreshing, which allows encryption keys to be regularly updated during a secure session.

3.2.5. Transport Layer: Wireless Datagram Protocol (WDP)

WDP provides a datagram layer for different types of bearers without User Datagram Protocol (UDP) support, such as GSM SMS. WDP offers a consistent service at the Transport Service Access Point to the upper layer protocol of WAP (Figure 2). This consistency of service allows for applications to operate transparently over different available bearer services.

Figure 2. WAP protocol stack



3.3. WAP Security

WAP security functionality includes the Wireless Transport Layer Security (WAPWTLS) and application level security, accessible using the Wireless Markup Language Script (WMLScript). For optimum security, some parts of the security functionality need to be performed by a tamper-resistant device, so that an attacker cannot retrieve sensitive data. Such data is especially the permanent private keys used in the WTLS handshake with client authentication, and for making application level electronic signatures. The WAP Identity Module (WIM) is used in performing WTLS and application level security functions by storing and processing information needed for user identification and authentication. The functionality in terms of the requirements and sensitive data, especially keys, can be stored in the WIM. WAP achieves application layer security by taking advantage of WTLS (Wireless Transport Layer Security), access control features in WML and WMLScript and WIM.

4. EMERGING TECHNOLOGIES OF PAYMENT SYSTEMS

Mobile Payment is using different new technologies to make the payments more efficient and trustworthy. Some of them are as follows:

- Biometric Payments
- Barcode Payments
- NFC Payments

4.1. Biometric Payment

Biometric payment is a kind of technology that allows people to pay at shops or markets with just touch of their fingers, moving their face or laying up their hands. Biometric authentication is different than normal authentication system as they won't need any tokens or passwords for their payment other than their biometrics. With biometric payment systems the account information is automatically recognized to finish the payment procedure.

Biometric authentication is Fast, Easy, Secure. No swapping card or writing of checks is required. People can leave their wallet behind. And above all, their biometrics is unique, so only the user can access the system. Biometrics based authentication applications that is critical to the growth of the global economy comprises of many features. These include but not limited to single sign-on, Web security, transaction security, application logon, data protections, workstations, remote access to resources, and etc.

4.1.1. Biometric Authentication Process

Biometric payment technology allows the consumer to pay with the touch of a finger on a fingerprint scanner linked to a payment file. The fingerprint template is typically linked to a router and transmission media necessary to clear the transaction through automated clearinghouse. Biometric payment providers (e.g., Pay-by-Touch and BioPay) require completion of a pre enrollment process in which index fingers are scanned and driver's license and banking information is recorded in an account database. This process reportedly takes less than two minutes. In addition to transaction settlement, biometric payment providers may also link captured transactions to loyalty reward programs, gift cards, discount coupons and Web access services. The processes involved in biometric authentication are enrollment process, verification process and identification process.

4.1.1.1. Enrollment Process

Enrollment relates to the process of registering the fingerprints of a customer against their other demographic data as a record of their biometric identity. It is a one-time process in which a customer is asked to present their fingers on a scanner

and the fingerprints recorded and stored. In this process the biometric template of the customer is captured and stored in biometric database. In an online biometric authenticated system, the verification is carried out by retrieving the customer's biometric template using their identity number and then matching that against a live fingerprint. The enrollment process involves recording the templates against an identity number. The typical steps in an enrollment process are:

- The customer is asked to enter a customer identity number (this could be a bank related number, a national ID or any other unique identity number).
- The customer is then asked to present their biometric template on a scanner (SFR300) that then captures the images.
- The enrolment system may ask the customer to present their biometric multiple times to ensure that the quality of image captured is good for verification.
- An ISO 19794-2 template is derived from the captured images.
- The template along with the raw image is stored in the biometric server (true Server) against the customer identity number for later retrieval and verification.

4.1.1.2. Verification Process

In this process customer biometric template is verified to authenticate the payment. In verification process the customer enters their customer identity number into the verification system. The system then prompts the customer to present their live biometric on the scanner. The live biometric is then compared with the biometric template stored against the customer identity number in the biometric server. In case the verification is successful the payment transaction is considered authenticated and the transaction sent to the bank for processing. In case of a failure the customer may be asked to present the biometric template again up to a certain maximum number of tries.

4.1.1.3. Identification Process

In the identification process, the system recognizes an individual by searching the templates of all the users in the database for a match (Figure 3). Therefore, the system conducts a one-to-many comparison to establish an individual's identity (or fails if the subject is not enrolled in the system database) without the subject having to claim an identity (e.g., "Whose biometric data is this?"). Identification is a critical component in negative recognition applications where the system establishes whether the person is who she (implicitly or explicitly) denies to be. The purpose of negative recognition is to prevent a single person from using multiple identities. Identification may also be used in positive recognition for convenience (the user is not required to claim an identity). While traditional methods of personal recognition such as passwords, PINs, keys, and tokens may work for positive recognition, negative recognition can only be established through biometrics.

4.1.2. System Elements

To implementing a biometric authenticated payment a system requires three primary system elements to be put in place by a bank or acquirer (Figure 4). These are:

4.1.2.1. Enrollment System

It is used for enrolling customers on to the program and recording their biometric identity. In enrolment stage the biometric images of the different individuals to be verified are first processed by feature extraction module; the extracted features are stored as template in a database for later use.

4.1.2.2. Verification System

Used at retail locations for verifying the live biometric template with the stored fingerprints for authenticating payments. The biometric image of the individual to be verified first processed by feature extraction modules; the extracted features

Figure 3. Biometric authentication system

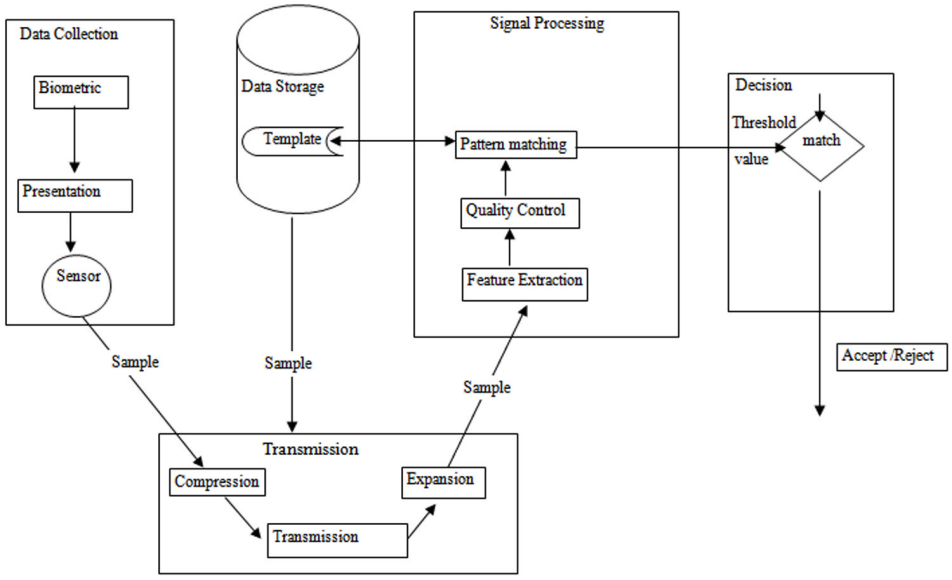
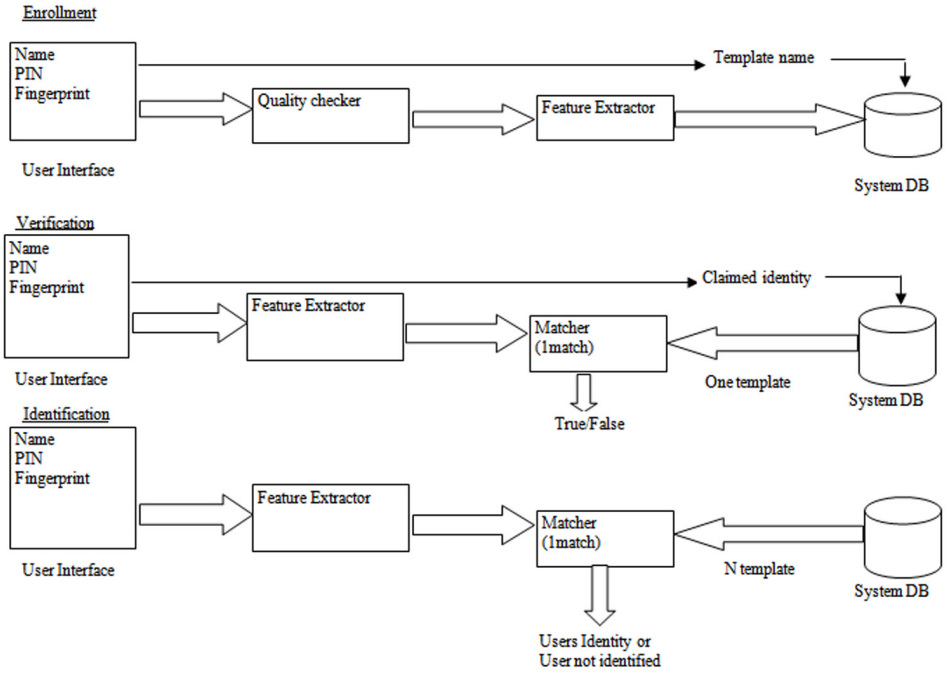


Figure 4. Enrollment, verification, identification in a biometric system



are then fed to a matching module with his/her identity ID, which matches them against his/her templates in the database.

4.1.2.3. Biometric Server

Used for storing the biometric template, extracting and verifying biometric template during a payment process and providing an interface to banks and acquirers for managing the customer data and reports.

4.1.3. Components for Secure Online Transactions

The authentication models for authenticating are to authenticate the customer who has registration in the service of the biometric payment system. Most models are based on network authentication system and are composed of client terminal, server side, which is used to collect the multimodal biometric data and to provide the services respectively. The biometrics template storage place and the verification place may be held at client side, server side and trusted third party (TTP) that may be a smart card to perform complex calculations. The different components that are interacting for secure online transactions for the biometric payment systems are:

4.1.3.1. Secure Online Banking Server (SBS)

It has access to customer's data; establishes connection with the Online Banking Software (BSW); conducts capital transactions and is able to identify a Biometric Trusted Device (BTD) as a communication partner to establish a secure connection.

4.1.3.2. Online Banking Software (OBS)

It is stored on the client and communicates with SBS in order to process different transactions.

4.1.3.3. Secure Biometric Trusted Device (BTD)

A trusted piece of hardware with predefined security criteria to provide secure functionality; cannot be manipulated by malware; has a biometric capture device as a fake resistant sensor which is qualified for unsupervised operation.

4.1.4. Biometric Information Systems

An additional hardware is required to implement the biometric template in the proposed methodology. Biometric identification systems (BIS) is based around a core *Automated Fingerprint Identification System (*AFIS) that offers full biometric integration – with the inclusion of fingerprints, palm-prints, facial images, descriptive data, signatures and documents. Known as multimodal biometrics (or 'fusion' technology), this approach optimizes the results of search queries, consequently achieving more accurate responses. Common BIS elements include:

4.1.4.1. Data Server

It is a central repository (e.g. Oracle database) for storage and near-immediate retrieval of biometric identifiers together with associated features and textual data. (Known as 'descriptor' data)

4.1.4.2. Work Stations

These are equipped with a camera and scanner to enable the capture, encoding and submission of finger/palm-print images, slap impressions, rolled fingerprint images, photographs, signatures and demographic information.

4.1.4.3. Review Stations

Are designed for the dedicated review and verification of search results, as well as match analysis.

4.1.4.4. Live Verification Stations

Allow the identification of individuals when the subject is present at the time of processing.

4.1.4.5. Optional Peripherals

Portable and single-finger scanning devices, cameras, two/ten-print card printers, automated case management systems, Web servers, application servers, mobile gateways, descriptor import/export modules.

4.2. Barcode Payments

The barcode technology has been developed with the creation of 2D barcodes to increase the data capacity of 1D barcodes. With the integration of cameras, mobile phones act as scanners, barcode readers and portable data storages and maintaining network connectivity. When used together with such camera phones, 2D-barcodes work as a tag to connect the digital and physical world. Today most of the mobile applications encode a URL or a website address inside a 2D barcode to visit a Web page containing a video clip or a document that can be accessed from a mobile Web browser. A 2D barcode can also represent a business card, an advertisement coupon, product information and it can be used in visual cryptography.

In mobile payment systems, 2D barcodes are used to support presale, buy and sell, post sale operations in the form of transactions. 2D barcodes can be used to present advertisements, coupons, and receipts, which can be captured and decoded by mobile client software on mobile devices. Moreover, 2D barcodes enable mobile devices to become a point-of-sale device that reads the barcode and facilitates payment transactions. After a payment transaction, 2D barcodes can be used to present a purchase receipt to gain access to the information about the purchased goods and services.

4.2.1. 2D Barcode-Based Mobile Payment

There are two ways to build 2D barcodes in mobile payment systems. The first approach is to build 2D barcode-based Position of Sale (POS) systems. The objective is to support mobile payment transactions between mobile users and mobile terminals at anytime and anywhere. This type of POS-based payment systems can be used in Parking lots, TAXI, airport and railroad stations. 2D barcodes are useful to support product information retrievals, secured payment transactions, customer and product verification, and mobile security checking.

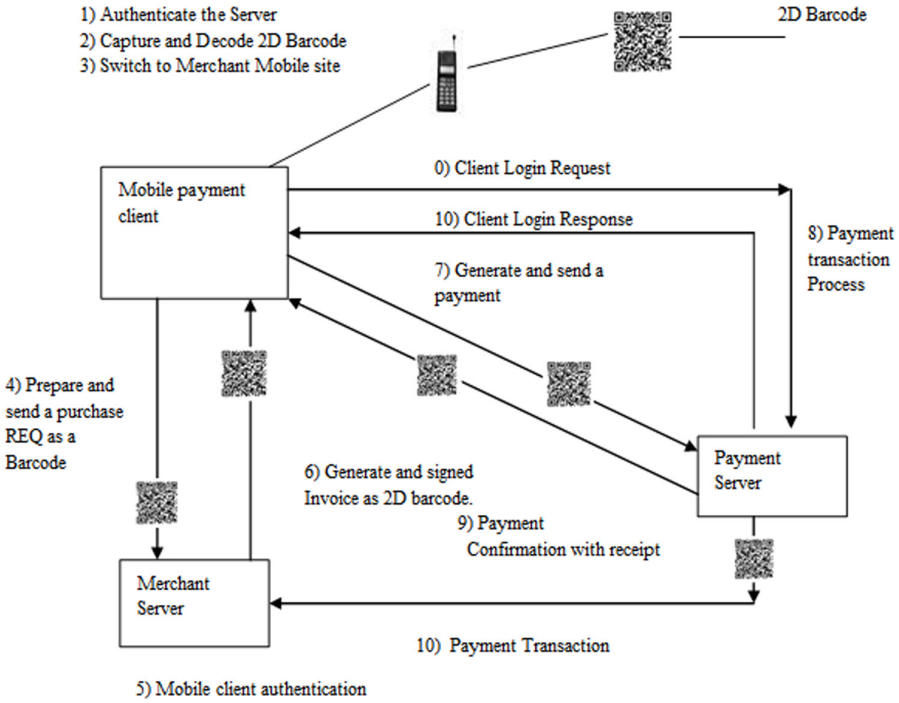
The other approach is to build 2D barcode-based systems to allow mobile users to issue mobile payment transactions using their digital wallets based on mobile payment accounts in a mobile payment server. Comparing with the existing account-based mobile payment systems, this approach has five distinct advantages:

- It provides the buy-and-sale payment services for goods identified using 2D barcodes.
- Mobile users can easily retrieve all related product information from 2D barcodes.
- It easily supports product and customer verification for post-sale services, such as delivery and pick-up.
- It increases the mobile security for payment transactions.
- It improves mobile user experience by reducing user inputs.

Following are the steps in the 2D barcode-based payment system using the second approach (Figure 5):

Step 0: A registered mobile user uses his/her user account and PIN to login the mobile payment system by sending a login request to the mobile payment server. The mobile

Figure 5. 2D barcode payment system



server processes mobile client authentication and sends a login response with the server certificate ID, and secured session ID, as well as a public key for the communications.

Step 1: The mobile client authenticates the mobile server with received public and server's certificate.

Step 2: The mobile client captures or receives a 2D barcode for an interested product from its advertisement. There are two scenarios in which a mobile user can get a 2D barcode. In the first case, a mobile user may use a mobile camera on the mobile device to capture the image of a 2D barcode from a posted product. In the second case, a mobile user may receive a mobile ad on a mobile device from a merchant. Meanwhile, the mobile client decodes the received 2D barcode, which includes product and maker's information, marketing data, merchant's mobile URL information.

Step 3: The mobile user clicks the given 2D barcode to switch the target merchant's mobile site using the provided URL in the received 2D barcode.

Step 4: The mobile user prepares and submits a purchasing request with a digital signature as a 2D barcode to the merchant server.

Step 5: The merchant server authenticates the mobile client based on the provided the secured session ID from the mobile client, as well as the public key. Meanwhile, the received signed request is validated by the merchant using the private key.

Step 6: The merchant server generates and sends a signed purchase invoice with a transaction ID to the mobile client.

Step 7: The mobile client prepares and sends a payment request with the same transaction ID and a digital signature to initiate a payment request. The digital signature is made using

the client private key. The entire message is encoded as a 2D barcode.

Step 8: A secure session is established between the payment server and the mobile client. In this step, the payment server validates the given security information, including the certificate from mobile client, session ID, public key, and received digital signature. The mobile payment server processes the payment transaction.

Step 9: The payment server prepares and sends a payment confirmation with a 2d barcode receipt to the mobile client. The mobile client displays the received confirmed message to the mobile user.

Step 10: The mobile server also sends a payment transaction completion notice with a 2D barcode to the merchant server. This barcode will be useful for the merchant to carry out the post-sale operations, such as pick-up validation or product delivery.

4.2.2. Mobile Enabled Security Solution in Mobile Payment

To address the security issues in the 2D barcode payment system the following components are required.

- **Authentication Management:** This component is built to support the required authentication functions for each party, including mobile client, merchant, and the payment server. In this system each party must be authenticated before any payment transaction.
- **Mobile Session Management:** This function component is designed to assure the security of a payment session between involved parties.
- **Certification Management:** This component is designed here to support the payment-oriented certification generation, validation, and management.
- **Mobile Key Management:** This component is built to generate, distribute, check public and private key based on the Elliptic Curve Cryptography (ECC) technique.
- **Message and Data Integrity Validation:** This component is useful to check the message and data integrity for the communications between mobile client and the payment server using encryption and decryption methods.

The mobile enabled security solution consists of three parts, which supports the security functions and needs in mobile client software, the mobile payment server, and the merchant server. Unlike other existing electronic payment systems, the major security solutions in the payment system used the Elliptic Curve Cryptography technique to deal with different security issues due its advantages in processing time, key lengths and key generation, and energy consumption in mobile computing over other cryptography techniques.

5. NFC PAYMENTS

The combination of the mobile device with the latest wireless technology NFC (Near Field Communication) makes possible variety of payment applications like ticketing, access control, content distribution, smart advertising, and peer-to-peer data/money transfer. NFC is a short-range wireless connectivity technology that evolved from the combination of existing contact less identification and interconnection technologies.

NFC is a standard based, short range wireless technology supporting the two way interactions among electronic devices. A cellular phone having a NFC device is able to communicate not only with Internet via wireless connections but also with smart card readers. NFC technology brings the user experience, convenience and security of contactless technology to the mobile devices, and is enabling quick transactions and services in

our day-to-day lives. NFC has revolutionized the mobile payments. The major advantage of NFC over other wireless communication technologies is its simplicity: transactions are initialized automatically, simply by touching the reader, another NFC device or an NFC compliant transponder. NFC is a proximity technology relying on the smart card standard ISO 14443 and allowing wireless transactions only over a distance of up to 10 centimetres.

NFC is a short range and standardised (ISO 18092) wireless communication technology that adds contact less functionality to mobile devices including mobile phones and PDA's (Personal Digital Assistants). Such devices can act both as a "contactless card" (based on its secure element and as a "contactless reader" and also operate in P2P mode with peer devices. These devices support various contactless communication standards, such as ISO 14443, ISO 15693, FeliCa and Mifare Standard.

The NFC driven payment model has a potential to evolve from the traditional payment model (where the consumer pays the merchant for the goods using mobile phone) into a new model where consumer can also act as a merchant.

From a technical point of view, NFC is a very short-range wireless technology allowing to connect electronic devices over 10 cm apart and then to transfer data between them at up to 424 Kbits/second. Operating at 13.56 MHz, the technology, initially described by NFCIP-1 (Near Field Communication Interface Protocol 1) and standardized on ISO18092, ECMA340 and ETSI TS102 190, also implements now NFCIP-2 (Near Field Communication Interface Protocol 2) which is defined in ISO 21481, ECMA352 and ETSI TS 102 312. By implementing NFCIP-2, NFC is becoming compliant with proximity and vicinity card standards (i.e. respectively ISO 14443 and 15693 as well as with Felica contactless smartcard system.

Interoperable, the technology can be used with multiple devices (e.g. keyboards, camera, SD cards, game console, etc.). Up to now and thanks to its worldwide deployment, cell phone is the preferred NFC-enhanced device. It is also the most suitable device to implement the three operating modes defined by the NFC forum.

5.1. NFC Operating Modes

The technology used in NFC is compatible with existing contactless infrastructure and NFC device offers three operating modes.

5.1.1. Reader/Writer Mode

In this mode the NFC device can read or write information such as URLs, SMS's in a tag or smart card e.g. Smart posters applications. Here, users touch the device or a cell phone with the tag embedded in the poster, which triggers the transmission of a URL to the phone. The URL could be used to open the Web browser without any human intervention.

5.1.1.1. Card Emulation Mode

In this mode the NFC enabled device emulates a contactless smartcard (ISO 14443). There is a secure element embedded in the device where sensitive data can be stored in a safe place and value added services requiring a high level of security such as payment applications can be made available to the customers.

5.1.1.2. Peer-to-Peer Mode

In this mode a connection is established between two NFC enabled devices and data can be exchanged between them. The NFC peer-to-peer mode (ISO 18092) allows two NFC enabled devices to establish a bidirectional connection to exchange contacts, Bluetooth pairing information or any other kind of data. To establish a connection a client (NFC peer-to-peer initiator) is searching for host (NFC peer-to-peer target) to setup a connection. The standards ISO14443 (for contactless smart cards) and ISO18092 (for NFC

peer-to-peer mode) do not specify encryption or security for the contactless communication at all. Such a feature must be implemented by the developer on application level. At the moment the two major players in the smart card market, NXP Semiconductors with their product Mifare and Sony with Felica, have implemented a proprietary encryption for their products on top for securing the communication.

The NDEF (NFC Data Exchange format) is used to transmit data. This mode is standardized on ISO 18092.

5.2. NFC Architecture

A mobile device integrated with NFC technology is typically composed of various integrated circuits, SEs and an NFC interface (Figure 6). The NFC interface is composed of a contactless; analog/ digital front-end called an NFC Contactless Front-end (NFC CLF), an NFC antenna and an IC called an NFC controller to enable NFC transactions. The NFC Controller is required for the analog digital conversion of the signals transferred over the proximity connection. (E.g. payment at POS is done through Single-Wire Protocol (SWP)). The SE provides a dynamic and secure environment for programs and data. The secure element is also called as tag emulation operating mode. It enables secure storage of valuable and private data such as the user's credit card information, and secure execution of NFC enabled services such as contactless payments. Also, more than one SE can be directly connected to the NFC controller. The supported common interfaces between SE's and the NFC controller are the Single Wire Protocol (SWP) and the NFC Wired Interface (NFC-WI). The SE can be accessed and controlled from the host controller internally as well as from the RF field externally. The host controller (baseband controller) is the heart of any mobile phone. Host Controller Interface (HCI) creates a bridge between the NFC controller and the host controller. The host controller sets the operating modes of the NFC controller through the HCI, processes data that are sent and received, and establishes a connection between the NFC controller and the SE. Also, host controller is able to exchange data with the secure element (internal mode e.g. for top up of money into the secure element over the air. NFC is closely related to RFID (Radio Frequency Identification). RFID is mainly used for remote tracking, tracing and identification of goods and persons without a line of sight while as NFC is used for more sophisticated and secure transactions like contactless access or payments. Both technologies have several layers and protocol concepts and are therefore open for the same attacks.

5.2.1. Types of Payments in NFC

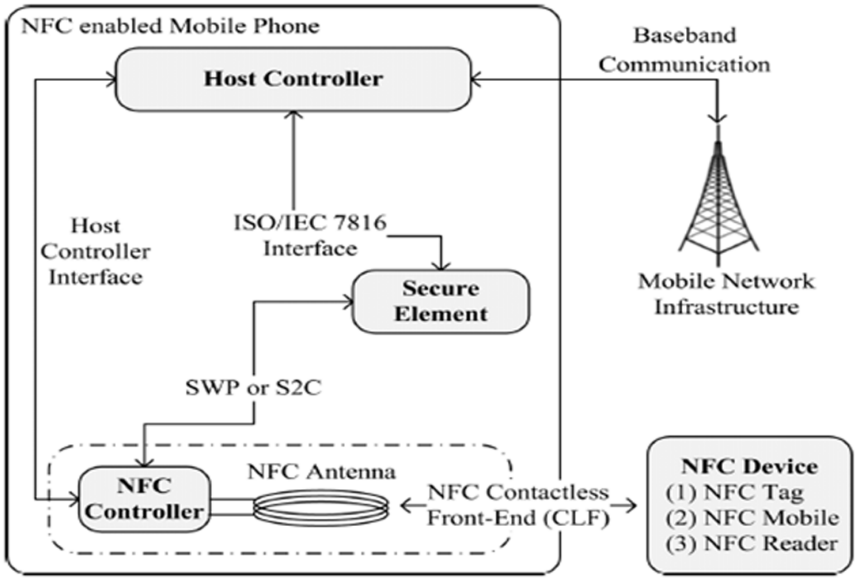
Near field communication (NFC) is short distance radio communication technology, enabling communication between two devices when they are in the close vicinity of each other. This technology is used in the contactless payment processing models.

In context of mobile payment processing, an NFC enabled mobile device can interact with an NFC enabled Point of sales (POS) device and engage in performing payment functions through NFC connectivity. The NFC implementation uses ISO/IEC 14443 standards for NFC card reader and NFC device communications. In order to complete a mobile payment transaction, it is essential that the mobile devices and POS equipments are both NFC enabled. There are different scenarios, as to how the NFC enabled mobile devices can be used to perform payment operations.

The following are the different NFC technology based mobile payment transactions.

- NFC Card Based Payment Processing
- NFC Mobile Wallet Processing

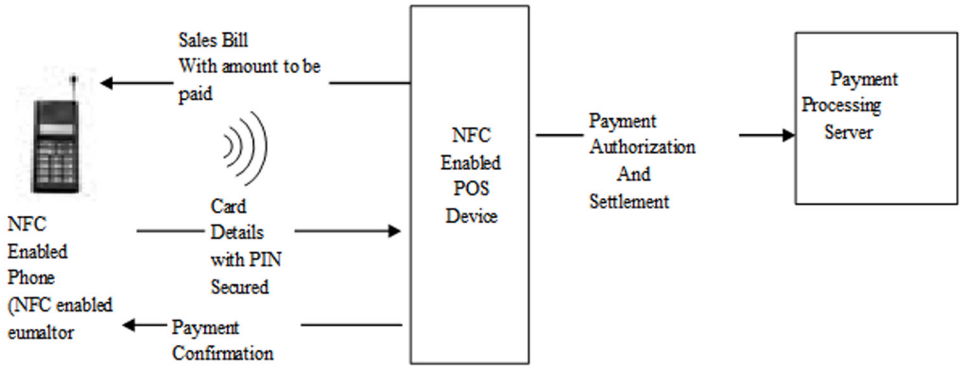
Figure 6. Architecture of NFC integrated in a mobile device



5.2.1.1. NFC Card Based Payment Processing

In this payment transaction processing, an NFC enabled mobile device is used to make card based (credit or debit) payments with an associated NFC enabled POS device (Figure 7). In this scenario, the actual card details along with the pin details are stored in the mobile device. The information is stored in NFC controller which acts like an NFC enabled smartcard. When a transaction is completed in an NFC enabled POS, the payments can be made by a NFC mobile device, by bringing into the contact of the concerned NFC POS. On close contact, the bill details are passed to mobile device, users will be able see the bill and press required button to make the payments. The card details along with pin are passed to NFC enabled POS, which will further process the card details to complete the payment transaction. The payment transaction between the NFC POS and payment gateway service provider will continue as it is done. After completion of payment processing,

Figure 7. NFC card based processing



the NFC POS sends a payment confirmation message to NFC mobile device, and the overall mobile transaction is closed.

5.2.1.2. NFC Mobile Wallet Processing

In this type of payment an NFC enabled mobile devices is used to make payments with NFC enabled POS, using user's mobile M-Wallet account (Figure 8). Mobile users, instead of using credit cards, use their M-wallet account to make the payments. The NFC enabled POS presents the bill to the users, who accepts the same to make payments, sending M-Wallet account details to NFC POS, that further interacts with user's M-wallet account service provider, for closing the payment transaction. After successful payment processing NFC-POS sends a confirmation message to the mobile device and then the overall transaction is closed.

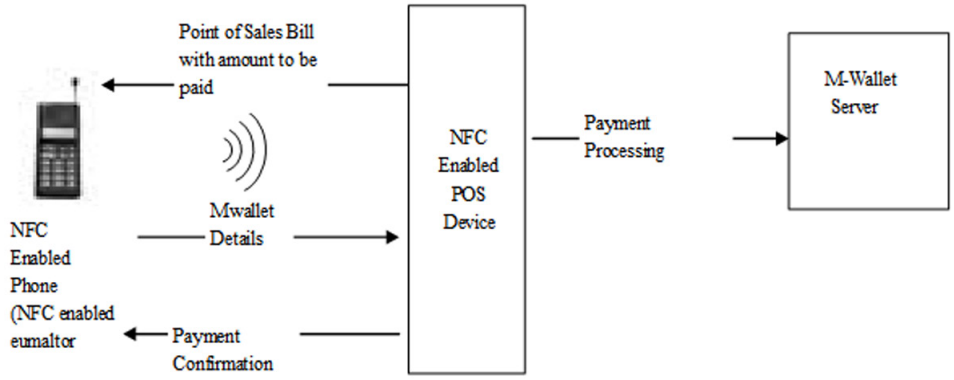
5.3. NFC Payment Processing

NFC capable POS devices let the merchant connect more closely with customers. The customer needs to have payment enabled an NFC-equipped mobile phone. The payment process works as described as follows:

- Consumer purchases an NFC enabled smart phone and sets up his or her card subscriptions.
- The credit card issuer transfers data to a Trusted Service Manager (TSM).
- The TSM "pushes" credit card data onto the consumer's smart phone. A mobile operator (such as Verizon or AT&T) manages a payment application and issues NFC secure components to make the consumer's phone payment capable.
- Consumer taps their NFC phone on an NFC capable mobile operator acceptance device to make payment via NFC.
- The transaction is routed through mobile operators secure payment gateway to the card provider for authorization and processing, and to service providers who may be providing couponing or loyalty rewards and discounts.

NFC is a technology for payment that allows two-way, real-time communication between the merchant and the consumer and enhances the payment process. Some of the NFC-enabled functions at the point-of-sale include:

Figure 8. Mobile wallet processing



- Increasing sales by making it easier for consumers to use virtual e-gift cards participate in loyalty programs and earn rewards at the POS.
- Two way communication (peer-to-peer) between the handset and POS device to transmit coupons, loyalty rewards, payment and promotional messages.
- Providing links and unsurpassed payment convenience for social media fan favourites and group discount offers.
- Gathering customer data efficiently through NFC-enabled devices for improved consumer analytics.
- Enabling alternative payments such as peer to peer.

5.4. NFC Payment Architecture

There are different actors in the NFC payment architecture, where these actors' acts as an enabler in a business to business relationship with banks and other service providers, in terms of creation of different applications with security features on the SIM Card. There is another actor that has a dominant role. That is the payment card scheme owners, namely VISA and MasterCard. They have launched pilots all over the world and have started transactions with their contactless payment card, PayWave, PayPass. Since contactless payment cards and NFC payments, through EMV, can work in a similar way these network owners are very dominant in the NFC payment ecosystem. Further, they are interacting with the payment industry and are engaging in collaborations with handset manufacturers. For example VISA have engaged in collaboration with Nokia and together executed trials on M-payments trough NFC.

5.4.1. Customer

The customer (end user) is at the most important actor of the NFC payments. The consumer owns the payment credential (card) and initiates service requests and agreements. Without the customers, the service of NFC and m-payments will be worthless, no matter how technologically advanced and workable this invention is. Therefore it is important for all actors to be aware of and consider the customers role in the m-payments.

5.4.2. Merchant

The merchant is the customer's counterpart in the NFC payment systems. The merchant offers goods or services for sale and decides which payment options to offer to the customer. Merchants benefit from the operational efficiencies generated by faster transactions and fewer requirements to handle cash, which lower costs and enhance customer convenience. Merchants, like financial institutions, can offer their customers purchase-related and loyalty services, such as paperless receipts. Merchants can also make their gift card and loyalty programs more effective; customers' "payment cards" are always available in their mobile phones.

Merchants are also able to deliver advanced mobile marketing and promotion programs that leverage the mobile device and proximity technology to deliver context-sensitive messages to customers, influencing their behaviour inside and outside of the store. Mobile promotions and couponing are prominent features of multiple NFC mobile payment pilots and are proven to have positive influence on consumer behaviour and great acceptance by customers.

5.4.3. Mobile Contactless Payment Application Service Provider (MCPA SP)

The service provider issues the payment application to the customer. An MCPA SP must be a payment service provider and is also the card issuer. The service provider determines the profile of the payment application and the terms of use.

5.4.4. Mobile Network Operator (MNO)

In NFC payment systems OTA most often use the MNO's mobile network. This does not mean, that the MNO has to have an active role in the NFC payment system, unless as an SE issuer for the UICC, or through subsidising or selling NFC-enabled handsets.

As an important factor in the mobile payment systems, it can be argued that the NFC payment system benefit from the MNO's participation because of its strong distribution power and advanced mobile services experience. The MNO is a highly active part of the NFC payment system as SE issuer when the UICC is the SE.

5.4.5. Trusted Service Manager (TSM)

TSMs offer a single point of contact with mobile operators for financial institutions, transit authorities, and retailers who want to provide a payment, ticketing, or loyalty application to customers with NFC-enabled mobile phones. TSMs provide services to send and load the NFC application over the air to the mobile phone and to aggregate, send, and load personal consumer data over the air. In a large NFC ecosystem, use of a neutral third-party TSM can be the most desirable scenario. The Trusted Service manager should be separated into two parts; governance and operational. The governance part is the one who sets up all the rules, it manages and monitors all the regulations within the ecosystem and gives certifications to the actors involved. The operational part deals with the management of applications and is also a single point of contact to its customers and consumers. However, financial institutions or MNO's can also function as TSMs. The role of a TSM is critical in the proximity mobile payments system since it can enable interaction among many service providers and multiple MNO's.

The role of the TSM can be divided into several key functions.

- Interconnect with MNO & Service Providers
- Guarantee end-to-end security
- Application lifecycle management
- Enrol new user
  - Create Security Domain
  - Download OTA c-less application
- Activate/Deactivate services
- Update User Interface
- Manage NFC customer database

These functions are the core business of the TSM and are something that has to be handled with care. Many of these functions deal with sensitive issues such as trust and security.

5.4.6. Handset Manufacturer (HM) and or Platform Provider

The HM has an important role in the NFC payment systems by manufacturing and selling NFC enabled handsets. It can also act as an SE issuer for the embedded SE. For the sake of simplicity, the HM is assumed to include the role of a platform provider. The HM (and or platform provider) is a part of the NFC payment ecosystem as an SE provider for the embedded SE. The HM regards their function or role very easy to predict and understand which is to be in charge of manufacturing mobile phones with NFC devices implemented. Even though their role is quite clear, the execution of it is much more difficult. This has to do with i.e. the space available inside a phone and the different standards that are changing every so often.

5.4.6.1. Acquirer/Bank

The acquirer is responsible for handling financial acquisition in payment systems. That is, it initiates the clearing and settlement of payment transactions through payment schemes and banks.

5.4.6.2. Payment Scheme

The payment scheme (card scheme) is responsible for handling agreements with scheme participants, setting fees and establishing technical, functional, branding and certification policies for scheme participants (Figure 9).

In addition to direct relationships with relevant systems, the payment scheme have many indirect relationships, for example, the certification of SEs and POS technology to ensure it meets the required security and interoperability standards prior to market release.

5.5. NFC Security Approaches

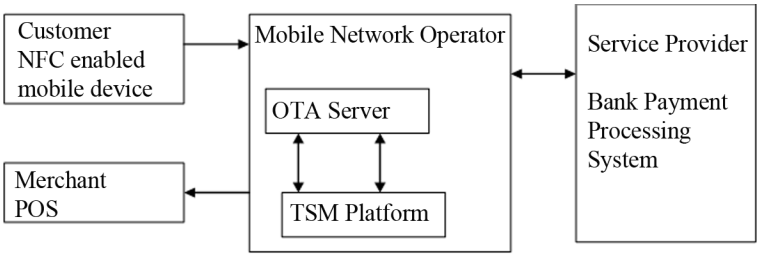
Contactless payment are implemented by American Express, MasterCard and Visa, is secure. The financial payments networks used to process contactless payments are the same networks that process millions of magnetic stripe transactions securely every day.

The financial payments industry has designed multiple layers of security throughout the traditional credit and debit payment systems to protect all parties involved in a payment transaction. Most of these protective measures are independent of the technology used to transfer the consumer payment account information from the payment card or device to the merchant POS terminal and are used for both magnetic stripe and contactless transactions. For example, online authorization, risk management and fraud detection systems are used to detect potential fraudulent activity for any credit or debit card payment transaction.

For contactless payments, the financial industry also uses added security technology, both on the contactless device as well as in the processing network and system, to prevent fraud. While implementations differ among issuers, examples of security measures that are being used include the following.

- **Industry Standard Encryption:** At the card level, each contactless card can have its own unique built-in secret "key" that uses standard encryption technology to generate a unique card verification value, cryptogram or authentication code that exclusively identifies each transaction. No two cards share the same key, and the key is never transmitted.
- **Authentication:** The issuers verify that the contactless payment transaction has a valid card verification value, authentication code or cryptogram before authorizing the transaction. Therefore, at the system level, issuer has the ability to automatically detect and reject any attempt to use the same transaction information more than once. Thus, even if a fraudster should "read" information from a contactless transaction, or even multiple transactions from the same card, this information would be useless.
- **Confidentiality:** The processing of contactless payments does not require the cardholder name to be exchanged between card and terminal. The best practices being

Figure 9. NFC payment architecture



used within the industry do not include the cardholder name in the contactless chip.

- **Control:** Some contactless payment cards and devices do not include the cardholder's account number, but use an alternate number that is associated with a payment account by the issuer's backend processing system. This alternate number would not be able to be used in other payment transaction (e.g., with a magnetic stripe card or on the Internet). In addition, cardholders control both the transaction and the card throughout the transaction. Cardholders do not have to surrender either a card or their account information to a third party during a contactless transaction and contactless payment devices are designed to operate at very short ranges so that the consumer needs to make a deliberate effort to initiate the payment transaction.

In addition to the above mentioned security financial institutions prepare the account data, and send the payment account information to a TSM. The TSM delivers the consumer's payment account information over the air (OTA) through the mobile network to the secure element in the mobile phone. Once the payment account is in the phone, the consumer can use the phone as a virtual payment card at merchants who accept contactless credit and debit payments. Payments are processed over the current financial networks with credits and debits to the appropriate accounts.

The transmission of payment, personalization, and life cycle management information from the issuer to the TSM is secured by standard Internet technologies, such as secure sockets layer (SSL) or virtual private networks (VPNs). Global Platform's secure channel protocol provides for transmission of sensitive account data between the TSM and the SE in the mobile device and storage of such information in the SE. Account data is further kept secure from OTA sniffing by encryption provided by the MNO. When the consumer uses the NFC device for payment, the transaction is protected using the dynamic cryptogram authentication technology already in place for contactless credit and debit cards.

- **Secure Delivery of Financial Data:** Mobile contactless payments do not require that account data be stored on a physical card. The data is passed securely from the issuing bank through a TSM to the SE in the mobile handset. The data is protected by cryptography throughout the process; the TSM has a critical role in managing the security of the process and keeping the cryptographic keys secure through the use of both physical and logical security measures.
- **Protecting Stored Payment Application and Account Information:** Within the mobile phone, both the payment application and consumer account information must be protected, and different NFC applications must be able to work securely and independently of each other. Security approaches used include:
  - Storing the payment application and data in the SE.
  - Using Global Platform-specified security domains and hierarchy to provision data OTA to the SE.
  - Using smart card technology inherent in the SE to authenticate all communications with the application to update or change operational parameters and to provide built-in tamper resistance security features that recognize hostile attacks and take appropriate protective measures, such as blocking the application.
  - Providing a mobile wallet for accessing the payment account information in the SE during a transaction, with

an optional personal identification number (PIN) authorizing access to the wallet.

- Leveraging existing and future EMV contactless card transaction authentication security technology.
- Leveraging existing issuer host system.

6. EXAMPLES OF REAL WORLD MOBILE PAYMENT APPLICATIONS

The existing wireless payment systems can be classified into three types: account based payment systems, token-based payment systems, mobile POS (point of sale) payment, and mobile wallets payment systems. But, the scenario of mobile payments is still in infancy. People are still not aware of mobile payments and still people face lots of dilemma in doing transactions and payments. People are not aware of the differentiation between mobile payments and mobile banking. Especially rural parts due to poor connectivity, erratic power supply, low income level of people and the remote locations of the states. Some of the payment systems used is Beam, Pay-as-you-go, Mchek, PayMate and UID projects in micropayments. Other existing payment systems are PayPal, Mobipay, Nokia Wallet and Vodafone's m-pay bill. Mobile FeliCa and Mobile Suica are the two successful solutions launched in Asian market.

6.1. Beam

Beam is a micropayment service aimed at the non banked rural population of India. Beam distributes prepaid vouchers that one can purchase in the denomination of Rs100 -1000 and load their account against the mobile number through SMS or IVR. The strategy for the Beam seems to be a little confused. They claim of serving the rural crowd but the agency is targeting the urban youth. A related opportunity in Beam could be micro-transfers, wherein the migrated rural crowd could use the service to transfer money to their family's Beam account back home. The family member could then transfer the value to the Beam agents account in the village and receive cash. This could be an alternative to money order. On the face of it the service seems to have no differentiator from ITZ Cash cards.

Limitations:

- Inefficient, costly and unsecured modes of money transfer.
- Because of the technological limitations account is not recharged successfully. Either customer never gets the balance, or double recharge is done on one single transaction.
- There are several business issues in addition to Regulatory and Supervisory issues.

6.2. Pay-As-You-Go

This is a cell phone service and is applying to small scale solar energy systems. Simpa Networks partnering with solar manufacturing Selco India allows Hardware upfront customers, then purchase pay-as-you-go cards in increments of 50, 100,500 rupees which supplies them with a cable that they enter to unlock the solar system. Customers can also top off their account with their cell phones.

Limitations: Renewable energy installations come with an upfront cost that poor communities in India cannot afford. People spend the little that they earn immediately with no real savings.

6.3. MChek

It allows a cell phone to act like a debit card. It is a mobile based secure transaction platform that can be used for remote authentication, authorization and notification of payments from bank account using mobile phone. Its services are available to

almost everyone who owns a mobile phone and a bank account. SIM cards from Airtel, Vodafone, TATA IndiCom; TATA DoCoMo comes with the Mchek application preloaded. Mchek developed in-house, claims 128-bit, 3DES, and end to end encryption. However, 3DES takes 56, 112, or 168-bit keys, with no option to trim or augment keys, rendering this statement highly suspect. Mchek does, however, add an Interactive Voice Response (IVR) call back feature to each transaction which calls the handset a transaction ostensibly originates from to confirm the transaction details using touch tones and automated menus.

Limitations: Since services of Mchek can be utilized by registering mobile number with it. A 6 digit PIN is received to authorize the payments. At present Mchek provides facility by registering Credit card for payments such as Visa and Master Card. The main disadvantage with this system is that it cannot be used in rural India due to the infrastructural and technological problems.

6.4. PayMate

Paymate offers mobile payments solutions through tie-ups with Banks, merchants and other financial institutions. It had partnered Essar's mobile retail chain Mobile Store to offer mobile payment services, and Tata Teleservices and Corporation Bank to offer a mobile money transfer service, named Green. It also operates mobile payment service in Sri Lanka, Nepal and UAE. It also offers merchant mobile POS solutions in the US through transaction service provider-TSYS. Also, it is a mobile based loan repayment service that is extended to remote rural villages of India through registered agents.

Limitations:

- Paymate offering Mpayment Facility in which Consumer is required to register on Website. Whether Consumer who do not have this facility will or will not be able to use mobile payments?
- One of the most crucial and basic elements to making mobile money services a success is ease of use and reliability. However, mobile operators, banks and payment providers are struggling to convince that the new services are better than those in use today. In other cases, Customers simply do not see the need for the payment functionality to be developed. A lot of work still needs to be done to promote customer acceptance.
- Tie up with credit card and some banks.
- Registration is required with banks through service Provider.

6.5. Osaifu-Ketai

Osaifu-Ketai literally means Wallet Mobile. It is a trademark of NTT DoCoMo, which developed the system. It refers to mobile phones that integrate Sony's Mobile FeliCa ICs, as well as to services provided by applications on these phones. Although it was developed by NTT DoCoMo, the system is also supported by other mobile phone operators, making it the standard mobile payment system in Japan. Osaifu-Ketai services include electronic money, identity card and loyalty card, fare collection of public transits or credit card.

FeliCa, developed by Sony, is the de facto standard technology used for Japanese smart cards. Many of these cards accept Osaifu-Ketai (Mobile FeliCa) system as well, or plan to accept it in future. Osaifu-Ketai can provide more convenient services than plastic FeliCa cards. For instance, it can automatically recharge itself via the Internet, or provide the latest information. It can also be used as a ticket for an airplane or an event, by downloading an electronic ticket. Unlike plastic cards, a single Osaifu-Ketai phone may accept multiple applications, each equivalent to different cards. Osaifu-Ketai provides many functions on a single mobile phone. Therefore, there is a great risk if the phone is lost, broken, or stolen.

Osaifu-Ketai basically functions even without radio transmissions, so the applications cannot be terminated just by closing a phone account. A user has to contact each service provider to stop all the functions. There are some phones that can lock the functions via a phone call or an E-mail. Since Osaifu-Ketai can function as identity card (such as member card, company card, or key card), there is also a risk for those who authenticate it.

Limitations:

- Osaifu-Keitai provides many functions on a single mobile phone. Therefore, there is a great risk if the phone is lost, broken, or stolen. Osaifu-Keitai basically functions even without radio transmissions, so the applications cannot be terminated just by closing a phone account. A user has to contact each service provider to stop all the functions. There are some phones that can lock the functions via a phone call or an E-mail.
- Since Osaifu-Keitai can function as identity card (such as member card, company card, or key card), there is also a risk for those who authenticate it.

6.6. M-PESA

Developed by Vodafone and launched commercially by the company's Kenyan affiliate Safaricom, M-PESA is a small-value (all transactions are capped at $500) electronic payment and store of value system accessible from ordinary mobile phones. Once customers have an M-PESA account, they can use their phones to transfer funds to both M-PESA users and non-users, pay bills, and purchase mobile airtime credit for a small, flat, per-transaction fee. The affordability of the service has been key factor in opening the door to formal financial services for Kenya's poor.

Extremely rapid uptake of M-PESA is a strong vote of confidence by local users in a new technology as well as an indication of significant latent demand for remittance services. In recent months, M-PESA has begun allowing institutional payments, enabling companies to pay salaries and collect bill payments.

Limitations:

- Financial institutions are facing difficulties in reconciling deposits initiated by M-PESA users to customers' accounts.
- Banks are delaying informing customers that money has been credited to their account.
- Customers are also finding it difficult to make withdrawals from a bank account using the M-PESA channel.
- Problems include resolving incompatible software and, thus far, very limited middleware for financial institutions and Safaricom's respective systems; customer data-entry errors, particularly for account numbers; money transfer and reconciliation delays; and lack of transparency on customer fees for M-PESA platform access. (The fee structure is complicated and, because Kenyans are accustomed to paying unusually high fees for all banking and money-transfer services, they are less inclined to demand clear explanations on pricing.)
- Several financial institutions are now embarking on their own mobile banking services and agent networks (Equity Bank, Kenya Commercial Bank and Cooperative Bank lead in these efforts). Others, including most large MFIs, are developing or looking into more compatible middleware.
- Processing delays.
- Customer error.

6.7. PayPal

It is a global e-commerce business allowing payments and money transfers to be made through the Internet. Online money transfers serve as electronic alternatives to paying with traditional

paper methods, such as checks and money orders. Originally, a PayPal account could be funded with an electronic debit from a bank account or by a credit card at the payer's choice. But some time in 2010 or early 2011, PayPal began to require a verified bank account after the account holder exceeded a predetermined spending limit. After that point, PayPal takes funds for a purchase from funding sources according to a specified funding hierarchy. The funding hierarchy is a balance in the PayPal account, a PayPal credit account, PayPal Extras, PayPal Smart Connect, PayPal Extras Master Card or Bill Me Later, a verified bank account, other funding sources, such as non-PayPal credit cards. The recipient of a PayPal transfer can request a check from PayPal, establish their own PayPal deposit account or request a transfer to their bank account. PayPal is an acquirer, performing payment processing for online vendors, auction sites, and other commercial users, for which it charges a fee. It may also charge a fee for receiving money, proportional to the amount received. The fees depend on the currency used, the payment option used, the country of the sender, the country of the recipient, the amount sent and the recipient's account type. In addition, eBay purchases made by credit card through PayPal incur extra fees if the buyer and seller use different currencies. In December 2010, PayPal services were attacked in a series of denial-of-service attacks organized by Anonymous. In spite of its international reach, PayPal has limited functionalities for multi-country users, most notably the impossibility to have bank accounts in several countries, or to have a shipping address in a different country than one's bank account or credit card. In 2003, PayPal voluntarily ceased serving as a payment intermediary between gambling websites and their online customers. At the time of this cessation they were the largest payment processor for online gambling transactions. In 2010, PayPal resumed accepting such transactions, but only in those countries where online gambling is legal, and only for sites which are properly licensed to operate in said jurisdictions.

Limitations:

- Because PayPal is not a bank, it does not have to work with you to resolve disputes between users or payment problems. Banks are subject to audits and regulations, but PayPal is an independent corporation and is not subject to the same rules banks comply with. If you have a dispute about a charge or a payment, PayPal employees will decide how to rule on the dispute. If they decide you were wrong, you should not have received that payment, or you are wrong, you owe that charge you are disputing, that's the end of it. There is no appeals process available, leaving you at the mercy of PayPal employees.
- Because of security issues and U.S. regulations enacted to limit the transfer of money to terrorists, PayPal sometimes freezes an account because of a suspicious circumstance. Accounts may be temporarily frozen because of suspected security breaches, or for a longer term as PayPal investigates potential improprieties. Accounts may be frozen for months leaving merchants without the ability to extract the funds in their account.

7. FUTURE RESEARCH DIRECTIONS

Wireless technologies and other pervasive computing have changed the way we communicate, do business and transactions. Further work could be done to add and use wireless protocols to increase the speed of the transactions and to further improve the security aspect at transport layer and network layer in addition to the usability. It would be very interesting to add extra hardware on mobile phones for easy installation of barcode technology, and NFC technology. Clearly wireless networks and mobile device technologies are still in rapid development. The growth of 3G/4G network technology and the Smartphone brings more and

more opportunities to mobile applications. The applications can be implemented in financial sector not only by the traditional commercial banks but by Internet payment agents, for example, PayPal. Furthermore, the implementation of the application is low cost and can also be easily integrated into the other end-to-end mobile applications.

8. CONCLUSION

The goal of this chapter is to research and to understand the concepts and emerging technologies that can benefit the mobile payments with respect mobile payment usability and security. Although the technologies in the development of mobile payments have improved and are experiencing a significant development, mobile devices and wireless networks are still "resource-limited" compared to PCs and fixed-line network? The difficulty in building mobile payment systems lies in how to provide payment transactions with security and practicality.

The contribution of this chapter is as follows:

1. Some existing systems are understood in detail. Their advantages and limitations have been discussed. Based on the understanding of these systems different applications can be designed and developed that can be used in the real world. Also, research can be carried out about these systems.
2. The security mechanism is understood thoroughly and is concluded that these systems provide security at transaction, network level and application level. The Payment Systems developed should provide the security at each and every level to improve the customer satisfaction as well as value chain of an organization.
3. In addition to the above mentioned, there is lack of new technologies in the existing payment systems which can be easy to use and can add another level of security and trust worthiness during transactions like NFC payments and Barcode payments.

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APPENDIX

List of Abbreviations

EMV: Electronic Master Visa
HCI: Host Controller Interface
HTML: Hypertext Markup Language
HTTP: Hypertext
ICC: Integrated Circuit Card
IMT-Advanced: International Mobile Telecommunications Advanced
IP: Internet Protocol
ISO: International Standard Organization
ITU-R: International Telecommunication Union Radio communication sector
IVR: Interactive Voice Response
LAN: Local Area Network
LCD Controller: Liquid Crystal Display Controller
LTE: Long Term Evolution
NFC: Near Field Communications
OTA: Over the Air
P2P: Peer to Peer
PAN: Personal Area Network
PIN: Personal Identification Number
PLMN: Public Land Mobile Network
POS: Point Of Sale
PSP: Payment Service Provider
PSTN: Public Switched Telephone Network
SE: Secure Element
SSH: Secure Shell Network Protocol for Secure Data Communication
SSL: Secure Socket Layer Protocol
SWP: Single Wire Protocol
TGPP: Third Generation Partnership Program
TSM: Trusted Service Manager
TTP: Trusted Third Party

UE: User Equipment
UICC: Universal Integrated Circuit Card used in mobile terminals in GSM and UMTS networks
URL: Unified Resource Locator
WAE: Wireless Application Environment
WAP: Wireless Application Protocol
WDP: Wireless Datagram Protocol
Wi-Fi: Wireless Fidelity
WIM: Wireless Identity Module
WiMAX: Worldwide Interoperability of microwave access
WLAN: Wireless Local Area Network
WML: Wireless Markup language
WML: Wireless Markup Language
WPKI: Wireless Public Key Infrastructure
WSN: Wireless Sensor Networks
WSP: Wireless Session Protocol
WTA: Wireless Telephony Application
WTAI: Wireless Telephony Application Interface
WTLS: Wireless Transport Layer Security
WTLS: Wireless Transport Layer Security
WTP: Wireless Transaction Protocol

Chapter 77
The Use of Soft Computing for Optimization in Business, Economics, and Finance

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ABSTRACT

Optimization methods have had successful applications in business, economics, and finance. Nowadays the new theories of soft computing are used for these purposes. The applications in business, economics, and finance have specific features in comparison with others. The processes are focused on private corporate attempts at money making or decreasing expenses; therefore the details of applications, successful or not, are not published very often. The optimization methods help in decentralization of decision-making processes to be standardized, reproduced, and documented. The optimization plays very important roles especially in business because it helps to reduce costs that can lead to higher profits and to success in the competitive fight.

1. INTRODUCTION

There are various optimization methods appropriate to use in business and economics: classical ones and methods using soft computing such as fuzzy logic, neural networks, genetic algorithms, and the theory of chaos.

Soft computing differs from conventional (hard) computing in that, unlike hard computing, it is tolerant of imprecision, uncertainty, partial truth, and approximation. In effect, the role model for soft computing is the human mind. The guiding principle of soft computing is: Exploit the tolerance for imprecision, uncertainty, partial truth, and approximation to achieve tractability, robustness and low solution cost. The basic ideas underlying soft computing in its current incarnation have links to many earlier influences, among them Zadeh's 1965 paper on fuzzy sets. The inclusion of neural computing and genetic computing in soft computing came at a later point.

At this juncture, the principal constituents of Soft Computing (SC) are Fuzzy Logic (FL), Neural Computing (NC), Evolutionary Computation (EC) Machine Learning (ML) and Probabilistic Reasoning (PR), with the latter subsuming belief networks, chaos theory and parts of learning theory. What is important to note is that soft com-

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puting is not a melange. Rather, it is a partnership in which each of the partners contributes a distinct methodology for addressing problems in its domain. In this perspective, the principal constituent methodologies in SC are complementary rather than competitive. Furthermore, soft computing may be viewed as a foundation component for the emerging field of conceptual intelligence.

The mentioned applications in this chapter are as follows:

- Risk investment
- Risk management (loans, mortgages, direct mailing)
- Optimization of number of objects (devices, stock)
- Prediction of time series
- Journey optimization
- Description of economic phenomena (stock market).

The program MATLAB® with Fuzzy Logic, Neural Network, and Global Optimization Toolbox is used. The fields of applications of optimization methods in business, economics, and finance cover a wide area of applications.

2. FUZZY LOGIC

2.1 Fundamentals of Fuzzy Logic

In classical logic, a theory defines a set as a collection having certain definite properties. Any element belongs to the set or not according to clear-cut rules; membership in the set has only the two values 0 or 1. Later, the theory of fuzzy logic was created by Zadeh in 1965. Fuzzy logic defines a variable degree to which an element x belongs to the set. The degree of membership in the set is denoted $\mu(x)$; it can take on any value in the range from 1 to 0, where 0 means absolute non-membership and 1 full membership. The use of degrees of membership corresponds better to what happens in the world of our experience. Fuzzy logic measures the certainty or uncertainty of how much the element belongs to the set. People make analogous decisions in the fields of mental and physical behaviour. By means of fuzzy logic, it is possible to find the solution of a given task better than by classical methods.

The fuzzy logic system consists of three fundamental steps: fuzzification, fuzzy inference, and defuzzification (see Figure 1).

The first step (fuzzification) means the transformation of ordinary language into numerical values. For variable risk, for example, the linguistic values can be no, very low, low, medium, high, and very high risk. The variable usually has from three to seven attributes (terms). The degree of membership of attributes is expressed by mathematical functions. There are many shapes of membership functions. For example, for mf_1, $P = [0\ 0\ 3]$; mf_2, $P = [2\ 4\ 6]$; mf_3, $P = [4\ 6\ 7\ 9]$; mf_4, $P = [8\ 10\ 10]$; and so forth (see Figure 2).

The types of membership functions that are used in practice are for example Λ and Π. There are many other types of standard membership functions on the list including spline ones. The attribute and membership functions concern input and output variables.

The second step (fuzzy inference) defines the system behaviour by means of the rules such as <IF>, <THEN>, <WITH>. The conditional

Figure 1 Decision making solved by means of fuzzy logic

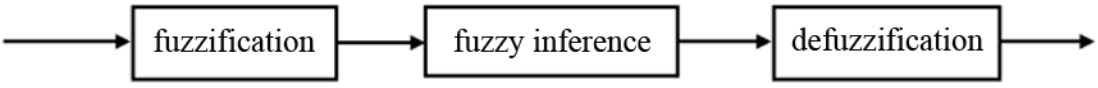
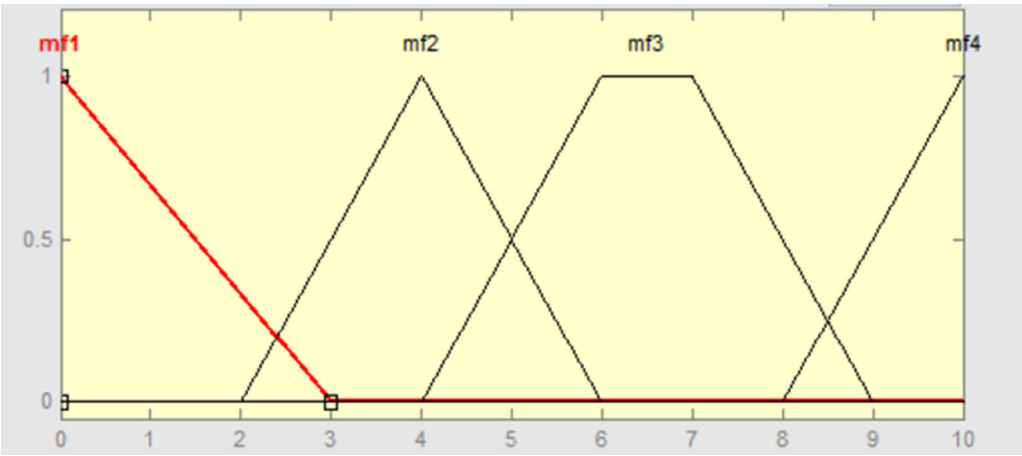


Figure 2. The types of membership functions Λ and Π



clauses create this rule, which evaluates the input variables. These conditional clauses have the form

<IF> I_1 is mf_a <OR> I_2 is mf_b... <OR > I_{N-1} is mf_y <OR >I_N is mf_z <THEN> O_1 is mf_{O1}<WITH> s.

The written conditional clause could be described by words: If the input I_1 is mf_a or I_2 is mf_b or... or I_{N-1} is mf_y or I_N is mf_z then O_1 is mf_{O1} with the weight s, where the value s is in the range <0–1>. These rules must be set up and then they may be used for further processing.

The fuzzy rules represent the expert systems. Each combination of attribute values that inputs into the system and occurs in the condition <IF>, <THEN>, <WITH> represents one rule. Next it is necessary to determine the degree of supports for each rule; it is the weight of the rule in the system. It is possible to change the weight rules during the process of optimization of the system. For the part of rules behind <IF>, it is necessary to find the corresponding attribute behind the part <THEN>. These rules are created by experts. The <AND > could be instead <OR >.

The third step (defuzzification) means the transformation of numerical values to linguistic ones. The linguistic values can be, for example, for variable *Risk* very low, low, medium, high, and very high. The purpose of defuzzification is the transformation of fuzzy values of an output variable so as to present verbally the results of a fuzzy calculation. During the consecutive entry of data the model with fuzzy logic works as an automat. There can be a lot of variables on the input.

The chapter is focused on applications. The fuzzy theory is described in books such as (Altroc 1996), (Dostál 2011), (Chen et al. 2004), (Chen et al. 2007), (Kazabov and Kozma 1998), (Klir and Yuan 1995), (Li et al. 2006), (The MathWorks 2010b).

2.2 Applications of Fuzzy Logic

Example 2.1: The Fuzzy Logic Toolbox enables setting up rules by means of neural networks using the command *Anfis*. The setup of fuzzy rules in the program environment MATLAB with the help of neural networks is presented for a case study, where the program creates the fuzzy rules by means of neural networks. The inputs and outputs are defined by Table 1, presenting the logical operation <AND>. We demonstrate four states. The first state represent the fact that the political risk is high (0) and economic risk is high (0) and it leads to state of output of no investment (0). The second state represent the fact that the political

risk is high (0) and economic risk is low (1) and it leads to state of output of no investment (0). The third state represent the fact that the political risk is low (1) and economic risk is high (0) and it leads to state of output of no investment (0). The fourth state represent the fact that the political risk is low (1) and economic risk is low (1) and it leads to state of investment (1).

The text file *Risk.dat* is created with the mentioned data at first (Table 2).

The commands *fuzzy* and *File-New FIS-Sugeno* create a fuzzy model in the MATLAB environment, then there follow commands *Edit-Add Variable-Input* that add the second input. The fuzzy model is saved in *IR.fis* file (see Figure 3).

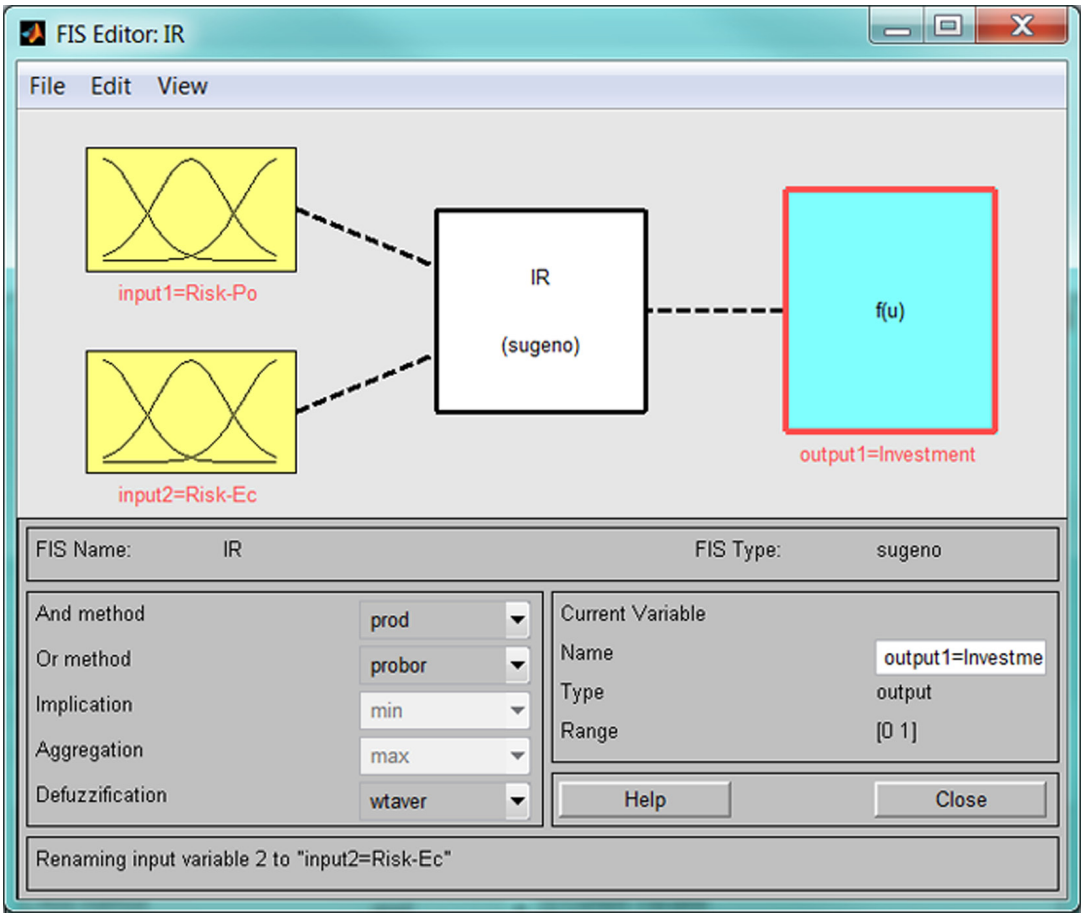
Table 1. The input and output values

State	Risk Po	Rick Ec	Investment
Order	Input1	Input2	Output
1	0 (H)	0 (H)	0 (N)
2	0 (H)	1 (L)	0 (N)
3	1 (L)	0 (H)	0 (N)
4	1 (L)	1 (L)	1 (Y)

Table 2. Input and output values

0	**0**	**0**
0	1	0
1	0	0
1	1	1

Figure 3. Fuzzy model



The command *Edit-Anfis* opens the editor. The choice of menu *Type-Training* and *From-file* and command *Load-Data* read the file *Risk.dat* (see Figure 4).

The Fuzzy Interface System is generated from the command *FIS* with the option *Grid partition*. It is set up with the numbers of two membership functions for both inputs *Number of MF's [2 2]*, then the Gaussian membership function is set up from the commands *MF Type gaussmf* and linear type *MF Type – linear*. The return is done by the *OK* menu (see Figure 5).

The values for training of neural networks create the rules chosen by options *Optim. Method-Hybrid*, *Error Tolerance* 0, and the number of *Epoch*s 20. The process of training starts with the command *Train Now*. It is desirable to watch the error training (see Figure 6).

The command *Structure* shows the created neural network used for generation of rules (see Figure 7).

The command *Test FIS – Training data* enables comparing trained data with the real ones, possibly with testing and checking data (see Figure 8).

The dependence of outputs on input can be displayed by standard commands (see Figure 9). The surface reflects the proper generation of rules.

It is possible to display the generated rules (see Figure 10).

The command *Rules* enables the verification of created rules (see Figure 11).

The presented case study describes the methodology of creation of rules by means of neural networks using the data from databases. The problem could involve complicated tasks, where a large number of rules are created. If the rules

Figure 4. Reading of data and their display

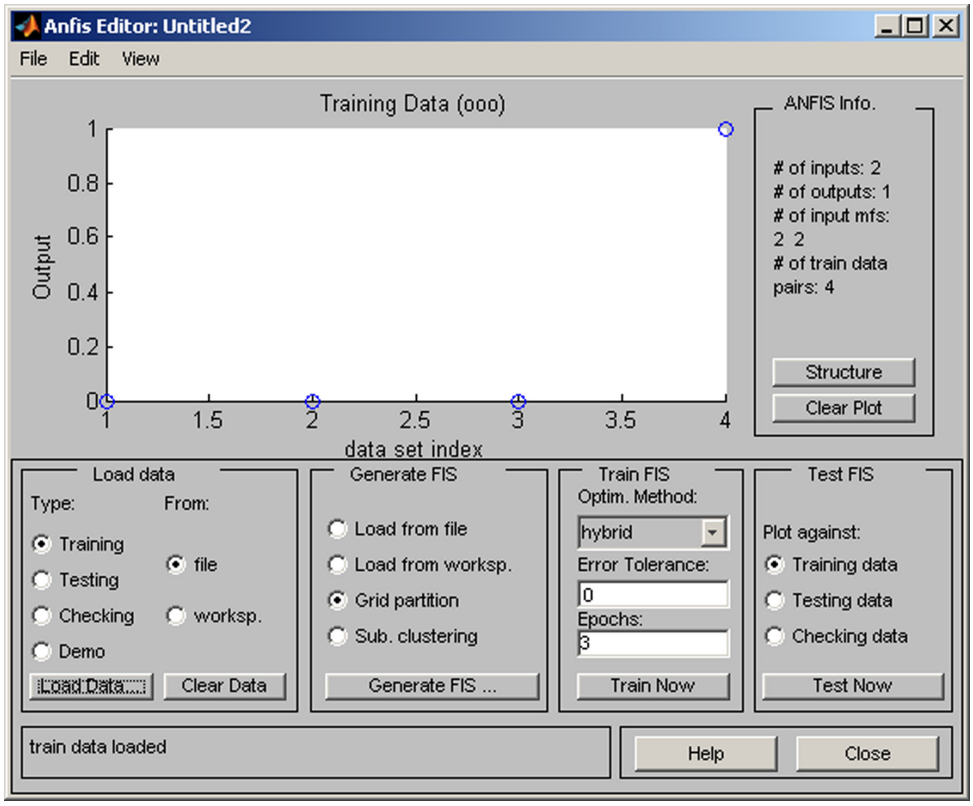
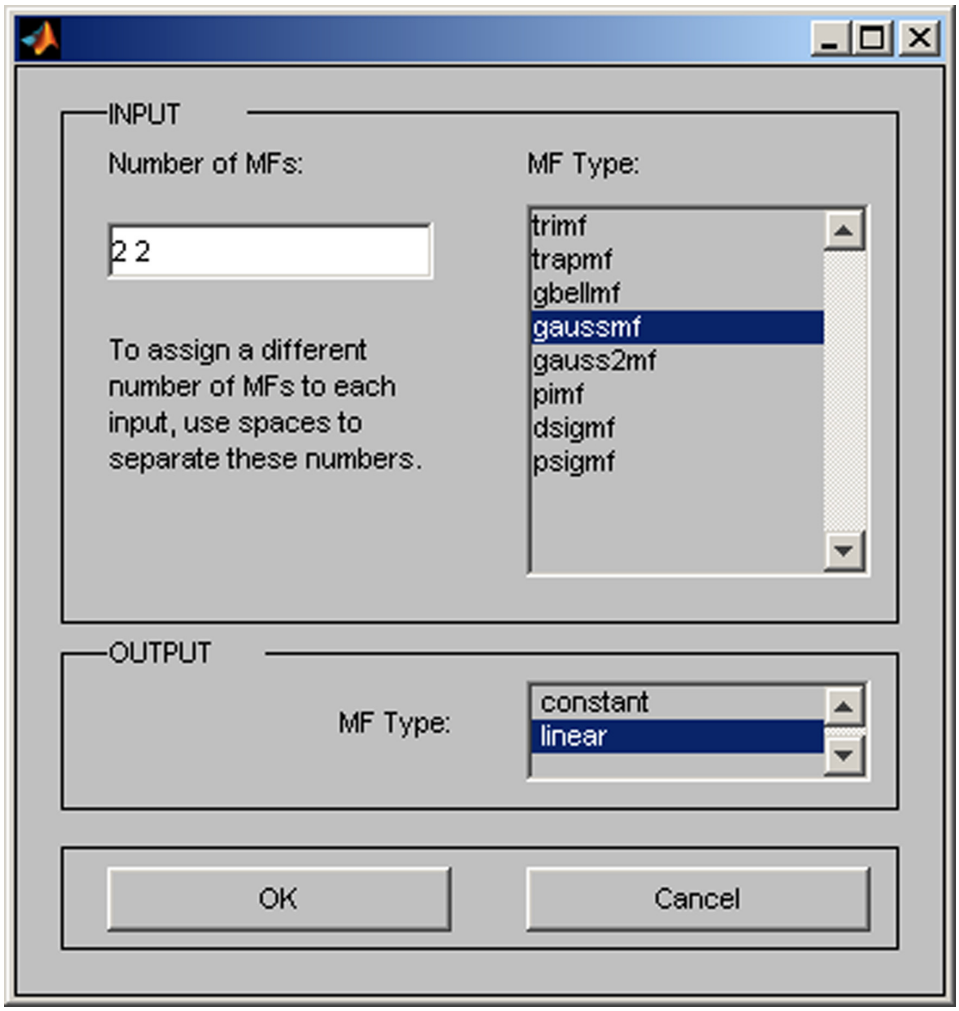


Figure 5. The setup of membership functions



could not describe the solved problem successfully, the displayed surface shows "disturbances." In the case of wrong generalization, the trained model does not correspond with new data.

The advantage of the use of fuzzy logic in comparison with classical methods is in the fact that vague terms could be processed by fuzzy decision making model. This example presents risk of investment. More inputs are generally used.

Example 2.2: There are situations when more rule boxes are necessary for using the decision-making process and for their connection. The connection can be done by creation of an M-file that enables reading the input data, but also the transfer of results to other blocks. The case presents the use of fuzzy logic at direct mailing, whether the client visit personally, sent him a letter or not to speak to him (see Figure 12).

The input variables in block B_1 (Figure 13) and their attributes are *Loan* I_{1a} (none, small, medium, high) and *Salary* I_{1b} (low, medium, high). The input variables in block B_2 (Figure 14) and their attributes are *Age* I_{2a} (young, medium, old, very old), *Children* I_{2b} (no, a few, many) and *State* I_{2c} (single, married, divorced). The input variables in block B_F (Figure 15) and their attributes are *Place* I_3 (big city, city, village). The rule blocks with attributes are *Finance* (excellent, good, bad),

Figure 6. Anfis editor-error training

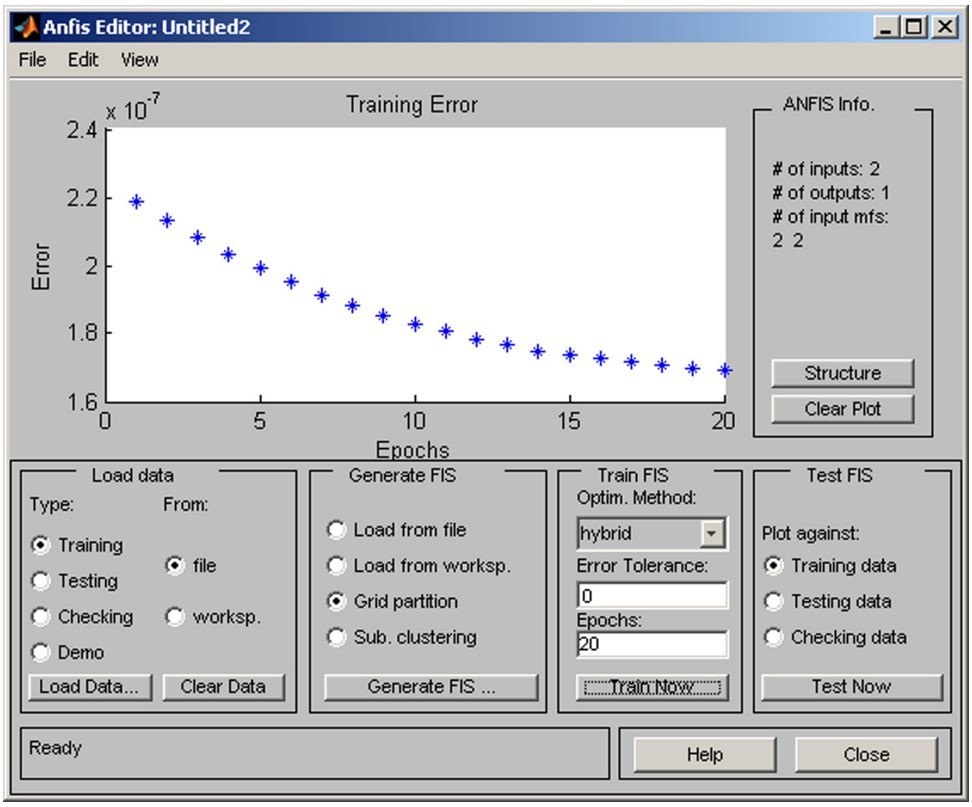


Figure 7. Created neural network

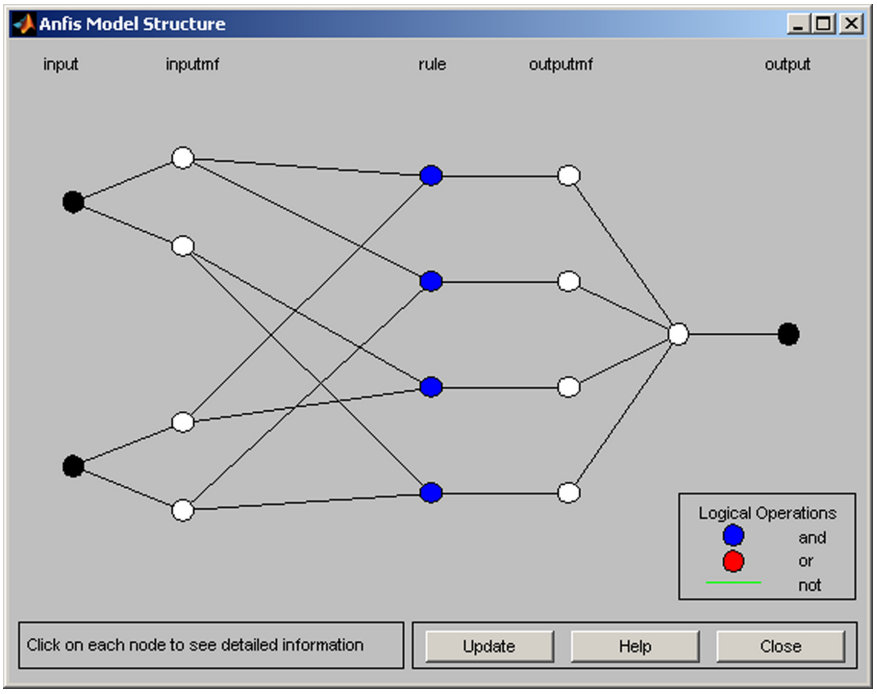


Figure 8. Evaluation of training

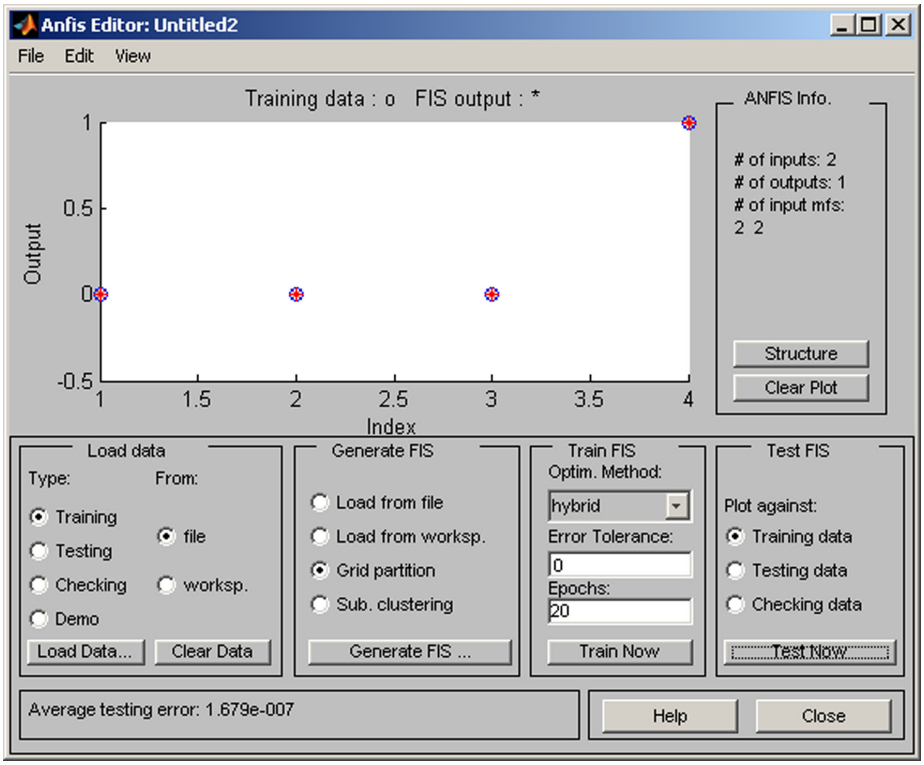


Figure 9. Dependence of output on inputs

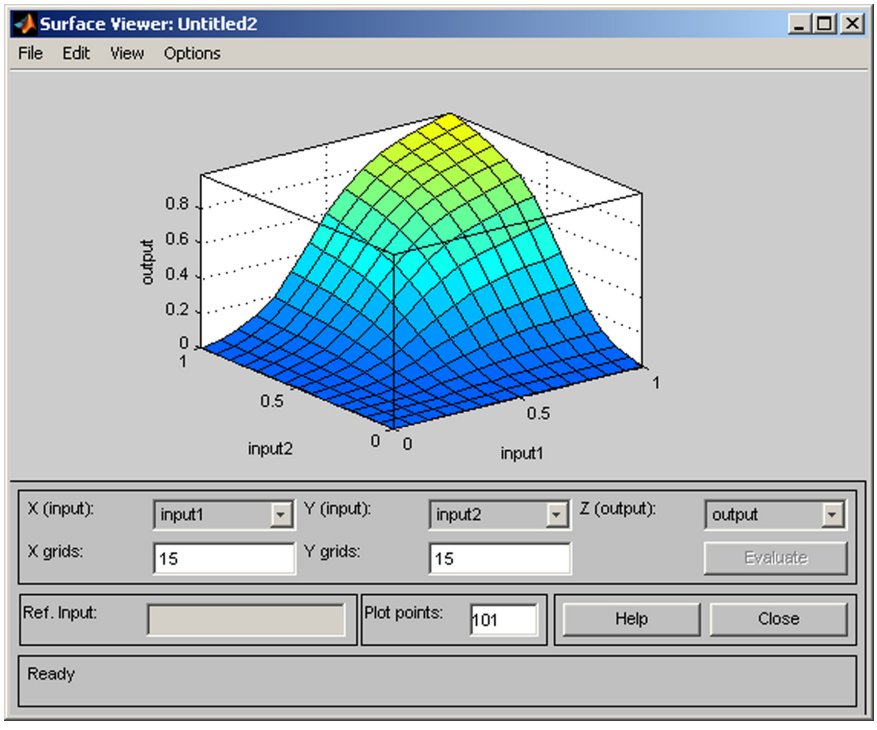


Figure 10. Generated rules

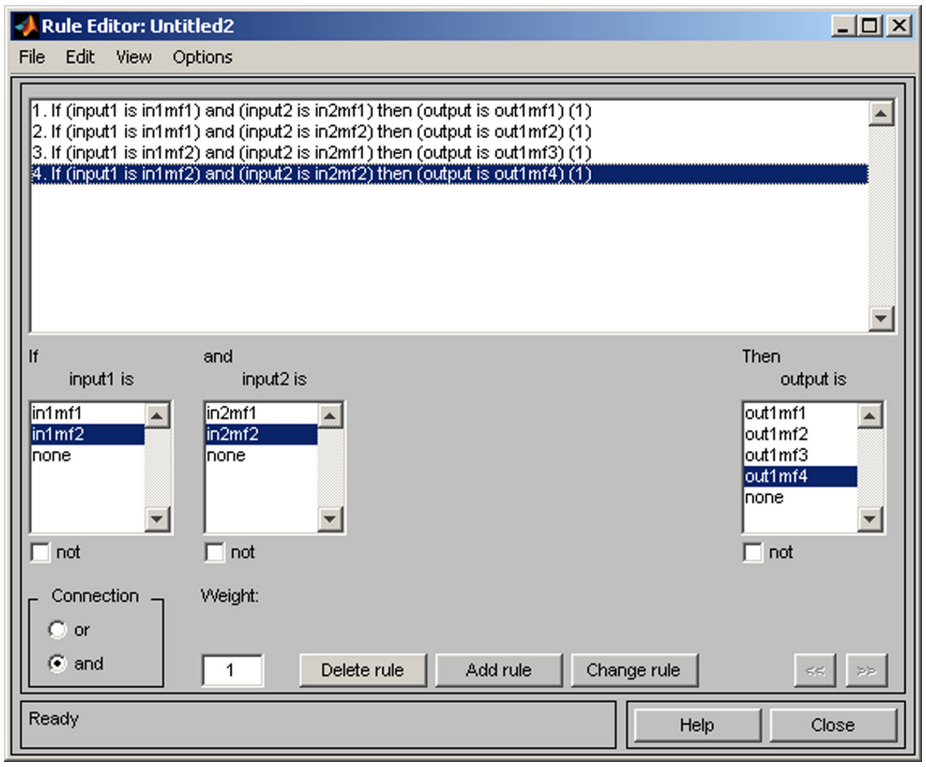


Figure 11. Verification of rules

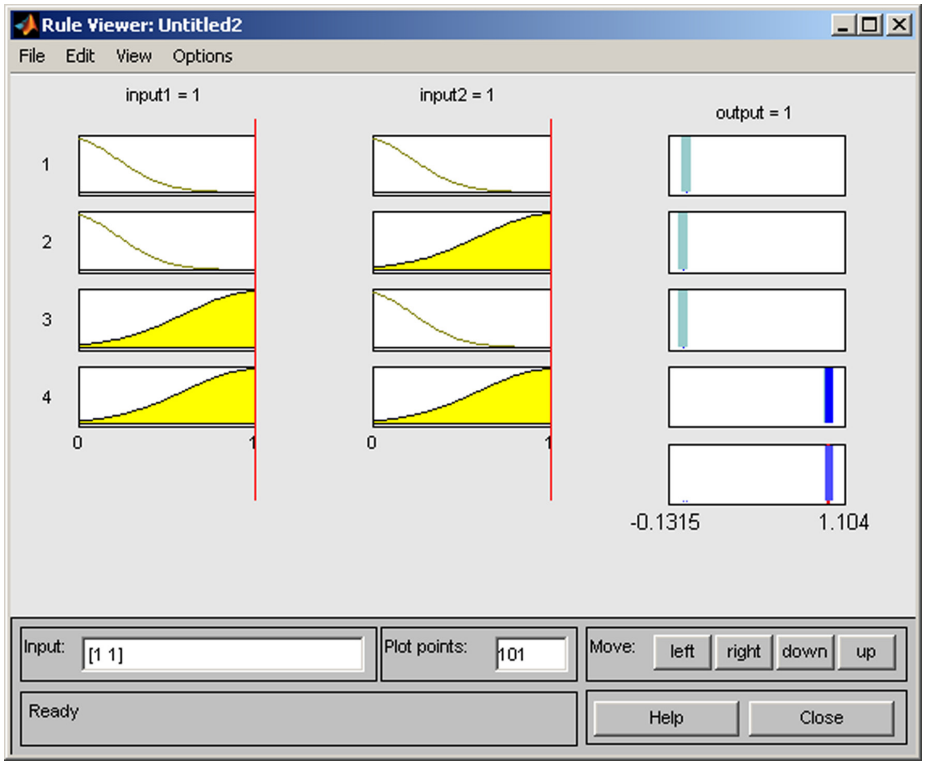
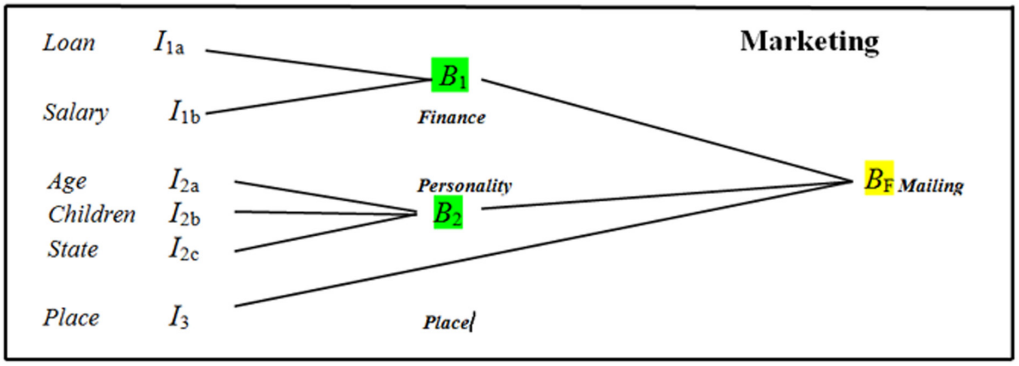


Figure 12. Connection of rule blocks



Personality (unsuitable, suitable, good, excellent); and output *Mailing* (inactivity, mail, personally).

The M-file *BF.m* (Prog. 2.1 in the Appendix) provides the calculation. The results of the calculation (Results 2.1 in the Appendix) are presented by inputs I_{1a}, I_{1b}, I_{2a}, I_{2b}, I_{2c}, I_3 with values 0, 1, and 0.5. The results are the attributes Inactivity (client will not be spoken), or Personally (client will be visited), or Mail (a letter will be sent to him).

The advantage of fuzzy logic is in the use when values can be described only by vague terms in comparison with classical methods. The vague

Figure 13. Box B_1

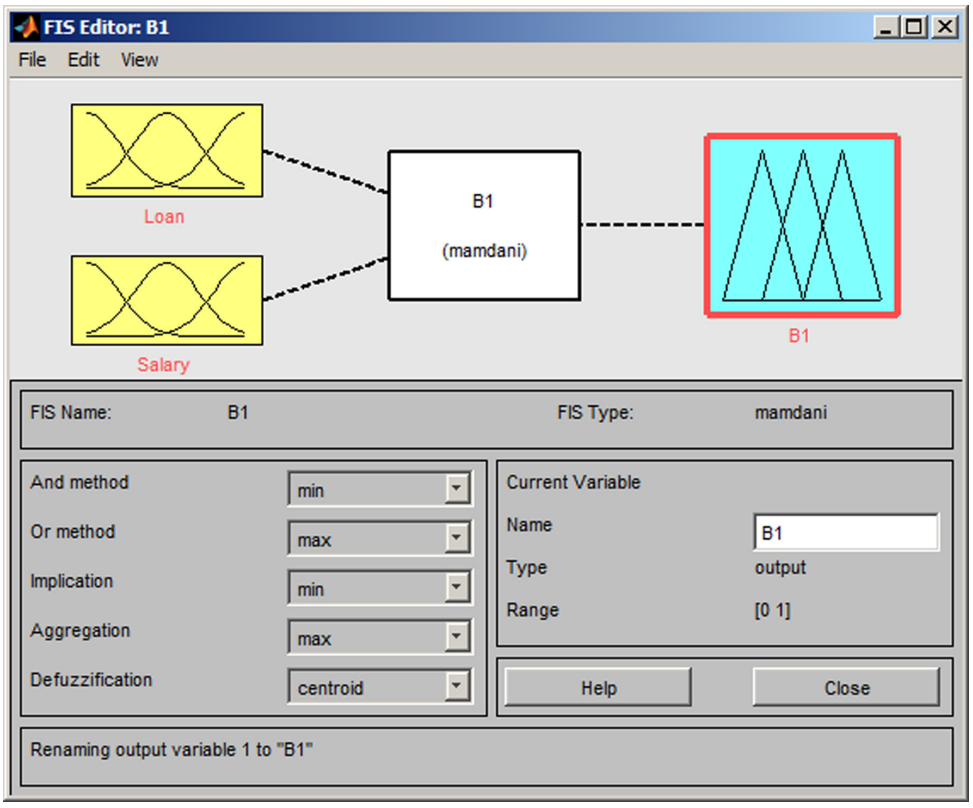
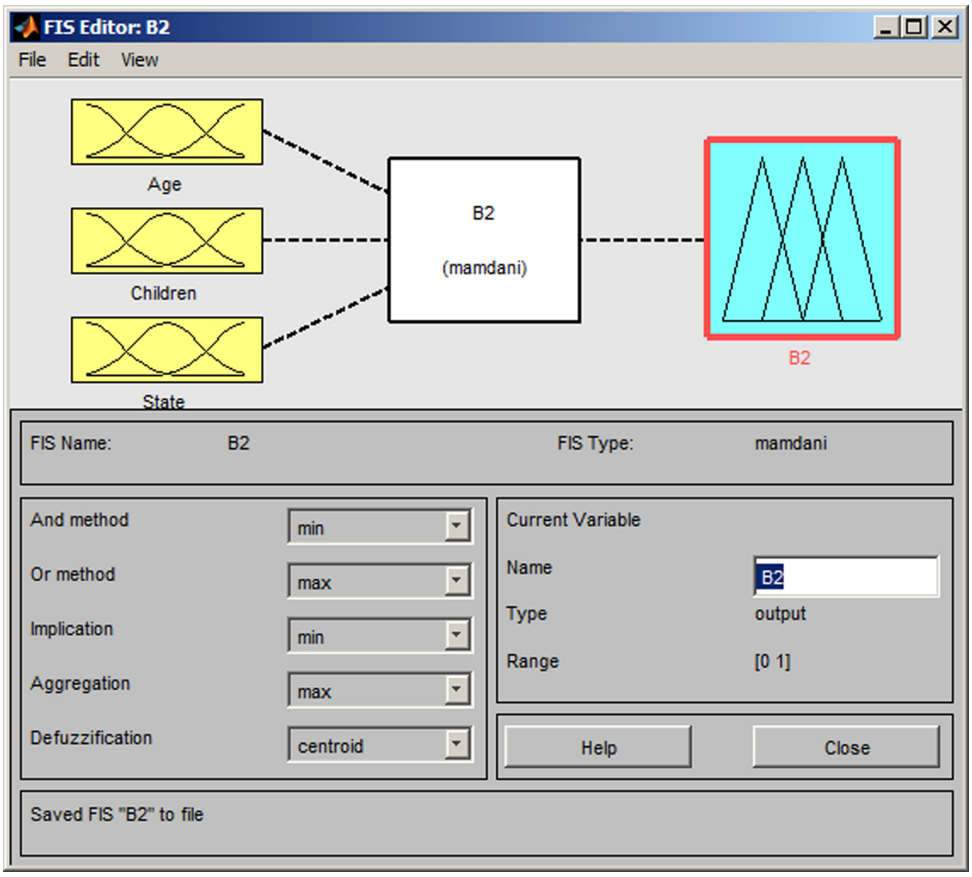


Figure 14. Box B_2



terms could be processed by fuzzy decision making model. The example presents the decision making in direct marketing.

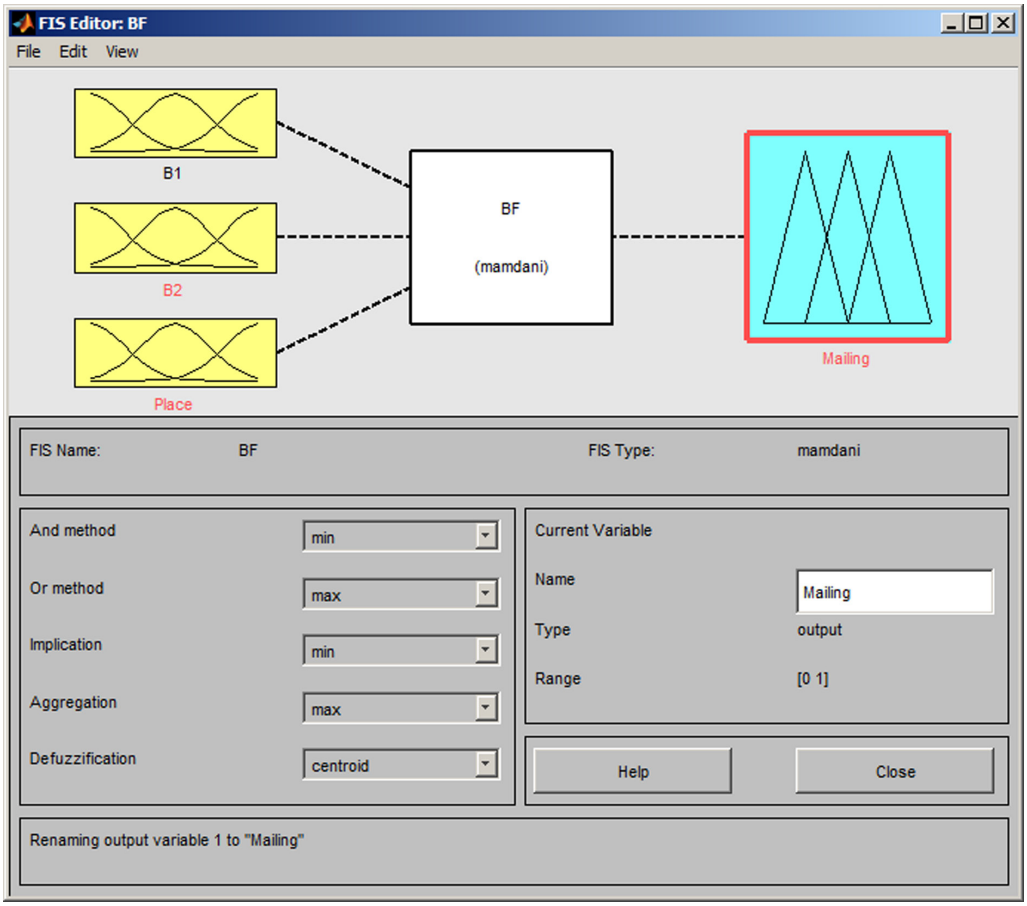
3. NEURAL NETWORKS

3.1 Principles of Neural Networks

The history of the development of neural networks started in the first half of the twentieth century. The first publications were by McCulloch. Later Pitts worked on the simplest model of a neuron, and after that Rosenblatt created a functional perception that solves only problems involving areas that are linearly separable. When the multi-layer network was discovered by Rumelhart, then Hinton and Williams created back-propagation methods for multi-layer networks. A great boom of neural network applications has been ongoing since the mid-1970s.

The neural network model represents the thinking of the human brains. The model is described as a "black box." It is not possible to know the inside structure of the system in detail. We make only a few suppositions about the inner structure of the system. It is simulated by a "black box" that enables us to describe the behaviour of the system by the function that performs transformation of input and output. It is suitable to use neural networks in cases where the influences on searched phenomena are random and deterministic relations are very complicated. In these cases we are not able to separate and analytically identify them.

Figure 15. Box B_F



They are suitable for simulation of complicated and often irreversible strategic decision making. The biological neuron can be presented in a simple way that consists of many inputs (dendrites), body (soma), and one output (axon) as shown in Figure 16. The inputs are processed by neurons. The output information is spread by the axon to terminals that are called "synapses." The synapsis communicates with the dendrites of other neurons.

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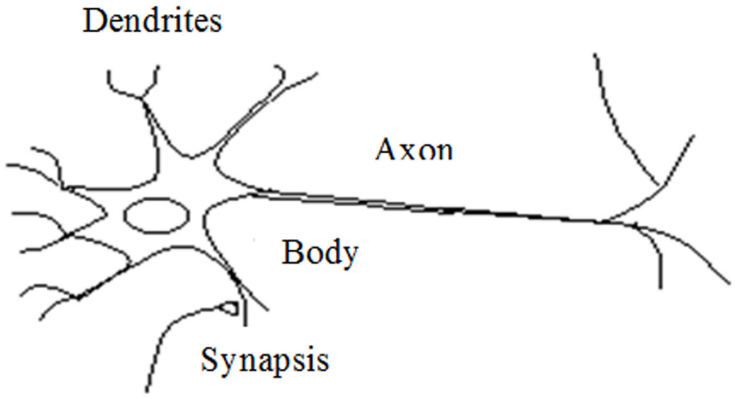
The neural network works in two phases. In the first phase the network presents a model of a complicated system as a "curious pupil"; it tries to set up parameters so as to best correspond to the topology of neural networks. In the second phase, the neural network becomes an "expert" to produce the outputs based on the knowledge obtained in the first phase. During the building up of a neural network, the layers of the network must be defined (input, hidden, output); single input and output neurons specified, and the method

Figure 16. The biological neuron



of connecting the neurons among them identified (the setup of transfer functions among neurons).

The simplest neural network is called a "perceptron." It may have an input of R variables $p_1, p_2, p_3, \ldots, p_R$. These variables are multiplied by weight coefficients $w_1, w_2, w_3, \ldots, w_R$. The threshold value b influences the output; it increases the value of sum just about this value. The formula is

$$a = w_1 * p_1 + w_2 * p_2 + w_3 * p_3 + \cdots + w_R * p_R \sum_{i=1}^{R} w_i p_i + b.$$

Figure 17 shows the single-layer neural network–perceptron.

The most important MATLAB functions are hardlim $n = 0$ for $a<0$ and $n=1$ for $a \geq 0$, purelin $n=a$, logsig $n=1/(1+e^{-a})$ and tansig $n=(e^{a}-e^{-a})/(e^{a}+e^{-a})$ (see Figure 18).

The simplest transfer function is hardlim, when output value is equal 1 or 0, according to whether the value a is less than 0 or equal and bigger than 0. With this function the transformation gives us standardized values. The function logsig has values in the interval from 0 to 1. The function

Figure 17. Perceptron

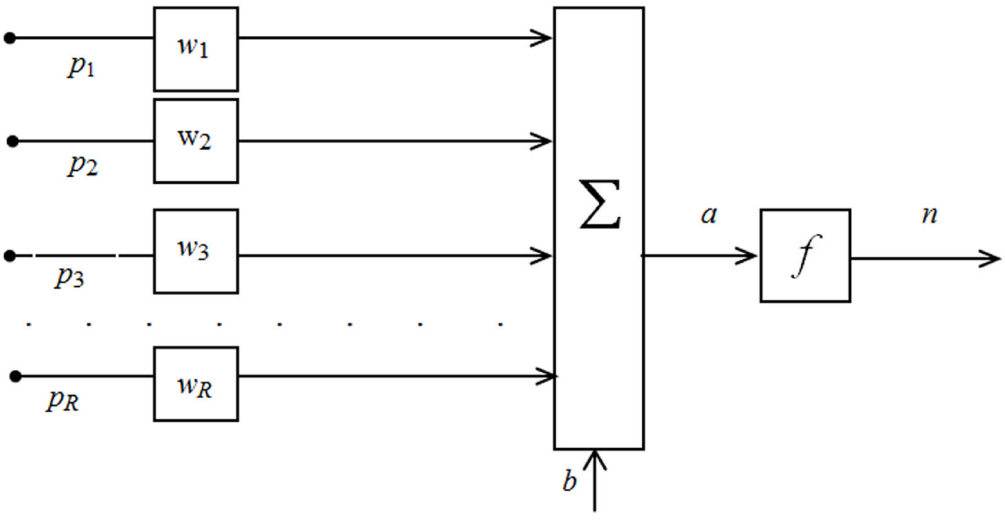
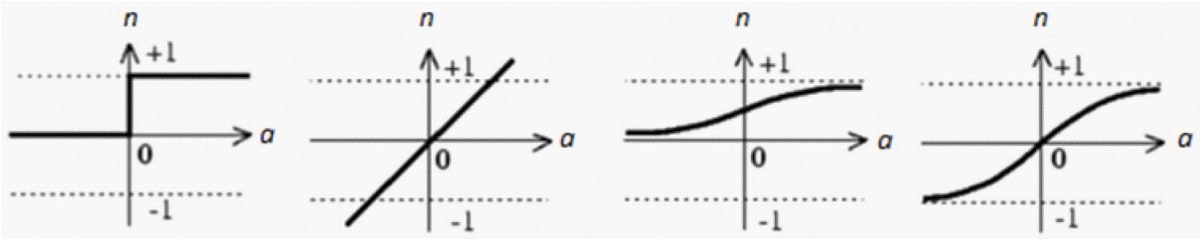


Figure 18. Transfer functions hardlim, purelin, logsig, and tansig



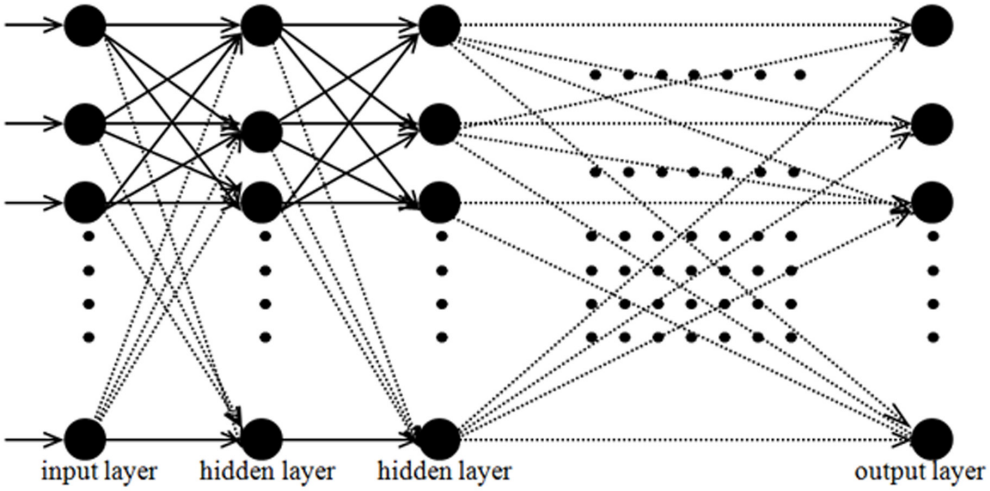
tansig has values in the interval from −1 to 1. The output values could achieve high values in case of not using such or similar transfer functions, which is the problem especially of multi-layer neural networks. The value *b* is the so called threshold value that increases the value of sum (sum of inputs *x* weight coefficient) just about this value.

Figure 19 presents a multi-layer network with input layer, hidden layers, and output layer. For perception and multi-layer networks it is possible to write the equation in the matrix form $\boldsymbol{n} = \boldsymbol{f}(\boldsymbol{w} * \boldsymbol{p} + \boldsymbol{b})$.

The back-propagation method is used for calculation of weights of neural networks. It consists of two steps. First, it is necessary to make a calculation of outputs on the basis of inputs and weights (forward step). Next it is necessary to calculate the error *E* as a square difference of calculated output *n* and expected output *o* over all outputs, using an equation in the form $E = \Sigma (n_i - o_i)^2$. The value *E* is used for the backward calculation of weight (backward step). The process is repeated till the values of *E* converge to an acceptable value (the problem of learning is an optimization task, in which the error function *E* is a fitness function that must be minimized).

The chapter is focused on applications. The fuzzy theory is described in books such as (Altroc 1996), (Azoff 1994), (Bose and Liang,1996), (Dostál 2011), (Gately 1996), (Hagan and Demuth 1996), (Chen et al. 2004), (Kazabov and Kozma 1998), (The MathWorks 2010c).

Figure 19. The diagram of multi-layer network



3.1 Applications of Neural Networks

Example 3.1: There are many tasks from business, economics, and finance where clustering helps to make correct decision making. The Kohonen neural network can be used for these purposes. This example describes the method of calculation, how the program is created, and how the case study is applied. The algorithm is as follows:

1. Setup of the number of input variables n according to the structure of input pattern and determination of a number N of efficient neurons according to condition $L \leq n/(4\log N)$, where L is the number of patterns to be recognized by the network
2. Setup of initial values that are selected as random values in the range <-0.5;0.5>
3. Setup of the shape and radius of initial environs of the winning neuron $NE(t_o)$; at first it is a maximum, then it is decreased step by step to be $R_c(t) = 1$
4. The use of the first learning pattern x_1 and foundation of the winning neuron is done in such a way that the Euclidean distance of its weighted vector w_j from x_1 is the smallest. The calculation is done according to the formula

$$D_j = \sum_{i=1}^{n} \left(x_i(t) - w_{ji}(t) \right)^2 \rightarrow \min$$

for j=1, 2, …., N. The ideal case is the situation when $\min_j D_j \rightarrow 0$

5. The adaptation of weighted coefficients is done according to the formula

$$w_{ji}(t+1) = w_{ji}(t) + \alpha(t)\left(x_i(t) - w_{ji}(t) \right)$$

for $j \in NE_c(t)$ and $w_{ji}(t+1) = w_{ji}(t)$, for $j \notin NE_c(t)$.

The teaching is continued until the weighted coefficients do not change if a random pattern from the collection of learning patterns is used.

The example presents the objects recorded in MS Excel format in *DC.xls* file (Table 3). This task is solved by the program *NNC.m* (Prog. 3.1 in the Appendix).

The program is started using the command *NNC* in the MATLAB program environment. It is necessary to set up the number of clusters, in our example 4 and number epochs 1000. During the process of calculation the data are dynamically displayed in a three-dimensional graph. When the calculation is finished the input parameters and the results of the calculation are presented in the Appendix (Results 3.1).

The results are presented by coordinates of clusters and assignment of objects to the clusters. The two and three-dimensional stem graph is drawn (Figure 20 and Figure 21). The task solves the problem of minimizing the costs of constructions of transmitters of mobile network.

Table 3. Coordinates of objects

		Coordinates of Objects		
Number	Object	x_1	x_2	x_3
1	Praha	37	72	191
2	Brno	72	30	194
3	Ostrava	100	57	215
4	Plzen	18	60	354
5	Olomouc	83	42	209
6	Liberec	47	100	402
7	Hradec Kralove	59	76	231
8	Ceské Budejovice	36	24	391
9	Usti nad Labem	30	99	326
10	Pardubice	64	67	229
11	Zlin	89	32	330
12	Kladno	30	74	451
13	Opava	94	59	255
14	Jihlava	8	81	525

Figure 20. Two-dimensional graph: 4 clusters

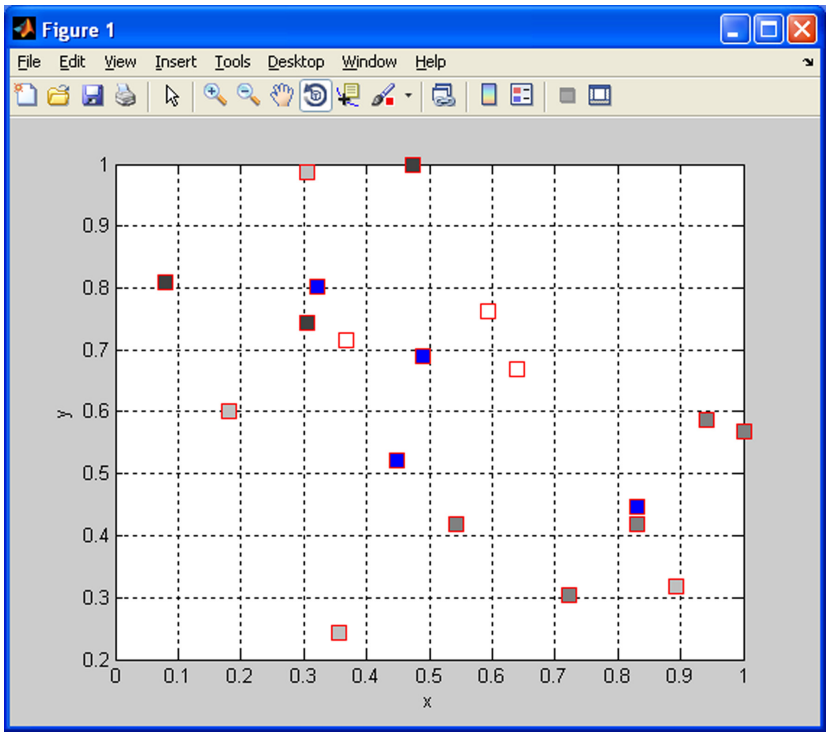
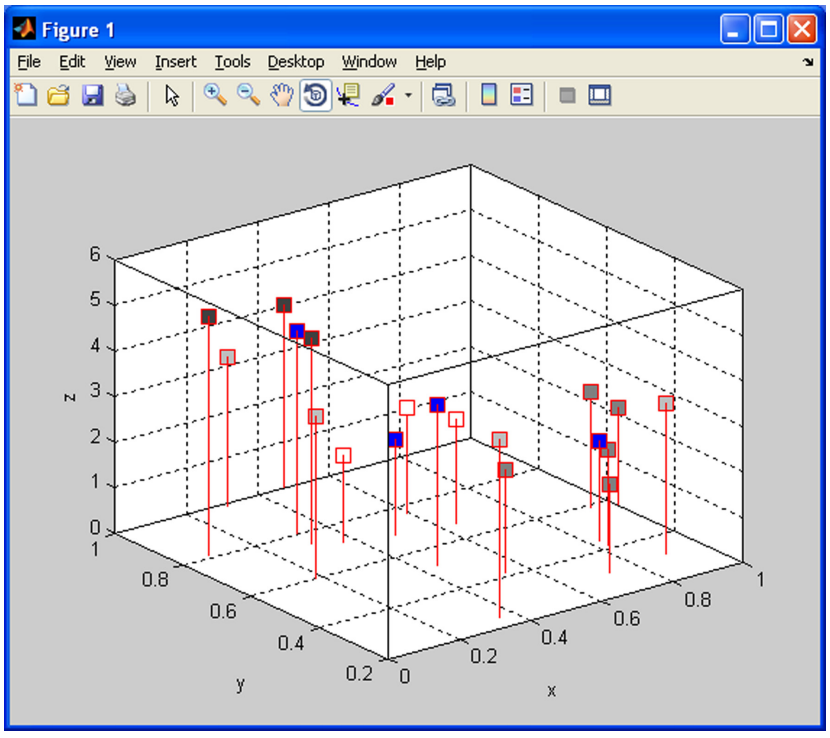


Figure 21. Three-dimensional graph: 4 clusters



The advantage of neural network theory is in successful use of clustering problems that are used quite often in economy and finance.

Example 3.2: The Neural Network Toolbox of MATLAB contains a special toolbox for prediction of time series, which is quite often used in the business and economics. This example presents the prediction of time series from history created by the number of sold products recorded in *D.xls* file. The menu is called from workspace using the command *ntstool*. At first, it is necessary to setup the type of neural network. The Nonlinear Autoregressive Model (*NAR*) was chosen (see Figure 22).

Then it is necessary to click on button *Next* and download the data from the *D.xls* file. When the data are downloaded, the window is closed using the command *Finish* (see Figure 23).

After the data have been selected, as in Figure 24, the command *Next* opens a window for the setup of *Training*, *Validation,* and *Testing*. The default value can be used or it could be changed (see Figure 25).

The command *Next* enables the setup of the network architecture represented by *Number of Hidden Neurons* and *Number of Delays*. The default value can be used or it could be changed (see Figure 26). The commands *Next* and *Train* start training the neural network (see Figure 27).

The process of training is displayed in the window and after the process of training it is possible to evaluate the graph to determine whether the correct training was done, for example *Performance* (see Figure 28). It is possible to evaluate the mean square error *MSE* and fit of prediction (see Figure 29). The process of training may be repeated several times using the command *Retrain*.

Figure 22. Choice of neural network

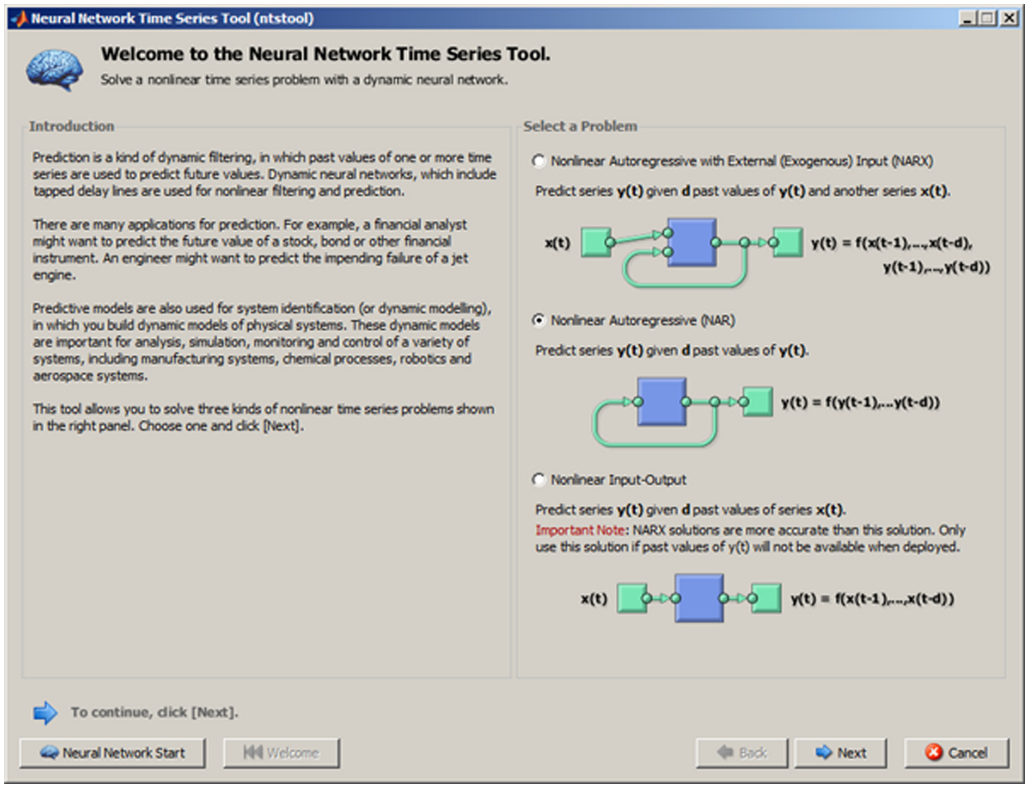


Figure 23. Download of data

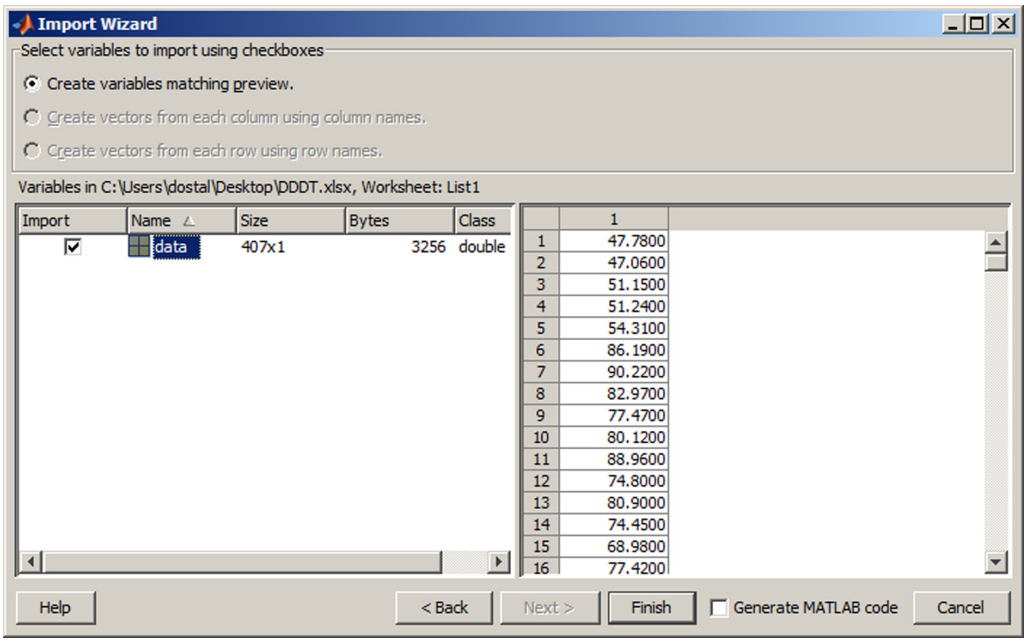


Figure 24. Select of data

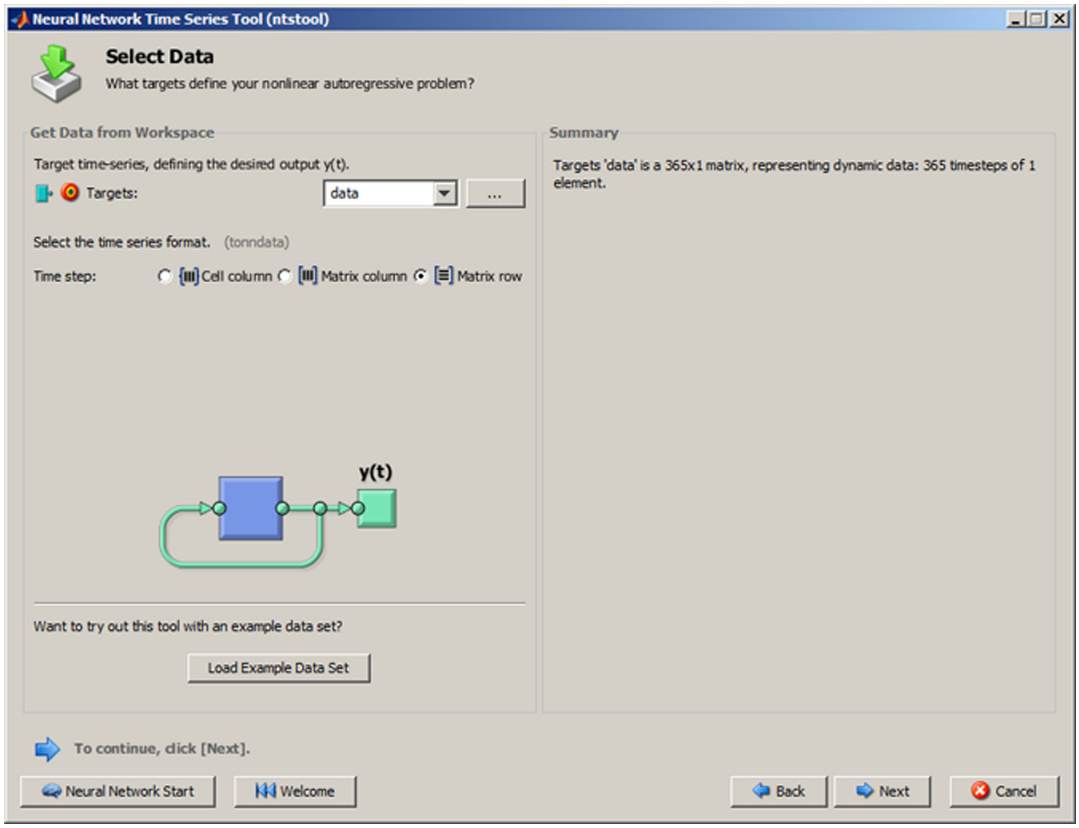


Figure 25. Setup of parameters

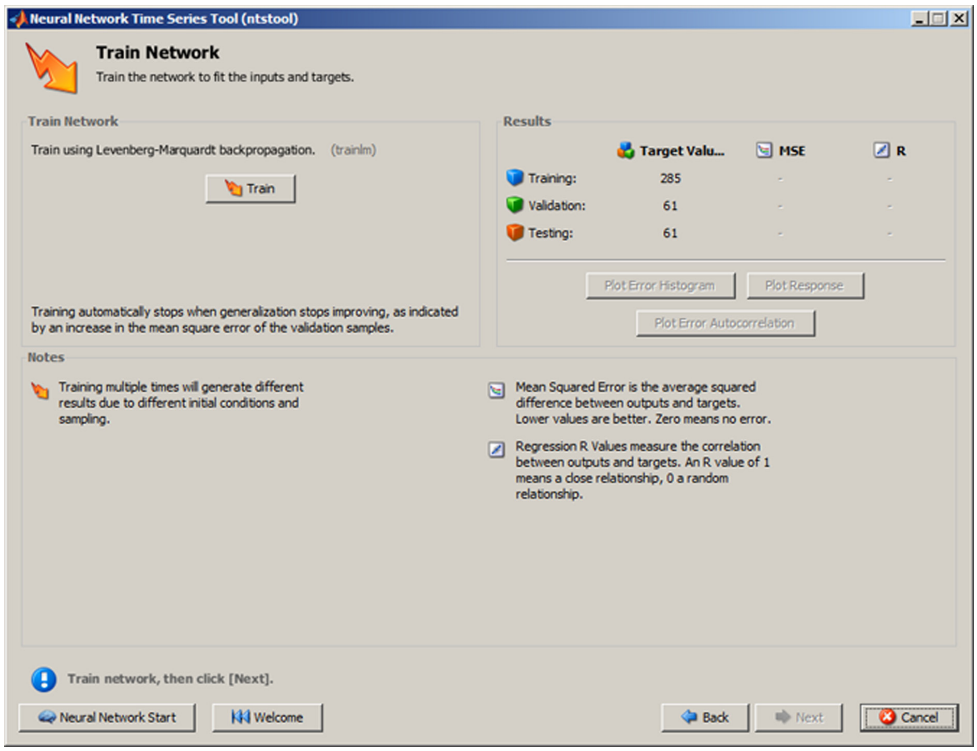


Figure 26. Set of network

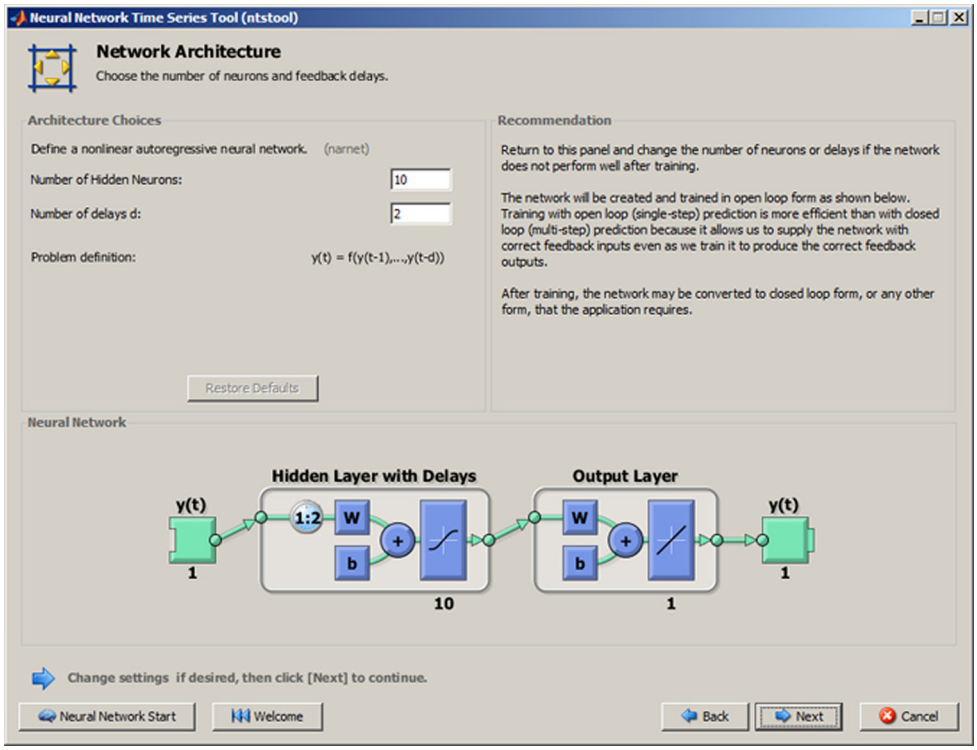
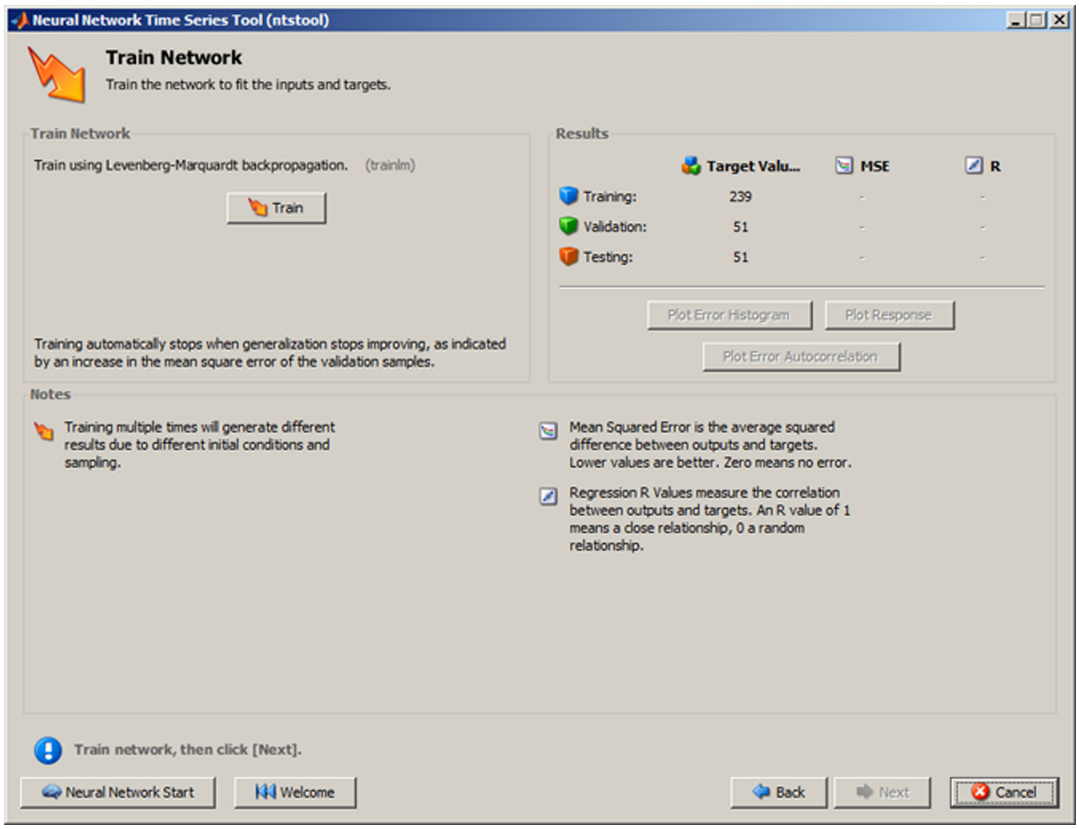


Figure 27. Process of training



When the results of training correspond to the required demands, the output has to be saved as a variable, for example *output* (see Figure 30).

Saved data sets could be used for evaluation, for example to display them at workplace or transferring data into MS Excel. The graph is presented in Figure 31. The graph presents history of 120 days of selling products and its prediction for next 30 days to help to set up a plan of production.

The script could be saved any time in an M-file using the menu *Advanced Script* shown in Prog. 3.2 in the Appendix.

The advantage of neural network theory for prediction is in their abilities of description of nonlinear economic and financial time series. The disadvantage is, that neural network is like a black box. The prediction of time series fails when time series have a random course.

4. GENETIC ALGORITHMS

4.1 Principles of Genetic Algorithms

Genetic algorithms are used in studies where exact solution by systematic searching would be extremely slow, which is well suited for solving complicated problems. Genetic processes in nature were discovered in the nineteenth century by Mendel and developed by Darwin. The computer realization of genetic algorithms discovered in the 1970s, is connected with the names of J. Holland and Goldberg. Recently there has been considerable expansion of genetic algorithms in the spheres of economic applications and the decision making of firms and companies.

Let us mention a few terms that are used in the branch of genetics: chromosomes, selection,

Figure 28. The process of training

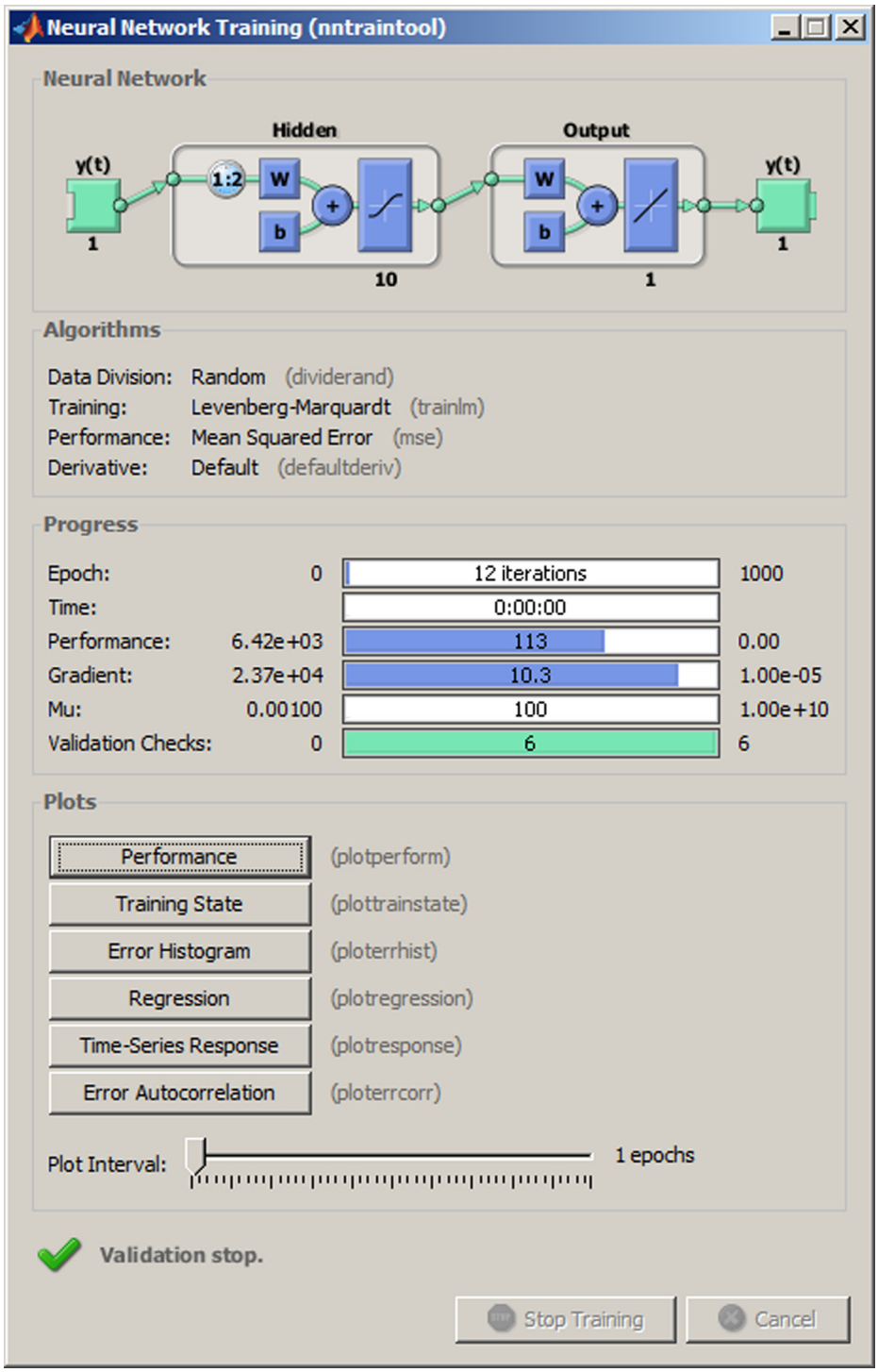


Figure 29. Process of retraining

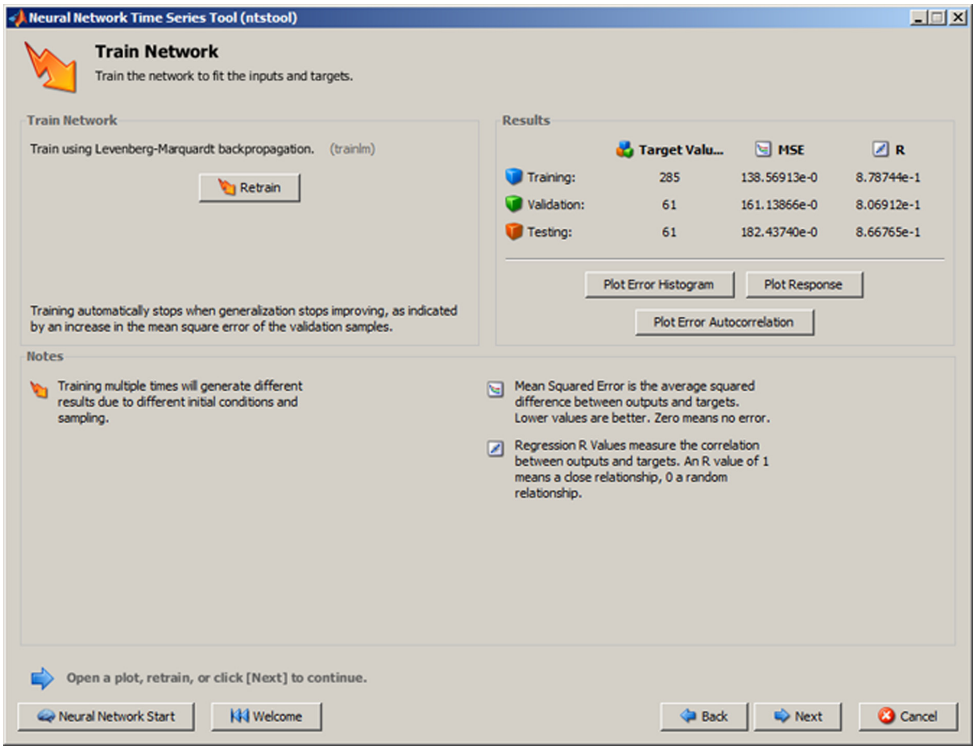


Figure 30. Saving the data

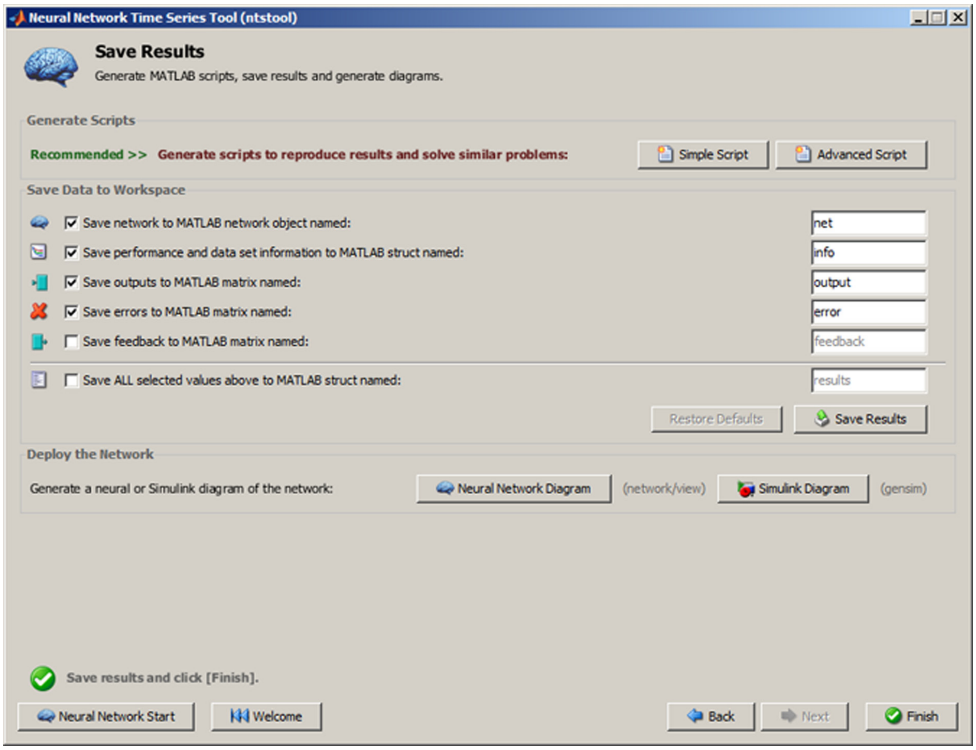
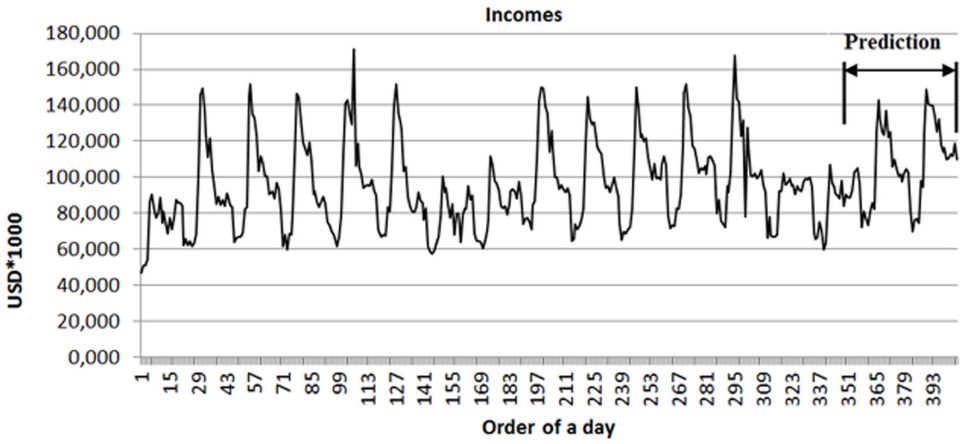


Figure 31. Historical and predicted data of time series



crossover, mutation, population, parents, and offspring. The chromosomes consist of genes (bits). Every gene inherits one or several bits and its position in chromosomes. We say that the chromosomes have locus. The information coded in chromosomes consists of phenotypes. Most of the implementations of genetic algorithm work with the original representation of chromosomes is binary representation: 0 and 1. A chromosome is represented by a binary string, e.g. 0101. These binary strings mostly represent coded decimal numbers. The operators of selection, crossover, and mutation are most often used in genetic algorithms. The diagram is then chained, where the permitted symbol occurs in at least one position (in case of binary representation it is 0 or 1). For the handling of chromosomes, several genetic operators have been proposed. The most used operators are selection, crossover, and mutation.

The process of selection involves the choice of chromosomes that become parents. The fitness of the parents plays an important role in the process of selection. The process of selection is presented in Table 4 when the number 7 (binary 0111) is bigger than 2 (binary 0010). In this case the chromosome with number 7 (binary 0111) progresses to the next generation as the strongest specimen (it leads in computations to better solutions and thus to higher profit).

The process of crossover involves the exchange of part of two or more parent's chromosomes, which causes the modification of the chromosomes of the offspring. The crossover is presented in Table 5.

The crossover can be improved by selection of more parents. The crossover can have more crossing points. This process is called a multi-point cross when more division points are generated. The generalized crossover is done according to the pattern of zeros and ones generated by alternative divisions.

The process of mutation involves the modification of chromosomes. The modification is done

Table 4. Selection

Population I.		Population II.
0111	>	0010
7	>	2

Table 5. Crossover

Parents	Offspring
1**/001**	1/100
1/100	**1/001**

by random change of some bit. The mutation is not frequent. The mutation is presented in Table 6.

The genetic algorithms work in such a way that the population of chromosomes is created at first. Then the population is changed by means of genetic operators until it is found that the parents are the same (the value of fitness function does not change after some number of iterations). The process of reproduction repeats. Each epoch of population (one generation) represents three steps: selection, crossover, and mutation (see Figure 32).

Note: A fitness function is a function that prescribes the optimality of a solution and correlates closely with the algorithm's goal (for example maximum profit or minimum costs in business.)

When the genetic algorithm is applied to a problem in the decision making of firms (whose decisions are not reversible), each chromosome codes some solution of the problem (thus a chromosome is a genotype and the corresponding solution is a phenotype). Chromosomes with higher fitness functions in genetic algorithms are preferred. The higher the value of the fitness function during the process of iteration, the better the solution of the economic problem. The commercially sold programs do not demand knowledge of binary algebra.

For processes where optimization is required, it is possible to use not only genetic algorithms but also ant colony, particle swarms, bee hive colony algorithms, and others.

The chapter is focused on applications. The genetic algorithm theory is described in books such as (Davis 1991), (Dostál 2011), (Chen et al. 2005), (The MathWorks 2010d).

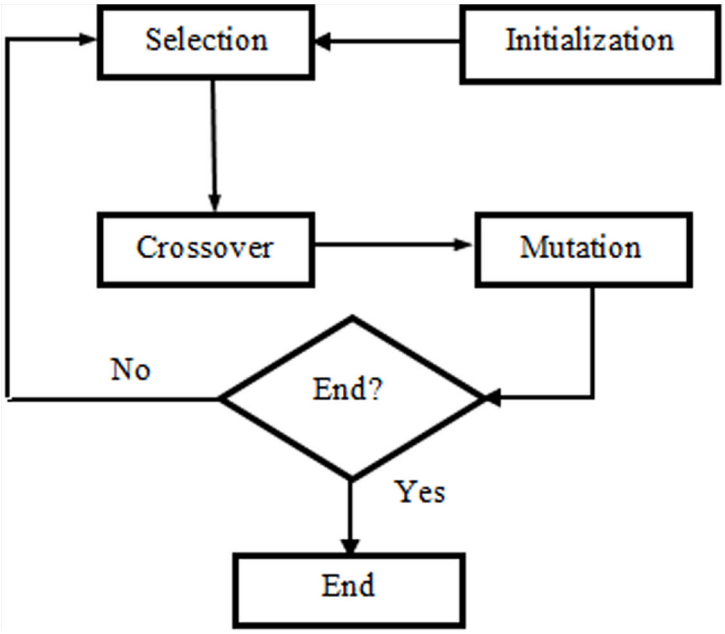
Table 6. Mutation

Before	After
1001	**01**01

4.2 Applications of Genetic Algorithms

Example 4.1: Cluster analysis problems can be solved by means of genetic algorithms to solve economic problems. The aim of a genetic algorithm as an optimization task is to divide a set of

Figure 32. The reproduction process



N existing objects into M groups. Each object is characterized by the values of K variables of a K-dimensional vector. The aim is to divide the objects into groups so that the variability inside groups is minimized. The sequence of steps is as follows:

1. Let $\{x_i; i = 1,2, \ldots, N\}$ be a set of N objects. Let x_{il} denote the value of the lth variable for the ith object. Let us define for i=1, 2, …, N and j=1, 2, …, M and the weights

$$w_{ij} = \begin{cases} 1 & \text{if the } i\text{-th object is a part of the } j\text{-th group} \\ 0 & \text{otherwise} \end{cases}$$

2. The matrix $W = [w_{ij}]$ has the following properties:

$$w_{ij} \in \{0;1\} \; and \sum_{j=1}^{M} w_{ij} = 1$$

3. Let the centroid of the jth group $c_j = [c_{j1}, c_{j2},..., c_{jK}]$ be calculated so that each of its elements is the weighted arithmetic mean of relevant values, i.e.

$$c_{jl} = \frac{\sum_{i=1}^{N} w_{ij} x_{il}}{\sum_{i=1}^{N} w_{ij}}$$

4. The inner stability of the jth group is defined as

$$S^{(j)}(W) = \sum_{i=1}^{N} w_{ij} \sum_{l=1}^{K} (x_{il} - c_{jl})^2$$

and its total inner group variance as

$$S(W) = \sum_{j=1}^{M} S^{(j)} = \sum_{j=1}^{M} \sum_{i=1}^{N} w_{ij} \sum_{l=1}^{K} (x_{il} - c_{jl})^2$$

5. The distances between an object and a centroid can be calculated in this case by means of common Euclidean distances

$$D_E(x_p, x_q) = \sqrt{\sum_{l=1}^{K} (x_{pl} - x_{ql})^2} = \left\| x_p - x_q \right\|$$

6. The aim is to find a matrix $W^* = [w_{*ij}]$ that minimizes the sum of the squares of distances in groups from their centroids (over all M centroids), i.e. $S(W^*) = \min_W \{S(W)\}$.

The software MATLAB and its Global Optimization Toolbox are used for the software applications that can be used to solve these types of problems. The input data are represented by coordinates $x_1, x_2,..., x_K$ that characterize the objects. It is possible to define any number of groups. The fitness function is the sum of squares of distances between the objects and centroids. The coordinates of centroids $c_{j1}, c_{j2},..., c_{jK}$ (j = 1, 2,..., M) are changed. The calculation assigns the objects to their centroids. The whole process is repeated until the condition of optimum (minimum) fitness function is reached. The process of optimization ensures that the defined coordinates $x_{i1}, x_{i2},..., x_{iK}$ (i = 1, 2,..., N) of objects and assigned coordinates $c_{j1}, c_{j2},..., c_{jK}$ of groups have the minimum distances. The fitness function is expressed by following formula

$$f_{\min} = \sum_{i=1}^{N} \min_{j \in (1,2,\ldots,M)} \left(\sqrt{\sum_{l=1}^{K} (x_{il} - c_{jl})^2} \right),$$

where N is the number of objects, M the number of groups, and K the dimension. Input data are represented by 15 objects with x_1 and x_2 coordinates.

It is convenient to program the task as shown in the program called *DPGA.m* (Prog. 4.1) in the Appendix. The input data are in an MS Excel format file *DP.xls* which corresponds to Table 7. The Program *Group.m* (Prog. 4.2 in the Appendix), is used for calculation of Euclidean distances and Program *Draw.m* (Prog. 4.3 in the Appendix), is used for drawing the graph.

The program enables setting up the number of required groups and the population size. The larger the number of individuals the more precise the solution but the longer the duration of the calculation. Next, the program sets up the options for optimization and the optimization command *ga* is called. The program involves the calculation of the fitness function and fills the variables with data that inform us about the coordinates of centroids and the assignment of objects to groups and display them. Two- (z axis is zero) or three-dimensional tasks can be solved.

The program is started by the command *DPGA* in MATLAB. Then it is necessary to set up the requested number of groups, e.g. *Number of groups* = 4 and *Population size* = 1000. When the calculation is terminated, the input parameters and results of calculation are displayed on the screen. The results are presented by coordinates of centroids and assignment of places to groups (Results 4.1 in the Appendix). Figure 33 presents the graph and Figure 34 its application in a geographical map.

Table 7. Coordinates of places

	Town	x_1	x_2
1	Prague	37	72
2	Brno	72	30
3	Ostrava	100	57
4	Plzen	18	60
5	Olomouc	83	42
6	Liberec	47	100
7	Hradec Kralove	59	76
8	Ceske Budejovice	36	24
9	Usti nad Labem	30	99
10	Pardubice	64	67
11	Zlin	89	32
12	Kladno	90	74
13	Opava	94	59
14	Karlovy Vary	8	81
15	Jihlava	54	42

The advantage of genetic algorithm theory is that enables to solve practical application that belongs to hard difficult problems to solve. The genetic algorithms outperformed classical methods in speed of calculation to find one of the best solutions.

Example 4.2: This example shows that the program environment MATLAB with the Global Optimization Toolbox may also be used to solve the travelling salesman problem. The coordinates of the visited towns x_p and y_p must be set up. The aim of the task is to find the shortest tour under the condition of visiting each town only once. The challenge is that when the number of towns is high it is not possible to use exhaustive algorithms to search all combinations. The use of genetic algorithms shortens the calculation time. It finds one of the best solutions very quickly. The problem is programmed in the MATLAB environment (Prog. 4.4 in the Appendix).

The variables *xx* and *yy* are the coordinates of contour of Czech Republic. The command *save* saves the coordinates of contour. The number of cities is set up to 15. The variable locations is setup by coordinates of towns. Next two commands *for* closed using the command *end* create two cycles that calculate the distances between each pair of towns. The setup of vectors of pairs of towns x_1, y_1 and x_2, y_2 are saved to variable distances and the distances between towns are calculated by the Pythagorean Theorem as the hypotenuse of coordinates of two points. The cycles fill up only lower left matrix; the next command does this for the upper right one. Thus the cross matrix of distances among towns is set up. The last commands solve the optimization. The program calculates the fitness function *FitnessFcn*, defined

Figure 33. Places and their centroids

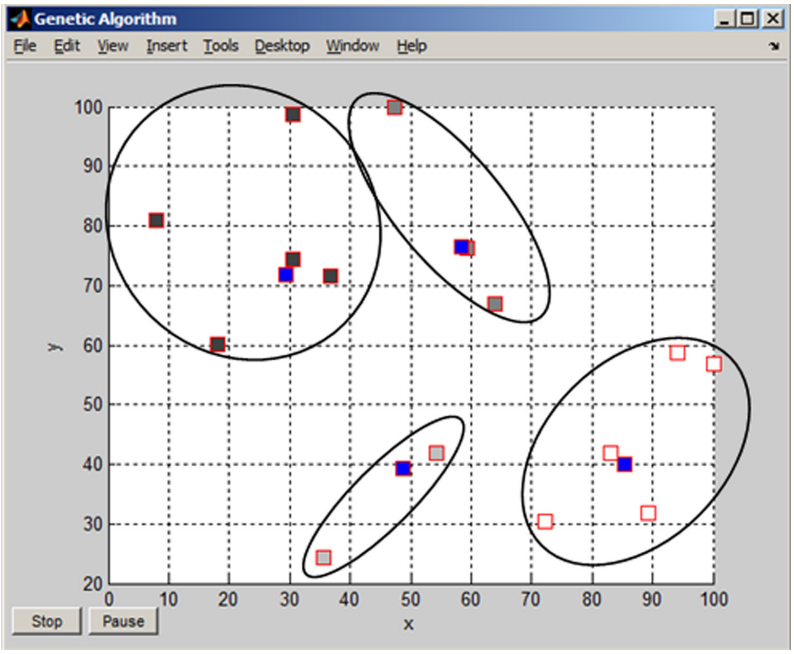
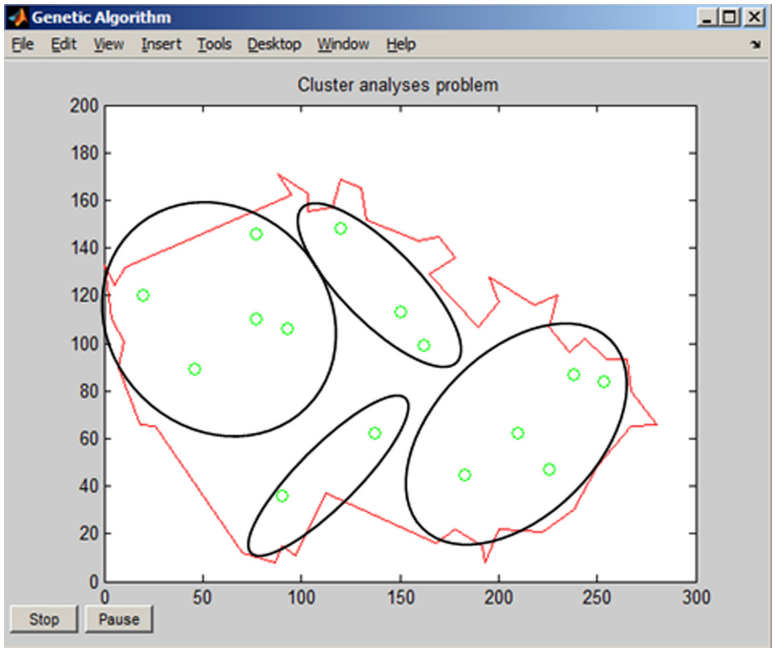


Figure 34. Geographical map



by the M-file as a function called *TSMfit(x, distances)*, with parameters of the number of towns and distances between towns. The resulting value of the function is the total tour distance around the towns for the searched combination. The function *TSM_plot1* is placed in the M-file with name *M_plot1(state,locations)* with parameters *options*, *state* a *flag*. The command *gaoptimset* sets up variable *option* obtaining parameters of calculation of optimization by means of the genetic algorithms. It is necessary to do the setup if the default values are not used. The type of population *PopulationType* is set up as *custom*; the range *PopInitRange* as the dimension [1;cities]; the population function *CreationFcn* as @*TSMcre_p*; the crossover function *CrossoverFcn* as @*TSMcro_p*; the mutation function *MutationFcn* as @*TSMmut_p*; the drawing function *PlotFcn* as *TSM_plot*; the number of generations *Generation* as value 500; the population size *PopulationSize* as value 60; the termination of the calculation after constancy of 200 generations as *StallGenLimit*; and the fact that the calculation of fitness function will be done by vector and that the value *Vectorized* is set up as *on*.

The next-to-last command sets up the variable *numberOfVariables* as the number of generated towns. The last command provides the optimization. The key command is *ga* with the parameters of the fitness function *FitnessFcn*, number of towns *numberOfVariables*, and the setup parameters of optimization *options*. The output variable *x* is a vector of command of visited towns; *fval* is a value of the fitness function pepresented by the value of the shortest tour fulfilling the conditions; the value *reason* provides information about program termination; and the variable *output* provides information about the calculation of each generation.

Writing out the variable *options* presents the setup of the parameters of optimization (Results 4.2 in the Appendix). The function *TSMfit* is defined by an M-file (Prog. 4.5 in the Appendix).

The command *zeros* sets up the variable *scores* to be zero. Two cycle commands *for* closed by commands *end* provide the calculation of the total tour for the given combination using the cross table *distances* of distances between towns. The command *size* returns the values of dimension of matrix in the size $m \times n$. The command *length* returns the value of the greatest dimension. The function *TSM_plot1* is defined by an M-file (Prog. 4.6 in the Appendix).

The command *persistent* ensures that the named variables are local. The command *load* downloads from *tsm.mat* file the coordinates of the polygon x_x and y_y that were saved by the *TSM.m* program. The command *plot* draws the contour of the state in red colour *Color, red*. The command *axis* defines the coordinates of the graph [0 300 0 200] and the command *hold on* enables the drawing of the actual graph. The next commands set up the values for drawing the towns and their connections. The command *min* finds the smallest value of the matrix. The command *title* writes out the title of the graph. The command *plot* draws the coordinates of towns in a green colour and the next command *plot* draws connections among towns by a blue line. The command *holds off* ends the drawing in an active window.

The program uses the M-files for permutation (*TSMcre_p*), crossover (*TSMcro_p*), and mutation *TSMmut_p* that are part of the MATLAB library (Prog. 4.7, Prog. 4.8, and Prog. 4.9 in the Appendix). These M-files are described in the MATLAB library.

The program starts by writing *TSM* on the display and press the command *Enter*. The graph is continuously displayed during the process of optimization. Figure 35 presents the graph at the beginning of optimization and Figure 36 at the end of optimization. The shortest tour is found. The mentioned example should be automated as a part of a decision-making tool not dependent on human beings.

The display on the screen presents the end of optimization, the value of the fitness function, and the reason for the end of the calculation (Results 4.3 in the Appendix).

Figure 35. Tour before optimization

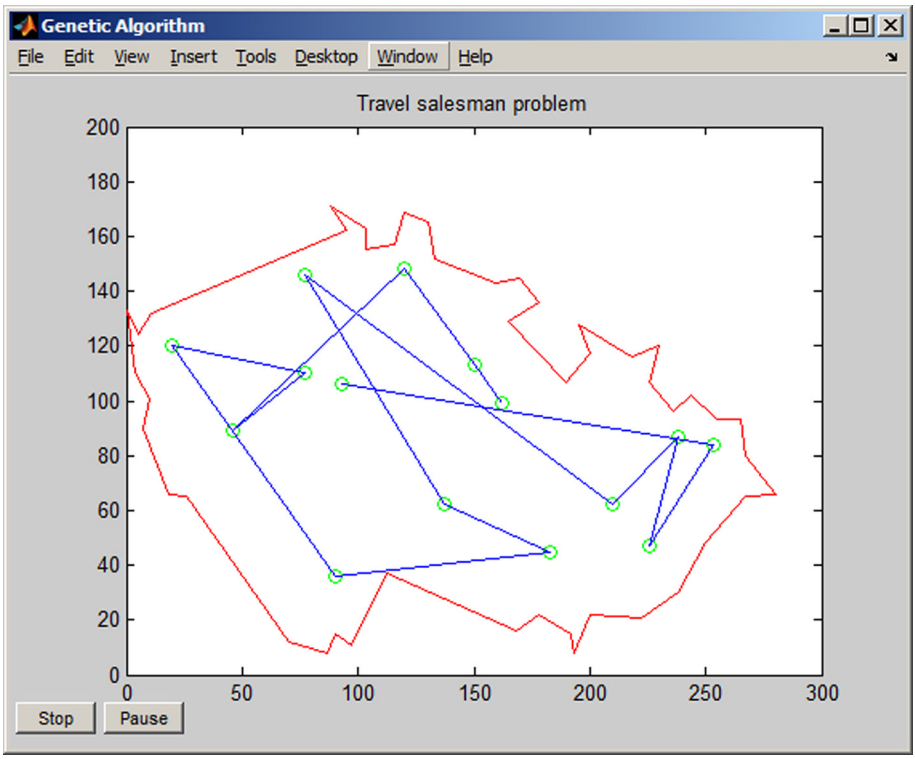
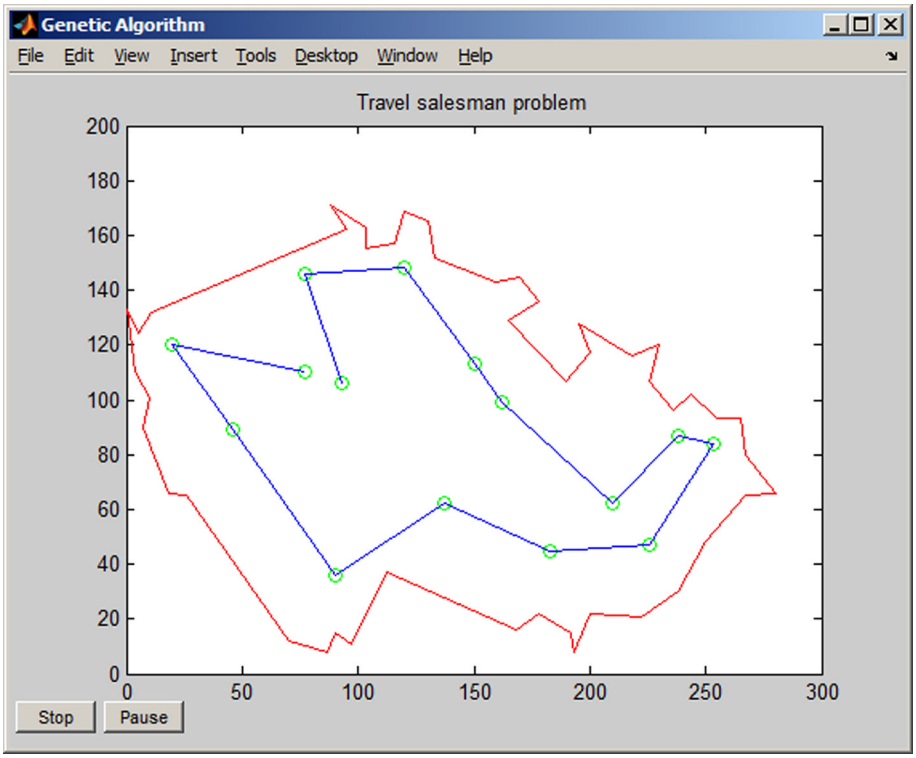


Figure 36. Tour after optimization



The advantage of using the genetic algorithm is in the speed of calculation, especially with increasing numbers of visited towns. Note: It is empirically proved and described in the literature that the genetic algorithms found the suboptimum near to the global optimum successfully and very quickly.

Example 4.3: The optimization task could be solved by various methods, not only by genetic algorithms that are quite often used in business and public services. Some algorithms can give better solutions than others. Different results are obtained when the entire state space of solutions is not searched. For example the Exhaustive method finds the best solution, but the calculations could last weeks. The present example compares twelve methods solving the travelling salesman problem (Exhausive, Backtracking, RandomSearch, Greedy, Hill Climbing, Simulated Annealing, Tabu Search, Ant Colony, Genetic Search, Particle Swarms, DNA Genetic Search, and Bee Hive Colony). Ten places were used and it was measured the time of calculation, the value of fitness function, and number of attempts that were necessary for finding the minimum value, which in this case is Yes (Table 8).

The best results from the point of view of fitness function, speed of calculation, and number of attempts were obtained using the Greedy, Ant Colony, and Bee Hive Colony algorithms. Good results were provided by Tabu Search, Particle Swarms, and DNA Genetic Search. The Random Search and Simulated Annealing algorithm found the longest tours, which mean undesirable high expenses of the tour. The Exhaustive algorithm search had the highest calculation time, but it found the global minimum for this problem.

Figure 37 presents the best solution of the optimization task when the whole state space of solution was searched by the Exhaustive algorithm. The worst time of calculation and the worst solution were obtained using Random Search, with results not usable in practice (Figure 38).

We should mention that the optimization processes have their pros and cons. Their virtues include the fact that they solve complicated problems very easily and search for the maximum or minimum very successfully. The Genetic algorithm, Ant Colony, Particle Swarm, and Bee Hive Colony, in comparison with classical searching algorithms, search for the local extreme better (finding the solution nearest to the optimum) and require fewer math operations than the other methods. Evolution algorithms are useful for the solution of various problems that must be solved in decision making in business, economics, and finance.

Optimization methods based on evolutionary algorithms solves successfully difficult problems such as travel salesman problem, especially with increasing number of cities. Some methods give better results and some give worse results. The use of various methods must be tested and the best one to be use in practice.

5. THEORY OF CHAOS

5.1 Fundamentals of Chaos

An early proponent of chaos theory was Henri Poincaré. In the 1880s, while studying the three-body problem, he found that there can be orbits which are nonperiodic, and yet not forever increasing nor approaching a fixed point. Later studies, also on the topic of nonlinear differential equations, were carried out by G.D. Birkhoff and A. N. Kolmogorov. An early pioneer of the theory was Edward Lorenz whose interest in chaos came about accidentally through his work on weather prediction in 1961. Lorenz's discovery, which gave its name to Lorenz attractors, showed that even detailed atmospheric modelling cannot in general make long-term weather predictions. Mandelbrot described both the "Noah effect" and the "Joseph effect." In 1975 Mandelbrot published The Fractal Geometry of Nature, which became a classic of chaos theory. The same year, James Gleick published Chaos: Making a New Science, which

Table 8. The comparison of optimization methods

Method	Time [sec]	Fit. F.	No. of Attempts	Min
1. Exhaustive	426.21405	2.6274	1x	Y
2. Back Tracking	21.54944	2.6274	1x	Y
3. Random Search	0.01945	3.43841	20x	N
4. Greedy	0.02030	2.6274	1x	Y
5. Hill Climbing	0.00543	2.6274	10x	Y
6. Simulated Annealing	0.01638	2.91421	20x	N
7. Tabu Search	0.38592	2.6272	2x	Y
8. Ant Colony	1.0983	2.6274	1x	Y
9. Genetic Search	1.33721	2.65847	5x	Y
10. Particle Swarms	1.75342	2.62739	3x	Y
11. DNA Genetic Search	21.1449	2.62739	3x	Y
12. Bee Hive Colony	0.02345	2.674	1x	Y

Figure 37. Graph from exhaustive methods

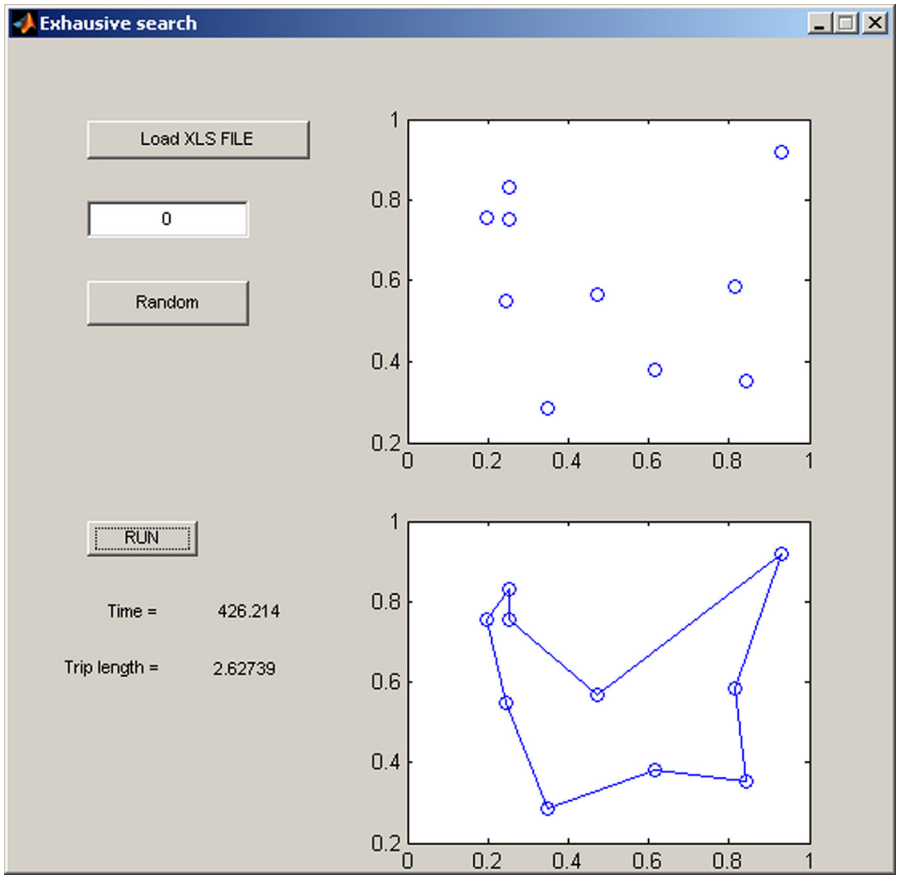
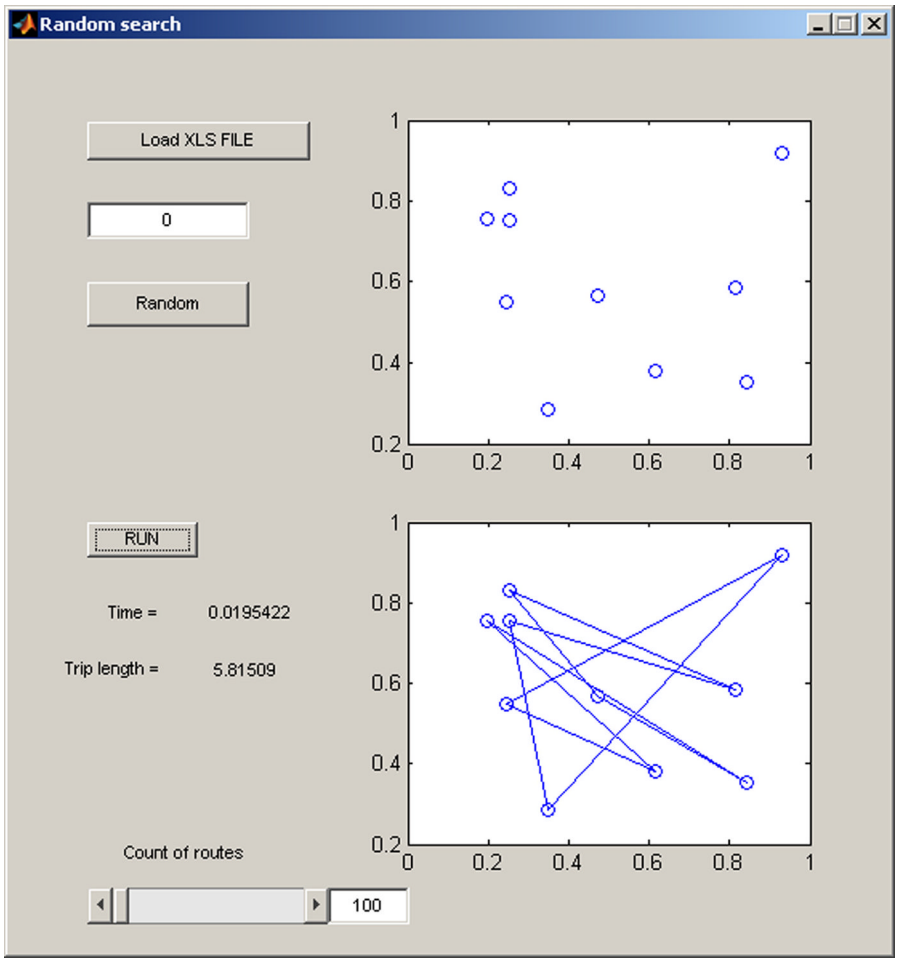


Figure 38. Graph from random search methods



became a best-seller and introduced the general principles of chaos theory.

The theory of chaos came into being in solution of technical problems, where it describes the behaviour of nonlinear systems that have some hidden order, but still behave like systems controlled by chance. A linear model can describe a real system only if it is linear. If this is not fulfilled, then such models can simulate the real system only under ideal conditions, only for a short time. If a system is a nonlinear dynamic, a deterministic system it can generate not only the permanent trends and cycles, but it can also include random-looking behaviour. Processes of such behaviour are present in the economy.

In this respect we can talk about two categories that are in opposition to each other: order and randomness. Chaos is something in between. It involves some degree of order. Some phenomena can appear random, but after the study of these phenomena some inner order can be discovered that governs these phenomena. For example, the movement of people at a railway station can appear accidental, but in fact it is behaviour with order controlled by the arrival and departure of trains. Also, the economy can exist in states of various degrees of order, chaos, and randomness. The behaviour of an economy is influenced quite often by natural disasters, political changes, etc.

In connection with chaos it is possible to speak about a so-called attractor, which represents an equilibrium position. An attractor is a condition towards which a dynamical system evolves over time. That is, points that get close enough to the attractor remain close even if slightly disturbed. Geometrically, an attractor can be a point, a curve, or even a complicated set with a fractal structure known as a chaotic attractor.

The geometrical explanation of an attractor could be done with the help of a pendulum. The attractor can be:

- **Point**: The stability is represented geometrically by a point. For example, when a pendulum is displaced, its final equilibrium position is reached when movement ceases.
- **Cycle**: The balance is represented geometrically by a limited cycle. For example, when a pendulum is moving with constant energy (potential energy plus kinetic energy = const.), its equilibrium position is reached when movement is cyclical.
- **Chaotic**: It is represented geometrically by order underlying the apparent chaos. For example, when the pendulum is driven by random energy, then the equilibrium position will be represented by a movement in zone (no point or cycle).

The chapter is focused on applications. The chaos theory is described in books such as (Barnsley 1993), (Dostál 2011), (Gleick 1996), (Peters 1994), (Peters 1996), (Trippi 1995), (The MathWorks 2010a).

5.1 Applications of Chaos

Example 5.1: The complicated behaviour in economy could be illustrated by the equation in the form

$$P_{t+1} = \frac{P_t}{1 + a\sigma_t} + (V_t - P_t) \ ,$$

where P_{t+1} simulates the market price of the share, σ_t is the volatility of yield of share, a is

a coefficient of market aversion against risk, V_t is fundamental "inner" value of share in time t, $V_t - P_t$ is the response of market on the change of inner value. The initial values (P_0, σ_0, V_0) could be different in the same way as the coefficients of market aversion against risk. If the value $\sigma = 0$ and market is neutral to risk $a = 0$, then $P_{t+1} = V_t$. Figure 39 presents graphically the course of P_{t+1} dependence on time with aversion to risk $a = 0.3$, $V_t = 10$ * rand and $\sigma = 3$*rand. The course of the curve reminds one of real values of time series of shares, commodities, currency ratios, and values of indices on the stock market. The simulation is presented in Figure 39 and the program, *M-file MP.m*, in the Appendix (Prog. 5.1).

The theory of chaos can describe and explain some economic phenomena. This example presents possible behaviour on the stock market.

Example 5.2: The business cycle could be simulated by a van der Pol differential equation in the form $x^{II} + \alpha(x^2 - 1)\, x^{I} + x = \beta\sin(\omega t)$ where x denotes an economic variable such as production, the x denotes productivity with respect to time t, α is an endogenous damping parameter, β.

β denotes the driver amplitude and ω denotes the driver frequency. The dependence of $x = f(x)$ is presented in Figure 40 and corresponds to behaviour of chaotic attractors ($\alpha = 1$, $\omega = 0.45$, $\beta = 0.988$). See the Program, *M-file BS.m*, Prog. 5.2 in the Appendix.

There is no evidence that economic systems have point or cycle attractors. Their attractors behave chaotically. Nevertheless, in case of the displacement of an economic system from balance, the system tries to get into an equilibrium position (for example, the displacement of economy of some states). Therefore the prediction of the

Figure 39. The graph of function P_{t+1} with parameter $a = 0.3$

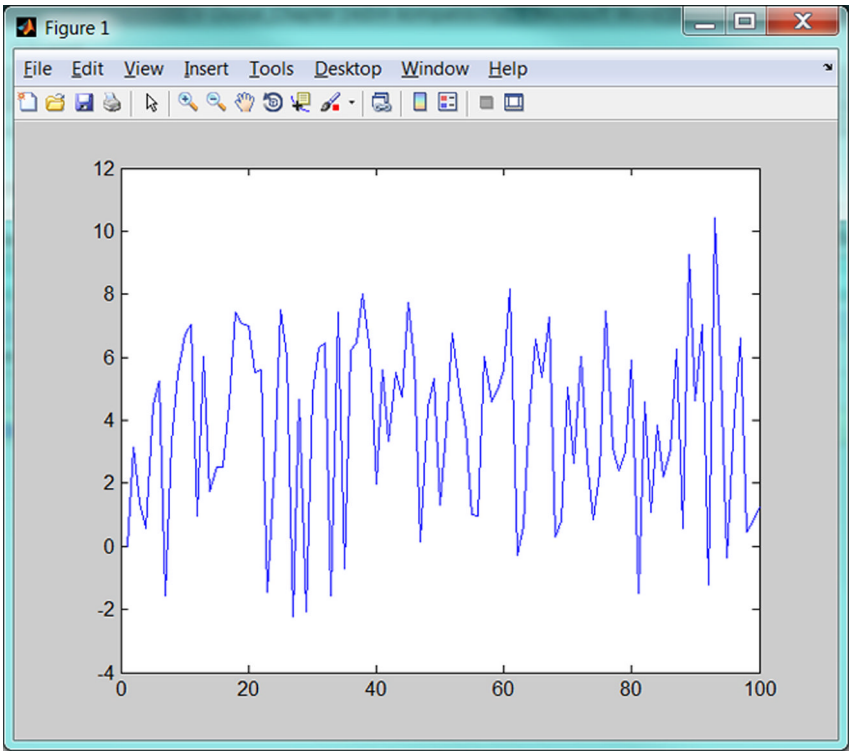
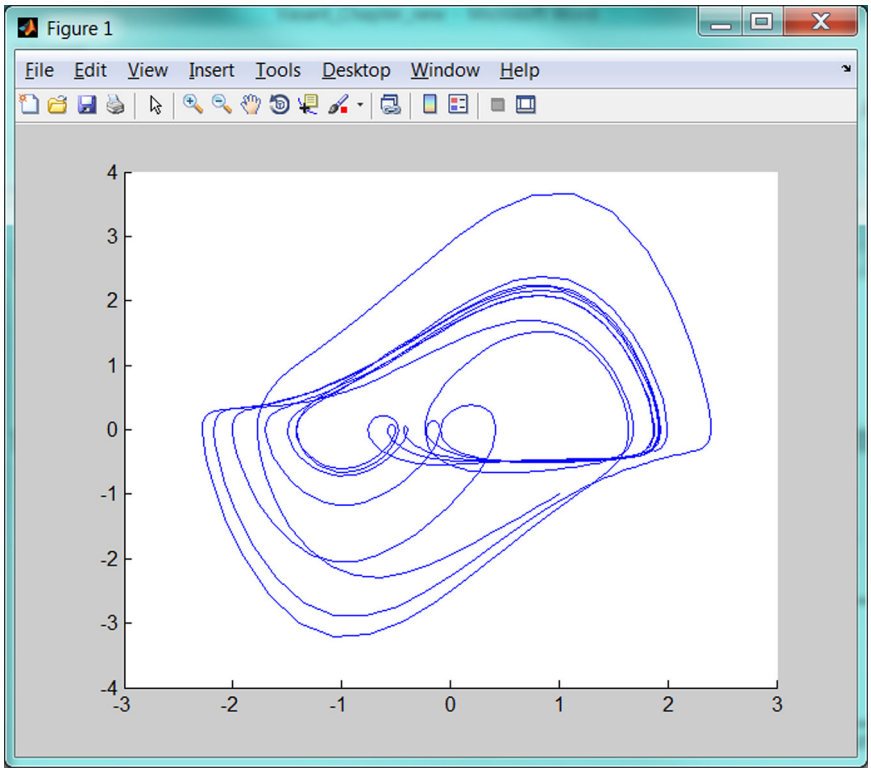


Figure 40. Graph of chaotic attractor



behaviour of economic development is restricted by contemporary knowledge, and the longer range predictions are uncertain. The theory of chaos could describe some economic and financial phenomena. The research is done very intensively.

FUTURE RESEARCH DIRECTIONS

The use of soft computing finds its place in the field of business, economics, and finance among other methods. It is done by successful applications in practice where especially vague terms, uncertainty imprecision, uncertainty, vagueness, semi-truth, approximations and non-linear behaviour with noise are frequent phenomena. The future research must be directed to build-up the models for complex decision making processes. The future trends that are expected from the soft computing technologies, which may satisfy these needs, are as follows: new fuzzy, neural networks, genetic algorithms models and their combinations. The future research will be focused in various applications to support decision making to be quicker and more precise because processed amount of data are increasing exponentially. More and more decision making will be done by automatic systems without influence of human being. These automatic decision systems must be designed to be robust and avoiding failures.

The future research of soft computing applications in business, economics, and finance will be focussed especially on improvement in these fields: data mining, data analyses, mortgage loan applications, loan pre-screening processes, client financial risk, client asset allocation, marketing, manufacturing at economic optimum, searching for faulty or fraudulent audits or suspicious financial transactions, predictive optimal supply-chain, predictive intelligent security, protection credit card fraud, time forecasting, time series prediction, prediction of thrift failures, new product pricing, customer classification, investment management and risk control, investment advising, detection of financial crisis, flow shop scheduling, solution of travelling salesman problem, etc.

The development of quick, more precise, part-time or fully automated decision making systems where soft computing methods will be used they will save time, decrease wrong decisions, avoiding human failures, reduce costs that can lead to higher profit, or decrease expenses in business and they can help to compete successfully.

CONCLUSION

The business, economic and financial applications have specific features in comparison with others. The processes are focused on optimizing income or profit, or decreasing expenses. Therefore, such applications, both successful and unsuccessful, are not published very often because of secrecy in the highly competitive environments among firms and institutions. The advanced decision methods can help in decentralization of decision-making processes to become standardized, reproduced, and documented. The advanced decision-making methods play very important roles in companies because they help to reduce costs that can lead to higher profit and they can help to compete successfully, or decrease expenses in institutions. The decision-making processes in business are very complicated because they include political, social, psychological, economic, financial, and other factors. Many variables are difficult to measure; they may be characterized by imprecision, uncertainty, vagueness, semi-truth, approximations, and so forth.

The use of the theories mentioned above is in the sphere of analyses and simulation. Except the applications such as risk investment, risk management, optimization, prediction of time series, journey optimization, description of phenomena it could be many other applications it could be mentioned mortgage loan risk evaluation, direct mailing decision making, stock market decision, stock trading decision, decision making evaluation, client risk evaluation, supplier risk evaluation, etc.

The use of these computing methods can lead to higher quality of analyses and simulations that can be used for decision-making and control processes in business, economy, financial areas, or the public sector.

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KEY TERMS AND DEFINITIONS

Artificial Neural Network: A mathematical model or computational model that is inspired by the structure and/or functional aspects of biological neural networks.

Business: The state of being busy either as an individual or society as a whole, doing commercially viable and profitable work.

Economic: Economics is the social science that analyses the production, distribution, and consumption of goods and services.

Finance: The management of money or "funds" management.

Fuzzy Logic: Deals with reasoning that is approximate rather than fixed and exact.

Genetic Algorithm: An evolutionary algorithm-based methodology inspired by biological evolution to find computer programs that perform a user-defined task.

Optimization: The act of rendering optimal.

Soft Computing: Soft computing is a term applied to a field within computer science which is characterized by the use of inexact solutions to computationally-hard tasks.

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APPENDIX

Programs

Prog. 2.1: M-file BF.m

```
clear all
B1v = readfis('B1.fis');
UdajB1 = input('Input values in the form [I1a; I1b]: ');
VyhB1 = evalfis(UdajB1, B1v);
B2v = readfis('B2.fis');
UdajB2 = input('Input values in the form [I2a;I2b;I2c]: ');
VyhB2 = evalfis(UdajB2, B2v);
BFv = readfis('BF.fis');
UdajBF(3)=input('Input values in the form [I3]: ');
UdajBF(1) = VyhB1;
UdajBF(2) = VyhB2;
VyhBF = evalfis(UdajBF, BFv);
if VyhBF<0.5 'Inactivity'
   elseif VyhBF<0.8 'Mail'
   else 'Personally'
end
fuzzy(BFv)
mfedit(BFv)
ruleedit(BFv)
surfview(BFv)
ruleview(BFv)
```

Prog. 3.1: M-file NNC.m

```
clear all;
P=(xlsread('DCN','Data'))';
num=input('Number of clusters:');
epochs=input('Number of epochs:');
net=newc([0 1; 0 1; 0 1],num,0.1);
net.trainParam.epochs = 1;
for k=1:epochs
   net = train(net,P);
   w = net.IW{1};
   stem3(w(:,1),w(:,2),w(:,3),'sr','MarkerFaceColor','b','MarkerSize',10)
   grid on;
   hold on
   Q=P';
```

```
   for i=1:size(Q,1)
       for j=1:(size(w,1))
           distances(j)=sqrt((Q(i,1)-w(j,1))^2+(Q(i,2)-w(j,2))^2+(Q(i,3)-
w(j,3))^2);
       end
      [min_distance(i),assignment(i)]=min(distances);
   end
for i=1:size(Q,1)
      stem3(Q(i,1),Q(i,2),Q(i,3),'sr','MarkerFaceColor',[assignment(i)/
num,assignment(i)/num,
      assignment(i)/num],'MarkerSize',10)
      xlabel('x');ylabel('y');zlabel('z');
   end
   figure(gcf)
   hold off
end
total_distance=sum(min_distance)
Q;w;assignment
```

Prog. 3.2: M-file Pred.m

```
targetSeries = tonndata(data,false,false);
feedbackDelays = 1:2;
hiddenLayerSize = 10;
net = narnet(feedbackDelays,hiddenLayerSize);
net.inputs{1}.processFcns = {'removeconstantrows','mapminmax'};
[inputs,inputStates,layerStates,targets] = preparets(net,{},{},targetSeries);
net.divideFcn = 'dividerand';
net.divideMode = 'time';
net.divideParam.trainRatio = 70/100;
net.divideParam.valRatio = 15/100;
net.divideParam.testRatio = 15/100;
net.trainFcn = 'trainlm';
net.performFcn = 'mse';
net.plotFcns = {'plotperform','plottrainstate','plotresponse',...
 'ploterrcorr', 'plotinerrcorr'};
[net,tr] = train(net,inputs,targets,inputStates,layerStates);
outputs = net(inputs,inputStates,layerStates);
errors = gsubtract(targets,outputs);
performance = perform(net,targets,outputs)
trainTargets = gmultiply(targets,tr.trainMask);
valTargets = gmultiply(targets,tr.valMask);
testTargets = gmultiply(targets,tr.testMask);
```

```
trainPerformance = perform(net,trainTargets,outputs)
valPerformance = perform(net,valTargets,outputs)
testPerformance = perform(net,testTargets,outputs)
view(net)
netc = closeloop(net);
[xc,xic,aic,tc] = preparets(netc,{},{},targetSeries);
yc = netc(xc,xic,aic)
perfc = perform(net,tc,yc)
nets = removedelay(net);
[xs,xis,ais,ts] = preparets(nets,{},{},targetSeries);
ys = nets(xs,xis,ais);
closedLoopPerformance = perform(net,tc,yc)
```

Prog. 4.1: M-file DPGA.m

```
function DPGA
global LOCATION;
num=input('Number of groups:');
num=3*num;
PopSize=input('Population size:');
FitnessFcn = @Group;
numberOfVariables = num;
LOCATION=(xlsread('DP','Coordinates'))
my_plot = @(Options,state,flag) Draw(Options,state,flag,LOCATION,num);
Options = gaoptimset('PlotFcns',my_plot,'PopInitRange',[0;300],'PopulationSize
',PopSize);
[x,fval] = ga(FitnessFcn,numberOfVariables,Options);
assign=zeros(1,size(LOCATION,1));
for i=1:size(LOCATION,1)
    distances=zeros(num/3,1);
    for j=1:(size(x,2)/3)
        distances(j)=sqrt((LOCATION(i,1)-x(j))^2+(LOCATION(i,2)-
        x(size(x,2)/3+j))^2+(LOCATION(i,3)-x(2*size(x,2)/3+j))^2);
    end
    [min_distance,assign(i)]=min(distances);
end
assign;fval
xy=zeros(num/3,3);
for i=1:(num/3)
    xy(i,1)=x(1,i);
    xy(i,2)=x(1,num/3+i);
    xy(i,3)=x(1,2*num/3+i);
end
```

Prog. 4.2: M-file Group.m

```
function z=Group(x)
global LOCATION
z=0;
for i=1:size(LOCATION,1)
    for j=1:(size(x,2)/3)
        distances(j)=sqrt((LOCATION(i,1)-x(j))^2+(LOCATION(i,2)-
        x(size(x,2)/3+j))^2+(LOCATION(i,3)-x(2*size(x,2)/3+j))^2);
    end
    min_distance=min(distances);
    z=z+min_distance;
end
```

Prog. 4.3: M-file Draw.m

```
function state = Draw(Options,state,flag,LOCATION,num)
[unused,i] = min(state.Score);
x=state.Population(i,:);
for i=1:size(LOCATION,1)
    for j=1:(size(x,2)/3)
        distances(j)=sqrt((LOCATION(i,1)-x(j))^2+(LOCATION(i,2)-
        x(size(x,2)/3+j))^2+(LOCATION(i,3)-x(2*size(x,2)/3+j))^2);
    end
   [min_distance,assign(i)]=min(distances);
end
for i=1:size(LOCATION,1)
   view(2)
   plot3(LOCATION(i,1),LOCATION(i,2),LOCATION(i,3),'sr','MarkerFaceColor',[3*(
assign(i))/
   num,3*(assign(i))/num,3*(assign(i))/num],'MarkerSize',10);
   xlabel('x');ylabel('y');zlabel('z');
   grid on;
   hold on;
end
view(2)
plot3(x(1:size(x,2)/3),x((size(x,2)/3+1):2*size(x,2)/3),x(2*size(x,2)/3+1:size
(x,2)),'sr','MarkerFace
Color','b','MarkerSize',10); hold off;
```

Prog. 4.4: M-file TSM.m

```
xx=[0 5 11 95 88 103 103 116 120 130 133 159 170 178 165 190 200 195 218 230
226 236 244 255 265 267 280 267 250 238 222 200 193 192 178 168 112 97 90 87
70 26 18 7 10 4 0];yy=[106 45 84 89 62 148 113 36 146 99 47 110 87 120 62];
yy=[ 133 124 132 162 171 163 155 157 169 165 152 143 145 136 129 107 117 128
116 120 107 96 102 93 93 80 66 65 48 30 21 22 8 15 22 16 37 11 15   8 12 65 66
90 101 110 133];
save('tsm.mat','xx','yy');
cities=15;
locations(:,1)=[93  183 253 46 210 120 150 90 77 162 226 77 238 20 137];
locations(:,2)=[106 45 84 89 62 148 113 36 146 99 47 110 87 120 62];
for count1=1:cities,
    for count2=1:count1,
        x1 = locations(count1,1);
        y1 = locations(count1,2);
        x2 = locations(count2,1);
        y2 = locations(count2,2);
        distances(count1,count2)=sqrt((x1-x2)^2+(y1-y2)^2);
        distances(count2,count1)=distances(count1,count2);
    end;
end;
FitnessFcn = @(x) TSMfit(x,distances);
TSM_plot = @(options,state,flag) TSM_plot1(state,locations);
options = gaoptimset('PopulationType', 'custom','PopInitRange',[1;cities],'Cre
ationFcn',@TSMcre_p, 'CrossoverFcn',@TSMcro_p, 'MutationFcn',@TSMmut_p, 'Plot-
Fcn', TSM_plot, 'Generations',500, 'PopulationSize',60, 'StallGenLimit',200,'V
ectorized','on');
numberOfVariables = cities;
[x,fval,reason,output] = ga(FitnessFcn,numberOfVariables,options);
fval
reason
```

Prog. 4.5: M-file TSMfit.m

```
function scores = TSMfit(x,distances)
scores = zeros(size(x,1),1);
for j = 1:size(x,1)
    p = x{j};
    f = distances(p(end),p(1));
    for i = 2:length(p)
        f = f + distances(p(i-1),p(i));
    end
    scores(j) = f;
end
```

Prog. 4.6: M-file TSM-plot1.m

```
function state = TSM_plot1(state,locations)
persistent xx yy
load('tsm.mat','xx','yy');
plot(xx,yy,'Color','red');
axis([0 300 0 200]);
hold on
[unused,i] = min(state.Score);
genotype = state.Population{i};
title ('Travel salesman problem')
plot(locations(:,1),locations(:,2),'go');
plot(locations(genotype,1),locations(genotype,2));
hold off
```

Prog. 4.7: M-file TSMcre_p.m

```
function pop = TSMcre_p(NVARS,FitnessFcn,options)
totalPopulationSize = sum(options.PopulationSize);
n = NVARS;
pop = cell(totalPopulationSize,1);
for i = 1:totalPopulationSize
    pop{i} = randperm(n);
end
```

Prog. 4.8: M-file TSMcro_p.m

```
function xoverKids  = TSMcro_p(parents,options,NVARS,...
FitnessFcn,thisScore,thisPopulation)
nKids = length(parents)/2;
xoverKids = cell(nKids,1); % Normally zeros(nKids,NVARS);
index = 1;
for i=1:nKids
    parent = thisPopulation{parents(index)};
    index = index + 2;
    p1 = ceil((length(parent) -1) * rand);
    p2 = p1 + ceil((length(parent) - p1- 1) * rand);
    child = parent;
    child(p1:p2) = fliplr(child(p1:p2));
    xoverKids{i} = child; % Normally, xoverKids(i,:);
end
```

Prog. 4.9: M-file TSMmut_p.m

```
function mutationChildren = TSMmut_p(parents, options,NVARS,...
FitnessFcn, state, thisScore,thisPopulation,mutationRate)
mutationChildren = cell(length(parents),1);
for i=1:length(parents)
    parent = thisPopulation{parents(i)};
    p = ceil(length(parent) * rand(1,2));
    child = parent;
    child(p(1)) = parent(p(2));
    child(p(2)) = parent(p(1));
    mutationChildren{i} = child; % Normally mutationChildren(i,:)
end
```

Prog. 5.1: M-file MP.m

```
y=zeros
for  i = 1:99;
   y(i+1)=y(i)/(1+0.3*3*rand)+(10*rand-y(i));
end
plot(y); title ('Chaos'); xlabel ('P_t'); ylabel ('P_t+1')
```

Prog. 5.2: M-file BS.m

```
h=0.1;
alfa=1;
omega=0.45;
beta=0.988;
x(1)=0;
y(1)=1;
%y(2)=0.895;
dy(1)=-1;
ddy=beta*sin(omega*0)-alfa*((y(1)^2)-1)*dy(1)-(y(1)^2);
y(2)=y(1)+h*dy(1)+((h^2)*ddy)/2;
hold on;
for i=2:1000
     x(i)=x(i-1)+h;
    y(i+1)=((2*(h^2)*beta*sin(omega*x(i))-y(i)*(2*(h^2)-4)-y(i-1)*(2-
    h*alfa*(y(i)^2)+h*alfa)))/(2+h*alfa*(y(i)^2)-h*alfa);
    dy(i)=(y(i+1)-y(i-1))/(2*h);
end
yy=y(1:1000)
plot(yy,dy);
```

Results

Res. 2.1: Results

```
Input values in the form [I1a; I1b]: [0;0]
Input values in the form [I2a; I2b; I2c]: [0;0;0]
Input values in the form [I3]: [0]
ans =Inactivity
Input values in the form [I1a; I1b]: [1;1]
Input values in the form [I2a; I2b; I2c]: [1;1;1]
Input values in the form [I3]: [1]
ans =Personally
Input values in the form [I1a; I1b]: [0.5;0.5]
Input values in the form [I2a; I2b; I2c]: [0.5;0.5;0.5]
Input values in the form [I3]: [0.5]
ans =Mail
```

Res. 3.1: Input Parameters and Results of Calculation

```
Number of clusters: 4
Number of epochs: 500
Total distance =         5.3141
w =    0.3211    0.8013    4.4506
       0.8308    0.4471    2.1745
       0.4488    0.5221    3.5027
       0.4905    0.6905    2.0824
Assignment =      4     2      2     3
2     1     4     3     3     4      3     1
2     1     2
```

Res. 4.1: Coordinates of Centroids and Location of Places

```
Number of groups: 4
Population size:1000
assign =    1     4     4     1     4     2     2     3     1     2     4
1     4     1     3
  fval = 212.7160
  xy =   29.3064   71.9184    0.0947
            58.5215   76.3774    0.9532
          48.6974   39.3067   -2.7503
          85.3377   39.9134   -0.2225
```

Res. 4.2: Setup Options

```
PopulationType: 'custom'
PopInitRange: [2x1 double]
PopulationSize: 60
EliteCount: []
CrossoverFraction: []
ParetoFraction: []
MigrationDirection: []
MigrationInterval: []
 MigrationFraction: []
 Generations: 500
 TimeLimit: []
 FitnessLimit: []
 StallGenLimit: 200
 StallTimeLimit: []
 TolFun: []
 TolCon: []
 InitialPopulation: []
 InitialScores: []
 InitialPenalty: []
 PenaltyFactor: []
 PlotInterval: []
 CreationFcn: @TSMcre_p
 FitnessScalingFcn: []
 SelectionFcn: []
 CrossoverFcn: @TSMcro_p
 MutationFcn: @TSMmut_p
 DistanceMeasureFcn: []
 HybridFcn: []
 Display: []
 PlotFcns: @(options,state,flag)TSM_plot1(state,locations)
 OutputFcns: []
 Vectorized: 'on'
 UseParallel: []
```

Res. 4.3: Input and Results of Calculation

```
Optimization terminated: average change in the fitness value less than op-
tions.TolFun.
fval =     639.4138
reason = 1
```

Chapter 78
Emerging Legal Issues in Banking Operations

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ABSTRACT

This chapter deals with legal issues in banking activities, which have gained interest during the past decade. It determines the place of legal issues related to banking activities, such as consumer loans, credit cards, and electronic banking, which all have gained even more importance after the last global financial crisis. The chapter focuses on the comparative analysis of current legal issues in Turkey and in the European Union and the legal issues related to risks in the sphere of electronic banking and suggests potential strategies.

INTRODUCTION

While the development of electronic transaction in banking activities can offer a variety of benefits to society, there are multiple legal issues and security risks presented by this development. This work discusses several legal issues and risks in the banking activities.

The observation addresses three major issues. The first relates to the legislation which governs the banking activities. Particular emphasis is given to examining legislation in Turkey and comparison with the existing EU legislation. The second issue relates to the analysis of the benefits of electronic banking presented by the development of electronic technology. The third major issue of concern stems from the first and second: risks of electronic banking and possible legislative security issues.

The first section describes the legislation on the banking activities in Turkey. The analysis of the different types of banking activities is also given in the first section. The analysis of the legal banking issues in Turkey is given in the second section. The differences and similarities between the issues in European Union and Turkish Law are given in third section. The benefits of electronic banking, risks and further legal issues are analyzed in the fourth section, with a special emphasis on the development of electronic transactions.

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BANKING ACTIVITIES

The Article 4 of the Turkish Banking Law No. 5411 has defined the activities which the banks can engage in. Based on this article, there are several activities and limitations for engaging in these activities. According to this article (Turkish Banking Law No. 5411):

Without prejudice to the provisions of other laws, banks may carry out the following activities:

1. Accepting deposits.
2. Accepting participation funds.
3. Granting any sort of loan, either cash or non-cash.
4. Carrying out any type of payment and collection transactions, including cash and deposit payment and fund transfer transactions, correspondent bank transactions, or use of check accounts.
5. Purchasing transactions of commercial bills.
6. Safe-keeping services.
7. Issuing payment instruments such as credit cards, bank cards and travel checks, and executing relevant activities.
8. Carrying out foreign exchange transactions, trading of money market instruments, trading of precious metals and stones and safekeeping such.
9. Trading and intermediation of forward, future and option contracts, simple or complex financial instruments which involve multiple derivative instruments, based on economic and financial indicators, capital market instruments, goods, precious metals and foreign exchange.
10. Purchase and sale of capital market instruments and repurchasing or re-sale commitments.
11. Intermediation for issuance or public offering of capital market instruments.
12. Transactions for trading previously issued capital market instruments for intermediation purposes.
13. Guarantee transactions like undertaking guarantees and other liabilities in favor of other persons.
14. Investment counseling services.
15. Portfolio operation and management.
16. Primary market dealing for purchase-sales transactions within the framework of liabilities assumed by contracts signed with Treasury Undersecretariat and/or Central Bank and associations of institutions.
17. Factoring and forfeiting transactions.
18. Intermediating fund purchase-sale transactions in the inter-bank market.
19. Financial leasing services.
20. Insurance agency and individual private pension fund services.
21. Other activities to be determined by the Board.

Deposit banks shall not be engaged in activities cited in sub-paragraphs (b) and (t); participation banks shall not be engaged in activities cited in sub-paragraph (a) and development and investment banks shall not be engaged in activities cited in sub-paragraphs (a) and (b).

In an effort to present the banking activities in detail, we formed this section by reviewing the products and services provided by banks in general and regarding the Article 4 of the Banking Law No. 5411. Regarding the products and services offered by banks, banking activities can be divided into individual, corporate, SMEs, credits, credit cards, ATM (Automated Teller Machine) cards, smart cards, investment, and instantly banking activities.

Individual banking activities can include, deposit products, investment, credit, cards, insurance, retirement, payments (invoice, tax, loan, etc.), deposit box, money transfers, checks and bonds, etc.

Corporate banking activities include, credit, project financing, structured financing, derivatives, foreign-trade financing, cash management, investment, credit, cards, and insurance.

Commercial banking activities include investment, credit, cash management, foreign-trade financing, commercial cards, and insurance. SMEs (Small and Medium Size Enterprises) banking activities include, the same but more specific products and services with commercial banking activities but more specific.

Credit banking activities can be individual, corporate, and commercial. These activities can be in the form of cash-loan or non-cash loan and may include, fast credits, micro credits, consumer credit, education credit, export credit, import credit, home loan, vehicle loan, business loan, project financing, forfeiting, guarantee letter, reference letter, etc.

There are several forms of credit cards according to the scope of the bank and the income level of the consumer (platinum, gold, etc.). Smart cards can serve for transportation applications, university applications, etc.

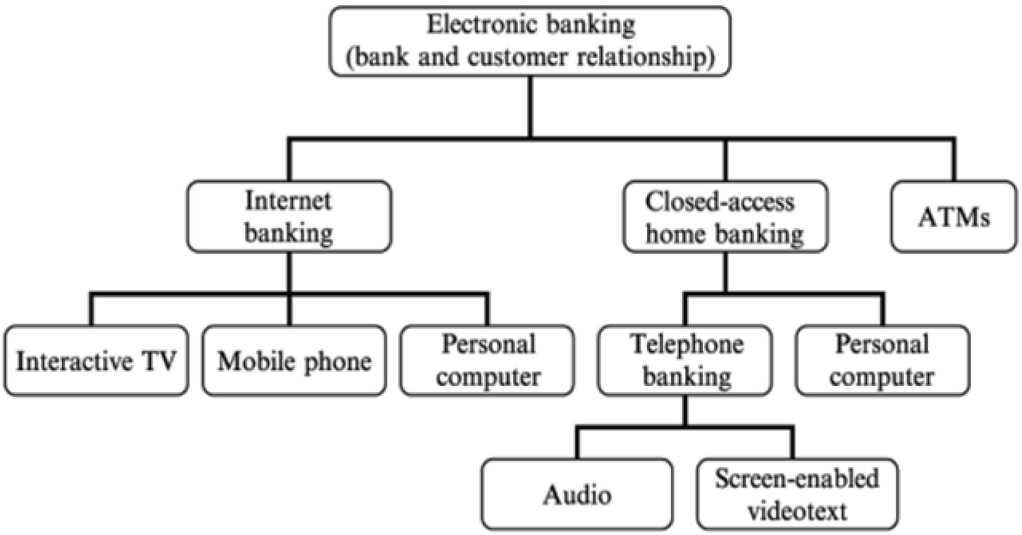
Investment activities can be in the form of investment fund, bonds, bills, stock, gold, derivatives, repo, Eurobond, etc. Banks offer different ways for customers to use electronic banking services (see Figure 1).

Instant banking activities and electronic banking activities can include, internet branch, videophone branch, telephone branch, money transfers, cash point, investment transactions Wap banking, cell phone banking, iPad applications, etc. Electronic money transfers can be in the form of EFT (money transfer to other banks), money orders (among the same accounts and/or to other recipients in the same banks and in form of Turkish Currency and/or Foreign Currency), and foreign currency transfers (by SWIFT, MoneyGram, Western Union, etc.). Electronic investment transactions can include buying and/or selling funds, FX, cross transactions, time deposit accounts, share certificate and/or gold transactions, repo and bills and bonds (Aydin, 2012).

EMERGING LEGAL BANKING ISSUES IN TURKEY

The difference of banks from the other financial institutions is their ability to decrease transactions' costs, provided service for monitoring risks for investors, and furthermore their ability to provide

Figure 1. Communication methods and access devices in electronic banking
Source: Gkoutzinis, Apostolos, Internet Banking and the Law in Europe: Regulation, Financial Integration, and Electronic Commerce, p. 8, Cambridge University Press, Cambridge, UK, 2006



fast and high amounts of liquidity. On the other hand, since the late 1970's the world experienced several banking crisis and these crisis have spread over the world very quickly. If a banking crisis (or a financial crisis) cannot be prevented, after affecting the banking system, it carries the risk of affecting the real economy. Especially the last global financial crisis attracted the attention on liquidity while the lack of liquidity in this period caused serious worries. In the meantime, banking system almost restructured through the efforts of Bank for International Settlements and Financial Stability Board and the central banks to create a resilient banking system. In addition to all these, there is an incredible fast increase in internet and mobile banking activities which brings a new security issues to the table. These type of activities make the legal environment for the banks very important to protect customers, macro economy and also protect banks from themselves (Barth, Gan & Nolle, 2005).

The Table 1 shows the last statistical information on banks in Turkey. As of the end of September, 2012, there are forty four active banks (Table 1).

They have 1,241,732 (million TL) assets, 10,111 branches, 184,332 personnel, and 16,372 (million TL) net profit (The Banks Association of Turkey, 2012a). 31 of these banks are deposit banks (16 of them are foreign investment banks), and 13 are development and investment banks.

21.4% of total shares of these 44 banks have been offered to public, and 55.4% of the rest 78.6% belong to investors who are resident in Turkey

Table 1. Banks in Turkey as of end of September 30, 2012

	Bank	Year of Establishment	Total Equity (million TL)	Net Profit Loss (million TL)	Number of Branches	Number of Personnel
1	Türkiye İş Bankası A.Ş.	1924	20.925	2.345	1.234	24.504
2	Türkiye Cumhuriyeti Ziraat Bankası A.Ş.	1863	15.818	1.886	1.510	23.359
3	Türkiye Garanti Bankası A.Ş.	1946	20.116	2.313	928	17.310
4	Akbank T.A.Ş.	1948	20.128	1.870	963	16.436
5	Yapı ve Kredi Bankası A.Ş.	1944	14.415	1.401	922	14.954
6	Türkiye Halk Bankası A.Ş.	1938	11.091	1.853	807	14.332
7	Türkiye Vakıflar Bankası T.A.O.	1954	11.051	1.009	741	13.223
8	Finans Bank A.Ş.	1987	6.634	660	530	11.459
9	Türk Ekonomi Bankası A.Ş.	1927	4.663	371	510	9.205
10	Denizbank A.Ş.	1997	4.691	585	600	10.080
11	HSBC Bank A.Ş.	1990	2.984	131	331	5.994
12	ING Bank A.Ş.	1984	2.803	230	320	5.333
13	Türk Eximbank	1987	3.615	165	2	409
14	Şekerbank T.A.Ş.	1953	1.736	178	272	3.517
15	İller Bankası A.Ş.	1933	9.099	264	19	2.478
16	Türkiye Sınai Kalkınma Bankası A.Ş.	1950	1.628	240	4	343
17	Alternatif Bank A.Ş.	1992	548	57	63	1.191
18	Citibank A.Ş.	1980	1.031	91	37	2.212
19	Anadolubank A.Ş.	1996	1.135	141	88	1.970

continued on following page

Table 1. Continued

	Bank	Year of Establishment	Total Equity (million TL)	Net Profit Loss (million TL)	Number of Branches	Number of Personnel
20	Eurobank Tekfen A.Ş.	1992	685	46	60	984
21	İMKB Takas ve Saklama Bankası A.Ş.	1995	322	45	1	223
22	Tekstil Bankası A.Ş.	1986	542	16	44	870
23	Deutsche Bank A.Ş.	1988	491	80	1	104
24	Fibabanka A.Ş.	1984	371	35	27	542
25	Aktif Yatırım Bankası A.Ş.	1999	386	52	7	413
26	The Royal Bank of Scotland N.V.	1921	443	30	3	95
27	Türkiye Kalkınma Bankası A.Ş.	1975	567	34	1	695
28	Turkland Bank A.Ş.	1991	368	20	27	513
29	Arap Türk Bankası A.Ş.	1977	406	52	7	271
30	Merrill Lynch Yatırım Bank A.Ş.	1992	95	28	1	36
31	BankPozitif Kredi ve Kalkınma Bankası A.Ş.	1999	485	21	1	135
32	Société Générale (SA)	1989	116	10	16	295
33	Turkish Bank A.Ş.	1982	163	1	20	290
34	JPMorgan Chase Bank N.A.	1984	271	40	1	56
35	Birleşik Fon Bankası A.Ş.	1958	608	29	1	225
36	Bank Mellat	1982	183	25	3	58
37	Portigon AG	1985	176	6	1	40
38	Nurol Yatırım Bankası A.Ş.	1999	111	3	2	45
39	Diler Yatırım Bankası A.Ş.	1998	92	3	1	19
40	GSD Yatırım Bankası A.Ş.	1998	80	5	1	27
41	Habib Bank Limited	1983	45	1	1	17
42	Credit Agricole Yatırım Bankası Türk A.Ş.	1990	67	0	1	15
43	Adabank A.Ş.	1985	43	0	1	42
44	Taib Yatırım Bank A.Ş.	1987	12	-3	1	13
	Total		**161.238**	**16.372**	**10.111**	**184.332**

Source: The Banks Association of Turkey, Statistical Reports, Banks According to Their Assets, http://www.tbb.org.tr/tr/banka-ve-sektor-bilgileri/istatistiki-raporlar/eylul--2012---aktif-buyukluklerine-gore-banka-siralamasi/1211

and 23.1% belong to foreign investors (The Banks Association of Turkey, 2012b).

One of our legal banking issues (banks exempt from fees) is the legal fees (Banking Law No. 5411 Article 140 and Provisional Article 13; Law No. 492 on Fees). There have been legal justification and the text contradictions between decisions of Supreme Courts' Special Panel departments and the Assembly of Civil Chambers. Finally the issue has been accepted by the Assembly of Civil Chambers' number 2010/12-443-471 decision. Secondly, Check Law No 5941 has brought many issues, which requires further and detailed discussion (Sanli, 2011).

An important discussion on the subject contractual interest and default interest rates continues today. As of 1 July, 2012 The New Turkish Commercial Code No. 6102 (New TCC) has come into

effect with the amendments-with the Law No. 6335 Amending the Turkish Commercial Code and Law on Effectiveness and Implementation Form of the Turkish Commercial Code-to the law even before it has come into effect. Article 3 addresses interest rate issue (same as it was in old Commercial Code) and accordingly interest rate is designated freely in commercial affairs. The upper limits of the contractual interest and default interest rates are defined in the Turkish Obligations Code No. 6098 which are in favor of the consumers who use credit cards and consumer credits. On the other hand, there is opinion this is an unfair intervention by the authorities while they should also protect the freedom of contract and freedom of initiative (Demir, 2012; Reisoglu, 2012).

Other issues can be summarized as follows (the limitations of scope do not allow us to further review all of these issues in this study):

- Commercial enterprise pledge.
- Preliminary attachment application on collection of bank receivables.
- Solidarity in terms of deposit accounts.
- The status of deposit of deceased in terms of heirs.
- Cost of filing in credit applications.
- Credit card annual fee.
- Postponement of bankruptcy applications.
- Liquid receivables regarding the execution of indemnity for denial concept.
- Surety in consumer law.
- Electronic banking regulations.

EMERGING LEGAL BANKING ISSUES IN EUROPE

Regarding the existence of 27 member countries, EU legal systems, banking systems and the existence of Union, its regulations and its complex structure, there are several legal issues related to banking activities. However, three of these legal issues have gain more importance nowadays: lack of consumer protection in credit markets, lack of regulations regarding the over-indebtedness or insolvency, and lack of regulation in electronic banking.

In the EU law, one of the important issues is the lack of consumer protection in credit markets. Although, there are several regulations regarding the credits, such as the Consumer Credit Directive and the Markets in Financial Instruments Directive, the EU consumers' lack of financial literacy is an emerging issue in the EU law. Especially, low-income and low-educated groups are not protected by law in a sufficient manner. The law needs to be updated at least to protect vulnerable groups and consumers from entering into too risky agreements. Banks should be held responsible, and it should include warn for the banks (Mak & Braspenning, 2012).

Another important issue is the lack of regulations regarding the over-indebtedness or insolvency. There are Consumer Credit directives of 1978 and 2009 but neither of them has addressed this issue, nor the other European Union law instrument. Just the Council of Europe Recommendation of 2007 addresses the issue but it is not sufficient in solving the emerging issues. Furthermore, same links between the Union countries increases the risks. The bridge between Denmark and Sweden (2000) could be useful to explain this risk. This bridge created increased relationships between Copenhagen (Denmark) area and the Malmö (Sweden). The over-indebtedness or insolvency issues reflected these areas as several debtors living in the one side, but are debtors in the both sides and filings of these individuals for personal insolvency in either country created serious legal issues. Therefore, there is a need for the member countries to recognize debt adjustment judgments made in another member countries and regulations in this field (Niemi, 2012).

Another emerging legal issue is related to electronic banking. The legal infrastructure of the electronic banking activities in Europe is an adjunction of the "law of contracts, the law-of the

banker customer relationships, the law governing distinct banking contracts and services, and in civilian codifications." Furthermore, in order to protect consumers, investors, and depositors, and maintain the transparency, fairness and disclosure there are special statutes, secondary statutory instruments and regulations (Gkoutzini, 2006). However, there is still lack of regulation in this subject. There are issues regarding the deposit protection and liability of supervisors (e.g. community deposit protection regime's scope, purpose, and validity) (Dempegiotis, 2008). For instance, in United Kingdom (UK), government agents can charge companies with fines if they cannot protect customers but companies are not obligated to notify customers about the issues related to security breaches. Because of the lack of regulation in this issue, in 2011, 14,000 customers' credit card details were stolen by the online hackers from one company (Booth, 2011).

ELECTRONIC BANKING

Benefits of Electronic Banking

Both individuals and business entities use internet and mobile applications to increase their efficiency to gain time and to attract and reach customers in a wider and faster way in case of business entities. These demands changed the way of working, business activities and banking. Banking system not only provides products and services through internet and mobile applications but also is able to reach very personal individual and corporate customer information, and make use of these information systems in order to maintain their activities. Therefore securing their information systems is becoming more important every day and both, legislators need to catch the speed of technology and banks should act in a more responsible manner.

In Turkey, number of registered total (retail and commercial) customers (in thousands) of internet banking who logged in at least once was 21,288 in March 2012 whereas it was 17,950 in the same period of 2011. The number of mobile registered total (retail and commercial) customers who logged in at least once was 1,444,835 in March 2012 whereas it was 912,788 in the same period of 2011 (The Banks Association of Turkey, 2012), see Tables 2, 3, and 4 for more detail.

There are several parties (operators, banks, merchants and customers) in the credit card market. In Turkey, the system operator is the Interbank Card Centre (ICC) and the issuer and acquirer is the banks, while in the USA and Europe, there are two separate financial agents as the issuer and acquirer (Dilek, 2012).

Electronic banking activities in Turkey include the activities given in the earlier parts of the study including ATM, internet and mobile services. More than two third of the bank's payments are done through internet banking in Turkey. One of the new applications is checks are coded now and banks put them through electronic clearing which minimized the time in the billing process (Aydin, 2012).

This rapid increase in the use of internet and mobile banking services arise for several reasons: a customer (individual and/or corporate) can use these services at any time which means not being dependable on 9 to 5 banking schedule which is a more convenient system, at anywhere without waiting anyone in line, with instant reach to the service, no geographic limits. That's electronic banking offers mobility, thus saving time and energy; and reaching and following financial information instantly (Lawrence, 2008). Another important benefit is saving money (e.g. lower fees) through electronic banking activities. For instance Europe applies lower fees for electronic banking activities from north to south and from rich to poor (Koskokas, 2011a).

Table 2. Internet banking statistics for Turkey: Number of customers using Internet banking services

	March 2011 (thousand)	December 2011 (thousand)	March 2012 (thousand)
Number of Retail Customers			
Active (A): That logged in at least once in the related three-month period	6,505	7,803	8,485
Registered (B): That logged in at least once	16,253	18,106	19,322
Registered (C): That logged in at least once in one-year period	8,498	10,389	11,304
Active(A)/Registered (B)	*40%*	*43%*	*44%*
Number of Commercial Customers			
Active (A): That logged in at least once in the related three-month period	723	803	844
Registered (B): That logged in at least once	1,697	1,892	1,966
Registered (C): That logged in at least once in one-year period	860	968	1,009
Active(A)/Registered (B)	*43%*	*42%*	*43%*
Number of Total Customers			
Active (A): That logged in at least once in the related three-month period	7,227	8,606	9,329
Registered (B): That logged in at least once	17,950	19,998	21,288
Registered (C): That logged in at least once in one-year period	9,358	11,358	12,313
Active(A)/Registered (B)	*40%*	*43%*	*44%*

Source: The Banks Association of Turkey, Internet and Mobile Banking Statistics March 2012, Report Code: DE22, April 2012.

Table 3. Internet banking statistics for Turkey: Investment transactions

	December 2011		March 2012		Net Change		March 2012
	Number of Transactions (thousand)	Volume of Transactions (million TRY)	Number of Transactions (thousand)	Volume of Transactions (million TRY)	Number of Transactions (thousand)	Volume of Transactions (million TRY)	Average Volume of Transactions (million TRY)
Investment Funds	2,483	21,002	2,333	18,886	-150	-2,116	8.1
Foreign Currency Transactions	2,382	24,169	2,364	18,695	-18	-5,474	7.9
Time Deposit Accounts	591	14,908	650	14,540	59	-368	22.4
Realized Share Certificate	4,957	17,686	5,289	20,285	665	5,600	3.8
Repurchasing Agreements	116	4,234	108	3,496	-8	-737	32.5
Bonds and Bills	95	1,235	101	1,099	6	-136	10.9
Gold Transactions	478	2,769	442	1,582	-36	-1,187	3.6
VOB	330	3,920	263	6,957	-67	3,037	26.5
Total	**11,432**	**59,922**	**11,550**	**85,540**	**117**	**-4,382**	**7.4**

Source: The Banks Association of Turkey, Internet and Mobile Banking Statistics March 2012, Report Code: DE22, April 2012.

Table 4. Internet banking statistics for Turkey: Financial transactions

	March 2011		December 2011		March 2012	
	Number of Transactions (thousand)	**Volume of Transactions (million TRY)**	**Number of Transactions (thousand)**	**Volume of Transactions (million TRY)**	**Number of Transactions (thousand)**	**Volume of Transactions (million TRY)**
Money Transfers	39,877	230,080	46,424	277,861	48,238	275,048
Payments	28,588	11,494	33,258	14,203	34,305	13,641
Credit Card Transactions	8,160	6,373	9,057	7,978	9,505	8,293
Other Transactions	1,823	21,228	1,709	21,908	2,201	24,042
Total	**78,448**	**269,175**	**90,448**	**321,949**	**94,249**	**321,023**

Source: The Banks Association of Turkey, Internet and Mobile Banking Statistics March 2012, Report Code: DE22, April 2012.

Risks of Electronic Banking

It is a serious challenge for the legislators to catch the speed of technology and make regulations simultaneously. This challenge results in insufficient protection for consumers by governing bodies and customers do not have control and monitor power over the activities of banks. Also, both internet and mobile banking activities require significant security applications which should be offered by the banks.

The lack of this assistance would result in frauds, information theft, identity theft, not being able to reach the personal account, and improper transfers in accounts. The main technology issues related to internet banking are: security, privacy (anonymity); authentication (difficulty to ensure that encrypted transactions cannot be changed in the final stage), and divisibility (the issue of being able to divide electronic fund just like the real money, such as into different units of currency). Banks offer several security features for their customers in an effort to decrease these risks such as 'security token devices' which can be in the form of PIN (login password)/TAN (one time password), signature based electronic banking (digitally and encrypted signing transactions); 'Attacks' which are designed to deceive the user in steeling login data and valid TAN; and 'countermeasures' such as digital certificates against information theft or manipulation of transactions (Koskokas, 2011b).

From a legal point of view, the contract between the bank and customer allows the information transmission from customer to bank and from bank to customer leading to establishment, change, exercise, or discontinuance of liabilities and legal rights. Therefore, these processes could result in legal issues for both parties which require clear and detailed regulations in this field (Weber, 2010).

In order to regulate the electronic banking environment several international standards have been set. Banks have to adopt most of these standards in order to provide the security in their IT systems for the resilience and standardization of the banking system, for the security of their customers, and to prevent fraudulent activities:

- **Banking for International Settlements (BIS):** "Management and Supervision of Cross Border Electronic Banking Activities" (2003)
- **BIS:** "Risk Management Principles for Electronic Banking" (2001)
- **Information Systems Audit and Control Association (ISACA):** "COBIT 4" and "COBIT 5" (information and technology governance framework)

- **International Organization for Standardization (ISO):** "ISO/IEC 27002:2005 (for information security management)
- **The Committee of Sponsoring Organizations (COSO):** "Enterprise Risk Management-ERM-Framework"
- Corporate Governance Codes (regulated by laws-such as New TCC the sub-clause C of Article 375 and Article 336 and-regarding the banking activities-regulation and supervision agencies-such as Regulation on Corporate Governance Principles by Banking Regulation and Supervision Agency) (Kondabagil, 2007).

RESULT

The last global financial crisis presented that an unsupervised banking system with lack of regulations, consumers' lack of knowledge regarding the banking activities, and uncontrolled and unanalyzed credits given by the banks could result in serious lack of liquidity which would also affect the real economy. After the crisis and with the influence of recession, bankruptcies, shrinking demand, increasing unemployment rates, emerging legal issues regarding the credits and credit cards draw attention to the complex products of banks, credit quality and the need for regulations to protect consumers in this field. Another important and related issue is the rapidly emerging technologic structure of the banking activities.

In this field BIS plays an important role whereas it has the power of making regulations for the banking system globally. But these regulations should be further supported with the legislations in countries. Legal frameworks should catch the speed of electronic banking in order to protect consumer, banking system, and transparency, and bank's responsibility in this field should be defined clearly and sanctions should be deterrent (Weber, 2010).

The risks inherent to electronic banking activities should be defined clearly and updated and measures should be regulated by the banking regulatory and supervisory agencies. These agencies supervision frequency and technology should be improved. First of all, the legislation related to electronic banking should consider bank and consumer relations while it is very loose because of the complex and changing structure of the electronic activities.

Banks should be more responsible while providing their products and services, in the customer information process regarding the banking activities, secure their IT systems, update them according to the emerging technologies and test all their electronic activities before applying them.

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Chapter 79
A New Macroeconomic Architecture for the Stock Market:
A General-System and Cybernetic Approach

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ABSTRACT

The old idea of segmented macroeconomics of the financial sector competing with the real economy is replaced by a new model, which manifests strong interaction, integration and co-evolution by circular causation relations between the monetary sector and the real economy with the bridging function of finance and financial instruments. The Money, Finance, Spending and Real Economy (MFSRE) model emerges. This model formalizes the new architecture for the macroeconomy, and its relationship to the stock market. In this model relating to a reconstructed state of the economy and the emergent structure of the financial architecture, money and spending are treated as complementary elements of growth and development. The overarching structure in the end is the MFSRE with its extensively complementary inter-variables relationship in a general system and cybernetic form of interrelationships. The economic organization of the MFSRE causes price stabilization and economic growth and development. These are signified in the social wellbeing criterion of the good economy. The stock market, exemplified by the empirical case study of Bangladesh's state of the economy and the Dhaka Stock Exchange, bring out the true example of the macroeconomic analysis. The new financial architecture with its stabilization, sustainability and growth and wellbeing as basic-needs regime of development is contrasted with old macroeconomic belief and policies based on outmoded macroeconomic beliefs and futures.

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INTRODUCTION

Stock market turnover rates, yields, yield rates, and stability are indicators of the health of the economy for those countries that depend upon such a financial institution. But it is not such an important support system for an economy that does not have stock market, and does not need one. Instead they depend upon real asset pricing mechanism for measuring the economic and social standards. The stock market is then not an essential institution to act as a barometer of economic change. But these two opposite views tell a much larger story about the economic processes and their social effects. Meera (2004, p. 59) puts the emptiness of the casino barometer of a stock market and its underlying financial system in value formation in the following words: "Financial institutions create money out of nothing but lend it out of interest. This characteristic of fiat money called seigniorage is at the root of financial crisis, monetary instability, and unjustness. The fractional reserve requirement also makes possible the creation of additional money through multiple deposit creation. All this has brought about huge volumes of liquidity in the global monetary system, which is responsible for the huge asset price bubbles faced in many countries."

To investigate into these opposite views regarding the financial system with or without stock market we note what lies behind stock market in the organization of asset valuation to protect the wealth of savers and to contribute to and reinforce the relationship that money and finance has with the real economy. Furthermore, stock market stability also requires inflation targeting and a participatory form of development model for the protection and wellbeing of the marginal savers. The ethical principle here linked with the economic objective is derived from Rawls' Difference Principle (1971) as an example. On the point of national wellbeing Rawls wrote (op cit, p. 14-15):"… inequalities of wealth and authority are just only if they result in compensating benefit for everyone, and in particular for the least advantaged members of society." The moral theme underlying the Difference Principle is equally applicable to the purpose of financial stability and social and economic measurement of wealth. The question then stands whether stock markets can deliver such a concept of wellbeing. Likewise, we need to ask whether there is an alternative economic and socially productive activity that establishes the total wellbeing criterion for the nation.

And on this objective issue the structural changes linked with stock market and alternative financial institutions also invoke the nature of participatory role between central bank and commercial bank on the matter of money, finance and real economy complementary relationships. On this issue Mishkin (2007a, p. 55) presents his view: "First, it (central bank) should advocate a change in its mandate to put price stability as the overriding, long-run goal of monetary policy. Second, it should advocate that the price stability goal should be made explicit…. Third, the Fed should produce an 'Inflation Report' … that clearly explains its strategy for monetary policy and how well it has been doing in achieving its announced inflation goal."

Furthermore, the issues of monetary relations involving central bank and commercial banks, and inflation targeting to stabilize prices also invoke the study of asset pricing mechanism for the common good on the wellbeing side. On this asset-pricing issue for inflation targeting Mishkin (2007b, p. 59) emphasizes the use of monetary policy for the stabilization of stock market fluctuations. He points out the importance of regulating the monetary policy effect on inflation targeting so that stock market effects on investment as a major form of spending (fiscal side) remains well maintained. Besides this there is need to maintain the transmission effect of stock market changes on household liquidity and household wealth.

Objective

Firstly, a combination of the above-mentioned socio-economic problems faced by the prevalent monetary, financial, and real economy relations is summarized in analyzing the causes of stock market turmoil. Next, the formalization of a new financial architecture with participatory linkages requires development and application of a revolutionary new form of model that is epistemologically premised on unity of knowledge. From the formalism of the new financial architecture comes out the problems of economy and society discussed above. These comprise firstly, the nature of functional relations between money, finance and real economy that leads to price stabilization, economic growth, monetary and fiscal expansion with appropriate financial instruments.

Secondly, there ought to be a dynamic basic-needs regime of development that can bring about, and that springs from the prescribed model of participative inter-relations between money, finance, and the real economy.

Thirdly, in the resulting kind of the sectorally unified model of inter-causal relations the issues of asset valuation, economic diversification, and central bank-commercial banking relations need to be designed. Fourthly, the social wellbeing implications of the emergent money, finance and real economy relations need to be evaluated in the midst of the complementary scenario of ethics and economics. In all, the emergent money, finance and real economy relationship with all the inter-variable relations between them and involving the ethical, economic and financial dimensions make up a systemic order of ethico-economic integration. We will refer to such inter-causal relations with ethics embedded in that system as the endogenous effect of ethics in the systemic context. We will infer from the analytical results of the systemic model of money, finance, and real economy how stock market stabilization by alternative design can be attained. The stabilization we will be searching for will comprise the dynamic inter-variable relations with money circulations. It will be shown how a select portfolio of financial instruments can be effective in resource mobilization of the financial and physical kinds.

Finally, we will discuss how the spending goals, productivity, technological change, and economic diversification obtained through over inter-variable participation can become effectual. The policy and structural consequences of such systemic interrelations in economic stabilization will be explained.

A REVIEW OF THE LITERATURE

Mark Blaug on Monetarism (Friedman) and Fiscalism (Keynes)

The origin of financial architecture for the stock market arises from the nature and function of money and spending and then takes the course to other critical directions relating to such inter-causal relations. This topic is cast in the incisive words of Mark Blaug (1993, p. 29):"The great debate between Keynesians and monetarists over the respective potency of fiscal and monetary policy has divided the economic profession, accumulating what is by now a simply enormous literature."

From such critical observations in the history of economic thought it is clear that financial instruments are to be appointed as ways of mobilizing financial resources into productive activity. Yet because of the relationship that arises between money and real resources by the nature of financial instruments and the institutional function of money with spending (fiscalism), the stock market acquires its specific meaning relating to such relations. If the relations implied here between money, finance and real economy along with the broader perspective of wellbeing are not proper, then instability and volatility causing loss in the wealth of shareholders and individuals disturb the stock market. The result then becomes an unwanted development in the economic system for

preserving the efficiency, productivity, stability, and wellbeing that ought otherwise to be engendered by a good non-banking financial institution.

We examine this conflict between monetary and fiscal (spending) regimes and policies defying steady-state equilibrium in Figure 1. Neither Keynes nor Friedman were restful with the idea of steady-state equilibrium with learning behavior caused by interaction between choices of monetary, fiscal (spending), innovative, productive and uncertainty in a changing economic system. Such an economic system remains permanently embedded in the social order. The result is a social political economy (Holton, 1992; Parsons, 1964; Parson & Spenser, 1956).

Consequently, monetary expansion joins with fiscal (real economy spending) expansion and gets interactively causal with productivity, economic growth and prices.[1] Figure 1 points out that a deflationary regime of (P,G) remains permanent in the monetarist regime, although it is denied by Keynesian in a productively expanding economy caused by spending (fiscalism). It is unknown where exactly the conflict between monetarism and fiscalism commences near to the full-employment of (P,G). There is no precise point for this. Hence the (P,G)-points becomes a random point in the probabilistic field of many such possible points defined by the intersections of Aggregate Supply (AS) and Aggregate Demand (AD) curves. Thereby, there exists a family of aggregate supply curves (monetarism) and deflated (P,G)-points shown by E_1, E_2, …, E_n, etc

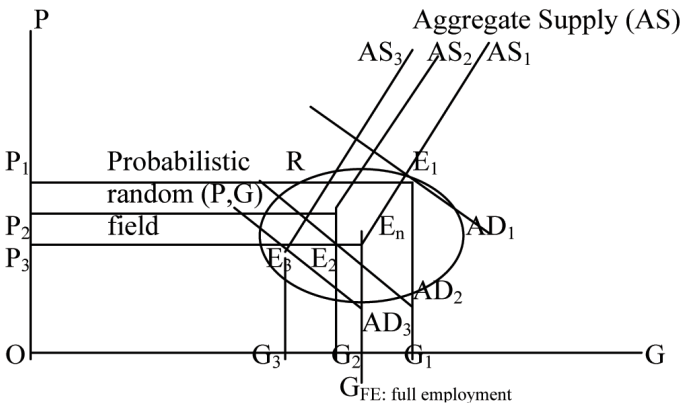
In the end, the joint effects of monetarist and fiscal regimes cause perturbations, instability, volatility, and drawdown of productivity in random fields of (P,G)-points in the deflationary domain denoted by R (Choudhury, 2011, 2012).

The price level and growth of output are macroeconomic variables. However, if stock market is considered to be a key signal of economic change then a significant weight is attached to stock market prices and yields. Consequently, stock market (P,G)-values adversely affect all other (P,G)-values. Thereby the macroeconomic indicators of (P,G) are affected.

Mishkin on Stock Market Stability via Inter-Causality Between Money, Finance and Real Economy

First we note the following mono-causal relationship explained by Mishkin in respect of monetary, fiscal, interest rate, and selected wellbeing variable (employment, E):

Figure 1. Deflationary effect in probabilistic random field of (P,G)-values under monetarist and fiscal expansion



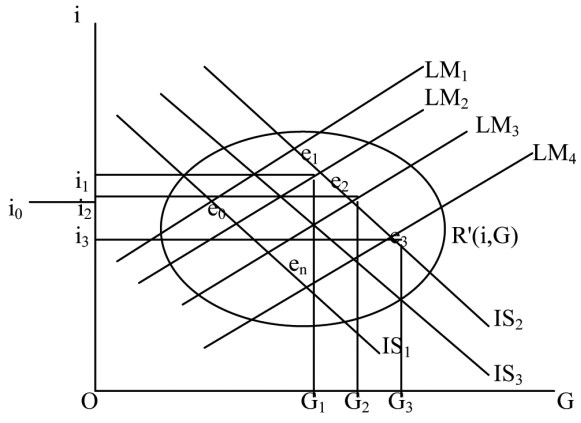
[M↑inclusive of f↑]⇒[random variations (r,c)]⇒ [Deflationary effects on{(P,G) ⇒E] (1)

where, M denotes the quantity of money in circulation; f denotes the fiscal (spending) variables; r denotes real rate of interest; c denotes discount rate; and E denotes employment.

In reference to Figure 1 we note that the bracketed term, [M↑inclusive of f↑], causes volatility and instability in the random probabilistic field R, as shown and explained. Besides, the resulting randomness in (P,G)-probabilistic field also causes productivity to stall and employment to become unstable, as between short-term and long-term employment uncertainties. The principal cause of such randomness and unpredictable behavior of the economic and financial sectors is the variations between short-term and long-term real interest rates and discount rates (r,c). Such variations in r reflect upon the random relations between M and f. The predominance of the stock market on all such variables reigns as the determining factor of economic instability and financial market volatility.

Figure 2 explains the above points. Using the simple version of the macroeconomic IS-LM curve we note the transference of the random probabilistic field R from Figure 1 to Figure 2 denoted by R' that is now characterized by random equilibrium points such as e_0, e_1, e_2, …, e_n etc. The random (r,c) effects are shown to be contained in R' as the domain of (G,r,c)-points. In the 2-dimensional diagram average values of r and c are used and denoted by 'i'.

Figure 2. Instability of (i,G)-domain with expansionary monetary and fiscal (spending regimes)



The Contest between the Classical, Monetarist, and Fiscalist (Spending) Views of Economic Regimes

Underlying the conflicting effects on price stabilization, economic growth, productive expansion of the economy, and socioeconomic wellbeing, is the absence of complementarities between these goals, and how they can be attained in a consistent and participative way by market-polity integration. The classicists, upon who followed the new classical school, the focus of economic organization was on the market process. Consequently, monetary policy and market process formed the backbone of private sector development. An expansionary monetary policy was found to reduce the real rate of interest. A lower rate of interest ought to stimulate the economy into higher output. But our arguments given above point out that, even though real output would increase by an expansion of real monetary aggregate, this would be at the expense of increasing prices and increasing real rate of interest. Thereby, the increase in real output is adversely dampened by the joint increases in inflation and real interest rate, the very two horns of the evil economic monster. The effects of monetary regimes on the expansion of the real economy, that is the private sector, cannot be sustained under such adverse price and interest rate effects.[2]

The Austrian School of Economics was the champion of the classical school of monetary phenomenon. It promoted private monetary unit, the laissez faire concept of this monetary unit as a private regulated commodity of market exchange, and the short-term as opposed to the long-run

effectiveness of monetary policy in mobilizing financial resources particularly for reducing unemployment and creating employment. On this matter Hayek (1999, p. 236) wrote: "I think it is very urgent that it becomes rapidly understood that there is no justification in history of the existing position of a government monopoly of issuing money."

Hayek's vision of private unit of currency value is echoed by leading exponents of the Austrian Economic School. On a similar note Ludwig von Mises (1981, p. 478) wrote: "Money is the commonly used medium of exchange. It is a market phenomenon. Its sphere is that of business transacted by individual or groups of individuals within a society based on private ownership of the means of production and the division of labor." The Austrian School as a great champion of the free market economic order promoted monetary regime over fiscal regime or spending regime including Government expenditure for the public good. According to the Austrian School voiced by von Mises (op cit p. 479), economic destabilization caused by inflationary pressure was due to the role of Government in trying to stimulate the economy with unwanted spending, when contrarily market correction should take care of the adjustment process to establish market equilibrium, and thereby, stable prices. Thus the role of spending regime by including government expenditure was not brought into a complementary relationship with monetary regime.

On this point von Mises (op cit, p. 481) wrote an important note on the market adjustment process of monetary aggregate on which the least role of Government interference, and thereby fiscal policy control, need to be exercised: "The main thing is that the government should no longer be in a position to increase the quantity of money in circulation and the amount of checkbook money – that is 100 percent – covered by deposits paid in by the public." This appears as an important point to note on the most efficacious and non-inflationary effect of monetary regime in a market economy.

However, the fiscal role of government expenditure to drive money into the productive directions of private sector as Keynesian would have desired, is kept outside of the equation of money and spending with productive and technological change at stable prices and increasing real output. This point has remained an unresolved approach in completing the important factors of progress. These are namely, price stability, increase in real output, decline or replacement of interest rates by inflationary targeting alternative, factor productivity and elastic full-employment point, technological change, and social wellbeing as a combination of market and non-market forces, regimes and policies. All these factors together configure the total resource mobilization under dynamic conditions of socioeconomic change.

The laissez faire monetary theory is projected in the writings of Yeager (1997, p. 412-13) whose striking words in this regard are as follows: "Government would be banished from any role in the monetary system other than that of defining a unit of account or *numeraire*. We envisage a unit defined in a bundle of goods and services comprehensive enough for the general level of prices quoted in it to be practically steady." Such a laissez faire conception of monetary exchange in concert with market exchange in real goods and services while an effective way of connecting money with the real economy, it puts ultimate independence of such monetary regime from government interference and governance that would otherwise come about by the presence of spending including government and private spending. The wellbeing objective and sustained economic stabilization by complementarities between the monetary regime and the fiscal (spending) regime as of markets and governments by their complementary roles is not targeted in the laissez faire conception of money and markets. Markets are upheld as the ultimate arbitrator of economic stabilization, growth and productivity generated by technological change.

From the above review of the literature one finds that monetarist approach is predominant

in the development of the market process and the private sector. It should then be obvious that the spending regime should combine with the monetarist regime to accelerate the process of market freedom but within the reigns of regulation and controls when the market process becomes destabilizing. The monetarists did not believe in such possibility. Thus monetarism remained disjoint from the spending regimes including government spending, budgetary controls, taxation and resource redistribution. It is obvious that in the absence of fiscal regime to complement with money circulation no fresh productivity of factor inputs, innovation and technological advance can be generated.

Consequently, by leaving the two policies and regimes separate of each other the prospect of economic stabilization with price, real output growth, and lower interest rate remains at best a short-run case. The long-run stabilization is unattainable by the use of any of the two policies and regimes. Thereby, sustainability, which is a long-run target of economic stabilization, is not attained by the use of any of the two policies. This is an economic fact based on the scarcity of resources in the long-run that causes aggregate demand pressures to destabilize the (P,Y,r)-relationship. Also it is a political fact by virtue of the case that the opposite economic and policy perspectives govern the elected party in their short-term lives. These points are brought out by Farmer (2010). Farmer (2010, p. 19) writes on the political versus market adjustment of the non-inflationary stabilization problem: "I take the idea that a sound theory must explain how individuals behave and how their collective choices determine aggregate outcomes. From Keynesian economics, I take the idea that markets do not always work well and that sometimes capitalism needs some guidance. These ideas form a coherent new paradigm for macroeconomics in the twenty-first century."

We argue in this paper that Governments are subjected to participatory relationship with the private sector as two sides of the same coin. These together aim at attaining economic stabilization, productivity and growth, assimilation of technological change, and bring about social wellbeing. Consequently, the economic, social and ethical goals are mutually inter-causal and thus embedded by organic relationship in the same general system of interrelations. In this way, the political agenda of control and guidance to stem the unwanted market situation is left to the assimilation of knowledge and learning in an evolutionary and civil system of public and private sector understanding through the participatory heart and mind of the social community. Such is a maturing community, whose gaze is attaining the goal that Foucault (see Dreyfus & Rabinow, 1983) referred to as a discursive society. Its totality of mature understanding in the framework of organic unity of relations is Foucault's usage of the word Episteme.[3]

Mainstream Consequences of Monetary and Fiscal Regimes Concerning Wellbeing, Money, Spending, Output, Prices, Employment, and Productivity by Technological Change

We can summarize the results of our succinct review of the literature in respect of the prevailing state of relationship between monetary and fiscal regimes across the great divide for the attainment of socioeconomic wellbeing by way of economic stabilization, economic growth, and technological change with productivity. We define this comprehensive objective function as a wellbeing criterion denoted by W(.) as follows:

$$W = W(y,p,M,F,r,\rho,\theta) \qquad (2)$$

where Y denotes real output; p denotes the price level; M denotes the quantity of money; F denotes spending; r denotes the real rate of interest; ρ denotes productivity of factors; and θ denotes technological change.

$$dW/d\theta = [(\partial W/\partial y),(dy/d\theta)]^{+} + [(\partial W/\partial p).(dp/d\theta)]^{\pm} + [(\partial W/\partial M).(dM/d\theta)]^{\pm} + [(\partial W/\partial F).(dF/d\theta)]^{\pm} + [(\partial W/\partial r).(dr/d\theta)]^{\pm} + [(\partial W/\partial \rho).(d\rho/d\theta)]^{+} + (\partial W/\partial \theta)^{+} \quad (3)$$

Our discussion in respect of the prevailing state of the given interrelations between variables point out that an overly dependence on monetary regime without complementarities with fiscal (spending) regime causes technology to be exogenous. Consequently, the simultaneous expansion of monetary and fiscal (spending) regimes is not considered in the light of what Myrdal (1957, 1958) referred to as circular causation relations between the variables signifying growth and development mentioned in this section. Likewise, there is a similar discussion by Young (1928) on the need for simultaneous interrelations between the variables. The same argument is launched against the prescription of fiscal (spending) regime. Consequently, as Blaug has pointed out, the monetary and fiscal (spending) regimes in macroeconomic stabilization and coordination have remain opposed to each other, in as much as also the private sector and public sector focus of monetary and spending regimes, respectively, remain opposed to each other.

The result of such dichotomous consequences in macroeconomic theory shows up in the indeterminate signs of the changes in the (p,M,F,θ)-variables by the exogenous effect of technological change. Since such exogenous technological change is positively related to factor productivities, therefore, the effects of M and F remain exogenous on factor productivities. The growth of output, and along with this the dynamics of employment, remain neutral to technological change and productivity growth in the long-run. That is, sustainability of economic stabilization, growth and policy coordination cannot be attained together.

In the end, since technological change denoted by θ remains exogenous to every variable in the category (y,p,M,F,u,ρ) in respect of price stabilization with increasing output, therefore, there cannot exist macroeconomic coordination between M and F regimes in the direction of non-inflationary economic growth. This result was brought out in Figure 1.

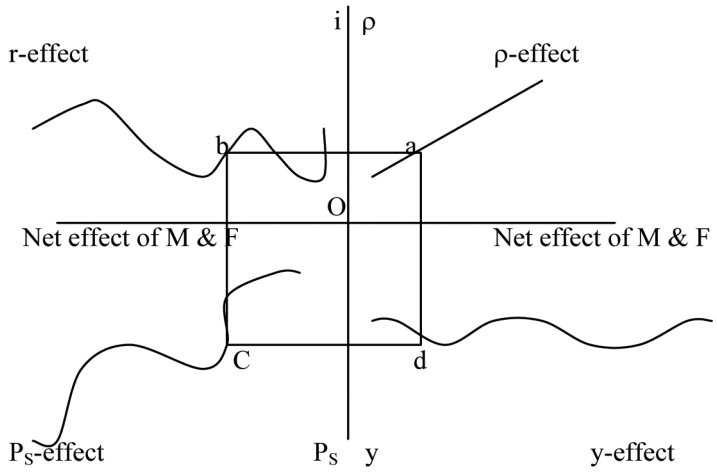
The Effects of Exogeneity between Monetary and Spending Regimes on the Stock Market

It was pointed out that if the stock market was assumed to play a significant role in economic growth, the stock market will assume a high weight in the average price level. Consequently, the exogenous effect of technological change on the variables causing non-sustainability of price stabilization and economic growth will also show up in the stock prices. The inability in holding on to stable prices in the field shown in Figures 1 and 2 now establishes a volatile relationship between stock prices and the variations in the real rate of interest. That is, the indeterminacy of nominal interest rate in the domain shown in Figure 2, will intensify the volatility of the stock price.[4]

Furthermore, as bonds and stocks represent a mirror image of the quantity of money in supply, therefore, variations in the bond and stock prices in the portfolio of financial assets cause volatility in short-term rates of interest. In the world financial markets the volatility of short-term interest-rates has been the cause of stock market volatility. Such variations in turn are the causes of intense degrees of speculation in the stock market with bonds and stocks backed mainly by financial papers. The ultimate result of such volatile movements of stock prices and short-term interest rates is a flight of capital away from the real sector to the financial sector under the force of financial speculation.

The relationship between the (y,p,M,F,i,u,ρ)-variables under the impact of exogenous technological change can be shown in Figure 3. The exogenous effect of θ on these curves will be certain shifts that remain an empirical fact. There is no exact direction of the shifts. For example, an upward shift of the y-curve could mean an upward shift of the predominant stock price curve P_S, but

Figure 3. Interrelationships between the (y,p,M,F,i,u,ρ) variables under exogenous technological change affecting productivity and net effect of monetary and spending (fiscal) regimes



a lower or higher net result on the r-curve caused by the joint effect of the monetary and spending (fiscal) curves.

Likewise, the productivity curve could shift upward along with the upward shift of r-curve due to the net effect of M and F curves on the income multiplier causing y curve to shift but at the expense of inflationary regime. The unemployment (u) effect will be similar to the y-effect at the long-run evolution of y to its full-employment level with uncertain net effect concerning M and F regimes. In the short-run the same M and F joint effect will yield an accelerated convergence towards full-employment followed by price pressure at the long-run neutrality between M and F and y along the classical version of the aggregate supply curve of output (Friedman, 1960, 1989).

On the other hand, the responses to the various variables to variations in i-variable can be shown by the following expression. The variable u will follow the same form of a random trend along with y under the net volatile effects of M and F and the y-variable and p-variable:

$$dW/di = [(\partial W/\partial y).(dy/di)]^{-} + [(\partial W/\partial p).(dp/di)]^{\pm} + \{[(\partial W/\partial M).(dM/di)]^{-} + [(\partial W/\partial F).(dF/di)]^{+}\}^{\pm} + [(\partial W/\partial i)]^{-} + [(\partial W/\partial \rho).(d\rho/di)]^{-} \quad (4)$$

Expression (4) shows that the net random (volatility) effect of variations in i depends strongly on the variations in $(dp/di)^{\pm}$ and $\{.\}^{\pm}$. Here, by the predominating effect, $p = P_S$. The same kind of random effects are transmitted to the wellbeing function through the other volatility effects.

How to Stabilize the Economy from the Deleterious Effects of Stock Market Volatility with Knowledge-Induced (y,p,M,F,i,u,ρ)[θ] Variables

The principal objective and the contribution of this paper are to develop a theory of complementarities between monetary and fiscal regimes in the light of circular causal (or inter-causal) relationships between the variables mentioned here. The implications are that M-F complementarities are formed by and result in (circular causation) complementarities and endogenous interrelationships between all the variables. The exception is the replacement of interest rates and interest-bearing financial instruments by trade-related instruments. This is the meaning of the M and F complementarities that enable unified interrelationships between money (M), spending

(F), finance (f), and real economy (y,p,u,ρ). We refer to the emergent model as MSFRE-model.

The emergent inter-causal relationships between all the variables in the presence of technological change and gains of productivity while replacing interest-bearing financial instruments with trade-related ones is an evolutionary learning phenomenon. Evolutionary learning is established by an epistemic view of circular causal relations in terms of systemic unity of knowledge (Maturana & Varela, 1987).

In economic terms there is an opposite movement between trade-related instruments (f) and interest rate caused by bank-savings. Bank savings cause withholding of financial resources from the real economy, while they are driven to interest-bearing opposites. Contrarily, if savings are continuously converted into productive spending by way of investment and consumption, then Savings = Spending always. An amount of savings in the bank is converted continuously into spending by way of engaging the productive process and market forces. Government integrates with the market process via specific joint ventures. This relationship yields the micro-money concept and it equates to the value of spending in the perfectly market trading venue. Government becomes an agent of market catalysis.

Consequently, the following results would hold: M.V = P.Y = Spending in nominal terms of price P and real income Y. Here $k = 1/V \rightarrow 1$ as $V \rightarrow 100$ per cent. That is, the equivalence between money and spending (fiscalism) becomes perfect when the circulation of a quantity of money is project-specific through-out the economy. This is similar to the Austrian concept of laissez faire concept of money. But in our case, the progress towards this perfect equality is through the activity of trade replacing interest rate. That is, savings are converted continuously into spending. Banks are to mobilize savings, not to hold them back -- even for future use. That is because the withdrawal of potential savings from being mobilized causes the output to remain below the potential level.[5] This is a continuous phenomenon in an economy that depends on interest rates as the basis of capital accumulation through bank savings. Keynesian idea of bank savings is based on such withdrawals from the real economy (Ventelou, 2005).

The further result is this: The necessary complementarities between the variables $\{y,p,M,F,f,u,\rho\}[\theta]$, mean that all these variables are positively complementary in respect of the systemic knowledge variable denoted by θ. This is an epistemological issue in unity of knowledge. In the real domain it is expressed by continuous reinforcing complementarities. Such unity of knowledge manifest by pervasive complementarities can be attained only by the action of θ on all the variables. Hence θ is of the epistemic category in unity of systemic knowledge. In fact, θ is equivalent to wellbeing, for it represents the continued cause and effect of interaction and integration forming into unity of systemic knowledge across evolutionary learning, as reconstructed interrelations proceed between the interacting and integrating variables.

The epistemic consequences are independent of time. Time is replaced by knowledge as the explanatory factor of dynamics and change. Time is treated as datum for purposes of recording the state of complementarities by endogenous forces, in which policies such as M and F and f participate.

The Generalized MSFRE Model of Unity of Knowledge

First Stage: Estimation of the Circular Causation Relations

Let **x** denote the vector $\{y,p,M,F,f,u,\rho,\theta\}$. In this every variable is induced by θ-values. Let an element $x_i \in \{y^1,p^2,M^3,F^4,f^5,u^6,\rho^7,\theta^8\}$, $i = 1,2,\ldots,8$ as marked out against the variables.

Complementary (inter-) relations between the variables imply:

$$x_i = f_i(\mathbf{x}_i'), \qquad (5)$$

where x_i' is an element of x excluding the particular x_i.

$$\theta = F(\mathbf{x}), \tag{6}$$

θ is thus a monotonic transformation of W(**x**). Hence it is itself a wellbeing criterion (Henderson and Quandt, 1971). θ-values are ranked by examining the state of complementarities as they ought to be (note otherwise the negative relationship between i and all the other variables).

Second Stage: Simulation of the Circular Causation Relations

The estimated coefficients of the system of Equations (5) and (6) are next simulated by giving them improved (revised) values to normatively aim for better levels of complementarities. Such selections are set by institutional discourse and policy measures.

The simulated θ-value then results as a function in the simulated **x**-values, say **x**^. All other symbols abide in their simulated forms.

The simulated system corresponding to (5) and (6) is,

$$x^_i = f_i(\mathbf{x}^_i') \tag{7}$$

$$\theta^ = F(\mathbf{x}^) \tag{8}$$

Such estimations and simulations will continue on over new sets of time-series or cross-sectional data. As well as, algorithmically the simulations can be continued on in reiterative processes.

Third Stage: Money, Spending (Fiscalism) and Real Economy Equivalences

$MV = PY$, as $V \rightarrow 1$,

with θ↑ (algorithmic simulation) resulting in,

$$M = PY. \tag{9}$$

Thus systemic unity of knowledge as episteme continuously simulates the circular causation relations with increasingly ranked θ-values in the case of a 100 per cent mobilization of micro-money circulation in real assets across the economy. A microeconomic (project-specific) outlook to macroeconomic aggregate of the strictly M1 (money supply) and liquidity type (money demand) is implied.

The principal hinge pin of the entire simulation by circular causation premised on unity of knowledge as the episteme underlying reiterative θ-values in complementary socio-economic inter-variables relations is the replacement of interest-bearing financial instruments by trade-related instruments. This in turn means the replacement of savings as financial withdrawal by banks from the real economy, by mobilization of savings into productive spending instead. Money is thereby mobilized into the real economy by using the appropriate trade-related financial instruments. The MSFRE model is now formulated by Equations (5)-(8) in continuity of evolutionary learning and/or by continued sequences of estimation and simulation over time-series and cross-sectional data.

Thus an important contribution of this paper is also to note the empirical basis of estimating and simulating the MSFRE by circular causation relations in epistemic reference. This is to extend the theory of circular causation and cumulative causation beyond Myrdal (op cit), Young (op cit) and Kaldor (Kaldor, 1975; see Toner, 1999).

The Stock Market in the Circular Causation Theory of MSFRE

The stock market phenomenon appears as a question: Is the stock market a logically acceptable financial institution in the MSFRE model? The answer centers on the fact that the MSFRE mobilizes financial resources only into real economic activity. The financial instruments therefore, are

simply endogenous mappings between the monetary and real economy via the circular causation relations between these sectors. The financial assets are now tied endogenously to real assets that are valued in financial terms and in which all forms of resources are mobilized. Financial assets lose their relevance to bank-savings in interest-bearing instruments.

In the presence of portfolios of real assets, real market exchange (trade) performs the sole function of valuation. Consequently, there is no speculation in such markets to generate wealth and capitalization. Price stability and responsiveness to sustainability as long-run phenomenon complementing the variables by their systemic evolutionary learning (θ-effect) establishes a dynamic basic-needs regime of development under the impact of appropriate technology (ρ) induced by θ.

Mishan's categorization of systemic interrelations for the MSFRE model can be formulated by the following chain relation:

$$[M\uparrow\Leftrightarrow F\uparrow\Leftrightarrow f\uparrow\Leftrightarrow r\downarrow\Leftrightarrow c\downarrow\Leftrightarrow \text{yields}\uparrow\text{but stabilizes}\Leftrightarrow (P\hat{}\rightarrow 0)\Leftrightarrow y\uparrow\Leftrightarrow u\downarrow\Leftrightarrow\rho\uparrow][\theta\uparrow] \quad (10)$$

⇔ implies circular causation of any one variable with the remaining variables, all being induced by evolutionary learning as systemic unity of knowledge between the variables, even as simulation is carried out with increasing θ-ranked values.

The emergence of basic-needs regime of development spells out the attained levels of wellbeing by the social choice of the 'good things of life'. In it the wellbeing function is simulated under the condition of pervasively complementary relations between the variables as shown, but with the key negative relationship with r and c. It is now logical that price stability will be maintained as output increases in the full MSFRE model.

Now in the absence of any need to have a capital market in the MSFRE form of the dynamic basic-needs regime of development, speculation and independence of the financial sector disappears. Volatility of the financial and economic sectors is annulled. The resulting regime reflects ethical integration with the socioeconomic basic-needs development regime (Streeten, 1981). We have thus established the conformable, sustainable, and complementary circular causation relations with the epistemic choice of knowledge-induced variables through simulation of wellbeing in the MSFRE model taken up in its entirety.

A Casual Reference to MSFRE Model in the Open Economy

The MSFRE model cogently maintains its consistency and completeness in the open economy case. Very briefly speaking, the foreign direct investments are now diverted away from portfolio (liquidity) investments (savings) into the real economy. The exchange rate mechanism is now determined by productivity spelled out by terms-of- trade.[6] Improving terms-of-trade depend upon effective diversification, productive transformation, and trade-orientation along the *dynamic* basic-needs regime of development. Price stability also stabilizes the terms-of-trade along with price stability. Stock markets are now segmented between the financial products and the real market exchange. Global economic integration of the real markets is causally related with the momentum of technological advance, productivity, and factor prices, prices of goods and services, fair terms-of-trade, and exchange rates.

Inter-country capital mobility occurs by way of resource mobilization into productive spending in the dynamic basic-needs regime of development through market integration in the MSFRE model applied to real markets. Money is now mobilized as financial resource by appropriate participatory financial instruments into the real economy. In these respects appropriate participatory financial instruments such as, equity participation, joint venture, trade financing, co-financing, and profit-sharing are used in a phased out situation

of interest-rate and exchange rate mechanism. Inflation targeting is thereby encouraged but within the dynamics of the MSFRE model.

In the end, along with economic stabilization effective terms-of-trade and exchange rate stabilization occurs. This facilitates foreign trade and free flow of tradable goods, resources and services between countries. Along with such free flows in goods and services, capital flow liberalizes in terms of joint ventures, equity participation, co-financing, trade-financing, and profit-sharing ventures. Capital formation now becomes a productive process in the dynamic basic-needs regime of development of the MSFRE model.

The relevance of stock market is now relegated to the above kind of function of maintaining economic stabilization and wellbeing. But to maintain such sustainable future knowledge induction on the continuity of such a process is required. Such evolutionary sustained and systemic learning is the result of the epistemic θ-induction. It requires participatory dynamics integrating together the public and private sectors and the global economic community (Commission on Global Governance, 1995). Formation of such participatory future, which is the result of circular causation between interacting and integrating agencies that are receptive to evolutionary learning in the unification experience, is an example of systemic unification of knowledge.

Empirical Issues: Stock Market and Macroeconomic Indicators-Case of Bangladesh Stock Market Near Financial Collapse

The prevailing reasoning in economic theory relating to the financial sector as a necessary one for a modern economy has disengaged various sectors of the economy on the face of a volatile stock market that inherits the dissociated and competing nature of the economy instead of a complementary one. We take the case of Bangladesh where the stock market volatility neared financial crash. This brought agony to the shareholders, most of whom are marginal savers led away to raise capital from the stock market to become rich by easy buck. But the dream was dashed.

Stock market turmoil started in Bangladesh near to 1210 after a resilient performance in earlier years. The causes cannot be attributed to fluctuations in short-term interest rates, because the discount rate of Bangladesh Bank remained fixed at 5 per cent throughout the period 2006 t0 2009, for which data are available (Table 1).

Instead of fluctuation in short-term interest rates as the cause of stock market volatility the data near to the year of capital-market turmoil in Bangladesh point out that in spite of a slight easing in the rate of inflation the rate of change in manufacturing GDP as a share of total GDP declined

Table 1. Some critical economic indicators to analyze Bangladesh stock market volatility

Years	Manufacturing GDP as % Share of Total GDP (%)	Growth Rate of % Share of Manufact GDP (%)	Inflation Rate (% Change of CPI) (%)	Rate of Change in Debt-Burden (% rate of Change in External Debt)	M1 as Percentage of Total Monetary Exposure (%)
2006	17.21	4.11	6.73	8.98	79.87
2007	17.77	3.25	9.10	6.31	79.32
2008	17.55	0.45	8.90	7.46	80.34
2009	17.87	0.11	5.42	4.08	77.04

Discount rate was held at 5% throughout this time period.
Source: Statistical, Economic, and Social Research for Islamic Countries (SESRIC) database.

throughout the period. This implies that adequate diversification of the Bangladesh economy in the direction of increasing manufacturing did not occur. Hence the total productivity in Bangladesh did not show the resilience that should be expected by manufacturing diversification. Diversification here is shown by the rate of change of the percentage share of manufacturing GDP. This remained low and declining on the time-trend.

The debt syndrome was also a factor in the stock market volatility. On a trend, the growth rate of external debt outstanding remained high, around an average annual of 6.71 percentage between 2006 and 2009. Thus external flow of investments and global confidence on Dhaka stock market remained weak. The only way to resuscitate the failing stock market was external remittances. This also indicated an unproductive use of remittances in the face of a failing diversification, and thereby productivity of the manufacturing sector.

It is then questionable why the stock prices of most companies in Bangladesh nose-dived as explained later. By mutual exclusion of the above factors by virtue of the data in Figure 2, it is probable that the main cause of the downturn was the lack of diversification and real sector productivity, and the debt problem in Bangladesh economy. Consequently, there was weakening link between the monetary sector and the real economic sector. This fact is further indicated by the continued high percentage distribution of Quasi Money (= Total Quantity of Money – M1) compared to the low percentage of M1. The meaning here is that real money did not flow into the real economy to generate output and thereby productivity. Much of the monetary aggregates in the form of quasi-money were locked in financial savings without a productive backing -- only to increase by interest income. Stock market was a key non-banking sector that used the savings of the banking sector on the basis of financial interest returns. This is sheer speculation intensity in the monetary usage. Whereas, what ought to have been the case of stabilization by and for sustainability would be the complementary linkage between money (i.e. M1), the financial sector (thus banks and stock markets), and the real economy (productivity and economic diversification).

The result of such sectoral segmentation in the otherwise much needed money, finance, and real economy complementary linkages, caused eroding confidence in the investors. Consequently, a flight of capital took place out of Bangladesh stock market. Those who could illegally transfer money out of stock market into the foreign holdings benefited from their corrupt practices at the expense of the marginal savers in the Dhaka stock market.

True asset pricing that would depend most significantly on economic productivity and diversity that are caused by sustained linkages between the monetary sector, the financial sector, and the real economy failed to exist. Thus it is the link between these sectors that otherwise is fundamental for the stabilization and sustainability of the economy and its growing resilience. The stock market became the Achilles' heel for Dhaka stock market volatility and its near dissolution close to the year 2010.

To come out of the erosion of investor confidence, and to restore confidence by the systemic signs of stabilization and sustainability, the state of the economy reflected in the kind of stock market model would be to pursue complementary linkages between the monetary sector and the real economy by means of appropriate financial instruments. The Bangladeshi foreign remittances can then be utilized in investments that would respond to the productivity gains generated by the complementary linkages causing diversification.

This paper therefore developed a generalized system and cybernetic model in the form of a complementary inter-sectoral participative model. The model while being of a system and cybernetic type is also deeply structural and strategic in nature. It invokes fundamental changes that remain embedded by the robust effect of mon-

etary policy, central bank and commercial bank relations, and the responses of the real economy to productive spending in order to support the development of diversified productive projects. Financial instruments that systemically reduce speculation and replace it by increasing levels of financial mobilization are the appropriate ones. We refer to such a participative and inter-sectoral complementary model of money, finance, and real economy linkages as the MFRE model (Mufeedh Choudhury, 2009).

An example of Dhaka Stock Exchange trade summary for February 16, 2012 points out the following picture on stock market volatility: 82 listed firms reported positive net percentage change for the trading day. 185 listed firms reported non-positive net percentage change for the same trading day. The total net percentage change was -161.68%.

CONCLUSION

Our study of the nature and volatility of stock market prices and yields was cast against the theory and performance of some principal macroeconomic indicators. The existing theory of macroeconomic coordination to stabilize the economy has deepened the problem of instability, volatility and unsustainable development due to the failure to complement the good things (indicated by variables) that would stabilize the economy and at the same time maintain the stability and growth of wellbeing. Money and Spending regimes and their inherent policies were complemented together by the endogenous learning process between them across evolutionary knowledge flows. These knowledge flows were derived on basis of the epistemic premise of unity of knowledge idea of inter-variable complementary relations.

Economic theory between monetarism (Friedman) and fiscalism (spending as per Keynes) is fractured beyond repair to date. Instead, a theory of complementary dynamics is required that can be useful for establishing sustainability and stabilization over the long-run. A new theory emerges that designs the complementary and participative dynamics of monetary and fiscal (spending) regimes for accelerated development. This kind of thinking and implementation of the design of the new monetary, fiscal, spending and real economy interrelations was formulated in an analytical model called the MFSRE model.

Economic analysis carried out in the framework of the MFSRE model presented an altogether new perspective of economic stabilization and sustainability by the principle of pervasive complementarities in the case of interest rate being replaced by participatory financial instruments that mobilize savings into the real economy, rather than accumulate them into bank savings. The resulting real economy in such a pervasive complementary systemic framework is the social economy that produces, consumes, distributes and trades in the good things of life. This assumes the design of dynamic basic-needs regime of sustainable development.

The case study of Dhaka Stock Exchange in Bangladesh is discussed as an example. The country is found to rely on old macroeconomic theory, perspectives, indicators and policies. This has established traditional beliefs on the stock market volatility. The experience proves that Bangladesh orientation in macroeconomic theory and its effects on the stock market remains outmoded. A new design of macroeconomic arrangement needs to be formalized and practiced in the interest of economic stabilization and social wellbeing. Such a model was our prescriptive MFSRE model and its conceptual analysis explaining theory and revealing the same by empirical facts.

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ENDNOTES

1 Consider the following compound function between Money, Spending, Growth, Price, and Productivity, F(M,S,G,P,Pr) = Constant. By the Implicit Function Theorem, M = F1(S,G,P,Pr); S = F2(M,G,P,Pr). By the Keynesian argument a full-employment target is attainable by (P,G)-stable relationship. Yet if a further monetary expansion occurs around the full-employment point of (P,G), the built-in income and money multipliers will push the economy into an inflationary phase and still maintain the neutrality of money and spending on the level of output. Thus a contradiction arises between monetary and fiscal regime in a productively expanding economy.

2 Consider the rate of change in real money denoted by m = M/P: log(m) = logM-logP, yielding $\dot{m} = \dot{M} - \dot{P} = [(a\dot{y} + b\dot{r}) - \dot{P}]$, according to the LM-curve in (y,r). Thus, increasing m-values imply $\dot{m} > 0$. That is, $(a\dot{y} + b\dot{r}) - \dot{P} > 0$; or, $\dot{y} > (\dot{P} - b\dot{r})/a > 0$. Since monetary policy is expected to contribute to market process and real sector growth according to the adage of monetarism, therefore, $\dot{P} > b\dot{r}$, even with parametric positive variations in variable 'b' according to monetarist perspective. Consequently, as r increases along the LM-curve by monetary supply, therefore $\dot{P}$ increases as well. Stability in (r,P) is lost. Y is drawn back. This conclusion supports the results shown in Figures 1 and 2.

3 Foucault, M. "By *episteme* we mean … the total set of relations that unite, at a given period, the discursive practices that give rise to epistemological figures, sciences, and possibly formalized systems … The episteme is not a form of knowledge (*connaissance*) or type of rationality which, crossing the boundaries of the most varied sciences, manifests the sovereign unity of a subject, a spirit, or a period; it is the totality of relations that can be discovered, for a given period, between the sciences when one analyses them at the level of discursive regularities."

4 Price of stock in perpetuity of $1 yield is written as, P = 1/i. Thereby, as i varies randomly, so also P in the portfolio of long-term assets becomes volatile.

5 Let Y_0 denote GDP at time t = 0,1,2,… ; s_t denote saving ratio at time t = 0,1,2,…; g denote a constant growth rate of GDP at time t = 0,1,2,… Disposable income after saving at time t = 0 is $Y_0(1-s)$, which increases to national income Y_1 at time t=1. $Y_1 = Y_0(1-s)(1+g)$. Likewise, $Y_t = Y_0.(1+g)^t (1-s)^t$. Now consider, $\partial Y_t/\partial s = -tY_0.(1+g)^t(1-s)^{t-1} < 0$ $\partial Y_t/\partial g = tY_0.(1-s)^t(1+g)^{t-1} > 0$ only due to the positive effect of g but dampened by the negative effect of s. These results remain true irrespective of a moment of time and in the continuous sense. Besides, the argument that a higher volume of savings would grow into more resources for investment in the future contradicts the fact that at any moment of time that volume of savings is a resource withdrawal. That amount of potential resource could otherwise have been used to

perpetuate economic growth and thereby development and social wellbeing.

[6] By definition, effective exchange rate (e) is $e = P_X/P_M = [(\Sigma p_{xi}.X_i)/\Sigma X_i]/[(\Sigma p_{mj}.M_j)/\Sigma M_j] = [\Sigma M_j/\Sigma X_i].[(\Sigma p_{xi}.X_i)/(\Sigma p_{mj}.M_j)] = \alpha.T$ where, P_X denotes average price of total exports X. p_M denotes average price of total imports M. X_i denote specific (i) export quantities. M_j denote specific (j) import quantities. p_{xi} denote specific (i) prices of imports. p_{mj} denote specific (j) import prices. $\alpha = [\Sigma M_j/\Sigma X_i]$ is a stabilizing constant in a dynamic basic-needs of sustainability. $T = [(\Sigma p_{xi}.X_i)/(\Sigma p_{mj}.M_j)]$ denotes stable terms-of-trade (T) in a dynamic basic-needs regime of development. Hence, exchange rates remain stable and avoid the interest-rate and exchange rate policed mechanism. This replacement comes about by the active epistemic conduct of wellbeing by θ-ranked values that reflect the actual and the simulated levels of unity of knowledge by complementarities between the variables in economic stabilization. In the end, effective exchange rate formula in the productivity driven dynamic basic-needs regime of development is given by, $[e = \alpha.T][\theta]$; now with the extended vector of circular causation relations between the variables, {y,p,M,F,f,r,u,ρ,Imports, Exports, Export prices, Import prices, e, T, α)[θ]. Note here the endogenous nature of all the variables in circular causation relations under the induction by θ-ranked values causes the coefficient-like parameter α to be variable under the dynamic effects of learning in the sustainability of the dynamic basic-needs of development.

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Chapter 80
Identifying Different Forms of Innovation in Retail Banking

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ABSTRACT

To be competitive and capture new customers, banks must develop continuous innovations that can reduce costs, enhance existing service quality, expand current service offerings, and increase market share. This article proposes a typology of different types of innovation in the retail banking sector on the basis of a case study of the leading French credit institution, Crédit Agricole. This bank does not innovate just incrementally, and radical innovations resulted from the launch of a new distribution channel, though several innovations are unrelated to new technology. This study adds to literature on innovation services by enhancing understanding of the different types of innovation. The empirical investigation further shows that the banking sector can develop process innovations, which give the bank a longer term competitive advantage. To innovate radically, the bank should anticipate the impact of its new offerings on different areas of the system.

1. INTRODUCTION

Despite growing service-related and innovation management research, researchers continue to call for further studies that can improve understanding of service innovation (Ordanini & Parasuraman, 2010). The service sector remains the "poor relative" in innovation management literature (Gallouj 2002), which concentrates instead on technical innovations (Damanpour, Walker & Avellaneda, 2009), especially in biotechnology, semiconductor, and other such industries (Baum, Calabrese & Silverman, 2000; Gilsing & Nooteboom, 2005; Roijakkers, Hagedoorn & Van Kranenburg, 2005). Yet such results rarely apply effectively to the service sector (Sundbo, 1997), because of its lack of standardization, as well as the relatively minimal investments in R&D for services, leading to an

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informal, customer-affiliated innovation process (Lusch & Nambisan, 2012). Common criteria for measuring technological innovations, such as the number of patents or R&D budgets, are not valid for services. Innovation in the service sector also is less tangible, reliant on human and relational factors rather than technology (De Jong & Vermeulen, 2003; Ettlie & Rosenthal, 2011). Furthermore, specific forms of innovation generally pertain to particular service sectors, which encourages researchers to concentrate on single-sector studies: five-star luxury hotels (Ordanini & Parasuraman, 2011), hospitals (Djellal & Gallouj, 2005), or retail networks (Cadwallader *et al.*, 2010).

In this study, we focus on the banking sector, which represents approximately 8% of the gross domestic product (GDP) and 4% of employment in member countries of the Organization for Economic Cooperation and Development (OECD, 2008). It also has undergone significant regulatory and technological changes and faced increasing competition in recent years with the arrival of online competitors (Athanassopoulou & Johne, 2004). In this difficult context, banks have had to innovate to remain competitive, whether to lower their costs or differentiate themselves from competitors (Drew, 1994; Han *et al*., 1998; Reidenbach & Moak, 1986; Storey & Easingwood, 1993). Despite increasing numbers of innovations in the banking sector (OECD, 2005), our knowledge in this area remains uncertain (Athanassopoulou & Johne, 2004; De Jong & Vermeulen, 2003; Menor & Roth, 2006; Oliveira & von Hippel, 2011; Reidenbach & Moak, 1986). Authors investigating banking innovation often consider the development of new offers (De Jong & Vermeulen, 2003) or implicitly assume that banks cannot innovate beyond new technologies (Ding, Verma & Iqbal, 2007; Karmarkar, 2000; Oliveira & Von Hippel, 2011). In this sense, an effective framework for innovation in the retail banking sector is lacking.

Innovation, in the literature, mainly refers to the creation of value directed toward the customer, though it also might involve other areas, such as a bank's organization (Oliveira & von Hippel, 2011). It also might feature several dimensions (Avlonitis, Papastathopoulou & Gounaris, 2001), including service concepts, processes (information systems or work methods), organizations (hierarchical level, structures), and external relationships (interfaces, intermediaries). We define innovation as occurring when the bank takes deliberate actions to increase its profits (De Jong & Vermeulen, 2003). With this definition, we aim to clarify the scope of innovation in banking, show how several categories of innovation apply in retail banking, and propose a typology of categories.

We begin by reviewing prior research into innovation in both banking and the general services sectors. With this information, we develop a typology for identifying innovations in the banking sector. Then we apply the proposed typology to France's main retail bank, the Crédit Agricole, to check its relevance. It leads into our discussion of the effects of an innovation on the innovation portfolio and the innovation process. Finally, we note some implications and limitations of our research.

2. INNOVATIONS IN BANKS: PRIOR LITERATURE

Prior literature on the banking sector suffers two main limitations: It focuses on new offers (visible innovations for customers) and assumes technological progress is the only source of innovation. We offer a typology that might better explain variety in banking innovations.

2.1. Limits to Extant Current Research

According to the first research on innovation in the banking sector, banks do not always rely on innovation as a means for development. However, those that establish and formalise development programs for new products perform better than

others, whatever their size (Reidenbach & Moach, 1986; Reidenbach & Grubs, 1987). Näslund (1986) compares financial and industrial innovation and shows that banks innovate, but their innovations are easy to imitate because they are also easier to implement. A bank that innovates benefits from its market leadership only for a very short time, because its competitors quickly imitate the new service offering (which cannot be patented).

Such research appears interested mainly in new service developments (NSD, Sundbo, 1997), largely ignoring other types of innovation, such as service delivery (e.g., Athanassopoulou & Johne, 2004; De Jong & Vermeulen, 2003; Menor & Roth, 2006). Yet the widespread exposure of banking to technological progress has changed many operational aspects of banking, especially in back offices (Cooper & De Brentani, 1991; Lusch & Nambisan, 2012). For example, the automation of administrative tasks allows staff to spend more time with customers in sales and advisory roles. Considering the influence of technological and IT progress, Barras (1986, 1990) offers a theory about the spread of technological innovation in services, such that a bank's adoption of a new computer system initiates a series of three phases of innovation:

1. The learning curve for the new software causes incremental process innovations, designed to improve service efficiency (e.g., automation of back office functions through a centralised mainframe computer system);
2. Improvements to the service quality stem from more radical process innovation (e.g., ATMs that cut costs and improve quality);
3. Product innovation may appear (home banking).

This theory predicts no innovations beyond technological possibilities; several other authors similarly focus on the role of technology-based innovative banking practices (Ding *et al.*, 2007; Karmarkar, 2000; Oliveira & von Hippel, 2011). For example, Ding *et al.* (2007) focus on the development of self-service activities (e.g., automatic cheque deposits, account balances, printing of bank statements), for which technology is an essential resource. Although the impact of technology on innovation in the banking sector is undeniable, banks also might innovate independently of technology (Djellal & Gallouj, 2005; Gadrey, Gallouj & Weinstein, 1995; Kandampully, 2002; Sundbo, 1997), which is only one component of service delivery. Other factors may initiate innovation: deregulation that allows the introduction of previously prohibited services, changing customer behaviours that create new requirements or needs, or increasing competition that pushes banks to differentiate themselves and develop new human resource skills (Cadwallader *et al.*, 2010). In addition, banking innovations are not always visible, such as social innovations that involve individual behaviours (e.g., new roles for company staff; Cadwallader *et al.*, 2010) or management innovations (Birkinshaw, Hamel & Mol, 2008). In services though, management innovations are even more likely to provide competitive advantage than technological prowess (Mol & Birkinshaw, 2009). Thus the Barras model represents a simplified version of the reality for banks (Gallouj, 2002).

Neither the approach that concentrates on NSD nor those based on technology impact take into account the variety of innovation in banking. Therefore, we need a typology that better addresses variety in banking innovation.

2.2. Proposed Typology of the Entire Scope of Banking Innovation

Few authors have tried to compile a typology of innovation in banking. Karmarkar (2000) concentrates on services related to new technologies (Internet, telephone, interactive terminals) and proposes a typology along two axes: means of access (i.e., centralized, such that the client must go to the service, or decentralized, such that the

client can access the service without moving) and the cost of access (from low to high).

With a broader review of innovation in services in general, we find several typologies (Table 1), though most of them rely on a single dimension, such as:

- The element affected by the innovation (product, process, or organization; Belleflamme, Houard & Michaux, 1986; Damanpour *et al.*, 2009; Hamdouch & Samuelides, 2001);
- The degree of novelty of the innovation, which can be combined with its risk level (i.e., new to the organization or new to the world; Birkinshaw *et al.*, 2008);
- Means of production (with or without customer participation; Sundbo & Gallouj, 1998).

These criteria, though relevant, tend to be isolated and cannot quite encompass the total variety of innovations in banking. Some classifications appear to build on several criteria, but they are not always explicit (de Vries, 2006). In this sense, no existing typologies are sufficiently operational to identify different types of innovation that may exist in the banking sector, which leads us to suggest a two-dimensional matrix (Table 2).

The first dimension relates to what exactly is being innovated, that is, the element that will be affected by the novelty. The second dimension relates to the degree of novelty of an innovation (how new?). Regarding the subject of innovation, we adopt Langeard *et al.*'s (1981) model of five components of a *servuction* system (neologism used by the authors to describe the production of a service: *serv*ice + prod*uction* = *servuction*). The back-office (i.e internal organization, or backstage) includes all traditional functions of a company that are invisible to the customer (marketing services, human resources, purchasing...) and their operations (working methods, equipment, information systems...). The front office consists of tellers (advisers), the physical medium (equipment used by the staff or customers in service delivery, such as branches, though also more generally the premises on which the service is delivered), and the customer, who is more or less involved in service production (define the problem and/or engage in operational tasks). Finally, the system delivers, as an output, the service or offer to the customer. This model thereby differentiates more service components than a product–process–organization approach, such that it can distinguish what is visible to the customer from that which is not. In addition, we can consider an essential constituent of a banking system, namely, the back office, where fundamental contributions often appear, such as management innovation (Hamel, 2006).

The second dimension, focused on the degree of novelty of the innovation, makes it possible to identify whether banks can develop innovations that are more than minor (Gallouj, 2002). An incremental innovation refers to items already available that the bank improves or recombines (Gallouj & Weinstein, 1997); radical innovations entail elements that are new to the company but already may exist elsewhere; and a banking sector innovation introduces an element that is entirely new, both to the company and the sector at large. We check this proposed typology by applying it to a French retail bank: Crédit Agricole.

3. METHODOLOGY AND RESULTS

We use a single case study to understand innovations in the banking sector, such that we detail each innovation developed by the studied firm and situate it in our proposed typology. In addition, we describe two examples of innovation in greater detail to highlight a recurrent phenomenon, namely, the cascade effect of innovation.

Table 1. Service innovation typologies in prior literature

Authors	Type of Service Studied	Classification Criteria	Identified Type of Innovation	Limits
Belleflamme *et al.* (1986)	Services in general	Innovation purpose	• Introduction of a new service • Innovation in the production process • Innovation in the *servuction* process • Combination of the three	Does not investigate the degree of innovation. Vague about the process of production and *servuction*.
Sundbo and Gallouj (1998)	–	Terms of innovation	• Customized innovation • Ad hoc innovation (coproduction with customer) • Recombination innovation • Incremental innovation • Formalisation innovation	Typology focuses more on the method of production (process) rather than the result
Hamdouch and Samuelides (2001)	NICT services (e.g., telecommunications)	Innovation purpose	• Organizational innovations (functions, tools, relations) • Commercial innovations (products, relations to customers)	Too focused on the impact of ICTs on service innovations
Djellal and Gallouj (2005)	Hospital	Innovation purpose	• Logistical and material transformation trajectory • Logistical and information processing trajectory • Methodological trajectory • Pure service trajectory • Relational trajectory	Categories sometimes seem close, because logistics normally includes the management of information flows
De Vries (2006), based on Gallouj and Weinstein (1997)	Several types	Several criteria	• Radical innovation • Incremental innovation • Ad hoc innovation • Architectural innovation	Conceptually interesting, but hard to use (lack of operability). The ad-hoc innovations are non-existent in retail banking.
Damampour *et al.* (2009)	Public service organizations	Innovation purpose	• Service innovation • Technological process innovation • Administrative process innovation	Distinguishes customer-oriented from business-oriented innovations

Table 2. Proposed retail banking typology

			Degree of Novelty		
			+	++	+++
			Incremental Innovation: Existing components, but either improved or recombined	**Radical Innovation:** New to the firm	**Banking sector Innovation:** New to the competitive environment
Service Components Which Are Subject To Innovation	**Output** (= new offer)				
	Front office **	Front Office employees (customer advisers, tellers)			
		Physical Medium			
		Customer participation			
	*Back office**	Support functions, information system...			

* Invisible to the customer, ** Visible to the customer

3.1. Single Case Study Methodology

To assess the relevance of our typology, we study a retail bank in depth to identify various innovations in the past decade and classify them. We selected the Crédit Agricole for several reasons. It represents the leading French credit institution, in terms of its equity capital (70.7 billion euros in February 2012), number of employees (more than 80,000), and its market share in retail banking (28% in 2012). Its net banking income also placed the Crédit Agricole in a leader position in 2008 (28.5 billion euros for Crédit Agricole in 2008; 27,4 for BNP Paribas). In 2012, however, Crédit Agricole is at the second place of the market on this criterion basis (35.13 billion euros), behind BNP Paribas (42.4 billion euros)[1]. As a leader in the retail market, it offers many innovations and has a reputation as one of the most dynamic banks in the marketplace. Furthermore, Crédit Agricole is highly decentralized, with 41 autonomous regional entities. We focus on the operations of one such entity, which adopts innovations developed by headquarters while also enjoys independence, being authorised to develop its own innovations.

To identify innovative practices, we conducted ten semi-structured interviews (Table 3), each of about one and a half hours, during 2007 and 2008. The interviews aimed to understand key innovations developed over the past decade, including their nature, origins, degree of novelty, and strategic impact on the entity.

To supplement the interviews, we collected data from internal secondary sources (memoranda written by headquarters, presentations of innovations to employees) and external sources (newspaper articles). The codification process followed recommendations by Huberman and Miles (2003). Each interview was coded and gradually refined, as soon as possible after each interview, providing a basis for subsequent discussions. We also compared the information, when possible, and undertook triangulation across the primary and secondary data.

Table 3. Overview of interviews within the regional bank

Interview Duration	Interviewee Job	Innovations Studied
1h45	Marketing Manager	Mozaic/Green Points/Products for Seniors/New agency concept
2h00	Vice Director	Insurance/Mozaic/Green Points/Products for Seniors/New agency concept
1h30	Bank service manager	Products for cross-border workers/Intelligent Billing
1h00	Agency manager	Products for cross-border workers
1h45	Cheque service officer	Automation of cheque deposits
2h00	International service employee	Products for cross-border workers
1h00	Marketing manager assistant	Mozaic/Green Points/Products for Seniors/New agency concept
1h30	Geographical area manager	Products for cross-border workers
2h30	Marketing manager	Products for cross-border workers/Mozaic/IHM/Seniors/New agency concept/Green Points/New methods of diagnosis/Square Habitat
1h30	Logistics officer	New agency concept/, GUI Ergonomics/Intelligent Billing

3.2. Crédit Agricole's Innovations

The regional entity we study regularly innovated or adopted innovations from the headquarters in the past decade. We particularly focused on the 12 innovations most frequently cited by the interviewees as real successes (see Table 4 for the description of the 12 innovations). All these innovations thus can be positioned in the matrix (Table 5). Our typology not only can encompass various innovations (despite their differences) but also distinguish among them.

Several observations pertain to the relevance of this matrix. First, no examples of innovations focused only on customers' degree of participation. It thus appears relatively rare in retail banking for customer participation to change, without prompting from the introduction of a new physical medium or front office employees. Although the marketing director of the regional entity admits that the focal bank has not developed any such innovation, the competition has done so[2]. Among the improvements made by innovating front office components (employees or physical medium), the most radical innovations entail the launch of a new distribution channel, which influences three front-office components.

These examples of banking innovation suggest several implications. Although technological progress opens many paths to innovation (online banking, cheque processing), in both the front and back office, many others are unrelated to new technology, such as the new offerings (products for cross-border workers, Pacifica, Square Habitat), some distribution channels (green points), or formal innovations regarding staff contacts with customers (new diagnosis methods). The easing of regulations, new customer needs (Payne *et al.*, 2008), and imitation of competitors (Abrahamson & Fairchild, 1999) are potential sources of innovation, which are at least as important as (if not more important than) information and communication technology progress. These results are consistent with Han *et al.* (1998) who emphasize the link between market orientation and innovativeness. They also point out, in the case of the French banking market, the value of having a competitor orientation (Day & Wensley, 1988).

These cases of innovation also show that retail banks can produce innovations with a high degree of novelty, though some of them are invisible to customers (e.g., cheque processing). In this case, the question is whether the bank creates value for customers and enhances its competitive advantage. Because back-office innovations lower costs, the

Table 4. The Crédit Agricole's innovations

Name of the Innovation	Description	Position in the Matrix
Mozaic	This specific offer targets young (10–25 years) consumers with a service package that includes various banking products (checking account, credit card, student loan at preferential rates, no fees) and other benefits (discounts on products from corporate partners such as cinemas, CDs, invitations to events).	It implies a new incremental offer, because the various services existed but were recombined and improved (i.e., adapted to the needs of the target market).
Loans for senior citizens	These packages include consumer loans, mortgages (lifetime mortgage loan), life insurance contracts, and so forth.	The incremental new offer entails a new assembly and enhancement of existing offers.
New methods of diagnosis	By creating branch-level diagnosis tools, this innovation facilitates the work of advisors who deal with insurance, savings, credit, tax optimization, and inheritance issues. These formalisation innovations (Sundbo and Gallouj, 1998) help the staff structure interviews and improve the bank's understanding of customers.	The incremental innovation enables front-office staff to propose offers that better meet customers' needs and expectations
Improved GUI ergonomics	Both customers and back office staff relied on this new graphical user interface (GUI). Customers found an easier to use ATM interface (colours, text, data density, screen layout, messages). For example, customers previously received cash from the machines and then waited to receive their cards. Many customers forgot to remove their card, leading to the need for many card cancellations and increased staff workloads. The innovation required customers to remove their cards before the machine would dispense the cash. The back office staff also began to use Google on their desktops (easier access to information through more fluid navigation, topic-based search assistance on the intranet since November 2007).	These incremental innovations span the front office (visible to the customer), in the form of a physical medium that is constantly improved in cooperation with customers, and the back office.
Pacifica (property insurance)	Crédit Agricole entered the property insurance market through a subsidiary. It offers customers packages composed of credit and insurance. Unlike its competitors though, Crédit Agricole created the first direct link from the insured to service providers, including a single contact and fast service (e.g., file processing within 48 hours). Finally, the offer made to those affected by the situation is new because it proposes to buy brand – new equipment for the client with no condition attached (other insurance company applying a dilapidation pourcentage).	This new offer corresponds to a radical innovation for the company (property insurance is new to Crédit Agricole) that requires staff to learn new skills beyond the core business (e.g., creation of a Claims Management Unit). However, the innovation is not new to the market, because other banks offer insurance services.
Square Habitat	Crédit Agricole real estate agencies process global transactions and leases, or manage property. For example, the new Green Mandate allows sellers to receive compensation if their property has not been sold after three months and one day. In addition, the Crédit Agricole is committed to advertising properties on sale every week in the press and provides proof of publication.	this radical innovation entails the company entering a new business market, as real estate agents. The Crédit Agricole had to learn new skills beyond its core business. Before 2006, its real estate involvement were limited. However, this activity is not new to the market; the basic service already was provided by traditional real estate agents.
Online bank	An internet site allows easy and constant access to accounts and provides an opportunity for access without moving.	This is a front office innovation (teller, physical support, customer participation) in a new distribution channel. It is radical for the company but not for the market; Crédit Agricole was not the first bank to launch the concept
Intelligent billing system	The new intelligent billing aims to customize service pricing for each customer (defined by age, quality, and so on). It offers a better understanding of the customer through the recording and analysis of data, which can then help customize the offer and retain customers.	As a back office innovation (invisible to the customer), it required the deployment of an ad hoc computer system to identify customer history and simulation and diagnosis software to adapt offers to customers. It is a radical innovation for the company that required new computer skills among the Crédit Agricole.

Table 4. Continued

Name of the Innovation	Description	Position in the Matrix
Products for cross-border workers	The specific traits of the regional market produce products for cross-border workers, with their high purchasing power and specific needs. For example, they can transfer cross-border wages to a French deposit account (which requires a partnership with foreign banks), foreign currency loans (consumer or real estate) at fixed or variable rates, and savings products that protect customers from unstable exchange rates.	Crédit Agricole has been a pioneer in setting up these specific offers for cross-border workers. They thus are new to the world. Although competitors have sought to imitate these offers, Crédit Agricole remains one step ahead.
Green Points	Crédit Agricole gives shops in rural areas the opportunity to provide banking services to their customers (cash withdrawal, bank transfer, applying for a credit card). This helps it maintain close relationships with customers in geographical areas without any branches. A new regulation prohibits staff members from transporting cash outside the branches prompted this innovation.	Despite a new distribution channel and front office innovation, the customer service remains the same. It is a banking sector innovation: no other bank proposes such a distribution channel.
New agency concept	A very dense network of entities is a prerequisite for a local strategy. The network determines the frequency of contacts and requires infrastructure to reduce operating costs and improve advice. To this end, the bank has developed a plan to renovate branches by including ATMs and give customers greater autonomy, as well as granting staff more time to undertake operations with higher added value.	This front office innovation redefined the staff mission, required an investment in a wide range of ATMs (physical media), and precipitated greater involvement by customers. With this innovation, Crédit Agricole is a pioneer and has the broadest automated network in France; it is therefore a banking sector innovation.
New cheque processing	A subsidiary, the Centre of Processing and Payment Operations, allows retailers or individuals to scan cheques, using automation in the branch, and store the information (amount, customer identification). This information goes directly to the Crédit Agricole platform, which helps secure transactions (no problems with lost cheques) and applies the credit to customers much faster (one day instead of an average of three days).	For this back office innovation, Crédit Agricole had to acquire new technological and organizational skills and make major investments. Moreover, this innovation is a banking sector innovation; Crédit Agricole was the first bank to introduce it (some competitors even outsource their cheque processing to Crédit Agricole).

Table 5. The typology applied to the Credit Agricole case

			Degree of Novelty		
			+	++	+++
			Incremental Innovation	**Radical Innovation**	**Banking Sector Innovation**
Service Components Subject to Innovation	**Output** (= new offer)		Mozaic Products for seniors	Pacifica Square Habitat	Products for cross-border workers
	Front office	Front office employees	New methods of diagnosis	Online bank	Green points New agency concept
		Physical medium	GUI Ergonomics (automatons)		
		Customer participation	-		
	Back office	Support functions, information system...	GUI Ergonomics (Employees' computer screens)	Intelligent billing	Cheque processing

bank can lower its prices or improve its service quality to attain a competitive advantage that may be easier to maintain over time, because its components also are less visible to competitors (Birkinshaw *et al.*, 2008). Those innovations occur less frequently but are more significant in delivering superior value to customers (Parsons, 1991).

3.3. Cascade Effect

Several innovations also led to other innovations in different areas of the *servuction* system (Table 6), regardless of whether their initial goal was to propose a new offer to the customer or improve the back office. That is, innovation spreads progressively to reach other elements or even the entire system, a phenomenon already mentioned in prior research (Barras, 1986, 1990; Damanpour & Evan, 1984; Fritsch & Meschede, 2001). However, our analysis shows further that these snowball or cascade effects may not relate to the use of a new technology. A new trend seems to be emerging: the higher the innovation's degree of novelty, the greater the impact on all the bank organization. A radical innovation or an innovation that the bank is the first (in the market) to implement exerts a greater impact on other parts of the *servuction* system than an incremental one. Finally, we propose that the starting point for a series of innovations may be the back office, the front office, or even the offering itself.

To illustrate the cascade effect, we examine in detail two innovations with different purposes (new offer and back office innovation) but the same degree of innovation (banking sector innovations): products for cross-boder workers and cheque processing (Table 7).

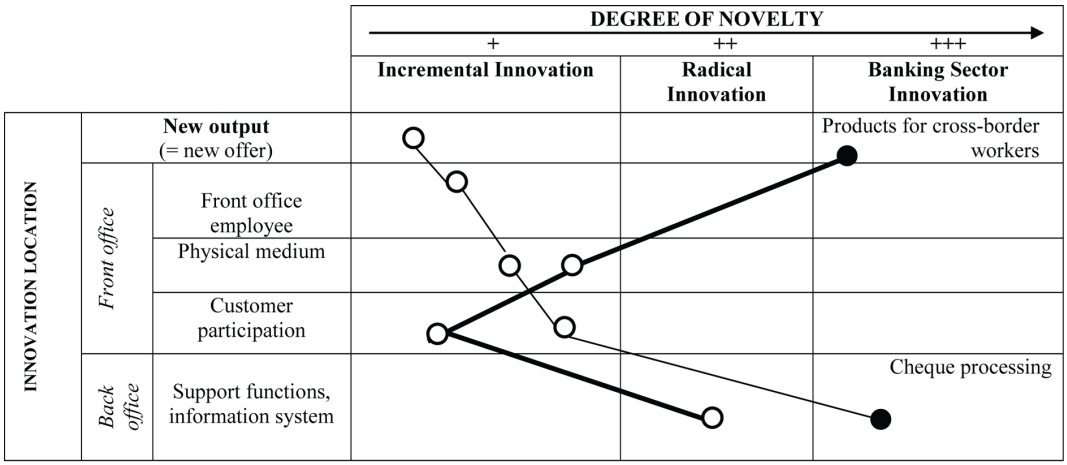
The *raison d'être* of the cheque processing innovation was to cut costs, because it was difficult to bill customers for this service. The new organization created by the Crédit Agricole allowed customers to deposit cheques 24 hours per day,

Table 6. Cascade effect of studied innovations

Studied Innovations	New Output	New Servuction Process			
		Front Office			Back Office
		Front Office Employee	Physical Medium	Customer Participation	
Mozaic (products for young consumers)	**+**	+	+	-	++
Products for seniors	**+**	-	-	-	-
New diagnosis methods	-	**+**	-	-	+
GUI Ergonomics: Automatons	-	-	**+**	-	-
GUI Ergonomics: Employees' computer screens	-	+	**+**	-	**+**
Pacifica (property insurance)	**++**	++	++	-	++
Square Habitat (real estate agencies)	**++**	++	++	-	++
Online bank	+	++	++	++	++
Intelligent billing	-	+	-	-	**++**
Products for cross-border workers (France/Swiss)	+++	-	+	+	++
Green points (agencies in shops in rural areas)	+	+++	+++	+++	-
New agency concept	+	+++	+++	+++	+
Cheque processing	+	+	+	+	+++

Notes: - No innovation in this part; + Incremental innovation; ++ Radical innovation for the firm; **+++** Banking sector innovation for the competitive environment. Grey cells correspond to the starting point of an innovation. See Appendix for the description of the 12 innovations.

Table 7. Impacts of cheque processing and products for cross-border workers



Notes: Black points indicate the starting point of the innovation; white points show the impact of the innovation on the other elements of servuction and therefore the cascade of changes that the innovation has triggered.

using a scanner. The images of the cheques are sent to a central platform that manages the flow from the different branches and credits customer accounts. Two video-coding workshops correct any errors (e.g., misread cheques) and the central cheque processing services compares the image file from the platform with the real cheques. The subsidiary then distributes cheques to the various regional entities and competing banks (checks of less than 5000 euros are archived for 60 days and images are returned to the branches every day). This back-office innovation (starting point) caused other innovations at various levels of the *servuction* system. In the front office, it prompted:

- Greater degree of customer involvement through cheque scanning;[3]
- Introduction of new physical media (successive generations of scanners);
- Reduced staff associated with cheque deposits.

In addition, service improved because the customer account is now credited within one, instead of three, days.

Regarding products for cross-border workers, this offer of new services (e.g., transfer of wages, fixed rate foreign currency loans) was accompanied by changes in physical media (specific areas on the website, new machines to change currency) and the back office. Changes in the back office included the development of new computer programs to monitor the stock markets and offer customers a competitive exchange rate, as well as partnerships with foreign banks that aggregated wages deposited by cross-border workers before making the transfer to Crédit Agricole in France.

This cascade of innovations gives rise to two key observations. First, a bank that wishes to innovate drastically needs to be able to change the various components of the service system in a coherent manner (Damanpour *et al.*, 2009). It must anticipate the impact of a radical innovation, which can affect different areas of the *servuction* system. Ettlie and Rosenthal (2011) similarly note the importance of the combined roles of senior managers, middle managers, and professionals in ideation and innovation development processes.

Second, some doubts remain about the relevance of research that only concentrates on new

service development, because it can only have a fragmented view of innovation mechanisms or outputs. The introduction of a new offer often produces other types of innovation. The performance of a NSD thus must be linked to another innovation, such as back office innovation.

4. CONCLUSION

Most literature is interested in NSD (Sundbo, 1997) or the role of technology in innovative activity (Oliveira & von Hippel, 2011). Yet innovation takes multiple forms. With this article, we aim for a better understanding of the multiple forms of innovation and propose a typology to classify them. Our case study of Crédit Agricole produces four main contributions. First, banks can innovate more than incrementally. They can market and sell completely new offers or implement original *servuction* processes. Second, banks can develop multiple innovations without any technological advances; for example, changing regulations and the varied needs of customers are important causes of innovation. Managers and customers thus should be encouraged to consider innovative codevelopments of new offerings. Third, our proposed typology can overcome some limits of previous works, by broadening the discussion to all banking innovations, not just to those of new services. Various back office innovations in the banking sector are not visible to the customer but may be strategic, particularly as a means to reduce operating costs. The bank must then take up the challenge of showing how it creates value to customers. Fourth, an innovation is rarely isolated. Especially if it is radical or new to the banking sector, it leads to other innovations in other components of the *servuction* system. Our typology highlights the impact of each innovation on the entire company.

Our findings also have practical implications for banks seeking to innovate. In particular, it is useful to recognize the different types of innovation that can provide a more or less sustainable competitive advantage. Managers should classify these innovations, using our typology, to identify their firm's degree of innovation–especially with regard to innovations with a high degree of novelty that are invisible to customers (e.g., cheque processing). In this case, customers cannot perceive the innovation directly, even though it provides a sustainable benefit compared with competitors' offers. Moreover, technological progress is not the sole source of innovation. It is possible to develop innovations that have no connection to new technology. Retail bank managers can look to regulations, new customer needs, and competitors for potential sources of innovation.

Of course, our results and implications are limited by the methodology used: our case study focused on innovation in one part of the banking sector (retail banking), one company (Crédit Agricole) and one country (France). It is difficult to generalize results from a single case study. However, the Crédit Agricole is a relatively representative bank of retail banking in France and Europe, thanks to its leading position in the French market and Europe (n°1 in France, n°3 in Europe) and through its presence in over 70 countries. Nevertheless, the phenomena studied here could be different in case of other types of banks. Future work could then look at the relevance of our results, including our typology, in investment banking. Furthermore, as every industry has special traits, empirical research in other types of industries could help establish the generalizability of our typology. Moreover, additional research might determine the importance of the process of implementing innovations in the banking sector by looking beyond the core organization (i.e., collaborators such as business partners or customers). The cascade effect we highlighted also should encourage researchers to apply qualitative methods to investigate banking innovation. In line with De Jong and Vermeulen (2003), for the process of emerging innovation, we propose further study of these processes that

depends on their type. Doing so may lead to a better assessment of the cascade effect; in turn, organizations may require a long-term view of customer relationships, that does not fit well with the short-term financial goals that tend to drive capital markets.

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ENDNOTES

1 http://www.credit-agricole.com/Le-Groupe/Presentation-du-groupe ; http://www.culturebanque.com/classement-banques-francaises-2012/

2 Specifically, Laydernier Bank offers a sponsorship system, whereby customers obtain benefits if they recommend that others open a bank account.

3 The customer deposits cheques without support from staff, then a receipt is automatically produced.

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Chapter 81
Data Mining using Advanced Ant Colony Optimization Algorithm and Application to Bankruptcy Prediction

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ABSTRACT

Ant Colony Optimization (ACO) is gaining popularity as data mining technique in the domain of Swarm Intelligence for its simple, accurate and comprehensive nature of classification. In this paper the authors propose a novel advanced version of the original ant colony based miner (Ant-Miner) in order to extract classification rules from data. They call this Advanced ACO-Miner (ADACOM). The main goal of ADACOM is to explore the flexibility of using a different knowledge extraction heuristic approach viz. Gini's Index to increase the predictive accuracy and the simplicity of the rules extracted. Further, the authors increase the information and the prediction level of the set of rules extracted by dynamically changing specific parameters. Simulations are performed with ADACOM on a few benchmark datasets Wine, WBC (Wisconsin Breast Cancer) and Iris from UCI (University of California at Irvine) data repository and compared with Ant-Miner (Parpinelli, Lopes, & Freitas, 2002), Ant-Miner2 (Liu, Abbass, & McKay, 2002), Ant-Miner3 (Liu, Abbass, & McKay, 2003), Ant-Miner+ (Martens, De Backer, Haesen, Vanthienen, Snoeck, & Baesens, 2007) and C4.5 (Quinlan, 1993). The results show that ADACOM outperforms the above mentioned algorithms in terms of predictive accuracy, simplicity of rules, sensitivity, specificity and AUC values (area under ROC curve). In addition, the ADACOM is also employed to extract rules from bank datasets (UK, US, Spanish and Turkish) for bankruptcy prediction and the results are compared with that obtained by Ant-Miner. Again ADACOM yielded better results and is proven to be the better choice for solving bankruptcy prediction problems in banks

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INTRODUCTION

The exponential advancement in digital and hardware technology over the last few decades has led to tremendous increase in the amount of data received and stored in various data warehouses and data repositories around the world. The data collection and handling is not of much concern but the useful and relevant information retrieval from the so called raw data is one area that has clearly seen loads of efforts coming into it recently.

Data Mining (DM) is one commonly used name to address the efforts put in to derive a set of high level knowledge, from data, which is said to be both comprehensible and accurate (Fayyad, Piatetsky-Shapiro, & Smyth, 1996). In other words we can say that DM is the process of automatically seeking, constructing, analyzing and validating the structural patterns in data and in turn using them, for prediction, on unseen data (Witten, Frank, 1999; Lu, Setiono, & Liu, 1995)

Decision trees (Quinlan, 1986), neural networks (Odom & Sharda, 1990) and genetic algorithms (Goldberg, 1989) are some of the data mining techniques employed to extract classification rules. Currently many classification algorithms are used to extract some kind of relevant pattern amongst the data in the form of a model which can be used in prediction phase for the classification of unseen data. These include decision tree (Quinlan, 1986), neural networks (Odom & Sharda, 1990), support vector machine (Vapnik, 1995). It is an undeniable fact that neural networks, support vector machine and statistical algorithms are strong when it comes to predictive accuracy but fall short in terms of simplicity and comprehensibility. It is nearly impossible to extract useful high level knowledge, from the model developed, which can be easily understood and comprehended by the user. Thus they are called 'Black Box'. This black box nature is overcome by the new algorithms which generate a set of easily interpreted rules as the model itself.

Recently efforts have been put into research, with success, related to nature-based approaches for finding the solution to classification problems. These include Genetic Algorithms (GA) (Mahfoud & Mani, 1996), Ant Colony Optimization (ACO) (Dorigo & Maniezzo, 1996., Dorigo & Stutzle, 2004) and Particle Swarm Optimization (PSO) (Sousa, Silva, & Neves, 2003) etc. which fall under Swarm intelligence (SI).

Since we developed a new variant of ACO-Miner we discuss more on ACO in the following. The basic ACO technique consists of a population of ants (artificial) which searches in the solution space of the given problem, guided by the pheromone trails and a heuristic approach. The pheromone update and evaporation take place depending upon the past exposure and experience of the ants (candidate solutions). This eventually increases the probability of finding the optimum solution to the problem in the next iteration (Dorigo & Gambardella, 1997).. Its significance and efficiency in various fields has been successfully demonstrated by successful applications to hard combinatorial optimization problems (Dorigo & Stutzle, 2004). In this paper we developed an advanced ant colony optimization algorithm (ADACOM) which makes use of a different but efficient heuristic approach. The new algorithm makes use of Gini's Index, instead of Entropy, as the measure of information level in a particular term. In addition to this the ADACOM tries to capture the overlooked information resulting from the parameter constraints. This is accomplished by dynamically varying the parameters so as to retrieve more knowledge from the data by compensating the simplicity of the rules extracted but significantly improving upon the predictive accuracy., Ripper, C4.5 (Quinlan, 1993), INN, logit (Ohlson, 1980) and SVM (Quinlan, 1986) are compared with ADACOM for the benchmark datasets.

BACKGROUND

The use of meta-heuristics to solve classification problems has emerged as a new line of research since the seminal work of Mahfoud and Mani (1996), where they employed GA to extract rules from data for stock prediction application. Later, Kim and Han (2003) and Shin and Lee (2002) also employed GA in different ways to extract rules in order to predict bankruptcy in banks. Then, particle swarm optimization miner (Sousa, Silva, & Neves, 2003) appeared in literature. Bacterial foraging technique (Kim, Abraham, & Cho, 2007) is not yet used for classification purpose. As regards the use of Ant Colony Optimization for rule extraction, Parpinelli, Lopes, & Freitas (2002) were the first to develop Ant-Miner to extract rules. Then improved versions of ant-Miner namely, Ant-Miner2 (Liu, Abbass, & McKay, 2002). Ant-Miner3 (Liu, Abbass, & McKay, 2003), Ant-Miner+ (Martens, De Backer, Haesen, Vanthienen, Snoeck, & Baesens, 2007) were developed.

Overview of Ant-Miner and Its Variants

Ant Miner (Parpinelli, Lopes, & Freitas, 2002) is considered as the first application of ACO for the classification task. This was used to extract 'If-Then' classifications rules from the given dataset. The extracted list of rules is an ordered rule list meaning that each rule is dependent on the previous set of rules and that the rules are to be interpreted in a sequential order for prediction. A brief description of ant miner algorithm (Parpinelli, Lopes, & Freitas, 2002) is given in Algorithm 1. The notation followed is the same as the one by Parpinelli et al. (Parpinelli, Lopes, & Freitas, 2002).

The Ant Miner works only for data which has categorical attributes. Therefore the data containing numeric attributes needs to be discretized as a preprocessing step. The discretization was performed on the raw data (without normalization) for all the experiments. Number of Buckets used for discretization is a user defined parameter and is fixed for the entire execution of the algorithm. It is a discretization parameter and refers to the number of categories for an attribute.

Each iteration of REPEAT-UNTIL loop of Algorithm 1 consists of rule construction, rule pruning and pheromone updating. Each ant starts with exploring the search space to find the best term to add to the rule. The rule is empty initially but with time the ant keeps on adding terms to it. Quality is the measure to differentiate amongst a pool of candidate solutions and select the best out of it. A term is of the form $A_i = V_{ij}$, where A_i is the i^{th} attribute and V_{ij} is the j^{th} value in the domain of the i^{th} attribute. And the next term to be chosen and added to the current rule is dependent on the probability value (P_{ij}) derived from the pheromone value (τ_{ij}) and the heuristic value (η_{ij}) of each term and normalized over all possible terms. $P_{ij}(t)$ is defined by Equation 1 with a the total number of attributes, b_i the number of values in the domain of the i_{th} attribute, x_i equal to one if the attribute A_i is not yet used by the current ant or zero, otherwise.

The heuristic function used to calculate the information associated with each term is defined in terms of Entropy and is given by Equation 2 where, k is the number of classes.

Initially the pheromone corresponding to each term is defined by Equation 3:

$$P_{ij} = \frac{\eta_{ij} \cdot \tau_{ij}(t)}{\sum_{i=1}^{a} x_i \cdot \sum_{j=1}^{b_i} (\eta_{ij} \cdot \tau_{ij}(t))} \quad (1)$$

$$\eta_{ij} = \frac{\log_2 k - H(W \mid A_i = V_{ij})}{\sum_{i=1}^{a} x_i \cdot \sum_{j=1}^{b_i} (\log_2 k - H(W \mid A_i = V_{ij}))} \quad (2)$$

$$\tau_{ij}(t=0) = \frac{1}{\sum_{i=1}^{a} b_i} \quad (3)$$

Algorithm 1. Pseudo Code for Ant-Miner

```
Training_set = {all training cases};
Discovered_Rule_List = []; % rule list is empty initially
WHILE (Training_set > Max_uncovered_cases)
t = 1; % ant index
j = 1; % convergence test index
Initialize all trails with the same amount of pheromone ();
REPEAT
Ant_t starts with an empty rule and incrementally constructs a classification
rule R_t by adding one term at a time to the current rule ();
Calculate Quality ();
Prune rule R_t ();
Update the pheromone of all trails by increasing pheromone in the trail fol-
lowed by Ant_t (proportional to the quality of R_t) and decreasing pheromone in
the other trails (simulating pheromone evaporation) ();
IF (R_t is equal to R_t-1)
% update convergence test
j = j + 1;
ELSE
j = 1;
END IF
t = t + 1;
UNTIL (t > = No_of_ants) OR (j > = No_rules_converged)
Choose the best rule R_best among all rules R_t constructed by all ants ();
Add rule R_best to Discovered_Rule_List ();
Training_set = Training_set – {cases correctly covered by R_best);
END WHILE
```

The ant at time t, denoted by, Ant_t keeps on adding the term to the current rule until the number of cases covered by the current rule is smaller than a user specified threshold i.e. *Min_cases_per_rule* or all attributes are used by the ant. In addition to this there is a restriction that only those attributes can be added to the current rule which have not already been used for the same rule to avoid inconsistencies. Next the rule formed by Ant_t is pruned in order to remove the irrelevant terms which may have been selected as a result of ignoring attribute interactions. Pruning is done by iteratively removing one term at a time from the rule while it improves the quality of the rule thus formed. Quality, denoted by Q, is computed by using the formula Q = Sensitivity ∗ Specificity, defined by Equation 4.

Here, $H(W| A_i = V_{ij})$ is the Entropy measure and is given by equation:

$$H(W \mid A_i = V_{ij}) = -\sum_{w=1}^{k} (P(w \mid A_i = V_{ij}) \cdot \log_2 P(w \mid A_i = V_{ij}))$$

where $P(w \mid A_i = V_{ij})$ is the probability of having class w for data instances with $A_i = V_{ij}$.

After the rule is pruned resulting in simplicity of the rule without compromising on the quality, the pheromone updation is carried out. For all the terms that belong to the current rule, the pheromone value is increased (pheromone deposition) using Equation 5 given below while the pheromone content of rest of the terms is decreased (pheromone evaporation) by normalizing it over all possible terms.

The next ant at time t+1, Ant_{t+1} starts constructing the rule using the terms with updated pheromone values. This procedure is repeated until all the ants have constructed a rule or until a specified number of consecutive ants construct the same rule. From this set of candidate rules the best rule is selected and added to the extracted rule list. The training set is updated by removing the cases covered by the best rule selected and the whole process is repeated until the number of uncovered training cases is lower than the user specified threshold i.e. *max_uncovered_cases.*

The variant Ant Miner2 (Liu, Abbass, & McKay, 2002) is different from Ant Miner in a way that it makes use of a simpler heuristic function which is found to be less accurate but also computationally less expensive. The small amount of errors induced as a result of change in heuristic function is said to be compensated by the pheromone level. The new heuristic function (η_{ij}) used is given by Equation 6 where T_{ij} is the set of remaining data instances, which are not yet covered by the rule list, having $A_i = V_{ij}$, and $|T_{ij}|$ the size of the dataset defined by T_{ij}:

$$Q = \frac{TP}{TP + FN} \cdot \frac{TN}{FP + TN} \tag{4}$$

where:

- **TP (True Positives):** The number of cases covered by the rule that have class predicted by the rule;
- **FN (False Negatives):** The number of cases that are not covered by the rule but that have the class predicted by the rule;
- **TN (True Negatives):** The number of cases that are not covered by the rule and that do not have the class predicted by the rule;
- **FP (False Positives):** The number of cases covered by the rule that have a class different from the class predicted by the rule:

$$\tau_{ij}(t+1) = \tau_{ij}(t) + \tau_{ij}(t).Q, \forall i, j \in R \tag{5}$$

$$\eta_{ij} = \frac{|\, T_{ij} \,\&\, CLASS = majority\, class(T_{ij})\,|}{|\, T_{ij}\,|} \tag{6}$$

The increased accuracy of Ant Miner3 (Liu, Abbass, & McKay, 2003) has been attributed to two major changes to Ant Miner2 viz. a different update rule and use of a transition rule that increases the probability of choosing those terms which have not yet been used in previously constructed rules. The pheromone function used in Ant Miner3 is defined by Equation 7 with ρ the evaporation factor, while the transition rule is given:

Transition Rule

IF $q_1 <= \beta$
  Loop
    If $q_2 <= \sum_{j \in J_i} P_{ij}$
    Then choose $term_{ij}$
  End loop
Else choose term with max $H(W| A_i = V_{ij})$

where:

- q_1 and q_2 are random numbers;
- β is a parameter $\in [0, 1]$;
- P_{ij} is the probability calculated according to Equation 1;
- J_i is the number of i-th attribute values.

The comparison of the heuristic and probability value functions used in Ant Miner and ADACOM are presented in Table 1 along with the pheromone update rule used.

MAIN FOCUS

Proposed Algorithm: Advanced Aco Miner (ADACOM)

When compared to the previous versions of Ant Miner the novelties proposed in ADACOM are as follows:

- Use of a different information retrieval approach or heuristic function. The algorithm makes use of Gini's Index instead of Entropy measure for calculating the heuristic value corresponding to each term and;
- Dynamically decrementing the minimum number of cases per rule to improve the predictive accuracy.

Different data mining techniques use different heuristics. A heuristic may be best suited for one while the same may not be acceptable for a different technique. With regard to the heuristic function used to calculate the information level of a term in Ant Miner Algorithm we can say that different heuristic functions perform differently in terms of accuracy. Ant Miner used Entropy based heuristic function while ADACOM uses Gini's Index as the heuristic function. The heuristic function (Gini's Index) used in ADACOM is defined by Equation 8.

Secondly, by altering the parameters dynamically we are actually increasing the search space for the Ant_t. Here minimum number of cases per rule *(Min_cases_per_rule)* is the parameter

Table 1. Comparison between Ant-Miner and ADACOM

	Ant-Miner	**ADACOM**
η_{ij}	$\frac{\log_2(k) - Info(T_{ij})}{\sum_{i=1}^{n} x_i \sum_{j=1}^{p_i} (\log_2(k) - Info(T_{ij}))}$	$\frac{\log_2 k - G(W \mid A_i = V_{ij})}{\sum_{i=1}^{a} x_i \cdot \sum_{j=1}^{b_i} (\log_2 k - G(W \mid A_i = V_{ij}))}$
$\tau_{ij}(t=0)$	$\frac{1}{\sum_{i=1}^{n} p_i}$	$\frac{1}{\sum_{i=1}^{n} p_i}$
τ update rule	$\frac{\tau_{ij}(t) + \tau_{ij}(t) \cdot Q}{\sum_{\forall i,j \in rule} \tau_{ij}}$	$\frac{\tau_{ij}(t) + \tau_{ij}(t) \cdot Q}{\sum_{\forall i,j \in rule} \tau_{ij}}$
$P_{ij}(t)$	$\frac{\tau_{ij}(t) \cdot \eta_{ij}}{\sum_{k=1}^{n} x_k \sum_{l=1}^{p_k} (\tau_{kl}(t) \cdot \eta_{kl})}$	$\frac{\tau_{ij}(t) \cdot \eta_{ij}}{\sum_{k=1}^{n} x_k \sum_{l=1}^{p_k} (\tau_{kl}(t) \cdot \eta_{kl})}$
Pruning	Yes (based on Q)	Yes (based on Q)

which is changed dynamically. By decrementing the *Min_cases_per_rule* we are actually trying to find a few additional rules, if possible, so as to improve the predictive accuracy. It is evident that this change may result into over fitting of data, which in turn may lead to loss of generality of the rule list extracted.

$$\tau_{ij}(t+1) = (1-\rho^{1}) \cdot \tau_{ij}(t) + \left(1 - \frac{1}{1+Q}\right) \cdot \tau_{ij}(t) \tag{7}$$

$$\eta_{ij} = \frac{\log_2 k - G(W \mid A_i = V_{ij})}{\sum_{i=1}^{a} x_i \cdot \sum_{j=1}^{b_i} (\log_2 k - G(W \mid A_i = V_{ij}))} \tag{8}$$

where, $G(W \mid A_i = V_{ij})$ is the Gini Index value and is given by:

$$G(W \mid A_i = V_{ij}) = 1 - \sum_{w=1}^{k} P^2(w \mid A_i = V_{ij})$$

Loss in generality results if rules covering, comparatively, less number of cases are extracted. In order to avoid this we set a lower threshold value i.e. new_lower_threshold, for the parameter *Min_cases_per_rule*. The description of ADACOM algorithm is given in Algorithm 2.

OVERVIEW OF BANKRUPTCY PREDICTION IN BANKS

The problem of failure prediction of financial firms and banks came into picture with the study of Altman (Altman, 1968) in 1960. Now it has grown into one of the most extensively researched area since last few decades. Due to the adverse affects of bankruptcy on creditors, auditors, stockholders and senior management, bankruptcy prediction has gained interest of people from nearly all the above mentioned domains (Wilson, & Sharda, 1994).

Altman developed appropriate quantitative models by applying data mining techniques including discriminant analysis (Altman, Marco, & Varet, 1994), logit (Ohlson, 1980). probit (Zmijewski, 1984) and neural networks (Fletcher & Goss, 1993; Odom & Sharda, 1990; Tam & Kiang, 1992). CAMELS rating, which was used by Federal Deposit Insurance Corporation Improvement Act of 1991 to indicate the safety and soundness of the institution, is a six part rating system. This rating evaluates banks and firms in terms of: *Capital Adequacy, Asset Quality, Management Expertise, Earnings Strength, Liquidity, and Sensitivity to Market Risk*. To a large extent CAMELS ratings clearly provide regulators with important information. But Cole and Gunther (1995) reported that these CAMELS ratings decay rapidly, which is of much concern.

Altman (Altman, 1984) made use of financial ratios and multiple discriminant analysis (MDA) for bankruptcy prediction. Later it was observed that bankruptcy prediction is not restricted to only these types of classifiers. The logit model is employed by Ohlson (1980) to predict firm failure. Back propagation neural network (BPNN) and discriminant analysis were employed by Odom and Sharda (Odom, & Sharda, 1990, Odom, & Sharda, 1990). BPNN was applied by Tam (1991) and when compared with MDA, logistic regression, k-nearest neighbor (k-NN) method and ID3. He found that BPNN outperformed other techniques. Then, Salchenberger (Salchenberger, Mine, & Lash, 1992) claimed that the neural network performed better than logit model in terms of various possible errors.

In 1996, Serrano-Cinca (Serrano-Cinca, 1996) compared SOM with LDA and BPNN in financial diagnosis. He proposed two hybrid neural systems consisting of LDA, BPNN and SOM.

Rahimian et al. (1996) compared the performance of BPNN, Athena (an entropy-based neural network) and single layer perceptron on the bankruptcy prediction problem. Next, Olmeda

Algorithm 2. Pseudo Code for ADACOM

```
Training_set = {all training cases};
Discovered_Rule_List = []; % rule list is empty initially
WHILE (Training_set > Max_uncovered_cases)
t = 1; % ant index
j = 1; % convergence test index
Initialize all trails with the same amount of pheromone ();
REPEAT
WHILE (True)
Ant_t starts with an empty rule and incrementally constructs a classification
rule R_t by adding one term at a time to the current rule ();
% takes min_cases_per_rule as one of % the parameters.
IF (no rule extracted) AND (min_cases_per_rule>new_lower_threshold)
min_cases_per_rule=min_cases_per_rule - 1;
ELSE
False
END IF
END WHILE
Calculate Quality ();
Prune rule R_t ();
Update the pheromone of all trails by increasing pheromone in the trail fol-
lowed by Ant_t (proportional to the quality of R_t) and decreasing pheromone in
the other trails (simulating pheromone evaporation) ();
IF (R_t is equal to R_t-1)
% update convergence test
j = j + 1;
ELSE
j = 1;
END IF
t = t + 1;
UNTIL (t > = No_of_ants) OR (j > = No_rules_converge)
Choose the best rule R_best among all rules R_t constructed by all ants ();
Add rule R_best to Discovered_Rule_List ();
Training_set = Training_set – {cases correctly covered by R_best);
END WHILE
```

and Fernandez (1997) compared a number of classifiers in stand-alone mode and developed a hybrid intelligent system based on those individual classifiers. Later, Varetto (1998) worked in the field of genetic algorithm (GA) and applied it for bankruptcy prediction and compared its performance with that of LDA. Gorzalczany and Piasta (1999) presented neuro-fuzzy classifier (N-FC) and rough classifier (RC) as two different hybrid intelligent decision support systems for firm bankruptcy prediction and compared the results with the work done previously.

Further, McKee (2000) reported a rough set based bankruptcy prediction model. After this, Mckee and Lensberg (2002) proposed a hybrid approach to bankruptcy prediction, which made use of GP and variables from a rough set model derived in prior research to construct a bankruptcy prediction model. They concluded that this hybrid produced better results compared to that of rough sets model alone. Later, Atiya (2001) proposed some new financial indicators for bankruptcy prediction problem. Swicegood and Clark (2001) designed BPNN which used bank call reports to extract variables and compared DA, BPNN and human judgment in predicting bank failures. Park and Han (2002) proposed a hybrid of analytical hierarchy process, case based reasoning and K-nearest neighbors technique for bankruptcy prediction.

Concurrently Becerra et al. (2005) reported the use of linear discriminant models, multi-layer perceptron and wavelet networks for corporate financial distress. According to them wavelet neural networks may have advantages over the multi-layer perceptron and probably be a viable alternative to the linear discriminant models. Then, Shin et al. (2005) used support vector machine (SVM) to predict corporate bankruptcy and concluded that SVM outperformed the BPNN in terms of accuracy along with reduction in training dataset. Another great step in this field was the proposal of an early warning system for detecting banks suffering from serious problems by Canbas et al. (2005). They applied this methodology to Turkish banks dataset. Later, Ryu and Yue (2005) introduced isotonic separation for prediction of firm bankruptcy.

Cheng et al. (2006) put forward a distress prediction model that can be said to be a hybrid of radial basis function network (RBFN) learning and logit analysis. They concluded that the performance of the proposed RBFN is far superior when compared to the traditional logit analysis and back propagation neural network (BNN). Further contribution came from, Ravikumar and Ravi (2006) who proposed a fuzzy rule based classifier (FRBC) for bankruptcy prediction and reported that FRBC outperformed the BPNN in the case of US banks dataset. Later, Ravi et al. (2007) proposed a semi-online training algorithm for the radial basis function neural networks (SORBF) and applied it to bankruptcy prediction in banks. Semi Online Radial Basis Function Neural Networks without linear terms (SORBF2) showed better performance as compared to other techniques such as ANFIS, SVM, MLFF-BP, RBF, Semi Online RBFN without linear terms (SORBF1) and Orthogonal RBF. Ravikumar and Ravi (2006) also proposed an ensemble classifier based on ANFIS, SVM, RBF, SORBF1, SORBF2, Orthogonal RBF and MLFF-BP for the bankruptcy prediction problem and reported that ANFIS, SORBF2, MLP are the most prominent models as they appeared in the best ensemble classifier combinations.

Another quantitative approach in this regard is the automatic extraction of prediction rules from huge financial datasets. The DM techniques such as neural networks, GA and inductive learning methods have been successful in obtaining useful bankruptcy prediction rules (Messier & Hansen, 1988; Shaw & Gentry, 1990; Shin & Lee, 2002). Our effort to apply ADACOM to various bank datasets including UK, US, Turkish and Spanish were put in keeping in mind the robust, efficient and comprehensible nature of ADACOM.

Later, Ravikumar and Ravi (2007) conducted a thorough review of all the works reported using statistical and intelligent techniques to solve the bankruptcy prediction problem in banks and firms during 1968–2005. They compared the techniques in terms of prediction accuracy, data sources, and timeline of each study wherever available. Further, Ravi et al. (2008) developed a novel soft computing system, based on Multi Layer Perceptron (MLP), Radial Basis Function (RBF), Classification And Regression Trees (CART), probabilistic neural network (PNN), fuzzy rule based classifier (FRBC) and principal component analysis (PCA) based hybrid techniques, for bank

performance prediction. Recently, Modified Great Deluge Algorithm based Auto Associative Neural Network (Pramodh & Ravi, 2007). principal component neural networks (Ravi, & Pramodh, 2008) and differential evolution trained wavelet neural network (Chauhan, Ravi, & Chandra, 2008) fuzzy rule based classifier preceded by feature selection (Chandra, & Ravi, 2009)and privacy preserving data mining (Ramu & Ravi, 2009) were applied to bankruptcy prediction with great success.

DATA

ADACOM was tested on a wide range of datasets. We worked on three different benchmark datasets from UCI (University of California Irvine) repository, namely, Iris, Wine and WBC (Wisconsin Breast Cancer) and four different bankruptcy datasets. Bankruptcy datasets include Spanish banks, Turkish banks, UK banks and US banks datasets. The Spanish banks' data is obtained from Olmeda and Fernandez (Olmeda & Fernandez, 1997) Spanish banking industry suffered the worst crisis during 1977-85 resulting in a total cost of 12 billion dollars. The data of ratios used for the failed banks was taken, from the last financial statements, before the bankruptcy was declared and the data of non-failed banks was taken from 1982 statements. The Spanish dataset contains 66 banks with 9 features, out of which 37 banks went bankrupt and 29 banks are healthy. The predictor variables are presented in Table 2.

Turkish banks' data was obtained from Canbas, Caubak, & Kilic (2005) Banks Association of Turkey published 49 financial ratios. Initially, Canbas et al. (2005) applied univariate analysis of variance (ANOVA) test on these 49 ratios, of previous year, for predicting the health of the bank in the present year. However, only 12 ratios were chosen as the early warning indicators, which have the discriminating ability (significant level is <5%) for healthy and failed banks one year in advance. Among these variables, 12^{th} variable has some missing values meaning that the data for some of the banks is not given. To avoid inconsistency we filled the missing values with the mean value of the variable by following the general approach in data mining. The Turkish dataset contains data of 40 banks out of which 18 banks went bankrupt and 22 banks are healthy. The names of the predictor variables are presented in Table 2.

The US banks' data is obtained from Rahimian et al. (1996). The names of the predictor variables are presented in the Table 2.

Altman (1968) in his seminal study used these ratios. Rahimian et al. obtained the data of 129 firms from the Moody's Industrial Manual, where 65 firms went bankrupt during the period 1975-1982. This dataset contains 129 banks out of which 65 banks went bankrupt and 64 banks are healthy.

The UK banks' data is taken from Beynon and Peel (2001). This dataset consists of 60 samples in total out of which 30 are bankrupt and other 30 are healthy.

The different type of datasets used along with the number of instances, attributes and classes are presented in Table 3. Here, an instance refers to the set of given values for attributes as an input while the class associated is the desired output.

RESULTS AND DISCUSSIONS

The ADACOM was implemented in MATLAB on a 1.83 GHz Intel(R) Core(TM) 2 CPU with 1GB of RAM. The ADACOM is tested thoroughly on both two and multi class problems. It was run on seven datasets namely Iris, Wine, WBC, UK, US, Spanish and Turkish. The first three datasets are benchmark datasets and have been used to compare ADACOM with Ant Miner and its variants in terms of predictive accuracy and the simplicity of the rules extracted.

Throughout the paper, we followed ten-fold cross validation testing method. Since the datasets had continuous attributes, therefore the data was

Table 2. Predictor variables for bank datasets

	SNO.	Predictor Variable Name	
Turkish Banks' Data	1	Interest Expenses/Average Profitable Assets	IE/APA
	2	Interest Expenses/Average Non-Profitable Assets	IE/ANA
	3	(Share Holders'Equity + Total Income)/(Deposits + Non-Deposit Funds)	(SE+TI)/(D+NF)
	4	Interest Income/Interest Expenses	II+IE
	5	(Share Holders' Equity + Total Income)/Total Assets	(SE+TI)/TA
	6	(Share Holders' Equity + Total Income)/(Total Assets + Contingencies & Commitments)	(SE+TI)/(TA+CC)
	7	Networking Capital/Total Assets	NC/TA
	8	(Salary and Employees' Benefits + Reserve For Retirement)/No. of Personnel	(SEB+RR)/P
	9	Liquid Assets/(Deposits + Non-Deposit Funds)	LA/(D+NF)
	10	Interest Expenses/Total Expenses	IE/TE
	11	Liquid Assets/Total Assets	LA/TA
	12	Standard Capital Ratio	SCR
Spanish Banks' Data	1	Current Assets/Total Assets	CA/TA
	2	Current Assets-Cash/Total Assets	CAC/TA
	3	Current Assets/Loans	CA/L
	4	Reserves/Loans	R/L
	5	Net Income/Total Assets	NI/TA
	6	Net Income/Total Equity Capital	NI/TEC
	7	Net Income/Loans	NI/L
	8	Cost of Sales/Sales	CS/S
	9	Cash Flow/Loans	CF/L
US Banks' Data	1	Working Capital/Total Assets	WC/TA
	2	Retained Earnings/Total Assets	RE/TA
	3	Earnings Before Interest and Taxes/Total Assets	EIT/TA
	4	Market Value of Equity/Total Assets	ME/TA
	5	Sales/Total Assets	S/TA
UK Banks' Data	1	Sales	SALES
	2	Profit Before Tax/Capital Employed (%)	PBT/C
	3	Funds Flow/Total Liabilities	FF/TL
	4	(Current Liabilities + Long Term Debit)/Total Assets	(CL+LTD)/TA
	5	Current Liabilities/Total Assets	CL/TA
	6	Current Assets/Current Liabilities	CA/CL
	7	Current Assets-Stock/Current Liabilities	(CA-S)/CL
	8	Current Assets-Current Liabilities/Total Assets	(CA-CL)/TA
	9	LAG (Number of days between account year end and the date of annual report)	LAG

Table 3. Data sets used

Data Set	Instances	Attributes	Classes
Iris	150	4	3
Wine	178	13	3
Wisconsin Breast Cancer	683	9	2
UK	60	10	2
US	129	5	2
Spanish	66	9	2
Turkish	40	12	2

discretized as a preprocessing step. When tested on Iris, Wine and WBC datasets and compared with the results obtained from those of Ant Miner and its variants, ADACOM is found to outperform them in terms of accuracy as well as overall performance. The results obtained are summarized in Table 4. It gives the average accuracy (Acc) in percentage, standard deviation in accuracy (σ_{Acc}), average number of rules (#R) and average number of terms per rule (#T/R), wherever applicable, for ten-fold cross validation of the three datasets mentioned above. The highest accuracy obtained corresponding to each dataset is marked underlined to reflect the corresponding algorithm which obtained that accuracy. From Table 4 it is clear that ADACOM is successful in obtaining highest accuracies for each of the benchmark datasets. ADACOM obtained minimum value of standard deviation for accuracy (σ_{Acc}) in all the three cases. It was not only successful in improving upon σ_{Acc} but decreased it drastically by 99.38% for Iris dataset, 99.22% for Wine dataset and by 99.99% for WBC dataset. In addition to this the average number of rules and the average number of terms per rule are found to be comparable with those obtained using other techniques.

Further ADACOM was tested for bankruptcy prediction datasets. It was tested on a total of four bank datasets viz. US, UK, Turkish and Spanish. The results obtained are tabulated in Table 5. The parameters i.e. number of ants, minimum number of rules, maximum uncovered data and the number of buckets (parameter used in discretization process) was varied to increase the search space and obtain better predictive accuracy. Figures 1 to 7 clearly show how accuracy varies with change in parameters for different datasets. The optimum range of parameters for each dataset was obtained as a consequence of rigorous testing. These are quoted in Table 6.

Table 5 presents average accuracy (Acc) in percentage, standard deviation in accuracy (σ_{Acc}), average number of rules (#R), average number of terms per rule (#T/R), average sensitivity, average

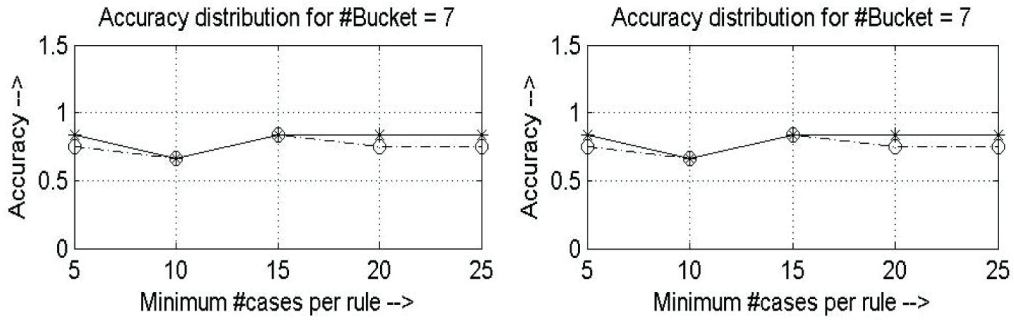
Table 4. Comparison of ADACOM with Ant-Miner and its variants and others

	Iris				Wine				WBC			
Technique	**ACC**	**σ_{Acc}**	**#R**	**#T/R**	**ACC**	**σ_{Acc}**	**#R**	**#T/R**	**ACC**	**σ_{Acc}**	**#R**	**#T/R**
ADACOM	96.67	0.03	4.1	1.3	96.66	0.04	5.4	1.4	97.43	0.01	8.3	1.3
AntMiner3	77.00	3.80	5.5	1.0	83.50	5.00	5.5	1.1	90.92	2.95	9.4	1.1
AntMiner2	81.80	3.22	5.4	1.0	85.53	6.42	5.6	1.0	91.54	2.74	9.4	1.1
AntMiner	76.60	3.89	5.6	1.0	84.50	5.67	5.6	1.0	91.14	2.44	9.7	1.1
RIPPER	93.30	1.94	3.2	1.2	90.68	4.88	4.9	2.1	95.35	2.51	4.6	2.4
C4.5	93.80	2.20	3.3		89.83	4.99	6.4		94.69	2.16	9.3	
INN	91.00	2.16			95.43	1.79			96.40	1.49		
Logit	93.80	2.90			94.33	2.63			96.63	1.00		
SVM	94.40	2.64			94.83	3.46			92.81	5.75		

Table 5. Comparison of ADACOM and Ant-Miner for bank datasets

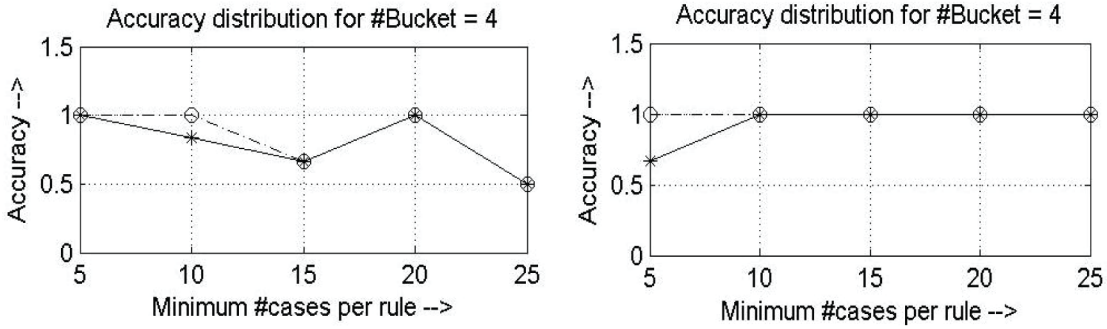
		Accuracy	σ_{Acc}	#R	#T/R	Sensitivity	Specificity	AUC Value
UK	ADACOM	86.67	0.07	2.8	1.8	68.50	74.67	7158.33
	AntMiner	86.67	0.11	2.7	2.0	57.33	73.83	6558.33
US	ADACOM	90.71	0.05	3.5	1.8	81.58	87.62	8459.72
	AntMiner	89.41	0.05	3.9	1.8	83.00	83.36	8318.06
SPANISH	ADACOM	96.67	0.07	2.7	2.2	90.00	94.67	9233.33
	AntiMiner	96.67	0.07	2.7	2.0	94.17	85.17	8966.67
TURKISH	ADACOM	92.50	0.17	1.9	1.1	90.00	47.50	6875.00
	AntiMiner	92.50	0.12	2.0	1.4	90.00	23.33	5666.67

Figure 1. Distribution of accuracy for US dataset: Dotted line corresponds to maximum uncovered data (Max_uncovered_cases) equal to 5 and solid line corresponds to maximum uncovered data (Max_uncovered_cases) equal to 10



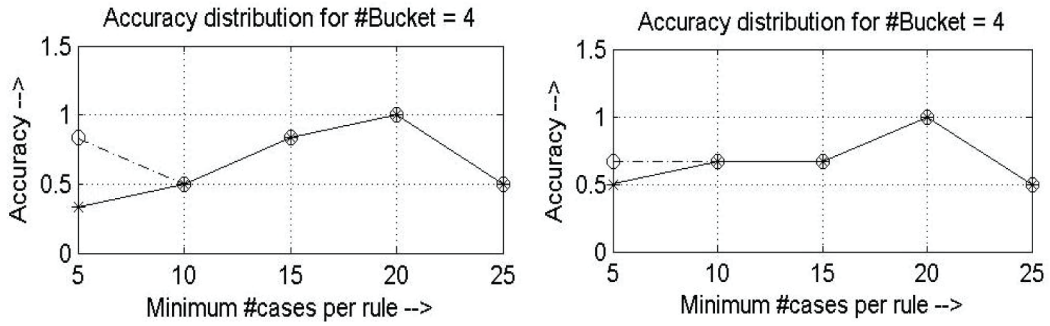
a) ANT MINER b) ADACOM

Figure 2. Distribution of accuracy for SPANISH dataset: Dotted line corresponds to maximum uncovered data (Max_uncovered_cases) equal to 5 and solid line corresponds to maximum uncovered data (Max_uncovered_cases) equal to 10



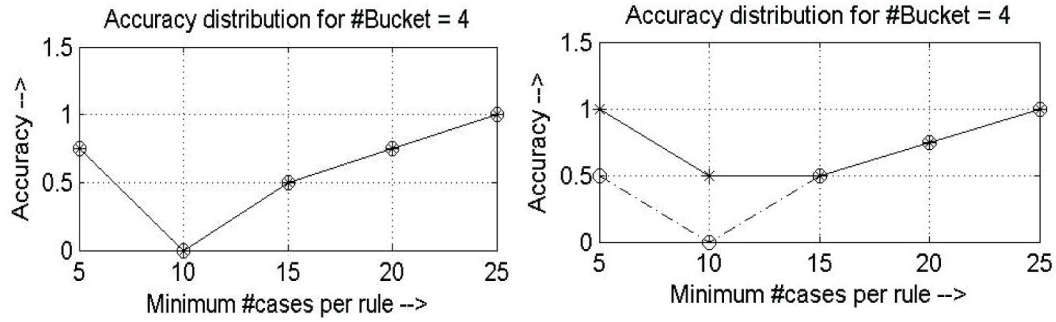
a) ANT MINER b) ADACOM

Figure 3. Distribution of accuracy for UK dataset: Dotted line corresponds to maximum uncovered data (Max_uncovered_cases) equal to 5 and solid line corresponds to maximum uncovered data (Max_uncovered_cases) equal to 10



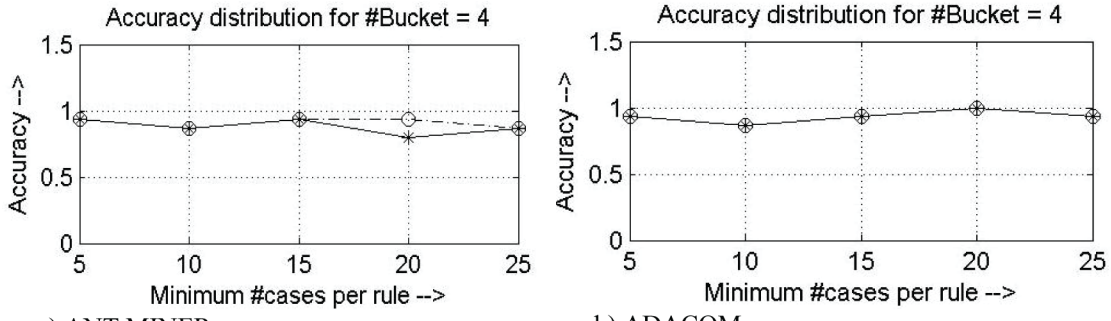
a) ANT MINER b) ADACOM

Figure 4. Distribution of accuracy for TURKISH dataset: Dotted line corresponds to maximum uncovered data (Max_uncovered_cases) equal to 5 and solid line corresponds to maximum uncovered data (Max_uncovered_cases) equal to 10



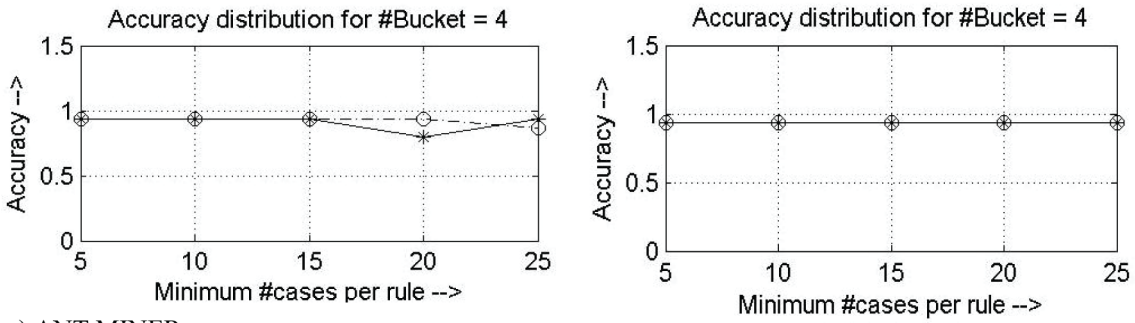
a) ANT MINER b) ADACOM

Figure 5. Distribution of accuracy for IRIS dataset: Dotted line corresponds to maximum uncovered data (Max_uncovered_cases) equal to 5 and solid line corresponds to maximum uncovered data (Max_uncovered_cases) equal to 10



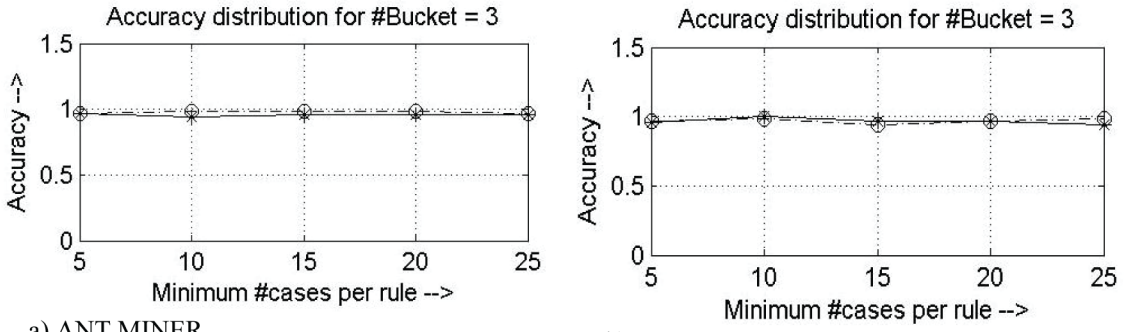
a) ANT MINER b) ADACOM

Figure 6. Distribution of accuracy for WINE dataset: Dotted line corresponds to maximum uncovered data (Max_uncovered_cases) equal to 5 and solid line corresponds to maximum uncovered data (Max_uncovered_cases) equal to 10



a) ANT MINER b) ADACOM

Figure 7. Distribution of accuracy for WBC dataset: Dotted line corresponds to maximum uncovered data (Max_uncovered_cases) equal to 5 and solid line corresponds to maximum uncovered data (Max_uncovered_cases) equal to 10



a) ANT MINER b) ADACOM

Table 6. Optimum range of parameters for different datasets (ADACOM)

	Buckets	Max Uncovered Data	Min Cases per Rule (Initial)
Iris	3-7, in steps of 1	5,10	5-15, in steps of 5
Wine	3-7, in steps of 1	5,10	5-20, in steps of 5
WBC	3-6, in steps of 1	5,10	5-25, in steps of 5
US	3-6, in steps of 1	5,10	5-20, in steps of 5
UK	3-6, in steps of 1	5,10	5-25, in steps of 5
Spanish	3-6, in steps of 1	5,10	5-25, in steps of 5
Turkish	3-6, in steps of 1	5,10	5-25, in steps of 5

specificity and area under ROC curve i.e. AUC value corresponding to each dataset.

Sensitivity in the context of bankruptcy is the ratio of the number of banks predicted correctly as bankrupt by the classifier to the total number of bankrupt banks. Sensitivity forms an important criterion for comparing classifiers and handling ties when it comes to bankruptcy prediction problem since we actually want a bankrupt bank to be predicted bankrupt. On the other hand specificity is the ratio of the total number of non-bankrupt banks predicted correctly by the classifier to the total number of non-bankrupt banks. Using sensitivity and specificity we calculate the area under ROC curve (AUC value) by taking 100 – Specificity on X-axis and Sensitivity on Y-axis and this again forms basis for ranking classifiers. The classifier which gives maximum AUC value is considered to be the best classifier.

ADACOM is compared with Ant Miner for the bank datasets. Accuracy is the first criterion in judging the strength of the two classifiers. Next is Sensitivity and then AUC value. The winning values are marked underlined for each dataset in Table 5. ADACOM is found to outperform Ant Miner in the case of US dataset by obtaining 90.71% accuracy while Ant Miner is found to be 89.41% accurate. For other datasets there occurs a tie which is tackled by considering the sensitivity and AUC values. For UK dataset ADACOM obtained 68.50% sensitivity while Ant Miner got just 57.33%. From the viewpoint of AUC value, since ADACOM gave significantly higher values of area under ROC curve for each of the dataset, we can say that ADACOM is a better classifier compared to Ant Miner.

The extracted rule list for Iris, Wine and WBC datasets is shown in Tables 7, 8, and 9 respectively. The other datasets are bank datasets and were used to find out how efficient ADACOM is, if applied to bankruptcy prediction problem. The extracted rule list for these datasets viz. US, UK, Spanish and Turkish is shown in Tables 10, 11, 12, and 13 respectively. The extracted rule list for each dataset is of human comprehensible type i.e. it can be easily understood by a layman and applied to use for prediction. The rule list is exhaustive, compact and accurate.

The significance of dynamically decrementing the parameter minimum cases per rule can be seen

Table 7. Extracted rule list for Iris dataset

S. No.	Antecedent	Consequent
1	1.00<=Petal Length<3.00 **AND** 0.1<=Petal Width<0.97	Iris Setosa
2	5.00<=Petal Length<6.90 **AND** 1.83<=Petal Width<2.5	Iris Virginica
3	3.00<=Petal Length<5.00 **AND** 0.97<=Petal Width<1.83	Iris Versicolor
4	4.3<=Sepal Length<7.9	Iris Virginica

Table 8. Extracted rule list for wine dataset

S. No.	Antecedent	Consequent
1	0.34<=Flavanoids<1.30 **AND** 4.80<=Hue<1.00	Type 3
2	11.03<=Alcohol<14.80 **AND** 20.60<=Alkalinity ofAsh<30.00 **AND** 0.98<=Total Phenols<2.00 **AND** 0.41<= Proanthocyanins <1.40 **AND** 4.80<=Hue<1.00	Type 3
3	278<=Proline<767	Type 2
4	10.60<=Alkalinity of Ash<20.60 **AND** 70<=Magnesium<128	Type 1

Table 9. Extracted rule list for WBC dataset

S. No.	Antecedent	Consequent
1	1<=Uniformity of cell size<4 **AND** 1<=Uniformity of cell shape<4 **AND** 1<=Marginal Adhesion<4 **AND** 1<=Bare Nuclei<4 **AND** 1<=Bland Chromatin<4 **AND** 1<=Mitoses<4	Benign
2	1<=Uniformity of cell size<4 **AND** 1<=Marginal Adhesion<4 **AND** 1<=Single Epithelial Cell Size<4 **AND** 1<=Mitoses<4	Benign
3	Bare Nuclei = 10	Malignant
4	1<=Uniformity of cell size<4 **AND** 1<=Uniformity of cell shape<4 **AND** 1<=Bland Chromatin<4	Benign
5	4<=Clump Thickness<7 **AND** 1<=Marginal Adhesion<4 **AND** 1<=Mitoses<4	Benign
6	Uniformity of cell size = 10	Malignant
7	7<=Uniformity of cell shape<10 **AND** 1<=Marginal Adhesion<4	Malignant
8	7<=Bland Chromatin<10 **AND** 1<=Mitoses<4	Malignant
9	4<=Uniformity of cell shape<7 **AND** 1<=Bland Chromatin<4	Malignant
10	4<=Single Epithelial Cell Size<7	Malignant
11	4<=Bland Chromatin<7	Malignant

Table 10. Extracted rule list for UK dataset

S. No.	Antecedent	Consequent
1	-0.088<=FF/TL< 0.151 **AND** 0.121<=(CL/LTD)/TA<1.034 **AND** 0.497<=CA/CL<1.497 **AND** 0.284<=(CA-S)/CL<1.196	Bankrupt
2	0.121<=(CL/LTD)/TA<1.034	Non Bankrupt

Table 11. Extracted rule list for US dataset

S. No.	Antecedent	Consequent
1	0.218<=RE/TA< 0.697 **AND** 0.042<=ME/TA<6.042	Bankrupt
2	0.142<=EIT/TA<0.299	Bankrupt
3	0.084<=WC/TA<0.394 **AND** 0.042<=ME/TA<6.042	Non Bankrupt
4	-0.226<=WC/TA<0.084 **AND** 0.042<=ME/TA<6.042	Non Bankrupt

Table 12. Extracted rule list for Spanish dataset

S. No.	Antecedent	Consequent
1	0.0016<=NI/TA<0.0226 **AND** 0.6916<=CS/S<1.0354	Bankrupt
2	0.0012<=R/L<0.0612	Non Bankrupt

Table 13. Extracted rule list for Turkish dataset

S. No.	Antecedent	Consequent
1	9.400<=IE/ANA<18.400 **AND** -24.899<=(SE+TI)/(TA+CC)<44.100 **AND** -37.100<=NC/TA< 33.899 **AND** -34.300<=SCR<24.699	Non Bankrupt
2	-34.300<=SCR<24.699	Bankrupt

in the change in accuracy distribution for the two versions (Figure 1 to Figure 7). It is observed that this feature improves the algorithm by making it more uniform and stable by overcoming the local minima and in the pursuit to reach global maximum, which in turn improves upon the predictive accuracy. Also it is evident, from the analysis done in the next section, that all the novelties introduced in ADACOM do not increase the computational complexity of the new algorithm much.

Analysis of ADACOM's Computational Complexity

In this section, we present an analysis of ADACOM's computational complexity. This analysis is divided into three parts:

1. Preprocessing;
2. A single iteration of the WHILE loop of Algorithm 2; and
3. The entire WHILE loop of Algorithm 2.

Then we combine the results of these three steps in order to determine the computational complexity of an entire execution of ADACOM:

1. **Computational complexity of preprocessing:** The values of all η_{ij} are precomputed, as a preprocessing step, and kept fixed throughout the algorithm. These values can be computed in a single scan of the training set, so the time complexity of this step is *O(na)*, where *n* is the number of cases and *a* is the number of attributes;
2. **Computational complexity of a single iteration of the WHILE loop of Algorithm 2:** Each iteration starts by initializing pheromone, i.e., specifying the values of all $\tau_{ij}(t_o)$. This step takes *O(av)*, where *a* is the number of attributes and *v* is the number of values per attribute.

Next, we have to consider the REPEAT loop. Let us first consider a single iteration of this loop, i.e., a single ant, and later on the entire REPEAT loop. The major steps performed for each ant are:

1. WHILE loop performing rule construction;
2. Rule evaluation;
3. Rule pruning; and
4. Pheromone updating.

The computational complexities of these steps are as follows:

1. **WHILE loop performing rule construction:** The choice of a condition to be added to the current rule requires that an ant considers all possible conditions. The values of η_{ij} and $\tau_{ij}(t)$ for all conditions have been pre-computed. Therefore, this step takes *O(av).* In order to construct a rule, an ant will choose *k* conditions. Note that *k* is a highly variable number, depending on the data set and on previous rules constructed by other ants. In addition, $k \leq a$ (since each attribute can occur at most once in a rule). Hence, one WHILE loop iteration or a single rule construction takes *O(avk)*. This is repeated *(l-m)* number of times; where, *l* is the minimum number of cases per rule and *m* is the new lower threshold value. Hence, the complete while loop takes *O(avk(l-m))*;
2. **Rule evaluation:** This step consists of measuring the quality of a rule, as given by (4). This requires matching a rule with *k* conditions with a training set with *N* cases, which takes *O(kn)*;
3. **Rule pruning:** The first pruning iteration requires the evaluation of *k* new candidate rules (each one obtained by removing one of the *k* conditions from the unpruned rule). Each of these rule evaluations takes on the order of *(n(k-1))* operations. Thus, the first

pruning iteration takes on the order of $n(k-1)$ k operations, i.e., $O(nk^2)$. The second pruning iteration takes operations $n(k-2)(k-1)$ and so on. The entire rule pruning process is repeated at k most times, so rule pruning takes at most $n(k-1)k + n(k-2)(k-1) + n(k-3)(k-2) +... + n(1)(2)$, which is $O(k^3n)$;

4. **Pheromone updating:** This step consists of increasing the pheromone of terms used in the rule, which takes $O(k)$, and decreasing the pheromone of unused terms, which takes $O(a)$. Since $k \leq a$, pheromone update takes $O(a)$.

Adding up the results derived in a), b), c), and d), a single iteration of the REPEAT loop, corresponding to a single ant, takes $O(avk(l-m)) + O(kn) + O(k^3n) + O(a)$, which collapses to $O(avk(l-m) + k^3n)$. In order to derive the computational complexity of a single iteration of the WHILE loop of Algorithm 2, the previous result $O(avk(l-m) + k^3n)$ has to be multiplied by z, where z is the number of ants. Hence, a single iteration of the WHILE loop takes $O(z[avk(l-m) + k^3n])$.

In order to derive the computational complexity for the entire WHILE, loop we have to multiply $O(z[avk(l-m) + k^3n])$ by r, the number of discovered rules, which is highly variable for different data sets. Finally, we then add the computational complexity of the preprocessing step, as explained earlier. Therefore, the computational complexity of ADACOM as a whole is $O(rz[avk(l-m) + k^3n] + an)$.

It should be noted that this complexity depends very much on the values of k, the number of conditions per rule, and r, the number of rules. The values of k and r vary a lot from data set to data set, depending on the contents of the data set. At this point it is useful to make a distinction between the computational complexity of ADACOM in the worst case and in the average case. In the worst case the value of k is equal to a, so the formula for worst-case computational complexity is:

$$O(rz[va^2(l-m) + a^3n] + an)$$

and since $l<m$, $v<a$ and $a<<n$ therefore, worst-case computational complexity is:

$$O(rz\, a^3n + an)$$

and is comparable to the complexity of Ant-Miner.

CONCLUSION AND FUTURE RESEARCH

We proposed a new version of Ant Miner (Parpinelli, Lopes, & Freitas, 2002) to be called, ADACOM, which makes use of Gini's index to extract the information corresponding to each variable from the dataset. In addition to this it involves dynamic parameter change to improve upon the prediction accuracy. Based on the experiments, we conclude that the ADACOM works better than the Ant Miner and its variants. We also conclude that ADACOM can be considered as a viable classifier for bankruptcy prediction problems.

Work in the direction to optimize the system parameters for improving the overall performance is carried out. We also tried to find out the optimal set of parameters which obtained the optimum accuracy while maintaining the simplicity and compactness of the rule base.

There is still tremendous scope of further improvement in terms of understanding the nature and influence of various system parameters. The heuristics applied and the pheromone updating and initialization approach are some of the critical areas of research, which still needs much research effort. In addition to this there is a scope to look into the term selection criterion by the ants, which if worked upon, may improve the predictive accuracy, noticeably. Another interesting area of research can be the application of the proposed algorithm to different diverse fields such as medicine, risk analysis, astronomy, agriculture

fraud detection, target marketing etc. Further, if possible, a hybrid of ADACOM and other data mining techniques to solve various classification problems can prove to be fruitful.

The proposed Advanced ACO algorithm (ADACOM) can undoubtedly be a suitable tool for extracting the best set of rules for any classification problem whether it is medicine application, churn modeling, fraud detection, customer credit worthiness analysis, customer profiling, target marketing or bankruptcy prediction.

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Chapter 82
The Use of Simulations as an Analytical Tool for Payment Systems

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ABSTRACT

Simulations are among the analytical tools in payment systems analysis. They can be used to overcome epistemological weaknesses of models and calibrations, and they are virtual experiments that do not affect the real performance of payment systems. The chapter is intended to give an inside view into the use of simulations as an analysis tool for payment systems as well as settlement systems. Section 1 highlights the basic features of payment systems in order to explain the usefulness of, and the most important questions addressed by, simulations. Based on these features, an epistemological assessment of simulations versus other analytical tools will show the range and limits of simulations (section 2). Following the historic development, the use of simulations for functional development will be explained in section 3, before dealing with oversight aspects (section 4). Finally, in section 5, the authors list a couple of practical tools to do simulations and to discuss tendencies in simulation tools and speculate on the future direction of research.

1. BASIC FEATURES OF PAYMENT SYSTEMS

The economics of payment systems requires a sound knowledge and understanding of institutional features. Payment economics mainly deals with features that were formerly subsumed under the term "transaction costs." Without transaction costs such as costs for searching, transferring, monitoring, bookkeeping, etc., neither the existence of money nor that of payment systems would be explainable. Therefore, economics of payment systems deals by definition with deviations from a pure economic theory in the sense of an Arrow-Debreu-World. In addition, knowledge of institutional features of payments system is at the very heart of it. Therefore, we will first have a look at the prominent features of payment systems in our times. Thereby, a first idea about the complexity of real existent payment systems and the considerable amount of variations may come up[2].

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1.1. Settlement Procedure

The settlement procedure is the core of a payment system. It defines how the incoming payment orders are settled. The possible choices can be ranged on a continuum from delayed net settlement to gross settlement. Gross settlement means that the settlement of incoming orders is done individually, one by one. Net settlement, however, implies the netting of at least two (at least partially) offsetting orders. In an extreme version, all payment orders for a day are collected and cleared altogether, and the net demands are settled at the end of a day. Net settlement requires less liquidity since usually many offsetting payments occur. It incurs, however, higher risks, since the whole bilateral credits could be at stake in case of a failure before settlement. Therefore, net settlement requires complex risk management schemes. On the other end of the continuum is a pure Real Time Gross Settlement (RTGS), which can be understood as settling all payment orders immediately after submission and with ultimate finality. This reduces the risk of settlement failures significantly, requires, however, a lot more liquidity, particularly when offsetting payments are unevenly distributed over the day.

RTGS has become the dominating settlement procedure in Large Value Payment Systems (LVPS) where the settlement risk is more prominent due to the higher value and urgency of the payments. In 1985 only three central bank operated RTGS systems, ten years later already sixteen, mainly industrialized countries, used RTGS, by the end of 2006 the number had risen to 93 (CPSS, 2005; Bech, et al., 2008) and in 2008 the World Bank counted 112 RTGS-systems out of 142 payment systems (Allsopp, et al., 2008). Retail Payment Systems (RPS), however, still settle mainly with net settlement procedures.

Between the two pure procedures, many hybrid versions are conceivable and some of them are realized: e.g. RTGS with liquidity saving mechanisms, and RTGS with bilateral or multilateral netting procedures that leave unsettled payments in a queue. These last schemes, if the procedures are executed very frequently, are known as continuous net settlement.

1.2. Governance

The higher the risks the more prominent is the role of central banks in payment systems. Central Banks are able to provide the ultimate settlement asset (central bank money) which in normal times does not bear a significant credit risk. Therefore, most LVPS and also some RPS settle in central bank money. Moreover, central banks have a decisive role in most LVPS, be it as operator, owner or overseer. This is warranted since the provision of the ultimate settlement asset creates a link for central banks between its role in payment systems and its functions in monetary policy and financial stability.

Some payment systems are settled in commercial bank money and are operated and owned by private institutions. They are, however, also subject of payment system oversight.

1.3. Systemic Interdependencies

LVPS are important financial infrastructures, and most other financial infrastructures rely on them. Foreign exchange settlement systems, security settlement systems, central counterparties and settlement banks, retail payment systems and sometimes other large value payment systems depend on LVPS. Frequently, LVPS also rely on other financial market infrastructures, such as security settlement systems that may play an important role in collateral management for liquidity provision.

1.4. Liquidity Provision

The operator of payment systems especially of LVPS faces several options about the intraday credit and liquidity: Whether or not they shall

provide intraday credit, unlimited or with a lending cap, fee-based, or free of charge, whether or not they shall require collateral, partially or totally, and which set of eligible collateral they shall define in terms of currency, quality, and liquidity.

1.5. Detailed Transaction Rules

Every operator of a LVPS defines the criteria for accessibility and may agree on certain special settlement procedures for linked infrastructures (ancillary systems), such as parallel processing or liquidity reservation.

In addition to the settlement procedure and liquidity provision, a payment system operator may choose other parameters which may influence the timing of payments and order submission by the participants, such as transaction fees, throughput rules, grouping of accounts, liquidity pooling, and technical requirements.

1.6. Outside Regulations

Banking supervision and liquidity rules do affect the participants and their payment behavior.

1.7. Economic Rationale for Participants

The participants use payment systems to settle transactions in order to fulfill their customer orders and their own trades on money markets, security exchanges, foreign currency exchanges and the like. Given the existence of the underlying order or trade, they face a two-fold decision: Firstly, about the payment system to use and, secondly, when to submit the payment order. The increasing compatibility and interoperability between payment systems may widen the relevance for the first choice (Manning, et al., 2009). In general, this choice should be based on cost and risk considerations. For the second choice, the participants will face a trade-off between liquidity costs, credit risk costs (unless the central bank provides intraday credit) and delay costs. In contrast, the impact of operational costs seems to be rather small. Some participants use an automated routing device to help them follow some sophisticated internal liquidity and risk considerations.

1.8. Business and Financial Environment

The environment of a payment system can make a large difference. The size and structure of the banking system, the features of financial markets (other payment systems, and post-trade infrastructure), the solvency of the respective institutions and the overall role(s) of the central bank may have an impact.

1.9. Technology

Payment systems require a substantial amount of technology, mostly communication and accounting technologies (FFIEC, 2010). At the heart of the system is a messaging and routing platform providing the communication infrastructure for the participants. The incoming messages have to be validated and transformed into orders accountable. That is done via clearing and settlement. Clearing establishes the final order to be settled. Settlement means, that the orders are credited or debited to the accounts of the parties of the transactions. Reliability and accuracy of the clearing and settlement system is of utmost importance to the integrity of the payment system. However, the rise in transaction volumes and values as well as the rising demand for user related services (e.g., communication and interaction modules) require an ongoing push for more elaborated and sophisticated systems including more powerful servers and faster communication channels.

All of these features make a difference to the performance of payment systems. They have–as far as possible–to be taken into account when analysing payment systems for functional development or oversight purpose. In addition,

the world of payment system is permanently changing (Kahn & Roberds, 2009). It reacts to technological developments (e.g. rising capacity of computational power), to market developments, be they of competitive or cooperative nature, and to regulation policies.

2. EPISTEMOLOGICAL ASSESSMENT OF SIMULATIONS AS ANALYTICAL TOOL

This section compares simulations, theoretical models, real experiments, and calibrations as possible analytical tools from an epistemological point of view. Given the features of payment systems, we will see why simulations rank very prominently among the analytical tools to study payment systems and which drawbacks they have.

Before starting the epistemological assessment, we need first a stylised description of what is done during simulations of payment systems[3]. A simulation of a payment system usually starts with the data of a real payment system for a set time-span (usually at least a day) as input. That means the simulation uses data about participants, their liquidity position, and the payments they submitted. In addition, the characteristics of the real payment system, such as the settlement procedure, the rules to grant intraday credit and all settlement algorithms will be used. The analyst will then change some of the input data in order to create a scenario. She can, e.g., delete or add submitted payments, merge participants, or postpone some or all payments from a participant to name a few possibilities. She can also change system parameters, e.g. add or delete or modify a settlement algorithm, increase or reduce the availability of intraday credit, or assume a system breakdown for a specific time-band. Now the analyst has to compare the output data of the various scenarios and from the real system. The comparison of the output data may yield some valuable insights.

In general, theoretical models and real experiments are superior analytical tools. Theory predicts an outcome and the analyst may prove that the theory cannot be rejected with the given data by experiments. This scientific approach has hitherto not rendered sufficient success in payment system analysis. To start with, real experiments are not really feasible in real payment systems, since they form the backbone of the financial system that is of systemic importance. Also, theoretical models of payment systems, although they have become quite sophisticated, are usually not able (yet) to cover all the relevant features. There are two reasons for this. The weaker one is the complexity of the processes before, during, and after a payment settlement. There is an outstanding plurality of features of payment systems. In addition, the transactions in payment systems do reflect the majority of transactions in an economy. In modern economies, barter trade is almost negligible and cash transactions are declining in importance[4]. Therefore, a sound model replicating the outcome of a payment system must be able to mimic almost all motivations and rationales of almost all agents in an economy. Moreover, microeconomic and macroeconomic policy issues intertwine in payment economics (Kahn & Roberds, 2009). Other reasons, which have hampered the theoretical modeling of payment systems, are their macro-features. Payment systems are subject to increasing returns to scale and strong network externalities. Moreover, they produce significant (positive and negative) externalities for the efficiency and stability of the system. Taken together, analytical models of payment systems must deal with non-linearities, an ongoing concentration process, hampered competition, and a high degree of public intervention.

One can neglect that and take a given sequence of submitted payments as given in order to analyse just the technical outcome of different processing rules. However, by doing so we are subject to the second reason for the inability of existing models to precisely predict the outcome of a LVPS, which

is the sequential nature of real time payment order processing. Every payment order, which is settled, changes the liquidity level of the respective participants. It may trigger another payment from the receiver of the first payment and may hamper subsequent payments of the sender, because her available liquidity is reduced. Depending on the settlement procedure (e.g. queuing rules) and the available liquidity, the process of settling of incoming payment orders may change after a single payment order was settled or queued or rejected.

Since simulations make use of the sequential nature of payment systems, they can produce results reliably. Simulations are virtual experiments. Just as real experiments, they make use of the full set of institutional features and of every single payment instruction of a payment system to be analysed. No information from the micro level is lost by abstracting from any individual case. In addition, the outcome of simulations of payment systems is as multifaceted as the real system.

Another approach for analysing data would be calibrations. Calibrations, however, do require tested behavioural assumptions, structural regularities, etc., to formulate at least a simple model. Hitherto, payment economists have rather begun to formulate some stylised facts rather than tested hypotheses. In addition, the plurality of business cases for transactions requires a plurality of hypotheses. In addition, calibrations of payment systems may at the current state of the art largely lack a micro foundation.

As a consequence, payment systems have emerged as a suitable subject for simulations. Simulation leads to a "what if"-analysis that forms a basis for scenarios. They do have weaknesses, however. The most important one is that the participants in a payment system are assumed not to react. The economic agents are taken to react mechanically rather than rationally. This feature is one of the problems articulated in the Lucas critique (Lucas, 1975). Simulations take the sequence of payment submissions as given and alter one or more of the institutional features or take out voluntarily some payment instructions without changing the other submitted payments. That will lead to a "what if" analysis, e.g. a simulation will show the outcome of a day's payments for the case that one participant has stopped submitting payments at noon. Everything besides the "technical intervention" of a participant failing to submit payments after noon will be calculated mechanically. No behavioural adjustments are taken into account and no consequences will be taken into account. Thus the "what if" analysis of a simulations intervenes and by the same time assumes that all (other) participants behave as if the intervention has not taken place.

This epistemological weakness weighs stronger with increasing intensity and widening scope of the intervention and with increasing time-span of simulated processes. In reality, a change of a basic feature of the payment system or a significant change of payment behaviour of a participant will trigger behavioural consequences very soon. Therefore, the results of a simulation are more realistic the less severe the assumed intervention and the shorter the time-span of simulated settlement.

Other measures to mitigate the epistemological weakness of simulations would include the robust design of simulations, the combination of simulations with other descriptive tools and agent based modeling. Robust design of simulations is a basic request for each analyst. Robustness can be enhanced by performing multiple simulations with similar but changing scenarios whereby the interventions should reflect a broad range of realistic changes as well as different time-spans and levels of intensity of intervention.

In current simulation approaches many analysts combine simulations with the use of descriptive analysis such as payment flow distribution (Northcott, 2002), network analysis (Lublóy, 2006; Wetherilt, et al., 2009; Schmitz & Puhr, 2007; Boss, et al., 2008), and participants' payment pattern analysis. If during the course of a simulation the resulting payment flows, structural coefficients, and payment patterns happened to

change significantly, the outcome would have to be subject to further scrutiny. The result may seem inevitable from the individual point of view and can be taken as a possible outcome. The result may also seem to be beyond realistic expectation and would–by best judging from the experience of payment patterns–not occur in reality. In that case, the simulation needs to be improved by additionally assuming behavioural changes of one or the other participant. It requires "agent based modeling."

Agent based modeling and simulation[5] mean, basically, deviating from the assumption of homogenous participants ignorant of the specific features of a payment system. It includes heterogeneous agents, strategic rules and sometimes, adaptive learning[6]. Whereas simulations, as an analytical tool, can overcome the problems of capturing the real complexity in theoretical models, they do abstract from behavioural reaction function of economic agents. On the other extreme are game-theoretic techniques. They derive a new equilibrium, if any, by abstracting from the real institutional complexity and tracking the moves given an explicit behavioural function. Somewhere in between these two tools are agent-based models. In fact, agent based modeling is intensively used in the design of decision support systems[7].

When using agent based modeling the analysts stay close to the complexity of the real systems (many banks, many links, and many features of the system) and assume that the agents (e.g. banks) react according to pre-defined rules (Arciero, et al., 2010a). Ideally, these pre-defined rules do reflect the known stylised facts of payment patterns, etc. They can differ from one agent to another and, thereby, create heterogeneous agents. The rules can comprise some sort of adaptive learning (and maybe also forgetting) and, thereby, create system dynamics.

As an example, Beyeler et al. (2006) used a rule for the decision whether to pay or delay given a level of liquidity and showed the reaction of the system on changing liquidity levels. These considerations were extended in Galbiati and Soramäki (2008) by deriving the liquidity levels endogenously via a game-theoretic approach. Banks choose their level of liquidity in many succeeding rounds and trade-off liquidity costs against cost of delay. Their ex-post costs are determined by their liquidity-level and the liquidity provided by others. In succeeding rounds, banks react on this outcome and adjust their initial level of liquidity until equilibrium is reached. A recent approach by Arciero et al. (2010b), made use of an explicit model of money market behaviour, calibrated it with real data, and simulated by taking into account some strategic behaviour of multiple agents.

An important methodological question is the use of real versus artificial data in simulations. Clearly, real data are real, not just realistic, and they are therefore superior. However, real data are of a sensitive nature and cannot be subject to public discussions. This forms a considerable hurdle for scientific exchange about simulations even across the insiders of a single LVPS. The use of artificial data does not touch any privacy issues. The data should, however, be created as realistic as possible making use of advanced descriptions of payment patterns. When artificial data are simulated according to some counterfactual assumptions, they become even more artificial. A case for using artificial data is to compare the real outcome with a hypothesis about patterns or structural features, e.g. Denbee et al. (2010) use random walk distribution of given payments to determine the degree of free riding on liquidity. Most simulations use real data since they are performed by central bankers having access to at least a single data set of a LVPS. Examples for the use of artificial data can be found in McAndrews and Wasilyew (1995) and Schulz (2010). Somewhere in between is a study using real data but artificially merging participants to increase step by step the degree of tiering in the system (Lasaosa & Tudela, 2008). Clearly, a rising degree of artificiality is intended and warranted since the study provided a picture of potential risks and efficiency gains by a changing tiering-structure.

3. SIMULATIONS FOR THE FUNCTIONAL DEVELOPMENT OF PAYMENT SYSTEMS

From the very start of complex systems, simulations had to be used for the functional development. Whoever wanted to build or improve a system as complex as a payment system had to rely on a number of simulation-runs to test the functionality, stability, and efficiency. Therefore, it is safe to say simulations were initially created and used for the sake of the functional development. This holds for the ongoing technical refinements and new releases, which needed to be checked in a simulation before being used in real production. This holds also for one-off events such as the introduction of the Euro. Preceding the introduction of the Euro was a simulation of the newly established TARGET-system over several months in order to be on the safe side when the new currency was launched in January 1999 (Hartmann, 1998). Another one-off event was the preparation for the year 2000. In an international large-scale one-off simulation nearly 500 internationally operating credit institutions from 20 countries, using 34 systems worldwide participated in the simulation. The so-called "Global Year 2000 test" was indeed a major simulation with multiple players participating (Hartmann, 1999).

The majority of these simulations for functional development are not published. They are part of the private research memory of system owners and were not designed for public debate. Published studies with respect to the functional development of payment systems cover usually topics of broad interest to more than one payment system, and usually more than one topic. Nevertheless, the following discussion is divided according the most important topics:

1. Introduction of RTGS-systems
2. Bottleneck solutions and analysis of liquidity requirements
3. Liquidity saving mechanisms/hybrid design of RTGS-systems
4. Interdependencies with other systems
5. Capacity analysis and structure of participants
6. Simulation of Retail Payment Systems

3.1. Introduction of RTGS-Systems

During the 1980s, a trend started to introduce RTGS-systems at least for LVPS. The major driver was the intended reduction of credit risk (Manning, 2009). A study by Humphrey (1986) can be called path breaking, although its detailed validity for other payment systems was limited. The study depicted a significant degree of systemic spillover in the US CHIPS system, which was at that time a Deferred Net Settlement System (DNS). Humphrey removed one participant and recalculated all remaining net settlement obligations. Some banks failed, because they were left with insufficient liquidity to fund the increase in net settlement obligations. Now the settlement was repeated and the net settlement obligations recalculated with the remaining banks. Humphrey observed quite sizable systemic effects. Out of a total of 134 banks some 50 banks failed within six iterations.

As the debate went on the results were further qualified, and more and more payment systems were designed as RTGS-systems. Using artificial data McAndrews and Wasilyew (1995) concluded that the risk of contagious default increased with the value of payments settled and the number of banks participating. A high degree of concentration means a higher propensity for contagion. Real data of the Italian LVPS were used to show that roughly four percent of failures are large enough to trigger systemic problems (Angelini, et al., 1996). Similarly, for the Finnish Interbank Payment System little risk of contagion was found for two major reasons: Firstly, the counterparty exposures did not exceed ten percent of the bank's own funds, and secondly, there existed hardly any long interbank chains (Kuussaari, 1996). Likewise

were the results for the Danish Interbank Netting System (Bech, et al., 2002) and for the Canadian Automated Clearing Settlement System (Northcott, 2002). Both studies conclude also relatively low systemic risks. These two studies are not fully comparable to other related studies. Firstly, both simulated payment systems covered only small value payments, and, secondly, the banks in the Danish Interbank Netting System benefitted in the observed period from an extremely abundant liquidity position. In a further ramification, Bech and Soramäki (2005) took the network effects into account. They qualified the results according the structural features of the given payment system using the centrality of a participant with respect to the solvency of the counterparts.

Summing up, the studies point to the need to qualify the results according to the special situation in each payment and banking system (Galos & Soramäki, 2005). However, the risk-reducing propensity of RTGS remained undisputed.

3.2. Bottleneck Solutions and Analysis of Liquidity Requirements

By the same token, an RTGS-system requires necessarily more liquidity than a pure net settlement system. Therefore, the trade-off between credit risk and liquidity costs as well as the trade-off between liquidity costs and delay costs (Arjani, 2007) became prominent topics in simulation studies. A basic idea was to find out a minimum level of liquidity (intraday liquidity) to settle the submitted payments in an RTGS-system. These studies (Leinonen & Soramäki, 2005; Hejmans, 2009; Petterson, 2005) helped to quantify the real liquidity needs of an RTGS-system above the Net-systems. The analysis about the impact of various liquidity levels on the system performance can be classified as studies for functional development as well as studies for oversight purposes.

As liquidity became a scarcer resource, analysts looked also into the possibility of banks allowing a larger degree of payment delays (meaning paying later than the set time, but still on the right day). The analysis of the trade-off between liquidity and delay costs suffers from the fact that delay costs are usually not observable by the system owner or overseer. However, as a simulation study was able to quantify the trade-off between liquidity levels and delay costs (Enge & Øverli, 2006) it provided at the same time estimates of delay costs.

This line of studies was also meant to take into consideration the behaviour of banks themselves. In an RTGS-system, banks rely heavily on incoming funds to finance their own submitted payments. If liquidity is costly, a bank may attempt to reserve liquidity, e.g. for the payments for which would cause higher delay costs. Thereby, banks would reduce the available level of liquidity in the system and may cause gridlock. In short, the simulations dealing with the trade-off between systemic risk and liquidity costs need to cover the payment patterns of banks (Afonso & Shin, 2008).

3.3. Liquidity Saving Mechanisms/ Hybrid Design of RTGS-Systems

Liquidity was seen as a public good by some authors (Denbee, et al., 2010). However, liquidity is no public good in the basic sense. It can only be used by the receiver of the payment. Surely, a high turnover ratio in a payment system leads to a higher liquidity efficiency. That means banks can send a multiple of their initial own liquidity as outgoing payments provided that offsetting incomings funds arrive. This is similar to a high velocity of money in the macro economy. Nevertheless, one would for the sake of a higher velocity of money not classify money as a public good.

The rising liquidity costs in RTGS and possible repercussions on system risk seem to thwart the endeavours to reduce the settlement risk by introducing RTGS-systems. As a result of this insight, in part gained by simulation studies, the discussion about hybrid design of RTGS-systems set in.

Hybrid systems deviate in certain respect from pure RTGS. A very basic idea is to introduce multiple settlement streams operating on a single platform as in the Canadian LVTS and in TARGET (CPSS, 2005, p. 38). In that case, part of the liquidity is for a limited time-span reserved for a special purpose. The purpose is to avoid bottlenecks for systemic connections, e.g. large ancillary systems. In general, simple hybrid systems violate the First-In-First-Out (FIFO) rule of pure RTGS by other detailed queuing arrangements, e.g. simply bypassing the FIFO-rule, different levels of priority, or a reordering of payments (CPSS, 2005, p. 5).

The examples show that including hybrid elements such as Liquidity Saving Mechanism (LSM) into RTGS does increase the rising complexity of algorithms in the system and does create an internal trade-off between liquidity and risk avoidance. First models with integrated LSM into RTGS focussing on CHAPS were provided by Jackson and McLaferty (2010).

A widely debated question in simulation studies was the specific variant of the queue-release algorithm for a hybrid system: Balance-reactive and receipt reactive. Balance-reactive algorithms release payments in reaction to a defined level of balance, whereas receipt-reactive algorithms react on a defined flow of incoming funds. In reality, only balance-reactive algorithms have been implemented. Nevertheless, a number of simulation studies focus on receipt-reactive systems. They analyze in simulations whether the theoretical evidence of receipt reactive systems being superior to plain RTGS in terms of costs of liquidity and delay. Balance reactive systems are also perceived to dominate RTGS, however, only in situations without liquidity shocks. Simulations by Johnson et al. (2004) and by Ercevik and Jackson (2009) display the degree of liquidity savings and the trade-off between liquidity and delay costs in hybrid systems. While the former see a receipt-reactive mechanism as dominating a RTGS, the latter depict for CHAPS that the liquidity savings are unevenly distributed and depend critically on the liquidity efficiency in the system. Willison (2005) tries to model hybrid systems and calculated an overall optimistic outcome about the superiority of hybrid systems. This not-simulated result, however, seems to hinge critically on an assumed total transparency of payments to be submitted.

3.4. Interdependencies with Other Systems

The overwhelming majority of literature on simulations in settlement systems deals only with payments and do not cover other systems. Some simulation studies, however, took into account special interdependencies to other systems such as securities settlement systems. The simulation have and will be also applied in analyses of settlement systems (e.g. for securities). The basic judgments about simulations as an analytical tool do not differ in that case. Examples for using a simulation tool in securities or equities clearing and settlement systems analysis are given by Hellqvist and Koskinen (2005) and by Hellqvist and Snellmann (2007).

3.5. Capacity Analysis and Structure of Participants

There are a couple of other topics in payment system simulation studies. The study of Kabadjova (2010) deals with the overall capacity constraint of a payment system and the possible scope of LVPS thereby contributing to the assessment of a possible merging of LVPS and Mass payments.

Another issue of importance is the structure of participants. Depending not least on the overall monetary policy some countries display a certain degree of tiering. That means also a tiered structure of participants in payment systems, direct and indirect participants. Lasaosa and Tudela (2008) simulated for CHAPS that a higher degree

of tiering leads to liquidity savings and higher liquidity efficiency. The liquidity savings arise from liquidity pooling and to a lesser degree from internalization.

3.6. Simulation of Retail Payment Systems

RPS have also been subject to the above listed topics of simulation studies. In addition RPS differ in some respects to LVPS which has been a special focus of some studies. Firstly, RPS are subject to fiercer competition. Usually, there exist more than one RPS in a country and most of them are of proprietary nature (CPSS, 2011; CPSS, 2003). Therefore, the choice of a single RPS for various payments becomes an issue (Rigopoulos, et al., 2006). Secondly, the diversity of various RPS is much more pronounced than in LVPS. The clearing and settlement of retail payments has developed according the advances of payment instruments and their schemes. Separate clearing arrangements for cheques, credit transfers, direct debit, ATM transfers, and card payments may exist, and they differ in terms of the technology required (FFIEC, 2010). Therefore, capacity constraints and consolidation procedures for the various clearing arrangements have become an issue of interest.

4. SIMULATIONS OF RISKS IN PAYMENT SYSTEMS (SIMULATIONS FROM THE OVERSIGHT PERSPECTIVE)

In many cases, simulations for the functional development of payment systems cover risks and can also be used by overseers. Nevertheless, it is worth separating the simulations, which were performed mainly from an oversight perspective for the sake of clarity of the interesting topics and, more important, because the epistemological status of simulations from oversight perspective is somewhat different. Simulation studies from an oversight perspective usually answer a hypothetical question. Of course, simulations for functional purpose are also of a virtual nature. However, as serious oversight-relevant problems occur, one might expect that participants would react more quickly. The basic assumption of a simple simulation–behavior will not change–is in oversight questions more doubtful. Moreover, in simulations for functional development, analysts can use payment pattern studies or network features as additional aspects to double check the realistic setting of their scenario and thereby overcome somehow the problems of virtuality. However, simulations for oversight purpose cannot make use of that to the same extent, because severe incidents and cases of failures in payment and settlement systems are of a rare nature and rather short-lived. Incidents happening at participants are not often precisely known to system operators or overseers (Lublóy & Tanai, 2008). A serious economic modeling, however, would require a sizable number of similar well-documented cases in order to estimate a reaction function of the system. Assessing risks requires two steps (Manning, et al., 2009): Firstly, estimating the probability that a given risk event occurs, and secondly, estimating a conditional loss distribution. In reality very few significant events in payment systems occur, meaning few sample points of the distribution function, which makes estimation questionable. The data constraints–due to limited occurrence of risk events–are a serious problem for quantification. Many conditional loss distributions can be approximated by a lognormal shape: A long tail with low probability for large impacts. Therefore, simulations play an even more important role in analysing oversight topics. However, they have to be treated with more caution than the functional oriented simulations.

There are four roots of settlement risk: credit risk, liquidity risk, operational risk, and business risk. The business risk means problems of the operator of the payment system, which hamper the proper functioning of the system. This risk would mean a dropout of the whole payment system. It

is subject to Business Continuity Planning. That is, of course, beyond the realm of simulation studies. The other roots of settlement risks are all subject of related simulation studies for oversight purposes in both manifestations: risks that have already matured and the risk of contagion. In addition, the impact of external changes like a shift in monetary policy implementation or a consolidation of participants or change in payment patterns are subject of related simulations.

Studies simulating the aftermath of an operational dysfunction at the level of a participant, an ancillary system, or the LVPS work with historical data. The studies vary on the number and size of affected participants, the timing of the assumed failure and its' time-span. The aim is to find the degree of disturbances to the system in terms of liquidity and credit risks and in terms of contagion[8]. Since overseers are concerned with the ultimate risk, their most useful approach is to find the worst-case scenario as long as it is still reasonable given the counterfactual assumption of behavioural continuity. Studies cover a range of possible indicators to watch: share of unsettled transactions, queued transactions, delayed transactions (Lublóy & Tanai, 2008), loss functions after contagion (Boss, et al., 2008), and indicators for the liquidity drain and sink effect (Schmitz, et al., 2006).

The detailed results seem to differ related to the various systems simulated and the assumptions during simulation. Some studies (Bedford, et al., 2004; Schmitz, et al., 2006; Ledrut, 2007) covering CHAPS, the Dutch and the Austrian LVPS come to the conclusion that an operational shock to a single participant may not trigger systemic risks. Quite the opposite can be said about the results of similar simulations covering the Swiss system and the Hungarian system (Glaser & Haene, 2008; Lublóy & Tanai, 2008). Similar results were achieved in a simulation of the Norwegian payment system (Enge & Øverli, 2006). They did not explicitly perform a study of operational dysfunctions but simply assumed shrinking levels of available liquidity and studied the outcome. They found considerable potential of the system and its participants to deal with significant outages and succeeding liquidity shocks for the Norwegian payment system[9].

In general, the use of gridlock resolutions and bilateral limits for sending participants yield considerable impact in cases of operational failure (Lublóy & Tanai, 2008; Mazars & Woelfel, 2005). Similarly, a simulation of the Japanese BOJ-NET Funds Transfer System demonstrated that Liquidity Saving Elements mitigated the contagion risks of liquidity shocks (Shirakawa, 2009). It is in this discussion about hybrid systems that simulations covered explicitly both functional development and oversight aspects. The trade-off between efficiency and risk was subject in a simulation of CHAPS. Lasaosa and Tudela (2008) found for CHAPS–which serves as the prominent highly tiered payment system–higher liquidity efficiency, but also higher concentration risks albeit somewhat lower credit risk in comparison to a not tiered system.

Simulations of risks in payment systems are not restricted to RTGS. An interesting topic is the possible reduction of the trade-off between risk and liquidity requirements in net settlement systems. There possible level of risks can be reduced by securing the net settlements, e.g., through margining, central clearing, introducing a central counterparty, collateral, limits on exposures and rules for loss sharing. Galos and Soramäki (2005) show in a simulation that a secured net settlement system can by introducing loss sharing rules, limits to exposures and collateralization[10] reduce the peak exposures in case of a failure by one half in comparison to an unsecured net settlement system.

To sum up, the various results point to the importance of the special national and systemic conditions, e.g. concentration ratio, the system specific algorithms, the liquidity available in the system, the existence of back-up procedures, and the like.

A beneficial side effect of simulation studies is used to find and prove the usefulness of indicators for the analysis of payment systems (Northcott, 2002; Lovin, 2010; Schmitz, et al., 2006), thus contributing to the understanding of descriptive statistics and the formulation of models.

For the future, it seems possible that a more pronounced split of simulations for functional development and those for oversight purposes or research may occur. The real systems are becoming more complex and realistic simulations may become more costly and complex, too. Assuming the related questions of functional development to become more detailed it seems plausible that simulations for functional development will be increasingly performed by the operators. The public discussion, however, may increasingly turn to oversight related questions.

5. EXAMPLES FOR SIMULATION TOOLS AND DIRECTIONS FOR FUTURE SIMULATIONS

The interested analyst is bound to the availability of appropriate data. Since these micro-data are of sensitive nature, analysis is mainly restricted to the operators and the oversight. On the side of the tools, a number of appropriate tools are available. The pioneer of payment system simulators is the very widely used Bank of Finland Payment System Simulator (see: http://pss.bof.fi/Pages/Default.aspx). The BOF-PSS is an easy to use tool capable of simulating a sizable number of possible payment systems and running on a PC. It provides for a number of options to mimic closely specific features of real payment and settlement systems. The tool is permanently improved and has an increasing range of output options for the use of complementary analytical tools (e.g., network analysis). The Bank of Finland is the only entity that can make adjustments and offers cooperation. The BOF-PSS is their contribution to the systemic analysis and are eager to serve a wide community of analysts using the BOF-PSS. A drawback of the BOF-PSS is its purely deterministic approach and difficulties to model strategic behaviour, e.g. for agent based modeling.

The Bank of England Interbank Payment and Settlement Simulator (Alentorne, et al., 2005) claims to have overcome these limitations. This simulator is, however, not publicly available and not used outside the Bank of England. It seems to be based on the Financial Network Analyser (FNA). The FNA (see: http://www.financialnetworkanalysis.com/) is a tool mainly developed by Kimmo Soramäki who came from the Finnish tradition of system analysis. It is an open-source project and used by a considerable number of researchers. The FNA is using methods developed in Social Network Analysis, Network Science and Agent based Modeling, but is also capable to perform a broad range of simulations of LVPS. It uses in its 2011 version a newly created simple user interface and covers a broad range of possible analytical tools. Another simulation tool, albeit somewhat sophisticated, is "Payment and Money Market Model" (P&3M). It was especially designed for Agent based simulations and developed by Pietro Terna (Terna & Bonafine, 2010). It is based on Swarm-Like Agent Protocol (SLAPP) in Python. Its main advantages are the flexible design to cover a large range of behavioral strategies and the openness of Python for future developments. The progress of the ongoing project is documented at http://web.econ.unito.it/terna.

What may be the directions for future simulation tools and simulations? I would like to mention three main trends:

1. We may see the design of standardized hypothetical scenarios for each LVPS with a regular check on certain variables; e.g.,
   a. Identify critical participants,
   b. Compute minimum liquidity level/ maximum liquidity required,
   c. Search for bottlenecks.

2. Simulation approaches will increasingly be integrated with descriptive analysis and
   a. Make use of tested behavioural assumptions,
   b. Make use of stylised facts about the resulting network structure,
   c. Derive plausible stochastic functions to substitute for deterministic simulations,
3. We may see a widely used integration of micro-founded agent based modeling into simulations.

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ENDNOTES

1 Dr Martin Diehl is payment system analyst at the Deutsche Bundesbank. This chapter represents his judgements and views and does not necessarily reflect the opinion of the Deutsche Bundesbank.

2 This list of features and concepts of payment systems is organized by their importance for the role of simulations as an analytical tool. A more detailed view on the complexity of payment systems and market infrastructures in general is provided by CPSS (2011) and Allsopp et al. (2008).

3 A basic description can be found in Leinonen and Soramäki (2003).

4 In addition, many cash transactions do also require preceding and succeeding non-cash transactions (e.g., if ATMs are used).

5 The literature often uses the term "agent based modeling," although some approaches should from an epistemological point of view rather be called "agent based simulations." The difference refers to the main analytical technique: Is it a solution of a model based on some calibrations or a simulation of micro-data adjusted by some modeling assumptions to yield a counterfactual result.

6 See the review article by Rocha (2006).

7 Some examples are provided in Rigopoulos et al. (2006), who develop a multiagent based simulation for the behaviour towards payment system selection.

[8] After the publication of the independencies study of CPSS (CPSS, 2008), a number of simulations cared more about interdependencies (e.g. Lovin, 2010; Boss, et al., 2008).

[9] Enge and Øverli (2006) also concluded from their results on the relation of liquidity and delay costs, thus proving the usefulness of simulations with real data to find estimators for hidden features of the real system.

[10] The rules were designed to resemble EURO1.

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Index

A

active portfolio management 505-506, 509-510, 516, 870
ad-hoc reporting 1048, 1055
adverse effects 128, 130, 799, 850
African Development Bank (AFDB) 131, 136
agent-based approach 350, 1228, 1232-1234
agent based modeling 220, 223-224, 226, 228, 232, 644, 1245, 1581-1582, 1588
agricultural credit 626, 635-636, 638, 640-641, 1083-1084, 1088-1091, 1093
alternative banking technologies 1179, 1192-1194
American Stock Exchange (AMEX) 246
analytical balance sheet 1284-1286, 1289, 1291, 1293-1294, 1296-1299, 1302
Ant Colony Optimization (ACO) 1554-1555
ant-miner 1554, 1556, 1572
Arabic culture 1262
Asian Development Bank (ADB) 131, 136
assess performance 1378

B

Balance Score Card (BSC) 544-546, 559
bank credit 459-461, 625, 635, 834, 1081, 1083, 1086, 1088-1091
bank image 487-488, 491-492
bank market 484, 1179-1180, 1186-1188, 1190-1191, 1193-1196
bank risks 518-519, 521-522, 526-530
bankrupt 240-243, 246, 1563, 1569
bankruptcy prediction 1554, 1560-1563, 1565, 1569, 1572-1573
  in banks 1560, 1562
Basel II and III 561-564, 566-568, 580, 582, 952-953, 960, 1153, 1268, 1283
behaivoral theories 674-675, 1214
behavioral finance 311-315, 317, 320, 325-326, 328, 352, 385-387, 867
behavioral intention 50-51, 470-471, 478, 489, 681, 687, 693, 825, 1215, 1219, 1221-1223, 1253, 1255-1257
behavioral rules 218, 223-225, 232
benchmark comparison 617
benefit analysis 2, 5-7, 9-11, 14-15, 582, 1059, 1065, 1068, 1070-1072, 1074
biometrics technologies 688, 693-694, 698
branch banking 1180-1183, 1194
Business Case Analysis (BCA) 1074
business financial reporting 1344, 1354
Business Impact Analysis (BIA) 1063, 1074
Business Intelligence (BI) 110, 1055
business model 159, 181, 191, 335, 563, 706, 708, 1017, 1033, 1066, 1104, 1368-1380, 1382
business model canvas 1375-1378, 1382
business model innovation 1372-1373, 1379, 1382
business per employee 411, 415, 428
Business-to-Business (B2B) 159, 1370

C

call money 950-951, 960
capital share 128
card market 1215, 1223, 1228-1229, 1231, 1233-1234, 1239-1240, 1446, 1516
card transactions 185, 188, 195, 1214, 1218, 1222-1224, 1230-1232, 1239, 1241-1245
cash balances 221, 224, 227
cash flow 29, 140-143, 161, 238-239, 246, 965, 1076-1077, 1202, 1207, 1209-1210
catch-up technology 126
central bank communication 592, 594-597, 610, 612
central bank money 220-221, 645, 659, 1286, 1296-1297, 1302, 1578
Certificate of Deposit (CD) 796, 956
change management 969, 1039, 1045
Chief Information Officer (CIO) 1263
chi-square 49, 123, 410, 415, 419, 423-424, 680, 780, 796, 843-844, 939, 1013, 1015, 1220

chit funds 663
circles processing 659
CKM model 916
climate change 128, 130
cognitive biases 317-318, 328
cohesion policy 758, 764, 772
co-integration 56-57, 61, 67, 453, 465, 951, 1303, 1306-1308, 1311, 1313-1314, 1319-1320, 1325
collateralized debt obligation 561
commercial banks 31, 55, 67, 95-96, 134, 161, 212, 221, 399-404, 406, 413, 455, 519-522, 526, 528, 626, 635, 638, 640-642, 688-689, 732, 907, 911, 948, 950, 958, 1151-1152, 1160, 1174, 1186, 1256, 1332-1333, 1369, 1372, 1457, 1522
commercial transactions 1234-1235
communication networks 128, 130, 1330
competition strategy 42
competitive advantage 18-19, 24, 27, 33-34, 36, 42, 79, 160, 181-182, 259, 487, 724, 741, 748, 908, 915, 919-920, 923-924, 929, 978, 981, 984, 1011, 1116-1117, 1212-1213, 1224, 1334, 1336, 1348, 1374, 1539, 1541, 1545, 1548, 1550
comprehensive analysis 1155
consumer behavior 332, 477, 487, 777, 1449
consumer protection 1340, 1515
content analysis 596, 607, 867, 882-883, 885
Control Objectives for Information and Related Technology (COBIT) 1263, 1265, 1268, 1280, 1283
conventional ICT 699, 705, 710, 712
corporate communication 876, 1385-1387
corporate dividend tax 1202, 1207, 1209-1210
Cost Benefit Analysis (CBA) 1074
country partnership 128, 130
credit cards 180, 182, 188, 200, 248, 342, 423, 425, 427, 430, 724, 777, 779, 781, 790, 1181, 1212-1219, 1221-1224, 1230-1231, 1242, 1251, 1331-1333, 1424, 1427, 1448, 1456, 1510-1512, 1515, 1519
credit default swaps 286, 561, 568
credit deposit ratio 54-55, 57-58, 61, 63-65, 67
credit risk transfer 561, 563
credit share 54-61, 63-65, 67
Cronbach's alpha 49, 679, 780, 823, 925, 939, 1013, 1220
cross-buying 932-933, 936-939, 941-942
currency issued 1284-1286, 1293-1294, 1302
customer knowledge 335, 907-908, 910-916, 918-929
customer knowledge expansion 919-924, 926-929
Customer Knowledge Management (CKM) 907-908, 910, 920
customer loyalty 174, 332-333, 345, 412, 487-489, 687, 717-718, 720, 921, 934, 942
customer profitability 332, 942
customer satisfaction 29-30, 163, 212, 247, 259, 275, 333, 336, 341-342, 345, 415, 487, 544, 547, 552, 720, 724, 818, 912, 915, 926-929, 932-939, 941-942, 1008, 1010-1016, 1046-1047, 1074, 1099, 1116, 1118, 1154, 1216, 1255, 1330, 1337, 1378
cybernetic 1521, 1534

D

dashboards 1048, 1052, 1055
data center 1061, 1065, 1074
data envelopment analysis 414, 1120, 1151-1152, 1154, 1158, 1178
data mining 914, 922, 950, 1002, 1496, 1554-1555, 1559-1560, 1563, 1573
decision tree 437, 440, 444, 450, 894-898, 1555
Delta model 1374-1377, 1379, 1382
dependent variable 45, 48, 50, 122, 143, 148, 169, 336-337, 341, 343, 407, 417, 419, 460, 478, 523, 607, 638-641, 664, 666, 672, 676, 680, 796, 808-809, 821, 837, 841, 844, 846, 860-861, 900, 1184, 1189, 1219, 1221, 1314, 1335
determinants 43, 51, 89, 98, 102, 143, 164, 334, 455, 479, 491, 594, 604, 606, 610, 670, 673, 682, 689, 740, 743-745, 752, 757, 762, 788, 812-813, 819, 1179-1180, 1184, 1190, 1193-1194, 1202-1205, 1212-1213, 1216, 1224, 1253, 1255-1256, 1293, 1346
developing economies 90, 670-671, 750, 764, 978, 983, 1004
digital marketing 110, 126
dirty price 953, 960
dividend puzzle 1211
dominant sectors 70-71, 88
dominant strategy 450
drop-out risk 330, 348
duopoly 435, 437, 441, 450

E

econometrics 54, 65, 453-454, 582, 949, 960
economic crises 103, 1284-1285, 1298, 1302
economic sectors 71, 88, 1189, 1532
economic transformation 740, 756, 764, 772
effective management 408, 709, 966-967, 1043, 1117, 1119
Efficient Market Hypothesis (EMH) 385-387, 389, 397

electronic banking (e-banking) 29, 31, 43-46, 48, 50-51, 160-166, 170-174, 247-252, 254, 256-265, 267-269, 272, 274-276, 330-332, 334, 345, 411, 424, 430, 478, 484-493, 535, 670-678, 680-682, 685-694, 698, 715, 718-722, 724, 818-822, 824-826, 935, 981, 1066, 1096, 1111, 1179, 1181, 1186, 1188, 1191-1192, 1194, 1212, 1214, 1255, 1260, 1329-1333, 1335-1340, 1343, 1370-1371, 1389, 1421-1423, 1427, 1430, 1441, 1510, 1512, 1515-1516, 1518-1519, 1545
adoption 484, 487-488, 492-493, 719, 1370
electronic business (e-business) 44, 160-163, 165, 171-172, 261, 672, 692, 716, 1340, 1343, 1369
electronic collaborative tools 993, 1002
electronic commerce (e-commerce) 78-80, 162-163, 172, 180, 184-185, 247, 250-251, 331, 468, 471, 474-475, 477, 479, 686, 693, 716, 1254, 1256, 1331-1334, 1343, 1433, 1455
electronic market (e-market) place 1343
electronic transaction 199, 692, 1256, 1510
emerging legal issues 1510, 1519
emerging technologies 212, 1037, 1432, 1438, 1457, 1519
end-of-day balance 227, 229-231
error correction 56, 58, 61, 459, 465, 1303, 1306, 1308-1309, 1314, 1316, 1326
European Union (EU) 108, 269, 741, 1153
EUROSTAT definition 109, 114, 126
executive management 252, 255-256, 265, 271, 1065
explicit knowledge 992, 995, 1002
external capital 139-140, 157, 764

F

fair price 953, 960
financial architecture 644-645, 1306, 1521, 1523
financial behavior 315, 776, 778, 796
financial constraint 157
financial contagion 282-283, 286, 288, 565
financial deregulations 886-887
financial distress 236-240, 242-244, 246, 283, 887, 1562
financial inclusion 55, 534, 537, 662, 664, 667, 669, 728-730, 733-734, 736-737
financial institutions 28, 44, 161, 163-165, 171-172, 196, 247-248, 261, 263, 269, 275, 283, 285, 294, 296, 298, 330-332, 335-336, 345, 400-401, 413, 461, 484-486, 518-519, 523-524, 533, 562-563, 580, 633, 636, 659, 671, 685, 688-689, 693, 730, 732, 796, 826, 886, 955-958, 978, 980-981, 1002, 1005, 1082, 1152-1153, 1155, 1159, 1174, 1223-1224, 1232, 1236, 1239, 1267-1268, 1325, 1332, 1368, 1371, 1373-1374, 1421, 1424, 1428-1429, 1449-1450, 1452, 1454, 1512, 1522
financial markets 29, 36, 138, 142, 311-315, 321-326, 330, 351-353, 355-356, 358, 368, 375, 385-386, 392-395, 397-398, 438, 503, 562-563, 593-595, 597, 609, 612, 778, 868, 870, 876, 951, 956, 1153, 1288, 1295, 1304, 1309, 1388, 1528, 1579
financial networks 191, 193, 283, 565, 581, 1452
financial services 19, 27-30, 33, 36, 45, 69, 95, 109, 126-127, 159, 186, 232, 248-252, 348, 410, 413, 533, 536, 672, 688, 698, 700, 706, 708, 728-732, 734-737, 935, 1005-1006, 1018, 1035, 1037, 1083, 1085, 1093, 1101, 1116, 1119, 1153, 1185-1186, 1230-1231, 1268, 1333, 1427, 1434, 1455
financial socialization 776-778, 780, 790-793, 796
financial stability 225, 283-286, 294, 520, 529, 592, 597-598, 602-604, 607, 609-610, 612, 1116, 1156, 1513, 1522, 1578
financial theory 311, 385
financial transactions 79, 180-182, 201, 331, 356, 486, 708, 712, 1002, 1213, 1259, 1262, 1319, 1330, 1370, 1496
Foreign Direct Investment (FDI) 70, 89, 102, 105, 740, 801, 850, 855
financial structure 105
flow 105
stock 105
f-test 637, 951, 960
functional development 1577, 1579, 1583-1584, 1586-1588
fund managers 505, 508, 617, 867, 869-870, 872-880, 882, 885
fund performance 614, 617, 868, 872
fuzzy decision making trial and evaluation laboratory 1115
fuzzy logic 1462-1464, 1467, 1471, 1500

G

Genetic Algorithm (GA) 1484-1485, 1487, 1491, 1500, 1561
global financial crisis 286, 592-593, 596, 610, 1152, 1174, 1303-1305, 1309, 1319-1320, 1325, 1421-1422, 1510, 1513, 1519
globally competitive power 128, 130
governance program 249, 253, 260
Granger causality 56, 58, 63, 453, 460, 465, 950, 1308-1309, 1316, 1320
Great Depression of 1929, the 127
Greenfield investments 95, 106, 747, 754

gridlock 222, 225, 659, 1584, 1587
gross/net NPAS 400, 405-406
growth investing style 509, 516-517

H

harmonization process 128, 130

I

ICT infrastructure 79, 261, 532, 545, 703, 724, 982
ICT strategy 538
identification and authentication 698, 1438
idle land 804-805, 811-812
incoming payments 219-220, 225-229, 654
incumbent banks 1369, 1371
Indian banking 43, 410, 445, 671, 913, 933, 948, 1004, 1008, 1025
Individual Retirement Account (IRA) 779, 796
industrial park 773
industry risk 887, 906
inflation 34, 305, 439, 452, 454, 460, 465, 524, 526, 528-529, 592-596, 604, 609-610, 630, 854, 857, 950, 960, 969, 1287, 1293, 1302, 1522, 1525, 1533
Information Security Governance (ISG) 247-248, 251
  frameworks 248-249, 253, 265, 275-276
Information Technology (IT) 161, 247-248, 269, 410-411, 545, 557, 919, 925, 1263-1264, 1266, 1329, 1331, 1353, 1369-1370
  governance 251, 1063, 1280, 1283
  maturity 1283
  tools 981
Information Technology Security Governance (ITSG) 247-248
  process 259-262, 264
  program 252, 257, 259-260, 272, 274-276
ING global 1385
initial values 225, 1494
institutional features 1577, 1581
intelligence dissemination 1012-1015, 1026
intelligence generation 1004, 1006-1007, 1012-1015, 1026
interbank payment system 649, 659, 1583
interest rate 218, 220, 222, 224, 231-232, 259-260, 294, 305-306, 308, 310, 438-439, 444, 460-461, 518-524, 526-530, 571, 592-595, 598, 610, 633, 699, 887-888, 948, 950-951, 954, 1037, 1047, 1084, 1152, 1156-1158, 1160-1161, 1163, 1171-1172, 1288, 1515, 1524-1525, 1527-1528, 1530, 1535
interest rate margin 518, 521-522, 524, 528-530
intermediation approach 1154, 1178
internal capital 137-140, 142, 157
internal market orientation 1004-1006, 1008-1009, 1012-1013, 1015, 1026
international financial markets 1309
International Financial Reporting Standards (IFRS) 833
international land transactions 797, 800, 808-809, 814
international marketing 1328-1330, 1335, 1340, 1343
international portfolio diversification 1303-1306, 1320, 1325
international stock investment 501, 517
international stock market 1326
Internet banking - See electronic banking.
intraday liquidity 220-221, 232, 649, 659, 1584
investment bank 127-128, 130, 132-134, 136
investment cost 559, 1068
investment perception 620
investor psychology 868, 885
Inward Foreign Direct Investment (IFDI) 106
  US financial flows 89
Islamic Development Bank (IDB) 131, 136

K

Key Performance Indicators (KPI) 1055
knowledge-based industries 109, 126, 755
knowledge-based society 1002
knowledge creation 112, 126
knowledge economy index 119-120
Knowledge Management (KM) 907-908, 918-919, 980
knowledge management system 979, 982, 996, 1002
knowledge sharing 919-920, 922, 924, 927-929, 978-979, 981-997, 1002

L

land grabbing 797-800, 803, 808, 813-815
language analysis 612
law of one price 323, 387, 394, 398
limits of arbitrage theory 398
liquidity 96, 218-232, 238-239, 242, 259-260, 283, 288, 290, 357, 365, 369, 399, 401, 406, 408, 440, 453, 460-461, 520-521, 528, 562, 571, 598, 616, 621, 644-645, 647-657, 659, 836, 870, 887, 891, 948-958, 960-961, 1152, 1156-1158, 1160-1162, 1171-1172, 1204, 1285, 1287-1289, 1291-1292, 1295-1298, 1302, 1314, 1434, 1513, 1519, 1522, 1531-1532, 1560, 1578-1587
Liquidity Adjustment Facility (LAF) 960

liquidity risk 259-260, 283, 659, 887, 948, 952-953, 955, 957-958, 1152, 1156-1158, 1160-1161, 1171-1172, 1586
Liquidity Saving Mechanisms (LSM) 644, 659
Logical Framework Approach (LFA) 2, 9, 15
logistic/logit regression 336-337, 339, 341, 343, 776, 779-780, 791, 796, 809, 1560
long position 364, 384, 393, 899

M

macroeconomy 1521
mainstream finance 326
mainstream technologies 1368
maize farmers 1081, 1083, 1085-1091, 1093
maize production 1088, 1091, 1093
mandatory disclosure requirements 832
market hypothesis 311-312, 314-315, 320, 324, 326, 385-387, 389-393, 395, 397, 504-505, 512-513
market-maker 362, 365, 384
market participants 224-230, 232, 352-353, 357, 366, 387, 389-393, 564, 579-580, 832, 952, 1231, 1233-1234, 1236
market share 9, 21, 240, 242-243, 247-248, 256, 330, 547, 562, 564-565, 580-582, 626, 688, 915, 1009, 1229, 1336, 1539, 1544
market timing 138, 141, 143-144, 148, 150, 152-153, 157
max-min strategy 440-441, 450
Mergers and Acquisitions (M&A) 106
microcredit 700, 1081, 1093
microfinance 532-542, 699-710, 712-713, 1081, 1083, 1085-1086, 1088-1091, 1093
microfinance banks 533-534, 538, 1083, 1085, 1088, 1091
microfinance sector 532-534, 536-538, 541-542, 700, 702, 704-706, 708-709
mixed strategies 440, 442, 451
mobile banking 29, 31, 161, 250, 424, 534-535, 715, 717-718, 721, 724, 730, 733, 735, 935, 1214-1215, 1253-1259, 1261-1262, 1453, 1513, 1516, 1518
mobile payments 180-186, 189-191, 193, 198, 211-212, 1254, 1256, 1432, 1434, 1445, 1450, 1453-1454, 1457
mobile technology 535-536, 699, 706, 710, 712, 731-732, 735, 1256, 1432
modern management 746
monetary base 454, 461, 948, 1284-1285, 1295-1296, 1298-1299, 1302
monetary policy 218-219, 221-222, 229, 232, 452, 454-455, 460, 518-520, 522-523, 526-527, 529, 592-598, 601, 603-604, 607, 609-610, 612, 645, 949-951, 954, 960, 1284-1285, 1287, 1289, 1292-1294, 1296-1299, 1302, 1522-1523, 1525-1526, 1534, 1578, 1585, 1587
money supply 452-455, 459-461, 465, 950, 954-955, 1286-1287, 1297, 1531
multi-agent modeling 562
multi-criteria business analysis 560
mutual fund 417, 423, 425-426, 614-621, 623, 868, 870, 872-873, 876-877

N

Narasimham Committee Report 400-401
nash equilibrium 435, 437, 440-442, 446, 451
national domestic production 625-627
Net Asset Value (NAV) 365, 384, 616, 957
net benefits 1228, 1232, 1234, 1236, 1348
net interest margin 1151, 1178
network externalities 1228, 1231, 1234, 1238-1241, 1245, 1580
new model 706, 708, 850, 852, 863, 1445, 1521
New York Stock Exchange (NYSE) 246, 387
noise trading 322, 324, 328
non-performing assets 399, 401, 406-408, 958
null hypothesis 56-57, 122-123, 343, 680, 796, 951, 960, 1082, 1089, 1190, 1307-1308, 1311

O

OECD definition 113, 126, 742
office size 1179-1182, 1184-1195
oligopoly 435, 437, 451, 557
Online Banking - See electronic banking.
opening liquidity 225, 229
open market operation 518-522, 524, 526, 528-529
Ordinary Least Square (OLS) 143, 625, 960
organization culture 984, 987, 995, 1003, 1039
organization strategy 1045
outgoing payments 219, 221-223, 226-227, 229, 644-645, 1584
outsourced activities 261, 263

P

participating equity 131
passive portfolio management 504-505, 516-517
payment card 184-185, 188, 194, 268, 1229-1240, 1245, 1449, 1451-1452

payment instrument 1230, 1232, 1236
payment systems 180, 182, 187-188, 212, 218, 220-226, 228-229, 283, 644-646, 656, 659, 1228, 1230-1231, 1245, 1256, 1333, 1434, 1438, 1441-1442, 1444, 1449-1451, 1453, 1457, 1577-1581, 1583-1588
payout policy 1202, 1211
pecking order theory 139, 157
perceived ease-of-use 1216, 1255, 1260, 1346
perceived risk 43, 45-46, 49-51, 487-488, 491-492, 670, 673, 675, 677, 679-682, 687, 1212, 1216, 1218, 1220-1223, 1256
perceived security 173, 686-687, 698, 1256
perceived trustworthiness 688, 698
perceived usefulness 43, 45-46, 49-51, 162, 470-471, 474-475, 478-479, 670, 673-676, 679-682, 687, 819, 822, 824-826, 1212, 1215-1216, 1220-1221, 1223-1224, 1253, 1255-1256, 1260, 1262, 1346
performance metric 1074
personal digital assistants 1432, 1445
phishing 163, 687, 689-690, 693, 698
portfolio investment 413, 506-507, 773
portfolio management strategies 501, 504-505, 507, 517
potential investors 109, 126
poverty alleviation 627, 712
poverty outreach 699-700, 709, 712
principal amount 399, 401
prisoners' dilemma 435, 441, 445
private organizations 130, 132, 1385
private sector banks 43, 45-46, 48, 51, 400, 402, 413, 424, 428, 442, 445, 670, 672, 674, 678, 682, 1018, 1025, 1224, 1401
production and trading systems 69, 88
production approach 1154-1155, 1178
profitability approach 1151, 1154-1155, 1178
profit per employee 411, 415, 428, 430
program management 1-2, 6, 9, 14, 1041
project financing 1511-1512
project management 2, 4, 6, 9, 14, 705, 935, 965-966, 969, 972-973, 1041, 1266, 1278
project stakeholder 14
Proof of Concept (PoC) 1055
prospect theory 311, 313, 315-317, 319, 328
public sector banks 51, 400, 402, 413, 423-424, 430, 442, 445, 615, 682, 735, 912, 1025, 1224, 1268-1269, 1277, 1279-1280
pure strategy 440, 442, 451

R

random walk hypothesis 386-387, 392, 398
rapid development 44, 180, 211, 326, 671, 920, 1194, 1456
Rate Sensitive Assets (RSA) 952, 960
Rate Sensitive Liabilities (RSL) 952, 960
Real Time Gross Settlement (RTGS) systems 219, 221, 659
Receiver Operating Characteristic (ROC) 348
reform 28, 54, 56, 60, 63-65, 67, 69, 75, 256, 400, 454, 634, 716, 957, 1230, 1267-1268
regional development 9, 15, 22, 127-128, 130, 132-134, 745, 758
relationship development 412, 932-933, 935-936, 941
relationship maintenance 932-933, 935-937
relationship marketing 410-412, 909-910, 934, 1119
relationship quality 932-935, 1119
relative advantage 43-44, 46, 49-51, 258, 670, 672-673, 675, 677, 679-682, 720, 1212, 1214, 1216-1217, 1220-1222, 1224
repo 438, 460, 519, 524, 562, 583, 949-951, 956, 960, 1512
Research and Development (R&D) 117, 637
  expenditures 22, 28, 31, 42, 137-144, 150-155, 748
reserve money 454, 951, 954, 1284-1285, 1294-1295, 1302
reserve requirement ratio 518-523, 526-530, 1285
residential mortgage backed securities 561-562
responsible investments 3-4, 11, 14
responsiveness 910, 1004, 1007, 1012-1016, 1026, 1121, 1277, 1319, 1330, 1532
retail investors 614-615, 620-621, 624, 870
return on assets 401, 407, 838, 933, 1151, 1157-1158, 1178, 1188
return on equity 838, 933, 1151, 1153, 1158, 1178, 1188
risk and return 317, 391, 618, 624, 888, 1155-1156, 1305, 1320
risk efficiency 1151-1152, 1155, 1158, 1162-1172, 1174-1175, 1178
risk management 30, 247-249, 255-257, 259, 262-265, 267-272, 275-276, 284-285, 287, 461, 536-537, 545, 552-554, 560, 872, 886-889, 894, 897, 901-903, 948-950, 952-953, 955, 973, 1161, 1163, 1264, 1277-1278, 1283, 1340, 1347, 1451, 1496, 1578

role model 109, 126, 1462
rule extraction 1556

S

safe energy 128, 130
saturation point 1228, 1234, 1240, 1245
scenarios generation 292, 305
segmented macroeconomics 1521
self-service technologies 714-715, 717
service factory 1096, 1100-1101, 1104-1106, 1111
service innovation 259, 921, 1004-1005, 1008-1009, 1011-1013, 1015-1017, 1026, 1100, 1539
service positioning 1095-1096, 1098, 1100, 1102, 1110
service processes 467, 1094, 1096, 1099-1100, 1103-1106
service process matrix 1094, 1096, 1101-1103, 1110
service production 1008, 1094-1095, 1099-1104, 1110, 1542
service quality 161, 258, 475, 488, 535, 724, 912, 916, 937, 1005, 1012, 1016, 1094, 1096, 1098-1100, 1102-1103, 1110, 1115-1119, 1121, 1123, 1129, 1136, 1139, 1154, 1256, 1336, 1539, 1548
settlement risk in payment systems 659
shareholders' wealth 1211
Short Message Service (SMS) 1224
short position 364, 384, 393, 1160
short-term interest 220, 222, 1288, 1528, 1533
simulation of joint losses 287
slacks based model 1154, 1158, 1178
Small and Medium Enterprises (SME) 79, 127-128, 132, 159, 1032, 1085
social capital 27, 744, 1003, 1389
socialization 776-778, 780, 790-793, 796, 1387-1388
social media 33, 110, 126, 914, 1384-1389, 1415-1417
social performance 80, 708, 713, 810
social sciences 48, 114, 312, 314-315, 885, 894, 949, 1220, 1269, 1422
soft computing 1462-1463, 1496, 1500, 1562
solvency 298, 400, 562, 948, 955, 961, 1156-1158, 1579, 1584
special economic zone 759, 773
stakeholder participation 9, 12, 14-15
state aid 741, 758-761, 763, 773
stationarity 56, 459, 465, 1245, 1307
stock investment styles 506-507, 517
stock market 137, 141, 242, 298, 314, 353-354, 365, 388-390, 468, 475, 615, 619, 868, 1288, 1303, 1306, 1309, 1311, 1313-1314, 1318-1320, 1325-1326, 1353-1354, 1434, 1494, 1496, 1521-1525, 1528-1529, 1531, 1533-1535
strategic planning 269, 1031, 1035, 1039, 1041, 1045-1046
strategic positioning 1374-1376, 1378-1380, 1382
structural equation modeling 169, 1255
structural liquidity 952-953, 961
Sustainable Development (SD) 1
systematic risk 571, 618, 906, 1305
systemic risk 96, 219-221, 225, 262, 282-287, 292, 294, 296, 298, 301, 305, 561-562, 564-566, 580-582, 1584

T

tacit knowledge 80, 116, 918, 982, 985, 988-990, 992, 995, 1002-1003
technological advance 126, 1527, 1532
technological innovation 22-24, 28, 42, 75, 162, 536, 907, 1541
technology acceptance 45, 162, 467-468, 470-471, 474, 487, 489, 535, 673-677, 687, 692, 1215-1216, 1253, 1259, 1262, 1346
Technology Acceptance Model (TAM) 162, 467-468, 470-471, 474, 487, 674, 687, 1215-1216, 1253, 1259, 1262, 1346
technology adoption 162-163, 171, 468, 477, 490, 674, 694, 715, 725, 934, 1259, 1346
technology use 173, 674, 722
telecommunications network 180, 182
Theory of Planned Behavior (TPB) 162, 468, 470-471, 474, 487, 675, 687, 818-820, 1346
Theory of Reasoned Action (TRA) 468, 470, 487, 674-675, 687, 820, 1215, 1346
trade concentration 68, 71, 88
trade diversification 68-69, 72, 88
tradeoff theory 140, 158
transaction costs 23, 161, 163, 243, 314, 319, 323, 394, 477, 505-506, 511, 682, 743, 808, 1093, 1577
transfer systems 186, 218-219, 659
transformation strategy 1045
Tunisian banks 818-819
Turkish banks 19, 30, 1117-1118, 1562-1563

U

underinvestment 140, 158
unit root, causality and cointegration 67
unrealized gains/losses 384
unsystematic risk 906, 1305

V

value added 68, 70-71, 81, 88, 99, 111, 747, 758, 809-811, 814, 854, 1070, 1078, 1102, 1106, 1445
value added per sector 70, 88
Value at Risk (VaR) 296, 955, 961
value chain 193, 212, 545, 1035, 1352, 1368, 1370
value investing style 509, 517
value payment 218-221, 223-224, 226, 565, 1578
Vector Auto Regression (VAR) 459, 465
vector error correction model 1303, 1306, 1308, 1326
virtual environment 1384, 1386
virtual infrastructure 126
Visegrad group 740-741, 744, 749-752, 754-765, 773

W

wireless technology 180, 1444-1445