JOURNAL of Applied Economic Sciences

JAES
Journal of Applied Economic Sciences

Volume X
Issue 4(34)

Summer 2015

ISSN-L 1843 - 6110
ISSN 2393 - 5162

Editorial Board

Faculty of Financial Management Accounting Craiova
No 4. Brazda lui Novac Street, Craiova, Dolj, Romania
Phone: +40 251 598265 Fax: + 40 251 598265

European Research Center of Managerial Studies in Business Administration
http://www.cesmaa.eu
Email: jaes_secretary@yahoo.com
Web: http://cesmaa.eu/journals/jaes/index.php

Editorial Advisory Board

JOURNAL of Applied Economic Sciences

*J*ournal of *A*pplied *E*conomic *S*ciences

Journal of Applied Economic Sciences is a young economics and interdisciplinary research journal, aimed to publish articles and papers that should contribute to the development of both the theory and practice in the field of Economic Sciences.

The journal seeks to promote the best papers and researches in management, finance, accounting, marketing, informatics, decision/making theory, mathematical modelling, expert systems, decision system support, and knowledge representation. This topic may include the fields indicated above but are not limited to these.

Journal of Applied Economic Sciences be appeals for experienced and junior researchers, who are interested in one or more of the diverse areas covered by the journal. It is currently published quarterly with three general issues in Winter, Spring, Summer and a special one, in Fall.

The special issue contains papers selected from the International Conference organized by the European Research Centre of Managerial Studies in Business Administration (www.cesmaa.eu) and Faculty of Financial Management Accounting Craiova in each October of every academic year. There will prevail the papers containing case studies as well as those papers which bring something new in the field. The selection will be made achieved by:

Journal of Applied Economic Sciences is indexed in SCOPUS www.scopus.com, CEEOL www.ceeol.org, EBSCO www.ebsco.com, RePEc www.repec.org and in IndexCopernicus www.indexcopernicus.com databases.

The journal will be available on-line and will be also being distributed to several universities, research institutes and libraries in Romania and abroad. To subscribe to this journal and receive the on-line/printed version, please send a request directly to jaes_secretary@yahoo.com.

Journal of Applied Economic Sciences

ISSN-L 1843 - 6110
ISSN 2393 – 5162

Table of Contents

1 **Ivan DERUN, Iryna SKLYARUK**
Accounting in World and in Ukraine – Retrospective Approach. Applied Science or Practical Activity? …451

2 **Ehsan RAJABI, Junaina MUHAMMAD, Mohsen AMINI KKHOZANI**
Do Money Supply, Inflation, and Interest Rate Matter towards Influencing Malaysian Stock Market Performance? …461

3 **Cicilia IONESCU**
Audit of Adequacy Degree for the Principle of Activity Continuity …479

4 **Patrik JANGL**
Influence of the Market Orientation on Business Performance of High-Tech Firms in the Manufacturing Industry: Comparison of Regression Models of "Market Orientation – Business Performance" in the Czech Republic and Germany …484

5 **Koi NYEN WONG, Soo KHOON GOH, Hooi HOOI LEAN**
Foreign Direct Investment, Oil Prices and Global Financial Crisis: Evidence from Singapore …494

6 **Luminița PISTOL, Rocsana TONIS (BUCEA-MANEA)**
Model for Innovation through Information Network Sharing …505

7 **Carmen LLORCA – RODRÍGUEZ, Anna MACCAGNAN, Tindara ADDABBO, Rosa M. GARCÍA-FERNÁNDEZ**
Poverty and Material Deprivation in the Crisis: Italy and Spain …514

8 **Wei-Bin ZHANG**
Oscillations in a Multi-Country Free Trade Model with Endogenous Wealth and Environment …534

9 **Rajmund MIRDALA, Aneta SVRČEKOVÁ, Jozefína SEMANČÍKOVÁ**
On the Relationship between Financial Integration, Financial Liberalization and Macroeconomic Volatility …552

10 **David CARFI, Alessandro ROMEO**
Improving Welfare in Congo: Italian National Hydrocarbons Authority Strategies and its Possible coopetitive Alliances with Green Energy Producers …571

11 **Hadhek ZOUHAIER**
Financial Efficiency, Competitiveness and Profitability of Islamic Banks …593

12 **Matúš KUBÁK, Radovan BAČÍK, Alexandra ANTALÍKOVÁ**
Tendencies toward Venal Behavior and Social Norm …607

Journal of Applied Economic Sciences
Volume X, Issue 4 (34), 2015

Accounting in World and in Ukraine – Retrospective Approach. Applied Science or Practical Activity?

Ivan DERUN
Faculty of Economics
Taras Shevchenko National University of Kyiv, Ukraine
ivanderun0601@gmail.com

Iryna SKLYARUK
Faculty of Economics
Taras Shevchenko National University of Kyiv, Ukraine
irinaskl@mail.ru

Abstract:

In this article it goes about the development of accounting from the standpoint of a scientific approach and practical activities. The main purpose of this study is to analyze this institution as an individual applied science. It was caused by multiple discussions in the academic circles about the place of accounting in science, as many economists share an idea that accounting is mostly a practical activity, not a scientific theory. This is due to the fact that the accounting practice is developing more rapidly than its theory. In the article, a special attention is paid to the study of the range of issues faced by the accounting theory, those it must solve as a result of new challenges in the economic reality, namely: the definition of a scientifically based methodology for determining fair value, the completeness of the information on intellectual capital in the reporting, a role of accounting as an entirely economic institution. Thus, it is reported in the article that accounting is an applied science, which in its research and own methodology has to use interdisciplinary tools to fight off these big challenges.

Keywords: accounting, accounting as social and economic institution, accounting theory, International Financial Reporting Standards, US GAAP.

JEL Classification: M40, M41, B10, B20.

1. Introduction

During its historical development, the issue of accounting is discussed extensively as to whether it is the science or profession, what its theoretical aspects are, and what the subject of its practice is. The impact of globalization and integration transformations on the economic development leads to some changes in the management system. Basically, it lies in the increasing role of managerial decision-making at the enterprise as a primary management unit with the accounting data as the key information base. This data must be provided by the highly qualified staff. The accounting profession, without which the business entity is not able to operate and develop, has got a mixed assessment. The reason for that is the fact that this profession is in high demand in every field of activity and is considered prestigious. However, knowing the importance of accounting as practice, the issue of the place of accounting in the science is still a subject of discussions. Thus it explains the relevance of the research topic.

The purpose of this study is to analyze and substantiate the theoretical principles of accounting as an applied science, which was caused by controversies and debates in the scientific works of the national and foreign scientists.

To reach this goal, the following objectives were set:

- to identify the current perspectives of the development of accounting as a science, which uses interdisciplinary tools in its own methodology;
- to highlight the main approaches to the interpretation of accounting as a practice or profession, and science.

The general scientific and specific methods of cognition were used in this study. Methods of analysis and synthesis, the unity of the logical and historical, theoretical generalization, a systematic approach to studying the genesis of accounting as the science and practice, and highlighting individual approaches to the interpretation of its essence and functioning peculiarities were used in the study. Applying the methods of induction and deduction, comparison and grouping, analogies and scientific abstractions, practical recommendations are given for the improvement and further development of accounting as applied science.

2. Accounting as a science: present status

The concept of science is multivalued like the notion of truth, for there is no absolute truth. It can only be relative. According to the conventional approach, a separate field of knowledge can be determined by science, if it has its own subject and methodological tools. However, this criterion for the definition of science is not correct, according to the famous Austrian economist J. A. Schumpeter who states that the majority of sciences are constantly moving from one research plane to another one over the time lag. Therefore, the identification of the certain sphere of knowledge as a science based on its subject and research methodology is not always logical. In particular, he states that economics is an unordered set of interconnected knowledge.

J. A. Schumpeter in his work "The History of Economic Analysis" defines science as a body of knowledge, which has produced a toolkit for searching and interpreting the facts (Schumpeter 2001, 8–12). Considering these ideas, the accounting differs significantly from the other areas of knowledge in economics, since it (as the applied science) has its own specific framework (account balance, debit, credit, etc.) and methodological tools (double entry, inventory, accounts, etc). In addition, Werner Sombart reported that the emergence of double-entry had caused the development of capitalism due to the emergence of the banking system in the thirteenth century (Sombart, 2005, 354–356).

Until the mid-20th century, most academic economists had considered accounting only as a field of practical activity at the enterprise. Currently, the most significant work in terms of theoretical foundations of accounting is the doctoral thesis of V. Paton "Accounting Theory". In his work V. Paton reports that any changes in cost for any reason should be reflected in accounting. In his dissertation he defined the basic postulates of accounting:

- the existence of a distinct business entity, which is a universal assumption, however, it is declared only;
- the continuity of distinct business entity, as the assumption that the enterprise will operate for a long period of time;
- the balance-sheet equation – the equality between assets and owned capital, and liabilities (sources of liabilities);
- monetary postulate (financial condition) – monetary valuation of assets, equity (owned) capital and liabilities are the reflections of the financial condition of the enterprise at the date of preparation of the financial reporting;
- the postulate of the expenses and the current value (cost and book value) – expenses make a realistic assessment to determine the initial value;
- cost accrual and income – origination of the profit due to the definite economic fact in the sphere of sales (Paton 1922, 471–497).

The situation changed back in the 50s of the 20th century as a result of increased criticism of experts about the reliability and relevance of the information presented in the financial reporting that disrupts the function of control over the accounting in the economic activities and communication between the users of the financial reporting. The essence of the criticism was in the fact that the reports issued by the American Institute of Certified Public Accountants (AICPA) were based on the practical necessity, but not on the logical understanding of the existing problem, i.e. the lack of systematization of existing practices of accounting. Thus, in 1959, on the initiative of E.R. Jennings, the Committee of Accounting Procedure was reorganized into the Accounting Principles Board, which carried out the first scientific studies associated with the development of the basic postulates of accounting and financial reporting (Kovalev 2013, 99). It was one of the first attempts to systematize the accounting theory. However, that attempt did not trigger any increase in the dynamics of scientific research in the field of accounting. So, in 1973, the Accounting Principles Board was liquidated. Instead, an independent organization of the American Institute of Certified Public Accountants was established – the Financial Accounting Standards Board, which began to represent the interests not only of professional accountants, but also of business owners, shareholders, investors, creditors, etc. It was the FASB, which established the conceptual framework of accounting. They were the basis of modern methods of accounting as an applied science (Hendriksenand Bredavan 2000, 54–56).

Accounting should be considered a science also according to the well-known scientific concept of T. S. Kuhn – the revolution in science, which is based on a paradigm shift. Many scientists tend to think that this concept is effective for exact and natural sciences, but it is not acceptable for humanities. In

particular, according to this concept, accounting cannot be a science, because this type of activity is a service field, thus it has a large share of subjectivity (Peasnell 1978, 220–221). However, we can't but agree with the idea of B. Cushing, who states that the revolution in science can cause major changes in any field of scientific cognition, and therefore we should speak about science in a broad context, but not in the narrow sense of the action of objective laws (Cushing 1989, 1). Thus, according to this logic, accounting is a science, for it provides the information about the financial situation in an economic unit to users of the financial reporting, which is related to a wide range of people.

According to the Kuhn's concept "paradigmale consensus" in accounting was formed in the XVI century, when the dominant theory of accounting in Europe was the theory of double entry. In the future, till the mid 60-s of the twentieth century, science was developing as "a normal science", when new discoveries in the accounting could be explained by the theory of double entry. On that time the accounting methodology was based on the use of historical prime cost. However, since the second half of the 60s of the twentieth century, when prices began fluctuating sharply, accounting as a science entered the "crisis" stage, because its methodology could not solve all the issues faced by accounting. In particular, it was the time when the state institutions began to actively intervene in the regulation of accounting at the legislative level, and the challenges of a social nature had changed (the increased necessity in the more informative financial reporting, strengthening of diagnostic functions of accounting due to the globalization of the stock market, etc). Furthermore, in early 90s of the 20th century the fair value of enterprises was materially different from their balance cost (the impact of the intellectual capital, the cost of which is not fully presented in the financial reporting of the enterprises now). These challenges led to complications and increased standards in the U.S. and Europe (IFRs and US GAAP). However, it does not allow to fully solving the current problems. In particular, the international accounting community is trying to solve these problems by the convergence of IFRs and US GAAP. But here another problem arises, which needs to be solved – the issue of dominance of recommendations and principles in accounting, those IFRs are based on, or to give the advantages to the detailed rules of accounting, which are the basis of US GAAP.

3. Development of accounting as a science: prospects of development

Despite a crisis in accounting as a science, some ontological research lines in this area continue developing. At the current stage of development of accounting the traditional research directions are predominant. In particular, studying of accounting as an information basis is quite popular. It serves other practical activities, e.g. banking, finance, and management. For instance, in the work of the outstanding scientist J. Weatherford, "The History of Money…" it goes about the development of human civilizations through the prism of the evolution of money. In particular, he states that the evolution of money had led to the development of mathematics, which in turn gave impetus to the emergence of double-entry accountancy and the birth of banking in the Italian city-republics that became one of the reasons for the development of primary accumulation of capital (Weatheford 2001, 104–105). This is the direction, which can be used for interpreting the current trends in the development of corporate finance, management accounting, etc. Another traditional area of the study of accounting is the interpretation of accounting as a set of methods of registration of the facts of economic activities (operation) and the provision of information about these facts to the users of financial reporting. That's the direction of traditional accounting, which is the most developed. At present, working in this direction is associated with the further development of standards for financial and tax accounting at the national level, and their harmonization and convergence in accordance with the requirements of IFRs or US GAAP (Volkova 2014, 20). These two directions in the ontology of accounting are actually the interpretation of accounting as a technical practice for fixing the facts of economic activities and reflecting the information about them in the financial reporting in the narrow sense.

At the present stage of the development of the traditional direction in accounting, one of the biggest challenges is that the current accounting system is not able to meet all the needs of users of the financial reporting. The problem object in accounting is the intellectual capital (Derun 2013, 107). Therefore, one of the key problems in the research of the accounting theory is the reflection of the intellectual capital in the accounting system of the enterprise.

The significance of the role of intellectual capital is especially important for multinational corporations that are listed on the international stock exchanges, because in the last 20 years the market value of such entities began to make a significant difference from its balance cost. In particular, Table 1

shows the data on the cost of the internally generated brands for some of the largest companies worldwide.

Table 1 – Cost of the brands of the transnational corporations, 2013 –2014, million dollars

NAME	INDUSTRY	Cost of the internally generated brand	
		2014	2013
Apple	Information technologies	104680	87304
Samsung Group	Electronics	78752	58771
Toyota	Automotive engineering	34903	25979
Coca Cola	Consumer goods	33722	34205
Shell	Oil production, oil processing	28575	29752
Bank of America	Financial services	26683	22397
McDonald's	Consumer goods	26047	21642
Nike	Consumer goods	20821	14942
Oracle	Information technologies	20635	16047
Chevron	Oil production, oil processing	19171	17674
PwC	Audit, outsourcing	16623	16375

Source: was systematized by the authors based on "The World's Most Valuable Brands", http://brandirectory.com/league ables/table/global-500-2014 (reffered on 11.02.2015).

The main reason for the big difference between fair and book value of enterprises is the fact that in accordance with IFRS and US GAAP the elements of intellectual capital (the greater part of structural capital and human capital) are not presented in the balance sheet, since they do not satisfy the basic requirements for the recognition of assets. Instead, they are recorded as expenses of the reporting period. To partially solve this problem one should include in the international standards the norm (provision), which would allow recognizing the internally generated non-material assets as long-term, for their value is significant respectively to the value of all assets in the balance sheet.

To solve this issue, at least one of the following questions is to be answered:

- Are intangible (non-material) resources really created by the business entity?
- Can the business entity influence these intangible resources?
- Do these intangible resources belong to the business entity?

To meet the needs of users of the financial reporting it is advised to specify in IFRS that the expenditures on the research and development of self-made intangible resources need to be capitalized, but not to be attributed to the expenses of the period, since they can be considered as capital investments in the creation of non-material assets. However, to avoid the distortion of the data in the accounting of these expenses it is necessary to meet the following conditions:

- the documentary evidence of having such expenses and their relation to the future intangible asset;
- these expenses must be directly associated with the non-material asset;
- the documentary evidence and justification of the fact that the results of the study will be used when creating the intangible asset, which will be applied by the enterprise and bring economic benefits in the future;
- have the intention to complete creating the non-material asset, as well as technical and financial resources for its completion.

Quite a similar problem applies to human capital (costs for employment, costs for training employees, etc), because the skills and mental abilities belong to the employees, but not the enterprise itself, making it impossible to control. However, the staff costs are long-term investments. Therefore, it is advisable to introduce a norm in IFRS that will determine that the costs involved in human capital can be recognized as long-term assets only if the company's employees have signed the collective agreement and the employment agreement. Otherwise, they should be considered as expenses of the period.

As for another traditional direction in studying the accounting theory, it should be the evaluation of assets and sources of their formation. At present, in the world there are two assessment models: a prime cost model and a fair value model. Both models are used in Europe, however, in the U.S. there are some

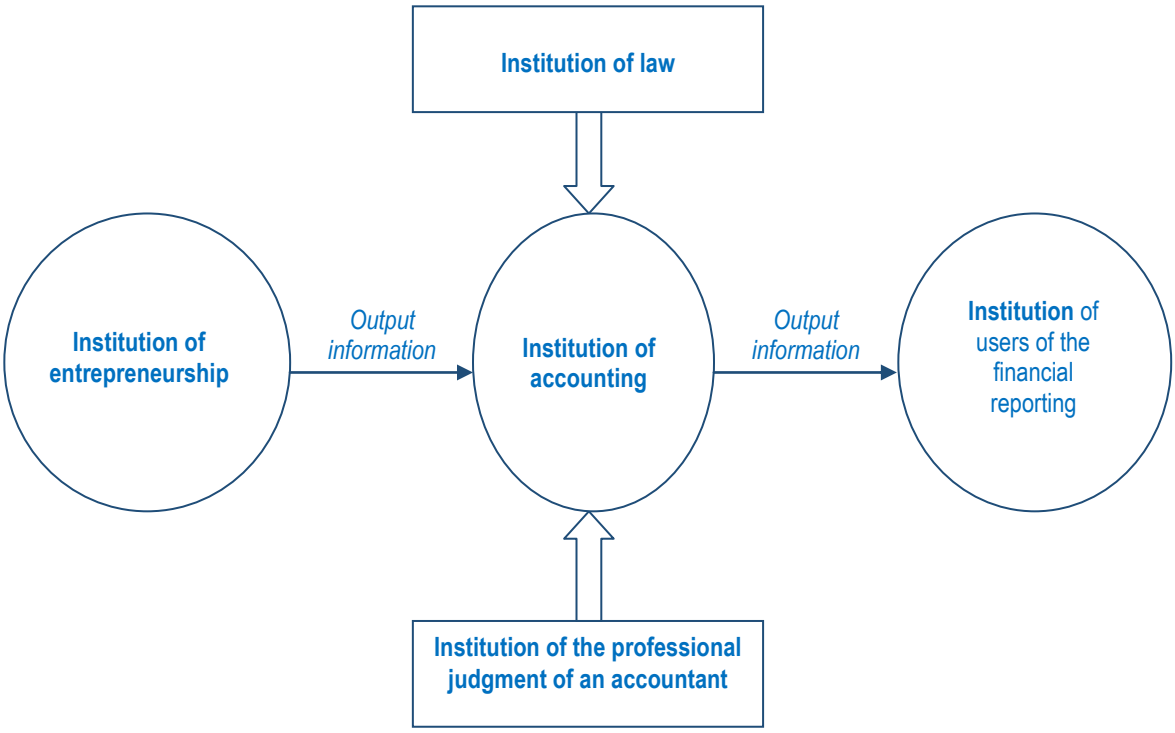
restrictions on the use of the revaluation model, which is due to the possibility of the unjustified excessive revaluation of the assets of the enterprises to increase the investment attractiveness and improve creditworthiness (Hurmann 2006, 45). However, it should be noted that in modern conditions of the development of economic relations the use of historical prime cost for the valuation of accounting objects may result in a fair presentation of the information about them in the financial reporting. For example, two plots of land of similar quality can cost differently. But, the fair value increases the comparability of their prices in the financial statements of the enterprises. Furthermore, the estimate based on the fair value is consistent, because its use requires periodic evaluations of major assets if their market value is substantially different from balance cost. In addition, some scientists state that there is a direct correlation between revaluation of long-term assets and the price of the enterprise shares.

Despite the significant advantages in using the model of fair value in the accounting, there is the problem to determine its methods. Thus, according to the research data of some scientists, among 1539 English and German companies only 3% use the fair value for valuation of the fixed assets (Christensen 2009, 3). This is due to the absence of active markets, a high price of the information-gathering process to determine a fair value, the lack of methodical recommendations on its definition, and the lack of qualified experts to assess the property. Thus, the theory of accounting needs to be studied in this aspect.

However, now there is an increasing tendency to consider the accounting in the broad sense as a social and institutional practice, which is able to influence not only the fixation of the facts of economic activities, but the management of organizations and public institutions. In this sense, there is the interaction between the methods of measurement of the activities (accounting methods) and the methods of business management. These studies can serve as the basis for the impact on the management of individuals, organizations, processes, etc. Accounting as a social and institutional practice should be considered in the following aspects:

- accounting as a method for quantitative activities, processes and events. It, in turn, opens the ways for the transformation of people's actions. For example, making the actual accounting records for such abstract things as assets, liabilities, own capital, income, expenses that cannot exist on their own.
- accounting as a complex linguistic structure. In this case accounting can be regarded as a dictionary, which has its own vocabulary and terminology that allows creating certain discursive ideas about the activities. For instance, making the report on the financial results is closely related to such notions as “accountability”, “responsibility”, “reliability”, “validity”, “efficiency”, etc. From this perspective, accounting gives the opportunity to apply own principles in various social conditions. Thus, accounting can be considered in terms of two aspects: a complex semeiotic system and communication environment.
- accounting as a lawmaking device. In this context it should be considered as a tool used by organizations to streamline their activities by increasing the environmental pressure with legal methods (Potter 2005, 267 – 272; Volkova 2014, 20; Zhuk 2012, 16).

So, at the present stage of the development, accounting is an applied social science, because from the point of view of sociology, it is the institution that transforms and interprets the information about the facts of economic activity of business entities (institutions) for users of the financial reporting (institutions) for making management decisions. But, on the other hand, we should keep in mind that the institute of accounting is influenced by the institute of law (statutory provisions) and the subjective judgments of an accountant or professional accounting organizations. So, accounting performs the function of informing and mutual understanding of people, as well as it is a means of making certain actions, i.e. it regulates the functioning of other institutions. Furthermore, the institution of accounting is influenced by other institutions of the system, where the professional judgment of the accountant acts as an informal institution. Thus, accounting can be viewed as a social phenomenon. In particular, Figure 1 shows accounting as an institution in the socio-economic system.



Source: was compiled by the authors.

Figure 1- Role of accounting as an institution in the socio-economic system

Thus, nowadays the idea of accounting is influenced not only by its own methodology, but also by methods of other sciences, namely: philosophy, sociology, political science, etc. Moreover, it is very popular in contemporary accounting research to use a cross-disciplinary approach, involving economics, history, sociology, linguistics, etc.

4. Accounting as a profession

As a separate science, accounting is a system of knowledge that has been evolving with the theories and practices specific only to it. The genesis of accounting suggests the usefulness and significance of the profession of the practicing accountant. The word 'accountant' appeared in the Middle Ages. When translated from German, it means 'bibliographer'. It is due to the fact that the movement of funds and commodity-material assets was recorded in special books.

In the past decades, accounting has undergone unprecedented changes. This is due to the significant expansion in the functions and competence of the accounting departments and services, which promotes the development of the accounting profession. We agree with the studies of Y.V. Sokolov and V.V. Kovalev that the accounting profession, starting from its occurrence till now, is characterized by prestige and usefulness. V. Y. Sokolov states that the farther you delve into the history, the more positive assessment of the accountancy employee is. And this can be explained by the fact that when the bulk of the population could neither read nor write, the accountants were able to do that and many other things, every literate person was needed and respected (Sokolov 2003, 6; Kovalev 2013, 90–91).

Quite often accountants were called 'bookish' or 'literate', which again proves their knowledge of literacy, the ability to read, write and count. Back in the 18th century, much attention was paid to double entries, and some approaches to the implementation and development of programs on studying accounting at schools were made [Sokolov 2003, 7]. The development of social relations, the need to obtain the reliable information on the activities of the entity led to the introduction of the accounting profession, the existence of which goes back for several centuries. In particular, in Tsarist Russia the accounting profession was officially founded by Peter I in the early eighteenth century. However, in the works of Benedetto Cotrugli "On Trade and the Perfect Merchant" (1458), the creator of the Italian accounting, accounting was mentioned as a science for the first time. The author was the first to consider accounting as a tool of management for a separate entity, on the one hand, and as a universal methodological science, on the other hand.

In 1494, the Italian mathematician Luca Pacioli published a book "A Treatise on the Accounts and Records" (Pacioli 1994, 270–276), where he interpreted the content of accounting transactions – debit, credit and balance. The role of accounting, as an infallible judge of the past, a required head of the modern and the future for each company, was mentioned by I. F. Sherr in the late 19th century (Sherr 1925)

At the stage of globalization and integration transformations, rapid changes in the business environment of the enterprise, global development of information technologies, the impact of the competitive environment and the increased competition from specialists of other professions (not accounting), the development of the economy, which is based on the modern knowledge, transforms accounting into a powerful financial centre in the information system that requires the involvement of highly qualified professionals – accountants.

In the current economic conditions there is a significant increase in the number of business transactions, which are to be properly recorded, and the accounting profession has gained an extraordinary significance. Below is the apt explanation of F. F. Butynets (Butynets 2005,156–157) of the term 'professional accountant':

- a manager who manages a team (the accountant must be an analyst, because effective management decisions are based on the comprehensive and systematic analysis);
- a specialist in the legal field (commercial, administrative, civil, labor, tax and financial law);
- a financier (financial analyst), who efficiently manages financial resources of the business entity.

The accounting profession is becoming more and more prestigious. It is in high demand and highly paid. Depending on the industry sector of the business entity, the functional responsibilities of an accountant and their place in the administrative apparatus, there is the following classification of accountants in Ukraine (Table 2).

Table 2 - Classification of accountants in Ukraine by functional responsibilities

ITEM	POSITION	BRIEF DESCRIPTION AND QUALIFICATION REQUIREMENTS
1	CHIEF ACCOUNTANT	- responsibility; - the ability to make decisions; - university degree in the related field (Master's degree, specialist); - organizational skills; - the ability to work with all departments and services; - postgraduate education in the field of management; - work experience of accounting in the occupations of the lower level: for those with a Master's degree – at least for 2 years, for specialists – at least for 3 years.
2	ACCOUNTANT-EXPERT	- practical experience of expert evaluation of the information in terms of financial accounting, taxation and law; - development of scientific prospectuses, methodological projects and recommendations; - University degree in the related field (Master's degree, specialist); - organizational skills; - ability to work with all departments and services; - the ability to make decisions; - adaptation of the rules of law to the specifics of the enterprise or related enterprises.
3	ACCOUNTANT-SPECIALIST	- accounting (records keeping) in individual areas (in terms of accounting objects); - detailed knowledge in the specific accounting object; - higher education
4	ACCOUNTANT-CASHIER	- basic higher education in the related field; - organizational skills; - adaptation of the law norms

Source: systematized by the authors on the Law of Ukraine "On Higher Education", http://zakon4.rada.gov.ua/laws/show/1556-18/page (reffered on 14.05.2015).

Considering the multi affectedness of the accounting profession, an accountant must be an expert in their field in various branches of business, as the information obtained as a result of business transactions is the information base for the economic analysis, control, audit, etc. Therefore, when teaching professional accountants, they train experts with a strong intellectual, theoretical and practical basis, those having an opportunity for the future career growth.

Some scientists state that the accounting profession is among the key ones, which are the most necessary for the development of the country. Their contributions and achievements have attracted the attention of the public (Chyzhevska 2007). The branch of 'accounting' is one of the branches, which are in the highest demand on the labor market of Ukraine and abroad, both broad and narrow specialists. The main requirement is the possession of knowledge necessary to perform their responsibilities, constant monitoring of changes in the regulatory legislation and improvement of their skills. So, this profession is attractive for graduates of schools, gymnasiums and lyceums, but it becomes increasingly difficult to master it. To meet the needs of the labor market, to ensure the effective implementation of the financial and economic activities of the business entities in compliance with the established rules and regulations of the national legislation and international standards, experts are trained for different educational-proficiency levels in this field.

The Law of Ukraine on Higher Education establishes the three-level structure of the higher education: incomplete higher, basic higher, complete higher, as well as educational-proficiency levels– Junior Specialist, Bachelor, Specialist, Master) (Table 3).

Table 3 - Brief description of the educational-proficiency levels of education for training accountants in Ukraine

ITEM	EDUCATIONAL-PROFICIENCY LEVELS	TYPE OF THE EDUCATIONAL INSTITUTION	BRIEF DESCRIPTION
1	JUNIOR SPECIALIST	Technical school, vocational school and other higher schools of the first level of accreditation	Educational-proficiency level of higher education of a person who on the basis of complete general secondary education has attained incomplete higher education, special skills and knowledge sufficient for discharging productive functions at a certain level of their professional activity, stipulated for initial positions in a certain type of economic activity.
2	BACHELOR	College and other higher schools of the second level of accreditation	Educational-proficiency level of a higher education of a person who on the basis of complete general secondary education has received a basic higher education, fundamental and special skills and knowledge about the generalized object of work (activity) sufficient to perform the tasks and duties (works) of a certain level of professional activity, stipulated for initial positions in a certain type of economic activity.
3	SPECIALIST	Higher schools of the third and fourth levels of accreditation	Educational-proficiency level of a higher education of a person who on the basis of educational-proficiency level of Bachelor has received a complete higher education, special skills and knowledge sufficient to perform the tasks and responsibilities (works) at a certain level of professional activity, stipulated for initial positions in a certain type of economic activity.
4	MASTER	Higher schools of the third and fourth levels of accreditation	Educational-proficiency level of a higher education of a person who on the basis of educational-proficiency level of Bachelor has received a complete higher education, special skills and knowledge sufficient to perform the tasks and responsibilities (works) at a certain level of professional activity, stipulated for initial positions in a certain type of economic activity.

Source: systematized by the authors based on the Law of Ukraine "On Higher Education", http://zakon4.rada.gov.ua/laws/show/1556-18/page(reffered on 14.05.2015).

In the higher educational institutions, training of specialists of all educational and educational-proficiency levels is carried out for branches and specialties based on the relevant educational and professional programs stepwise or continuously, depending on the requirements for the level of mastering a particular set of skills necessary for the future professional activity.

However in the world, namely in Europe, the educational-proficiency levels of specialists differ from those in Ukraine and are classified as Bachelor (the first cycle of education), Master (the second cycle), and PhD (in a particular subject area).

It's also worth noting that a significant role in the training of specialists in the field of accounting is played by international organizations. In particular, diplomas and certificates of professional organizations of other countries are in high demand on the labor market: the UK (ACCA), the United States (AICPA), and certificates of CAP and CIPA, the Russian certification of the Eurasian Council of certified accountants and auditors issued by the Ukrainian professional organizations.

According to the international standards of education and ethics, accounting standards, there is a list of academic subjects necessary for learning the theoretical and methodological aspects of accounting and the formation and application of knowledge in the complex conditions in the social, economic and legal fields.

Conclusions

When performing an abstract and logical analysis of the interpretation of the notion 'accounting' in terms of theoretical and practical aspects, it was found out that the definition of the category during its historical development was different. At present, the idea of accounting is influenced by not only its own methodology, but also the methods of other sciences, namely: philosophy, sociology, political science, etc. Moreover, it is quite popular to apply the interdisciplinary approach to the modern accounting research – at the intersection of economics, history, sociology, linguistics, etc.

Considering the evolutionary development of the accounting profession, the accounting education has a great social significance at the stage globalization and integration transformations. Therefore, there is a need for training highly qualified specialists of the new generation to ensure the successful management of accounting, reporting and overall functioning of business entities as individual institutional units, as well as to ensure financial stability in the country, by complying with the provisions of the legislation in terms of taxes and fees, which are deducted to the state budget.

References

[1] Schumpeter, J.A. (2001). *The History of Economic Analyses*, Saint Petersburg: Economic School, Volume 1, Translated into Russian, 552 p.

[2] Sombart, W. (2005). *Bourgeois: the History of the Spiritual Development of the Modern Economic Man*, Saint-Petersburg: Vladimir Dal, Volume 1, Translated into Russian, 637 p.

[3] Paton, W.A. (1922). *Accounting Theory*, New York: The Ronald Press Company, 529 p.

[4] Kovalev, V.V. (2013). Whether Accounting can be Treated as a Science: Retrospective of Views and Trends, *Vestnik of the Saint-Petersburg University: Economics*, 5(2): 90–112.

[5] Hendriksen, E.S., Breda, van M.D. (2000). *Accounting Theory*, Moscow: Finance and Statistics, Translated into Russian, 576 p.

[6] Peasnell, K.V. (1978). Statement of Accounting Theory and Theory Acceptance: a Review Article, *Accounting and Business Research*, 8(31): 217–225, http://dx.doi.org/10.1080/00014788.1978.9729124

[7] Cushing, B.E. (1989).A Kuhnian Interpretation of the Historical Evolution of Accounting, *The Accounting Historians Journal*, 16(2): 1–41.

[8] Weatheford, J.M. (2001).*The History of Money*, Moscow: Terra, Translated into Russian, 320 p.

[9] Volkova, O. (2014). Conceptual Accounting Space in Russian and Foreign Scientific Tradition, *International Accounting*, 296 (2): 16–26.

[10] Derun, I.A. (2013). Problems in Intellectual Capital Estimation and Its Reflection in Financial Statements, *Actual Problems of Economics*, 6 (144): 103–113.

[11] Hurmann, D., Saudagaran S.M, Thomas, W.B. (2006). The Quality of Fair Value Measure for Property, Plant and Equipment, *Accounting Forum*, 30: 43 – 59, http://dx.doi.org/10.1016/j.accfor.2005.09.001

[12] Christensen, H.B., Nikolaev V.V. (2009). *Who uses fair value for nonfinancial assets after FRS adoption?* Chicago: The University of Chicago Booth School of Business, 44 p., http://dx.doi.org/10.2139/ssrn.1265371

[13] Potter, B.N. (2005). Accounting as a Social and Institutional Practice: Perspectives to Enrich our Understanding of Accounting Change, *Abacus*, 41(3): 266– 288, http://dx.doi.org/10.1111/j.1467-6281.2005.00182.x

[14] Zhuk M.V. (2012).The Scientific Hypothesis Interpretation of Accounting as a Social and Economic Institution, *Accounting and Finance*, 2: 14–22.

[15] Sokolov J.V. (2003). *The Image of the Accountant in Literature and Films,* Moscow: ID FBK PRESS, Translated into Russian, 232 p.

[16] Pacioli, L. (1994). *A Treatise on the Accounts and Records,* Moscow: Finance and statistics, Translated into Russian, 320 p.

[17] Sherr, I.F. (1925). *Accounting and Balance,* M. Publishing house "Economicheskaya Zhizn", Translated into Russian, 576 p.

[18] Butynets, F.F. (2005). *My Profession is an Accountant*, Financst, Zhytomyr, ZhSTU, Translated intoUkrainian, 156 p.

[19] Chyzhevska, L.V. (2007), *Accounting as a Professional Activity: Theory, Organization, Development Forecast*, Zhytomyr, ZhSTU, Translated into Ukrainian, 527 p.

*** The World's Most Valuable Brands, http://brandirectory.com/league_tables/table/global-500-014 (referred on 11.02.2015)

*** Law of Ukraine "On Higher Education", of July 2014 #1556-VII (with changes and additions), http://zakon4.rada.gov.ua/laws/show/1556-18/page (referred on 14.05.2015).

Journal of Applied Economic Sciences
Volume X, Issue 4 (34), 2015

Do Money Supply, Inflation, and Interest Rate Matter Towards Influencing Malaysian Stock Market Performance?

Ehsan RAJABI
Department of Economics, Faculty of Economics and Management
Universiti Putra Malaysia
Rajabi.ehsan63@gmail.com

Junaina MUHAMMAD
Department of Accounting and Finance, Faculty of Economics and Management
Universiti Putra Malaysia
Junaina2012@gmail.com

Mohsen AMINI KKHOZANI
Department of Financial Engineering, Faculty of Engineering, Lenjan Branch
Islamic Azad University, Isfahan, Iran

Abstract:

This paper investigates the relationship between macroeconomic indicator and Shariah Compliant stock performance in Malaysia for two different periods which are before and after Bursa Malaysia joined forces with FTSE from 1999 to 2013. After controlling for multi-collinearity problem, the findings indicate that macroeconomic variables play an important role in determining Shariah Compliant stock performance in the Malaysian economic. One of the notable finding is that only money supply (M3) seems to significantly and negatively associate with the KLSI before FTSE join forces with Bursa Malaysia. After joining FTSE and Bursa Malaysia, only money supply (M3) has a positive and significant relationship towards FBMES. However, variables such as exchange rate, interest rate, and consumer price index have a significant negative relationship with FBMES. Furthermore, Crude Oil Price (COP) does not significantly influence Shariah Compliant stock performance in Malaysia for both periods.

Keywords: Shariah Compliant, Stock Performance, Money Supply, Vector Error Correction Model

JEL Classification: R5, E4, C1

1. Introduction

Previous findings indicate that there are certain relationship between macroeconomic variables and stock price (e.g. Maysami and Koh, 2000; Adel, 2004; Sohail and Hussain, 2011). However, many of these studies are conducted in developed countries and focus on conventional stock performance. Although macroeconomic variables have relationship with stock price, not all macroeconomic variables may have relevant relationship. Hasan and Nasir (2009) find that inflation and GDP are weakly correlated with stock price in Pakistan and Maysami and Koh (2000) reveal that money supply is not the determinant for stock price in Singapore stock index. For that matter, selection of factors for analysis is one main obstacle to analyse the impact of macroeconomics variables on stock price. There are only few researches done on the impact of macroeconomic variables towards Shariah Compliance stock performance especially in Malaysia. Furthermore there is no research has been carried out on the performance of the Shariah Compliant stock performance before and after adopting the new FTSE stock market index format.

Therefore, this study focuses on analyzing the short and long run relationship between macroeconomic variables (money supply, inflation, interest rate, exchange rate, industrial production index, and oil price) and Shariah compliant stock performance in the Malaysian stock market from the period of April 1999 to June 2013. In addition, we compare the relationship between macroeconomic variables and Shariah compliant stock performance before and after the introduction of KLSI and FBMES.

The research questions have been addressed based on the research objective. What is the relation between the macroeconomic variables and Malaysian Shariah compliant stock performance? How changes in the macroeconomic variables can affect the movement of the Malaysian Shariah compliant stock performance.

2. Literature reviews

The Kuala Lumpur Stock Exchange (KLSE) is the major stock exchange in Malaysia. The main market index of KLSE is known as Kuala Lumpur Composite Index (KLCI). The KLCI may act as a benchmark for the investors which provide them an accurate indicator of the performance of the

Malaysian stock market and Malaysian economy. The Kuala Lumpur Composite Index is replaced by the FTSE, an international index provider. The transformation of the index will use an internationally recognized index calculation for the purpose of more transparency and more tradable of the index. The FTSE Bursa Malaysia (FBM) KLCI consist of top 30 companies in the main board of Malaysian market that holds full market capitalization which meets the requirement of the FTSE Bursa Malaysia Index rules.

Kuala Lumpur Shariah Index (KLSI) which was established on April 17, 1999 is the step taken to facilitate participator in equity investment that is in line with the Islamic principles of Shariah. The KLSI become a benchmark for investor who wishes to make investment under the Shariah principles as well helping them with decision making. KLSI is the weighted average index which consist of companies from the main board of Bursa Malaysia as the Shariah approved securities by the Shariah advisory council of the securities commission, is proven to be indicator of the economic growth in Malaysia.

Companies have to go through a screening process based on quantitative and qualitative parameters in selecting Shariah – compliant companies. Companies that operate their activities according to the Shariah principles will be labeled as Shariah – compliant securities (SAC). Meanwhile, companies will be labeled as Shariah non-compliant securities if their activities involve elements such as financial service based on riba (interest), gambling, manufacture or sale of non-halal products, entertainment activities that are non-permissible according to Shariah, manufacture or sale of tobacco based product or related products, stock broking or share trading in Shariah -non compliant securities, other activities deemed non-permissible according to Shariah.

2.1 Macroeconomic variables and stock performance

This section will explain the theoretical framework on the relationship between macroeconomic variables and stock price. The effect of macroeconomic variables such as money supply, interest rates, exchange rates, inflation rates, industrial production index, and oil price towards stock price. The relationship between the variables in this study will be explained using the stock valuation model namely the discounted cash flow model. Each macroeconomic variable may affect the stock price on its own way either positively or negatively.

The two basic theories to determine stock return are known as arbitrage pricing theory (APT) and capital asset pricing model (CAPM). Both of these theories involve with the relationship between risk and expected return. However, the CAPM only uses market return as the factor to determine the stock return and this has been argued by different scholar as CAPM is regarded to be less efficient in explaining the risky asset prices. Based on Butt *et al*. (2010), there are several factors that may be significant to explain the volatility of stock return aside from a single market factor. As a result, the creation of APT has become an alternative model to determine stock return variation. During the creating the APT model, Ross (1976) assumed that firm factors and macroeconomic factors may cause uncertainty to predict asset return. According to Opfer and Bessler (2004), the APT model generated based on several numbers of economic variables.

Ihsan *et al*. (2007) argue that it is generally believed that financial news and economic factors will affect the movement of stock returns. Furthermore, Butt *et al.* (2010) claim that stock return can be affected both directly and indirectly by several macroeconomic factors and the factors could be used to predict the stock returns. Malaysia is considered as one of the most open economies in the world as Malaysian economy is sensitive to the domestic and abroad developments. As Malaysian economy drops, it will definitely affect the stock market performance.

Here, the standard stock valuation model such as a discounted cash flow model can be used to explain theoretically how the stock price can be affected by selected macroeconomic variables. In this model, stock price represents the discounted present value of the firm's future cash flow.

$$P_0 = \sum_{t=1}^{t=n} \frac{CF_t}{(1+r)^t} \quad (1)$$

Model (1) is the discounted cash flow model (DCF), where P0 is the valuation of stock price, CF_t is the cash flow of firm at time t, and r is the discount rate. The model indicates that any changes in firm's cash flow or discount rates can affect the stock price. Variables that could influence the firm's cash flow and discount rate are the economic conditions, market or industry condition and the firm's specific condition. Money supply, interest rates, inflation rates, exchange rates, industrial production index, and oil

price are the macroeconomic variables that would give implications to a country's economic growth differently thus will affect the cash flow of particular firms and the discount rate as well.

Monetary policy is one of the important economic variables that would influence the behavior of the stock market price movement. Various studies have been documented that examine the stock market prices are affected by the implementation of monetary policy. Money supply is the component of monetary policy that has been controlled by a central bank in order to stimulate the economic growth or to control the economic condition.

The relationship between the money supply and stock market prices have been investigated by previous researchers as they are believed that the frequent changes in money supply will influence the stock prices as the money supply implementation would give effect to the interest rates which is will impact the stock price thereby will affect the stock market price movement. Maysami and Koh (2000) explain that increase in money supply may cause the discount rate to increase, thus reducing the stock price. A negative effect is shown in this theory. However, the implementation of monetary policy will affect the economic growth differently. For instance, if the federal government implements a simulative monetary, the economic growth will increase. Sharma and Wongbangpo (2002) explain that increase in money supply will create a surplus of money balance and excess demand for equity, hence increase in equity price. This theory explains the positive effect of money supply and stock price. From this standard model, the money supply affects the price of equity securities (stocks) by the changes in economic condition, which influence the future cash flow that generated by the publicly traded business.

The interest rate is widely used as the macroeconomic factor for some researcher becoming the variable. According to many previous researchers, interest rate has a direct effect on the financial market as changes in the interest rate can leads investing decisions to make a change in the structure of investment, generally from the capital market to fixed income securities. It is also used by the central bank to control over the inflation rate of the country. Thus, the interest rate can be a good indicator for the movement of the financial market especially the stock market, such as the KLCI.

Maysami *et al*. (2004) argue that any changes in interest rate will change the cost of financing that could obtain by firms. Therefore, the changes in the cost of financing will affect the present value of future cash flows of firms. For instance, the lower interest rates will cause an in increase in the level business investment, as the firms are willing to pursue an additional project, as the cost of financing is lower. This circumstance should increase the present value of the cash flows and therefore boost stock price. Conversely, a higher interest rate will increase the cost of financing thus will reduce the present value of future cash flows and the stock prices will decrease as the firms will minimize their investment activities to control their cost.

Furthermore, investors tend to acquire stock using loans. Through this type of investment, investors will purchase stock with higher rate of return at a lesser cost of borrowing to maximize their profit. Increase in interest rates will result in higher cost of buying stocks, thus demand for stocks will fall and eventually decrease in price of the stocks.

In discounted cash flow model, it shows that any changes in the discount rate will affect the present value of future cash flow thus will move the stock price. Therefore, this model explains that the changes in interest rates influence the cost of financing thereby will affect the discount rate.

Inflation is still one of the most attractive macroeconomic factors for economists and researchers while it is crucial to examine its impact in both developed and emerging markets with relation to other economic factors. It is considered as an indicator for governments to test the effectiveness of their monetary and fiscal policy to monitor and control its economy, at the same time it shows economic stability of the country.

The effects of changes in inflation rates towards stock prices of companies that traded publicly can be explained through the discounted cash flow model. In theory, Inflation rates or price level can be affected by the level of aggregate borrowing and spending by households and firms. The spending level of households and firms are influenced by the interest rates.

Maysami *et al.* (2004) argue that an increase in inflation rate will most likely cause economic tightening policies, as a result increase the nominal risk free rate and raises the discount rate in the discounted cash flow model. Sharma and Wongbangpo (2002) explain the theory when inflation rate increases, the cost of production for companies will also increase, hence decreasing the expected future cash flows and profits by a company. This will result in reduce in the stock price.

The impact of changes of exchange rate towards a country's economy will depend on the level of trade balance and international trade. Thus, the depth of the impact will be based on the relative dominance of import and export sectors of the economy. For example, depreciation of Malaysian Ringgit will increase the products and services demand export.

Stock price and foreign exchange rates may have both positive and negative relationship between them. Maysami *et al.* (2004) believed that if the value of local currency depreciates will result in higher volume of export due to cheaper local product. Thus, cash flows and profit of companies will likely to increase and this leads to higher local stock price and this is only true when the goods are elastic.

Meanwhile, Adam and Tweneboah (2008) suggest a theory of the relationship being negative when local currency depreciates; hence it will increase the domestic price as well as local cost of production. As a result, cash flow reduced and profit margin of the company fall.

Industrial production index (IPI) is used as an economic indicator for a country. It can be used to measures the business output in several industrial sector of the economy namely utilities, mining and manufacturing in Malaysia. Some investors use the index to measure the growth in respective industry. The companies in the industry are believed to be performing better if the industrial production index grows. As a result, IPI may become a good indicator to the volatility of stocks. According to the Department of Statistics Malaysia, Malaysia's IPI from 2007 to 2013 had an average 1.37% and reach the peak at 14.2% on March 2010 and the lowest as -18% during January 2009.

Maysami and Koh (2000) and Sharma and Wongbangpo (2002) both argue that Industrial production Index have a positive relationship to stock price. Level of economic activities may likely influence stock price through corporate profitability in the same direction. Increase in output will raise the expected future cash flow and, thus increase the stock price. The opposite effect would be valid during recession.

In term of crude oil price, previous studies had stated that crude oil price may affect company's performance in several ways. Firstly, oil is related to the production process in producing product and services. An oil price shock will increase the production cost of a company, thus reduce the profitability and aggregate stock prices. Secondly, oil price may affect the discount rate via both real interest rate and expected inflation rate since both of it influenced by oil price. If expected inflation rate was expected to increase in the future, it will rate the discount rate, hence reduce the stock return. The changes in crude oil price may have an impact on the performance of a company.

In theory, oil price believed to have a negative relationship with stock price. There are two theories for this claim. First, Nandha and Faff (2008) and Mohanty *et al.* (2011) claim that increase in oil prices will increase the cost of production. Hence, it will decrease the cash flow and profit margin as demand for product reduced. As a result, stock price for the company will fall. Second, expected oil prices can affect the expected inflation rate and expected real interest rate. For country who exports oil will put downward pressure on its foreign exchange rate and upward pressure on its expected inflation rate. With higher expected inflation rate will cause discount rate to increase, which has negative effect towards stock prices. However, oil and gas sector seems to have a positive relationship with oil price as increase in oil price will increase the corporate revenue and profit, hence rises its stock price.

2.2 Empirical studies

Hosseini *et al.* (2011) study the relationships between stock market indices and macroeconomic variables in china and India. The author used data from 1999 to 2009, where the multivariate cointegration and vector error correction model technique included industrial production index, inflation rate, money supply and crude oil price. The result shows that money supply, inflation rate, and crude oil price has a positive effect on china stock market index but negative relationship for industrial production index in the long run. On the other hand, crude oil price and money supply were found to have a negative relationship towards Indian stock market index. However, inflation rate and industrial production affect the Indian stock market index positively in the long run. In the short run, only inflation rate significantly affect the stock market in china where as oil price is the only variable that have significant relationship with the Indian stock market.

Narayan and Narayan (2010) investigated the impact of oil prices on Vietnam's stock prices using data from 2000 to 2008. The study had used exchange rate and oil price as the determinant and vector autoregression model and error correction model were used. The finding of the study found that both oil

price and exchange rate positively affect stock price significantly in the long run. However in the short run, both oil price and exchange rate insignificantly affect stock price.

A study by Miller and Ratti (2008) which analyse the long run relationship between world oil price and international stock market from the year 1971 to 2009 for six OECD countries by using cointegrated vector error correction model. The result from their study indicates that oil price had a positive statistically significant relation with stock market indices for those six countries during the year 1971 to 1997. However, the relationship was no longer significant from the year 1980 to 2008.

Hasan and Nasir (2009) investigated the relationship among macroeconomic variables namely inflation, money supply, foreign portfolio investment, exchange rates, short term interest rate, oil price, and industrial production by applying autoregessive distributed lag approach using data from 1998 to 2009 in Pakistan capital market. The authors found that only money supply positive significantly affect stock market whereas Interest rate and exchange rate negative significantly affect stock price both In the short run and long run. They argued that efficient market hypothesis give the equity market to respond to new information immediately.

In contrast, Basher, Haug and Sadorsky (2010) investigate the relationship between oil prices and emerging market stock prices from 1988 to 2008 including exchange rate. The study result was a negative relation between oil price and stock price was found. They argued that increase in oil price will depress stock price and US exchange rate.

Chittedi (2011) applies ARDL model to evaluate the long run relationship between Indian stock market and oil prices from 2000 to 2011. The study revealed that changes in stock prices in India do have a significant impact towards changes in oil price. Unfortunately, volatility of oil price has no significant impact toward volatility of Indian stock price. The author argues that the Indian equity market is less affected by the recent global financial crisis. Other macroeconomic variables have a greater role compared to global oil price in influencing the equity price in India.

Sohail and Hussain (2011) study the dynamic relationships between macroeconomic variables and KSE100 index of Pakistan in term of both long run and short run by applying VECM and Vector cointegration. The macroeconomic variables used are consumer price index, industrial production, exchange rate, money supply, and interest rate. In the long run, industrial production, exchange rate and consumer price index positively affect KSE100 whereas money supply and interest rate have a negative relation. In the short run, only interest rate has a negative impact towards KSE100.

Singh (2010) have adopted Granger causality test BSE SENSEX and macroeconomic variables namely exchange rate, industrial production index, and wholesale price index in India from 1995 to 2009 to investigate the causal relationship and correlation between stock market and key macroeconomic variables. Strong correlation was found between BSE SENSEX and wholesale price index, and BSE SENSEX and industrial production index but no correlation for exchange rate. However, Granger causality test found a different result where only industrial production index Granger cause BSE SENSEX even though BSE SENSEX Granger cause both industrial production index and wholesale price index. The author concludes that industrial production index can be used to forecast stock market movement whereas the other two variables cannot be used to forecast stock market. Therefore, Indian market is in a weak form of market efficiency.

Kisaka and Mwasaru (2012) study the causal relationship between exchange rates and stock market in Kenya namely Nairobi Security Exchange (NSE) using monthly sets of data from 1993 to 1999. The author applied the cointegration test and error correction models to examine the causal relationship between the two variables. The empirical result suggests that stock market exchange rate and NSE have a cointegrating relationship to each other. Furthermore, exchange rate is expecting to Granger causes the NSE.

Momani and Alsharari (2012) examine the impact of macroeconomic factors on the stock prices at Amman Stock Market and to measure the impact towards the general index of prices and some sector index such as services, insurance, industrial, and bank. The macroeconomic factors used in the study were industrial production index, money supply, national product, and interest rate from the period 1992 to 2010 by adopting the multiple regression analysis. The result of the study indicates that interest rate shows a statistical significant relationship with Amman stock market and the effect was negative the sectors index. On the other hand, industrial production also had a significant impact to Amman stock market and shows a negative impact to general and sectors index except for insurance sector which had a positive impact.

Somoye *et al.* (2009) investigate the extent some market indices or factors affect the stock market. They specifically focused on twelve selected companies in the Nigerian Stock Exchange (NSE) to examine the relationship between several variables namely EPS, DPS, interest rate, foreign exchange rate, oil price, GDP, and inflation rate from 2001 to 2007. The result suggests that all the chosen variables have positive correlation to stock price in exception of interest rate and exchange rate. The authors argue that both foreign exchange rate and interest rate negatively and significantly affect stock price while GDP affecting stock price positively and significantly is accepted.

Afzal and Hossain (2011) investigated the relationship between macroeconomic variables and stock price in Bangladesh. The study applied the Granger causality test cointegration and error correction model to find the relationship between the variables. Dhaka Stock Exchange represents the stock price in Bangladesh and selected macroeconomic variables namely M1, M2, inflation rate, and exchange rate from the period of 2003 to 2011. The authors argue that Bangladesh stock market is not efficiently reflect with information available in respect to inflation rate, M1, and M2. Furthermore, the study found that there is a dynamic causal relationship from stock price to exchange rate where stock prices seem to act as information to predict the exchange rate movement. However, M2 shows a significant causal role in the short run in the multivariate analysis.

In order to find the long run and short run relationship between stock price and macroeconomic activities, Herve *et al.* (2011) investigate the role of macroeconomic variables in stock market volatility covering the period from 1999 to 2007. The macroeconomic variables were consisting of money supply, exchange rate, interest rate, consumer price index, and industrial production index whereas BRVM10 of Cote d'Ivoire acts as the stock price index. The authors employed the multivariate cointegration tests, impulse response function, forecast error variance decomposition analysis, and Granger causality to find the long and short run relationship between the variables. The findings strongly suggest that stock markets in Cote d'Ivoire are not able to capture information regarding the movement of macroeconomic variables. The selected macroeconomic variables were found to be very weak with stock price in a sense of linkage between them. Thus, macroeconomic factors are not suitable to forecast the future stock price in Cote d'Ivoire.

Alam and Udin (2009) study the impact of interest rate on stock exchange market by testing the efficient market hypothesis in several countries for the period of 1988 to 2003. The sample chosen by the authors were fifteen countries divided into two categories which are developing countries and developed countries. Furthermore the countries are well diversified geographically which consist of every continents. By applying the regression analysis, interest rate was found to have a significant negative relationship with share price for all of the selected countries and changes in interest rate has a negative significant relationship with changes in share price for six countries. The authors suggest that it will bring great benefits to those countries in stock exchange to attract more investors through demand pull, increment extensional companies investment through supply push if interest rate is controlled in those countries.

Ahmed (2008) investigates the dynamic causal relationship between key macroeconomic variables and stock prices for the period of 1995 to 2007 based on the real and financial sector of the Indian markets. The variables chosen for the research were interest rate, exchange rate, money supply, foreign direct investment, export, industrial production, NSE Nifty, and BSE Sensex in India. To find the long run relationship, the author applied the cointegration and Granger causality test to the variables. Furthermore, the author also applied variance decomposition and impulse response function to examine the short run relationships. The finding in the study reveals that both interest rate and foreign direct investment shows a significant relationship to the stock price while the other variable does not. Movement of stock prices is not only the result from changes in the key macroeconomic variables but it is also responsible for the movement of the macroeconomics elements in the economy.

In order to find the long run and short run relationship between stock price and macroeconomic in Malaysia,Ibrahim and Aziz (2003) employ the vector autoregression (VAR) modeling and cointegration test to find the dynamic long run connection between four selected macroeconomic variables and Malaysian equity market. The selections of variables were price level, money supply, real output, and exchange rate from1977 to 1998. The research revealed two findings. The first is that Malaysian stock market is positively relates to both industrial production and inflation rate in the long run. The second finding is that Malaysia stock market has a negative relationship with interest rate and money supply in the long run.

Elshareif (2007) applied the ARIMA and Ordinary least square, autocorrelation consistent covariance matrix model, and heteroscedasticity consistent to test the relationship between inflation and

real return according to Fisher's hypothesis in the Malaysian stock market from the period of 1987 to 2006. The results in the study suggest that there is a positive and independent relationship between inflationary trend and stock return. The author concludes that the hypothesis can be accepted in the Malaysia equity market which suggests that real financial asset is suitable to hedge against inflation in Malaysia.

Amin *et al.* (2009) examine the causal long and short run relationship between the Kuala Lumpur Composite Index and selected macroeconomic variables which are exchange rate, money supply, and inflation. The research focused during the pre and post crisis which was 1987 to 1995 and 1999 to 2007. The author employs the cointegration test, error correction model, impulse response function, and variance decomposition to test the relationship between the variables. The findings reveal the existence of cointegration between stock price and the selected variables. The author found that all three variables seem to significantly affect KLCI. Inflation rate has a positive relationship with stock price according to the results whereas money supply shows a negative relationship with stock price. On the other hand, exchange rate has a different pattern where the relationship was positive before crisis but changes to negative after crisis occur. Money supply, exchange rate, and inflation rate are considered to be a good variable for government to adjust for the purpose to stabilize stock price.

Rahman *et al.* (2009) explore the connection between stock price and selected macroeconomic variables in the Malaysia context in the VAR model. The variables used in the study were industrial production index, reserves, exchange rate interest rate, and money supply. The authors applied the cointegration and Granger causality test to find the linkages. Based on the Vector error correction model, Malaysian stock market seems to have a cointegrating relationship with all of the selected variables and all of it has a significant effect towards the stock market. Furthermore, the variance decomposition analysis suggests that Malaysia stock market has a stronger relationship with industrial production and reserves compared to the other variables.

Saini *et al.* (2006) examine the causal relationship between exchange rate and stock price in Malaysia by using the Granger non-causality test proposed by Toda and Yamamoto (1995). The research focused on 1993 to 1998 especially the crisis period. The findings reveal that there is a one way causality relation from exchange rate to stock price. In other words, depreciation of ringgit will lead to decline of stock market. The author suggest that foreign investor forecast currency depreciation tend to liquidate their share investment as further holding of the securities will lower their profits.

Ibrahim (2009) uses the standard cointegration technique and vector autoregresion analysis to test the dynamic relationship between Shariah Compliance stock performance in Malaysia and monetary policy variables namely exchange rate, Treasury bill, M1, M2, and M3 from 1992 to 2004. From the cointegration test, the author found that money supply has a negative relation to stock prices and exchange rate has a positive relation with stock price. Furthermore, the error correction models suggest that monetary policy variables are significant to predict the Shariah Compliance stock performance.

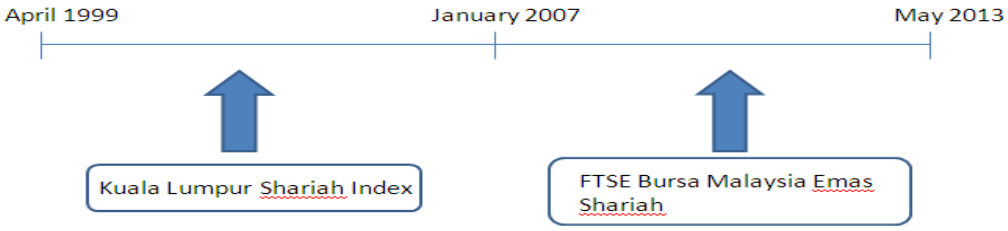
Hussin *et al.* (2012) analyze the dynamic relationship of oil price and macroeconomic variables towards the Shariah Compliance stock performance in Malaysia by applying the vector autoregression technique. The variables used in the study were exchange rate, crude oil price, and FTSE Bursa Malaysia Emas Shariah Index (FBMES) from the period 2007 to 2011. The cointegration test reveals that crude oil prices is positively and significantly correlates with FBMES in the long run. On the other hand, foreign exchange rate seem to have a negative long run relationship with FBMES but they are statistically not significant. The authors conclude that oil price may affect the Islamic equity market in Malaysia in the long run.

In order to find the relationship between the development of Islamic equity market and macroeconomic variables, Hussin *et al.* (2012) employed the Vector autoregression method to achieve this objective in Malaysia. The variables involved in the research were exchange rate, Islamic Inter Bank Rate (IIR), Money supply, consumer product index (CPI) , industrial production index (IPI) and, Kuala Lumpur Syariah Index (KLSI) from the period 1999 to 2007. The authors found that Shariah Compliance stock performance shows a positive relationship with inflation and economic growth rate but has a negative relationship with exchange rate, money supply, and Islamic investment rate. All of the variables have a significant relationship with the Shariah Compliance stock performance except for IIR. This suggests that IIR is not suitable to predict the changes in the Islamic equity market based on cointegration test. Based on the previous researches done over how macroeconomic variables affect the stock price movement, it is concluded that researches in different countries and economy have different findings.

3. Data and methodology

The study measures the variation of macroeconomic variables such as Consumer Price Index (CPI), Interest rate (IR), Money supply (M3), Exchange rate (Ex Rate), Industrial Production Index (IPI), and Crude oil price (COP). The CPI is a measure of inflation, interest rate will be measured by treasury bills rate, money supply to the economic is measured by M3, exchange rate is measurement of Ringgit Malaysia towards the USD, and oil price will be measured by Brent crude oil price per barrel.

The study used the data for period of 170 month which consist of before and after Bursa Malaysia joined forces with the FTSE Group. As a result, this study will divide into two different time period periods which is April 1999 to December 2006, and January 2007 to May 2013. The two different periods will represent the before and after Bursa Malaysia and FTSE Group joined forces. At the same time, the study uses Shariah compliant stock performance which was collected from Bursa Malaysia. The time frame for this research will be summarized in Figure 1.



Source: Authors

Figure 1 - Time frame

The data for each variable are monthly basis. Studies like Ibrahim and Aziz (1999) and Maysami and koh (2000) capture the long term movement in the volatility by using monthly price to avoid spurious correlation problem. Furthermore, monthly data was preferred over other time period because most of the macroeconomic variables under this study were available at monthly intervals. At the same time, all of the variables are transformed in natural logarithm form. Table 1 and will be the summary of the variables used in this paper.

Table 1 - Variables definition and measurement summary

VARIABLES	PROXY	KEYWORD	MEASUREMENT	SOURCE
Kuala Lumpur Shariah Index	Stock price	KLSI	Index	Yahoo.finance
FTSE Bursa Malaysia Emas Shariah	Stock price	FBMES	Index	Yahoo.finance
Money Supply	M3	M3	Ringgit Malaysia	Bank Negara Malaysia
Interest Rate	Treasury Bills	IR	Percentage	Bank Negara Malaysia
Inflation Rate	Consumer Price Index	CPI	Index	Data Stream
Oil Price	Brent Crude Oil Price	COP	Dollars/barrel	Data Stream
Exchange Rate	USD/RM	EX	Ringgit Malaysia	Data Stream
Industrial Product Index	Industrial Product Index	IPI	Index	Data Stream

Source: Authors

3.1 Vector Autoregressive Model (VAR)

In term of methodology, vector autoregressive model (VAR) will be applied to identify the relationship between Shariah compliant stock performance and six macroeconomic variables in Malaysia namely Consumer Price Index (CPI), Industrial Production Index (IPI), Money Supply (M3), Interest Rate

(IR), Foreign Exchange Rate of Ringgit Malaysia to United States Dollar (MYR) and Crude Oil Price (COP) according to discounted cash flow model. The model developed and adopted in this study is as follow:

$$KLSI_t = \alpha + \beta_1 M3_t + \beta_2 IR_t + \beta_3 CPI_t + \beta_4 COP_t + \beta_5 EX_t + \beta_6 IPI_t + \varepsilon_t \quad (2)$$

$$FBMES_t = \alpha + \beta_1 M3_t + \beta_2 IR_t + \beta_3 CPI_t + \beta_4 COP_t + \beta_5 EX_t + \beta_6 IPI_t + \varepsilon_t \quad (3)$$

To properly use the VAR model, the standard procedure of time series analyses will be followed. Firstly, the variables used in this study will undergo a stationary test. A commonly used Augmented Dickey Fuller (ADF) unit root test developed by Dickey and Fuller (1979) was applied on each variable. Applying the ADF test will enable to determine whether there is existence of unit root in macroeconomic variables. Through this method, the paper can detect if there is stationary of each variable by testing the time series data in term of levels and first difference. It is important to examine for stationary before advance further to investigate the relationship between the variables. The null hypothesis in this study suggests that the variables do have a unit root, whereas the alternative hypothesis suggests that the variables do not have a unit root. ADF equation as follows:

$$\Delta Y_t = \beta_1 + \beta_{t2} + \delta Y_{t-1} + \sum_{i=1}^{m} \alpha_1 \Delta Y_{t-1} + \varepsilon_t \quad (4)$$

The Perron (1988) suggests that PP test is more preferred over ADF test because it considered superior problem form time series with autoregressive model, because it ensured white noise error term in the regression. It uses a nonparametric statistical method in order to handle the serial correlation in the error term without adding lagged difference term. One of the advantages of PP tests over the ADF test is that it able to strengthen the general form of heteroskedasticity in the error term. Furthermore the PP test does not require user to specify a lag length for the test regression. PP equation as follows:

$$\Delta Y_t = \alpha + \pi_{2xt-1} + \varphi\left(t - \frac{T}{2}\right) + \sum_{i=1}^{m} \varphi i \Delta Y_{t-1} + \varepsilon_{2t} \quad (5)$$

After testing for stationary in the time series, this paper will proceed to measure the existence of long run equilibrium relationship between Shariah Compliance stock market and macroeconomic variables. The Cointegration technique is widely used by other researchers for examples kwon and shin (1999), Maysami and Koh (2000) and Ibrahim and Aziz (2003). A set of variables is considered to be Cointegrated if they are individually non-stationary and integrated in the same order, and the linear form is stationary. It is believed to be cointegrated if more than two of the stationary time series share a common trend.

For the cointegration test, this paper will use the maximum likelihood approach suggested by Johansen and Juselius (1990). Granger causality will be addressed for the non cointegrated series. However, error correction models will be adopted if the series are cointegrated. Error correction models will be adopted instead if the series are cointegrated. The Johansen and Juselius (1990) maximum likelihood estimator is based on VAR test. The procedure starts with the general VAR model which parameterized as a system of error correction model in order the VAR consist of mostly of lagged first differenced term and a set of lagged levels term. The VAR equation as follows:

$$\Delta Y_t = \sum_{i=1}^{k1} \Gamma_i \Delta Y_{t-1} + \prod Y_{t-1} + \varepsilon_t \quad (6)$$

3.2 Vector Error Correction Model

According to the information gathered through cointegration test of the chosen variables, this paper will instantly continue to examine the short run relationship between Shariah compliant stock performance and macroeconomic variables in granger sense. Based on Granger theorem, this paper applied the conventional bivariate Granger causality framework where the causal link from macroeconomic variables (Δlm) to Shariah Compliant stock performance ($\Delta lklsi) and (\Delta lfbmes$) can be expressed as follows:

$$\Delta lklsi_t = \alpha_0 + \sum_{i=1}^{k1} \alpha_1 \Delta lm_{t-1} + \sum_{i=1}^{k2} \alpha_2 \Delta lklsi_{t-1} + \alpha_3 EC_{t-1} + \varepsilon_{1t} \quad (7)$$

$$\Delta lm_t = \beta_0 + \sum_{i=1}^{k1} \beta_1 \Delta lm_{t-1} + \sum_{i=1}^{k2} \beta_2 \Delta lklsi_{t-1} + \beta_3 EC_{t-1} + \varepsilon_{2t} \quad (8)$$

$$\Delta lfbmes_t = \alpha_0 + \sum_{i=1}^{k1} \alpha_1 \Delta lm_{t-1} + \sum_{i=1}^{k2} \alpha_2 \Delta lfbmes_{t-1} + \alpha_3 EC_{t-1} + \varepsilon_{1t} \quad (9)$$

$$lm_t = \beta_0 + \sum_{i=1}^{k1} \beta_1 \Delta lm_{t-1} + \sum_{i=1}^{k2} \beta_2 \Delta lfbmes_{t-1} + \beta_3 EC_{t-1} + \varepsilon_{2t} \quad (10)$$

EC represent the error correction term. If the variables are found to be cointegrated, then this paper will include the error correction term or the residuals. There are two channels that can be observed. The first channel, this paper can examine the joint significance of the coefficient of the lagged for independent variables through the standard Granger tests. On the other side, the second channel of the equation is the adjustment causation of the dependent variable to the lagged deviation from the long run equilibrium and it is represented as EC term.

4. Empirical results

In this section, all of the result from the statistical analysis will be discussed especially on the relationship between Shariah Compliant stock performance in Malaysia and macroeconomic variables in two different periods which are before and after Bursa Malaysia joined with FTSE.

Firstly this paper will apply the correlation analysis in order to determine the appropriate variables to be used in this research. This method will prevent any multicollinearity problem among the variables. Second, this paper will perform unit root test to all of the variables in order to check whether the variables are stationary at first difference. Once the variables are identified to be stationary, this paper will proceed to the cointegration analysis in order to determine the long run relationship between independent and dependent variables. Lastly, VECM analysis will be applied in order to determine the short run relationship between the variables.

4.1 Correlation matrix between independent variables

Multicollinearity between variables may exist when two or more variables are used in a linear equation. Therefore, a multicollinearity test will be employed for all of the independent variables in this research. This paper considers any correlation coefficient between two variables to be more than 0.75 is strong. For example (Table 2 and 3), there is a strong correlation between M3 and CPI for both periods which might be the result of monetary expansion leads to recession in the market. A strong correlation exists between COP and CPI which might because of increase in oil price will increase the price of goods and services in the market thus increase the CPI. For this analysis, IPI was drop from the model to avoid any multicollinearity problem and the other variables remain in the model.

Table 2 - Correlation matrix for Model 2 (from 1999 to 2006)

Variable	LM3	LTB	LCPI	LCOP	LEX	LIPI
LM3	1.0000	-0.2106	**0.9862**	**0.9147**	-0.6431	**0.9318**
LTB	-0.2106	1.0000	-0.1382	-0.2900	-0.2916	-0.3428
LCPI	**0.9862**	-0.1382	1.0000	**0.9087**	-0.7115	**0.9091**
LCOP	**0.9147**	-0.2900	**0.9087**	1.0000	-0.6196	**0.9224**
LEX	-0.6431	-0.2916	-0.7115	-0.6196	1.0000	-0.5269
LIPI	**0.9318**	-0.3428	**0.9091**	**0.9224**	-0.5269	1.0000

Source: Authors

Table 3 - Correlation Matrix for Model 3 (from 2007 to 2013)

VARIABLES	LM3	LTB	LCPI	LCOP	LEX	LIPI
LM3	**1.0000**	**-0.1175**	**0.9555**	0.5533	-0.7230	0.4070
LTB	**-0.1175**	**1.0000**	**0.1234**	0.4384	-0.2731	0.4583
LCPI	**0.9555**	**-0.1244**	**1.0000**	0.5889	-0.6614	0.3500
LCOP	**0.5533**	**0.4384**	**0.5889**	1.0000	-0.7693	0.7393
LEX	**-0.7230**	**-0.2731**	**-0.6614**	-0.7693	1.0000	-0.6316
LIPI	**0.4070**	**0.4583**	**0.3500**	0.7393	-0.6316	1.0000

Source: Authors

4.2 Unit Root Tests

This paper has conducted the unit root test namely ADF and PP and the result is shown in Table 4. The lag length is chosen based on the Akaike Information Criterion (AIC). Both the AFD and PP are conducted based on trend and intercept. ADF test before Bursa Malaysia join FTSE agree that KLSI, M3, COP, IR there is no unit root problem, in other word this paper reject the null hypothesis which they are I(1) variable at 1% confidence level at first difference. CPI and EX show that there is unit root at first difference in the variables and must accept null hypothesis before Bursa Malaysia join FTSE. In other words these variables are not stationary. However in the 2nd difference form, both CPI and EX become stationary at 1% confidence level. Before Bursa Malaysia joins FTSE, ADF suggests that all the variables are stationary at 1% confidence level and 10% confidence level for IR at first difference. However, only COP was found to be stationary at level. Nonetheless, PP test shows evidence of stationary of all the variables for both periods in their first difference. As a result, this paper suggests the model for both periods as follows:

$$\Delta LKLSI_t = \alpha + \beta_1 LM3_{t-1} + \beta_2 LIR_{t-1} + \beta_3 LCPI_{t-2} + \beta_4 LCOP_{t-1} + \beta_5 LEX_{t-2} + \varepsilon_t \quad (11)$$

$$\Delta LFBMES_t = \alpha + \beta_1 LM3_{t-1} + \beta_2 LIR_{t-1} + \beta_3 LCPI_{t-1} + \beta_4 LCOP_t + \beta_5 LEX_{t-1} + \varepsilon_t \quad (12)$$

Table 4 - Unit Root Test – summary statistics

VARIABLE	LEVEL		1st DIFFERENCE		2nd DIFFERENCE
	ADF	PP	ADF	PP	ADF
MODEL 11 (BEFORE BURSA MALAYSIA JOIN FTSE)					
LKLSI	0.0021	0.2210	0.0005	0.0000	
	(-4.5721)***	(-2.7461)	(-4.9921)***	(-7.5865)***	
LM3	0.9755	0.9774	0.0000	0.0000	
	(-0.6177)	(-0.5864)	(-9.8196)***	-9.8243)***	
LIR	0.8544	0.0106	0.0000	0.0000	
	(-1.4008)	(-4.037)**	(-8.7551)***	(-9.1549)***	
LCPI	0.9967	0.9560	0.2738	0.0000	0.0000
	(0.0845)	(-0.8554)	(-2.6176)	(-10.9541)***	(-6.0030)***
LCOP	0.4513	0.3082	0.0377	0.0000	
	(-2.2592)	(-2.5410)	(-3.5747)**	(-9.3140)***	
LEX	0.9999	1.0000	0.9997	0.0000	0.0002
	(0.9997)	(1.7180)	(0.8212)	(-6.3489)***	(-5.3132)***
MODEL 12 (AFTER BURSA MALAYSIA JOIN FTSE)					
LFBMES	0.6418	0.6359	0.0000	0.0000	
	(-1.9052)	(-1.9169)	(-6.0870)***	(-6.0812)***	
LM3	0.4733	0.3861	0.0000	0.0000	

VARIABLE	LEVEL		1st DIFFERENCE		2nd DIFFERENCE
	ADF	PP	ADF	PP	ADF
	(-2.2167)	(-2.3814)	(-8.0952)***	(-8.0977)***	
LIR	0.6530	0.7694	0.0552	0.0000	
	(-1.8827)	(-1.6354)	(-3.4324)*	(-6.9710)***	
LCPI	0.1198	0.3949	0.0003	0.0004	
	(-3.0755)	(-2.3642)	(-5.1687)***	(-5.0915)***	
LCOP	0.0904	0.3411	0.0000	0.0000	
	(-3.2110)*	(-2.4714)	(-5.7194)***	(-5.7194)***	
LEX	0.5034	0.4827	0.0000	0.0000	
	(-2.1615)	(-2.1995)	(-8.7440)***	(-8.7442)***	

Source: Authors

Note: Lag Length is determined using Akaike Information Criterion (AIC); *, **, *** - indicates significant at 10%, 5%, and 1% level; Data represent the Augmented Dickey Fuller T-Statistics with intercept and trend

4.3. Cointegration tests

After this paper have concluded that all of the variables are found to be stationary at first difference, this paper shall proceed to identify the existence of long run equilibrium relationship between Shariah Compliant stock performance and macroeconomic variables. The table above is the summarized of the Johansen cointegration tests. Based on Schwarz criterion (SC), this paper has chosen lag length 1 for the cointegration test. Table 5 represent before Bursa Malaysia join with FTSE and Table 6 represent after Bursa Malaysia join forces with FTSE. Both of the periods were found at least 1 and 2 cointegration equation respectively. These findings suggest the existence of long run relationship between Shariah Compliant stock performance and the chosen macroeconomic variables namely M3, IR, CPI, COP, EX.

Table 5 - Cointegration tests summary for Model 11 and 12

MODEL	Null Hypothesis	Trace Statistic	Critical Value (5%)	Maximum Eigen Statistical Trace	Critical Value (5%)
MODEL 11 (BEFORE BURSA MALAYSIA JOIN FTSE)					
lag length = 1	R ≤ 0	99.70901*	95.75366	49.20064*	40.07757
	R ≤ 1	50.50837	69.81889	21.04741	33.87687
	R ≤ 2	29.46095	47.85613	12.38582	27.58434
	R ≤ 3	17.07514	29.79707	9.991319	21.13162
	R ≤ 4	7.083818	15.49471	7.033540	14.26460
	R ≤ 5	0.050277	3.841466	0.050277	3.841466
MODEL 12 (AFTER BURSA MALAYSIA JOIN FTSE)					
lag length = 1	R ≤ 0	126.8707*	95.75366	52.10016*	40.07757
	R ≤ 1	74.77052*	69.81889	35.72848*	33.87687
	R ≤ 2	39.04203	47.85613	24.20808	27.58434
	R ≤ 3	14.83395	29.79707	10.85592	21.13162
	R ≤ 4	3.978032	15.49471	3.818640	14.26460
	R ≤ 5	0.159392	3.841466	0.159392	3.841466

Source: Authors

Table 6- Cointegration Coefficients for Model 11 and 12

COINTEGRATION COEFFICIENT								
KLSI	LM3	LIR	LCPI	LCOP	LEX	Constant	R2	Adjusted R2
MODEL 11 (BEFORE BURSA MALAYSIA JOIN FTSE)								
1.0000	0.0695	-0.0939	-1.0866	-0.0386	-0.6019	6.5301	0.8725	0.8613

	(0.6701)	(0.0912)	(0.0992)	(0.4715)	(0.0270)*	(0.0035)		
	[0.4278]	[-1.7134]	[-1.6713]	[-0.7241]	[-2.2597]	[3.0261]		
	MODEL 12 (AFTER BURSA MALAYSIA JOIN FTSE)							
1.0000	0.5125	-0.0664	-2.322	0.0705	-0.3399	5.7098	0.9559	0.952
	(0.0005)*	(0.0427)*	(0.0001)*	(0.1198)	(0.0431)*	(0.0001)		
	[3.6324]	[-2.0650]	[-4.1943]	[1.5755]	[-2.0616]	[4.1882]		

Source: Authors
Note: *, represent 5% significant levels, ( ) represent probability, [ ] represent *t*-statistics

For model (11), the value of the adjusted R^2 is 0.8613 which indicates that 86.13% of the variation in KLSI is explained by the variation in the selected macroeconomic variables whereas for model (12), the adjusted R^2 is 0.952 which means that 95.2% of the selected macroeconomic variables can explain the FBMES.

Table 6 shows the long run equation between Shariah Compliant stock performance before and after Bursa Malaysia joined forces with FTSE group. This finding reveals that there is a positive long run relationship between Shariah Compliant stock performance and M3 for the two different periods. This paper results is not consistent with the findings of previous researchers such as Ibrahim and Yusoff (2001), Ibrahim and Aziz (2003), Azmy *et al.* (2009) and Hussin *et al.* (2012) for studies based on Malaysian data. The negative relationship can be explained by the direct relationship of increasing money supply within the market may cause higher inflation, hence raising the discount rate which will cause share price to fall.

However, the finding of negative relationship is consistent with the findings of previous research such as Maysami and Koh (2000) and Maysami *et al.* (2004) whereby the relationship was found to be positive and significant. These researchers explained that the positive relationship is based on the effect of money supply expansion and this would result to increase in economic activities and affecting the share price by gaining more profit, thus result in increased future cash flow of the firm. This paper claim that money supply is significant only in model (12) where 1% increase in money supply will increase the FBMES by 0.51%.

This study also reveals the relationship between Shariah Compliant stock performance and IR is negative for both of the models in the long run but the relationship is only significant in model (12). So if the IR increases by 1%, then there will be a decrease in the FBMES by 0.06%. This negative relationship between the two variables is expected where it is consistent with the findings of Maysami and Koh (2000), Wangbangpo and Sharma (2002) and Maysami *et al.* (2004) for the market in Singapore. Furthermore this paper shares the same findings with Hussin (2012) for the market in Malaysia. The root of this negative relationship between Shariah Compliant stock performance and IR refer the increase in interest rates would affect stock price to decline due to higher borrowing expenses and production cost which would reduce the future corporate profit Maysami *et al.* (2004). Furthermore, investors tend to acquire stock using loans. Through this type of investment, investors will purchase stock with higher rate of return at a lesser cost of borrowing to maximize their profit. Increase in interest rates will result in higher cost of buying stocks, thus demand for stocks will fall and eventually decrease in price of the stocks.

According to the analysis, CPI variable has shown a negative relationship with Shariah Compliant stock performance in the long run in both of the models but only model (12) show a significant in the relationship. An increase of 1% in CPI will reduce the FBMES by 2.32%. This finding is in inconsistent with the findings collected by Maysami and Koh (2000) and Wongbangpo and Sharma (2002). These researchers argued that higher inflation rate would cause cost of production to increase which would also reduce the future cash flow of the firm. Share price of particular firm would later decrease as a result to this situation.

However this finding is consistent with previous researches such as Ibrahim and Yusoff (2001), Ibrahim and Aziz (2003), and Hussin *et al.* (2012) for Malaysia. The scholars claimed that share price is positively related with inflation rate due to hedging operation. Equity may become a protection mechanism over threat from inflation volatility and result in higher demand for stock in the case of increasing future inflation rate.

In term of relationship between Shariah Compliant stock performance and COP, the finding proves the existence of positive relationship between these two variables in model (11). The basis of this

positive relationship may be due to increasing in oil price would speculate oil and gas index to increase, leading to enhancement in their share price. This is in line with research made by Hosseini *et al*. (2011). Another explanation for this positive relationship may be due to the fact that oil and gas companies depend on world business cycle and they react to rise in global oil price. On the other hand, the relationship between the two variables turns out to be negative in model (12). Researchers such as Nandha and Faff (2008) and Mohanty *et al.* (2011) claim that increase in oil prices will increase the cost of production. Hence, it will decrease the cash flow and profit margin as demand for product reduced. As a result, stock price for the company will fall. Second, expected oil prices can affect the expected inflation rate and expected real interest rate. However in the analysis, COP seems to be insignificant in both of the models.

Lastly, the finding reveals that foreign exchange rate (EX) is negatively and significantly related to Shariah Compliant stock performance in Malaysia for both of the models. For every 1% increase in EX will cause a decrease in both KLSI and FBMES by 0.6% and 0.34% respectively. This finding certainly support the findings of previous studies such as Kwon and Shin (1999) for the market in South Korea, Maysami and Koh (2000) for the market in Singapore, Wongbanpo and Sharma (2002) for the Thailand and Singapore market, Ibrahim and Yusoff (2001), Ibrahim and Aziz (2003), and Hussin *et al.* (2012) for the Malaysian stock market. This type of relationship can be explained when declining currency value would increase the cost of production due to higher price of imported capital goods and material. Thus, profit margin would decrease for that particular firm and its share price would also fall (Ibrahim and Yusoff, 2001). Another theory is that from the investor perspectives, decreasing currency value commonly means that the country is in heading for economic recession. Investor would probably withdraw their investment out of the country and this will affect the firm's profit due to lower foreign investor capital (Ibrahim and Aziz, 2003). As a result, share price will decrease.

4.4 Vector Error Correction model

Table 7 represents the summary of the short run relationship based on VECM test. The value of ECT-1 will explain the causal relationship for each of the variables for both periods. According to Table 7, the value of ECT-1 for KLSI is insignificant. It means that the variables M3, IR, CPI, COP, and EX does not cause KLSI in the long run. On the other hand, the value of ECT-1 in table 7 shows that FBMES variable is significant. This proves that the variables of M3, IR, CPI, COP, and EX are the long run cause for FBMES. Wongbangpo and Sharma (2002) who examined the relationship between macroeconomic and share index for several country like Indonesia, Malaysia, Singapore, Philippine, and Thailand also found similar and in line with this paper results.

For the short run relationship, this paper had conducted it by using Wald test on a group of the related coefficients. According to Table 7, none of the selected variables seems to be significantly causes KLSI. However, Table 7 shows a different result where EX is proven to be significantly causes FBMES. This means that Shariah Compliant stock performance is only influenced by foreign exchange rate in the short run whereas other variables do not show any significant relationship towards FBMES. This finding is in line with the research done by Hussin *et al.* (2012) in Malaysian Shariah Compliance stock performance who found foreign exchange rate is the short term cause for Shariah Compliance stock performance in Malaysia. Meanwhile, the FBMES is the short run cause for COP and IR.

Conclusion and recommendation

Many previous studies have indicated the existence of relationship between macroeconomic variables and the equity market but certain industry and sectors in different country may result in different significant macroeconomic explanatory power towards changes in equity price. The reason for this is because certain sector may have a different reaction and performance to different variability of the macroeconomic variables. This paper focus on the relationship that exist between macroeconomic variables (money supply, inflation, interest rate, industrial production index, exchange rate, and crude oil price) and Shariah Compliant stock performance in Malaysia for two different periods which are before and after Bursa Malaysia joined forces with FTSE. This is done by using Johansen Cointegration and VECM analysis in the Eviews 7 software. Correlation analysis for all of the independent variables was computed to detect and avoid multicollinearity problem among the independent variables. Industrial Production Index (IPI) was omitted from the equation and the other variables remain.

Table 7- Vector error correction model (short run relationship)

Dependent Variables	Independent Variables F-Statistic (Wald Test)						T-Statistic
	DLKLSI	DLM3	DLIR	DLCPI	DLCOP	DLEX	Ect-1
MODEL 11 (BEFORE BURSA MALAYSIA JOIN FTSE)							
DLKLSI		0.7671	0.5632	1.6362	0.0105	0.7667	-0.0173
		(0.3811)	(0.4530)	(0.2008)	(0.9183)	(0.3812)	(0.1274)
DLM3	0.7902		0.3502	0.0296	1.6332	2.2710	0.0007
	(0.3740)		(0.5540)	(0.8633)	(0.2013)	(0.1318)	(0.5741)
DLIR	2.9246	0.1169		0.8180	2.6877	1.0115	0.0758*
	(0.0872)	(0.7323)		(0.3658)	(0.1011)	(0.3145)	(0.0000)
DLCPI	0.0026	1.3901	0.0570		0.2703	3.8357	0.0004
	(0.9589)	(0.2384)	(0.8112)		(0.6031)	(0.0502)	(0.3808)
DLCOP	0.0675	2.6783	2.5273	1.5716		0.6952	-0.0432*
	(0.7950)	(0.1017)	(0.1119)	(0.2100)		(0.4044)	(0.0070)
DLEX	0.3433	0.0550	4.4727*	6.2115*	2.4083		0.0009
	(0.5579)	(0.8145)	(0.0344)	(0.0127)	(0.1207)		(0.1703)
MODEL 12 (AFTER BURSA MALAYSIA JOIN FTSE)							
DFBMES		0.9801	0.0012	0.1729	0.0029	9.7001*	-0.1552*
		(0.3222)	(0.9717)	(0.6775)	(0.9976)	(0.0018)	(0.0011)
DLM3	0.1512		0.7201	0.0015	0.2018	0.2018	0.0050
	(0.6974)		(0.3961)	(0.9686)	(0.6532)	(0.6532)	(0.6997)
DLIR	3.4017*	4.7764*		4.5489*	3.9728*	2.9827	0.0549
	(0.0011)	(0.0289)		(0.0329)	(0.0462)	(0.0842)	(0.2284)
DLCPI	1.0237	0.0105	0.2905		1.0528	6.7764*	-0.0240*
	(0.3116)	(0.9182)	(0.5899)		(0.3049)	(0.0092)	(0.0000)
DLCOP	9.0034*	1.9201	0.0399	14.3333*		2.6602	-0.3773*
	(0.0027)	(0.1658)	(0.8416)	(0.0002)		(0.1029)	(0.0001)
DLEX	0.6754	1.6578	0.5458	0.0380	0.1495		0.0066
	(0.4111)	(0.1979)	(0.4600)	(0.8453)	(0.6989)		(0.8111)

Source: Authors
Note: *, represent Significance at 5% level, ( ) represent probability

The findings from this paper indicate that macroeconomic variables play an important role in determining Shariah Compliant stock performance in the Malaysian economic. One of the notable finding that can be found in this research is that only money supply (M3) seems to significantly and negatively associate with the KLSI before FTSE join forces with Bursa Malaysia. However, the relationship changes once FTSE and Bursa Malaysia joins. Variables such as exchange rate (EX), interest rate (IR), and consumer price index have a significant negative relationship with FBMES. This finding is consistent with the likes of Maysami and Koh (2000), Ibrahim and Yusoff (2001) Wongbangpo and Sharma (2002), and Ibrahim and Aziz (2003). On the other hand, only money supply (m3) has a positive and significant relationship towards FBMES and this finding is in line with the like of Azmy *et al.* (2009) and Hussin *et al.* (2012) for studies based on Malaysian data.

The short run analysis was conducted through VECM test and this paper found out that none of the selected variables is the short run factor for the Shariah Compliant stock performance before Bursa Malaysia join with FTSE. However, after Bursa Malaysia join with FTSE, foreign exchange rate (EX) do cause the Shariah Compliant stock performance in the short run.

Several weaknesses and limitation were identified and should be improved in certain area such as analysis tools, methodology, and collection method. For starters, Kuala Lumpur Shariah Index (KLSI)

was introduced in 1997 but this paper use data from 1999 due to lack of data availability. This may affect the consistency and accurateness of this paper.

Another weakness is that this paper could include more variables such as tax rate, unemployment rate, gold price, earning per share, and dividend per share where this paper can evaluate the impact of non-macroeconomic variables and macroeconomic variables towards the Shariah Compliant stock performance in Malaysia.

Furthermore, there are many other ways to conduct this kind of research that might be more appropriate such as GARCH model, Impulse Response Function, and Variance Decomposition where it can measure the strength of the relationship towards the dependent variable. Nevertheless, this is further complicated by the difficulty to understand and apply these models suggested by previous researchers, which happen to be above my understanding and knowledge.

The finding has several significant implications towards the reader. Firstly, the finding shows that the new Shariah compliant stock performance has similar relationship with the Shariah non-compliant stock performance. This finding shows Shariah compliant stock performance also plays an important role in measuring stock performance. Furthermore, the new Shariah compliant stock performance is by far having a better performance compared to the old Shariah compliant stock performance because it has include the selected macroeconomic variables in assessing its performance. As a result, the quality is better and it will boost the confidence level of the reader especially investors. Last but not least, exchange rate has been a significant variable for Shariah compliant stock performance before and after the introduction of the new format whereby both local and foreign investor may be able to take advantage of the exchange rate movement for investing purpose.

Finally in term of recommendation for future research, the focus of this paper is only to examine the effect of changes in macroeconomic variables towards the Shariah Compliant stock performance in Malaysia. It does not cover other sectors and industries that play an important role in the Malaysian economy. Furthermore, this paper can be extending to more variables including non-macroeconomics variables towards the Shariah Compliant stock performance. Such researches are required to understand the behavior of the stock price movement especially the Shariah Compliant stock performance which will benefit investor, regulators, and researchers in the future.

References

[1] Abugri, B.A. (2008). Empirical Relationship between Macroeconomic Volatility and Stock Returns: Evidence from Latin American Markets. *International Review of Financial Analysis, 17*: 396-410.

[2] Adam, A.M., Tweneboah, G. (2008). Macroeconomic Factors and Stock Market Movement: Evidence from Ghana. *MPRA Paper No. 11256*.

[3] Afzal, N., Hossain, S. S. (2011). An Empirical Analysis of the Relationship between Macroeconomic Variables and Stock Prices in Bangladesh. *50 Bangladesh Development Studies, 34(4):* 95-105.

[4] Alam, M., Uddin, G.S. (2009). Relationship between Interest Rate and Stock Price: Empirical Evidence from Developed and Developing Countries. *International Journal of Business and Management, 4(3):* 43-51.

[5] Al-Sharkas, A.A. (2004). The Dynamic Relationship between Macroeconomic Factors and the Jordanian Stock Market. *International Journal of Applied Econometrics and Quantitative Studies, 1*: 97-114.

[6] Azman-Saini, W., Habibullah, M., Law, S. H., Dayang-Affizzah, A. (2007). Stock Prices, Exchange Rates and Causality in Malaysia: A Note. *IUP Publications, 1:* 7-13.

[7] Basher, S.A., Haug, A.A., Sadorsky, P. (2012). Oil Prices, Exchange Rates and Emerging Stock Markets. *Energy Economics, 34(1)*: 227-240.

[8] Butt, B.Z., Rehman, K.U., Khan, M.A., Safwan, N. (2010). Do Economic Factors Influence Stock Returns? A Firm and Industry Level Analysis. *African Journal of Business Management, 4(4):* 583-593.

[9] Chen, N.F., Roll, R., Ross, S.A. (1986). Economic Forces and the Stock Market. *Journal of Business, 59(3):* 383-403.

[10] El-Sharif, I., Brown, D., Burton, B., Nixon, B., Russell, A. (2005). Evidence On The Nature and Extent of The Relationship Between Oil Prices and Equity Value, The UK. *Energy Economic, 27*: 819-830.

[11] Habibullah, M.S., Baharumshah, A.Z. (1996). Money, Output and Stock Prices in Malaysia: an Application of The Countegration Tests. *International Economic Journal, 10(2):* 121-130.

[12] Hasan, A., Nasir, Z.M. (2008). Macroeconomic Factors and Equity Prices: an Empirical Investigation by Using ARDL Approach. *Pakistan Institute of Development Economics, 47(4):* 501-513.

[13] Herve, D.B., Chanmalai, B., Shen, Y. (2011). The Study of Ausal Relationship Between Stock Market Indices and Macroeconomic Variables in Cote d'Ivoire: Evidence From Error-Correction Models and Granger Causality Test. *International Journal of Business and Management, 6(12):* 146-169.

[14] Hosseini, S.M., Ahmad, Z., Lai, Y.W. (2011). The Role of Macroeconomic Variables on Stock Market Index in China and India. *International Journal of Economics and Finance, 3(6):* 233-243.

[15] Ibrahim, M.F. (2009). The Relationship Between Monetary Policy and Islamic Stok Market. *Labuan e-Journal of Muamalat and Society, 3:* 49-64.

[16] Ibrahim, M.H., Aziz, H. (2003). Macroeconomic Variables and the Malaysian Equity Market a View through Rolling Subsamples. *Journal of Economic Studies, 30(1):* 6-27.

[17] Ibrahim, M.H., Wan Yusoff, W.S. (2001). Macroeconomic Variables, Exchange Rate and Stock Price: A Malaysian Perspective. *IIUM Journal of Economics and Management, 9(2):* 141-163.

[18] Ihsan, H., Ahmad, E., Haq, M.I., Sadia, H. (2007). Relationship of Economic and Financial Variables With Behavior of Stock Returns. *Journal of Economic Cooperation, 28(2):* 1-24.

[19] Kisaka, S.E., Mwasaru, A. (2012). The Causal Relationship Between Exchange Rates and Stock Prices in Kenya. *Research Journal of Finance and Accounting, 3(7):* 121-130.

[20] Kwon, C.S., Shin, T.S. (1999). Cointegration and Causality Between Macroeconomic Variables and Stock Market Returns. *Global FInance Journal, 10(1*): 71-81.

[21] Levine, R., Zervos, S. (1998). Capital Control Liberalization and Stock Market Development. *World Development, 26(7):* 1169-1183.

[22] Maghyereh, A., Al-Kandari, A. (2007). Oil Prices and Stock Markets In GCC Countries: New Evdence From Nonlinear Cointegration Analysis. *Managerial Finance, 33(7):* 449-460.

[23] Maysami, R.C., Koh, T.S. (2000). A Vector Error Correction Model of The Singapore Stock Market. *International Review of Economics and Finance, 9*: 79-96.

[24] Maysami, R.C., Howe, L.C., Hamzah, M.A. (2004). Relationship between Macroeconomic Variables and Stock Market Indices: Cointegration Evidence from Stock Exchange of Singapore's All-S Sector Indices. *Jurnal Pengurusan, 24*: 47-77.

[25] Miller, J.I., Ratti, R.A. (2009). Crude Oild and Stock Markets: Stability, Instability, and Bubbles. *Energy Economics, Elsevier, 31(4)*: 559-568.

[26] Mohd Hussin, M.Y., Muhammad, F., Abu, M.F., Awang, S.A. (2012). Macroeconomic Variables and Malaysian Islamic Stock Market: A Time Series Analysis. *Journal of Business Studies Quarterly, 3 (4*): 1-13.

[27] Mohd Hussin, M.Y., Muhammad, F., Abu, M.F., Razak, A.A. (2012). The Relationship between Oil Price, Exchange Rate and Islamic Stock Market in Malaysia. *Research Journal of Finance and Accounting, 3(5):* 83-92.

[28] Mohmani, G.F., Alsharari, M.A. (2012). Impact of Economic Factors on the Stock Prices at Amman Stock Market (1992-2010). *International Journal of Economics and Finance, 4(1):* 151-159.

[29] Naifar, N., Al- Dohaiman, M.S. (2013). Nonlinear Analysis among Crude Oil Prices, Stock Markets' Return and Macroeconomic Variables. *International Review of Economics and Finance, 27:* 416-431.

[30] Narayan, P.K., Narayan, S. (2010). Modelling The Impact of Oil Prices on Vietnam's Stock Prices. *Applied Energy 87*: 365-361.

[31] Rahman, A.A., Mohd Sidek, N.Z., Tafri, F.H. (2009). Macroeconomic Determinants of Malaysian Stock Market. *African Journal of Business Management, 3(3)*: 95-106.

[32] Ross, S.A. (1976). The Arbitrage Theory of Capital Asset Pricing. *Journal of Economic Theory, 13*: 341-360.

[33] Singh, D. (2010). Causal Relationship Between Macro-Economic Variables and Stock Market: A Case Study for India. *Pakistan Journal of Social Sciences, 30(2):* 263-274.

[34] Wongbangpo, P., Sharma, S.C. (2002). Stock market and macroeconomic fundamental dynamic interaction: ASEAN-5 countries. *Journal of Asian Economics, 13:* 27-51.

Journal of Applied Economic Sciences
Volume X, Issue 4 (34), 2015

Audit of Adequacy Degree for the Principle of Activity Continuity

Cicilia IONESCU
Faculty Financial Accounting Management
Spiru Haret University
cicilia.ionescu@yahoo.com

Abstract:

Our entire research concerning audit of the adequacy degree for the principle of activity continuity of a an entity is based on the personal experience in auditing the financial statements but mainly on finding of a plausible answer at the following question: „Do the auditor opinion expressed in an Audit Report totally supports the assessing the credibility of financial statements?" The answer for this question is that „The Auditor report supports the assessment of financial statements but is not a warranty regarding the future viability of economic agent". This warranty, if the timing is not too optimistic, is insured by the action undertaken by the auditor in the direction of auditing of the degree of adequacy of the principle of activity continuity.

Keywords: financial statement audit, the auditor's opinion, audit report, activity going concern, the auditor's responsibility.

JEL Classification: H83

1. Introduction

In order to find answer at the above mentioned question, we want to remind that lately the financial statements of the economic agents which are subject to accountancy regulations which comply with international and European directives on accountancy have been audited by financial auditors, natural or legal persons. The auditing is performed fully in the line with the specific requirements of the EU directives, with the Development Programs of the Accountancy System in Romania and in force audit legislation.

In order to perform financial audit activities, the auditor, natural or legal person passes through important stages/phases, such as: understanding of accountancy and internal control systems, setting of general objectives of financial statements audit, expressing of an opinion regarding the image offered by the audited financial statements, audit of conformity according to the laws and requirements in force, auditing regarding the adequacy degree of the principle of activity continuity as basis for the preparation of financial statements, sectional auditing of the financial statements, drafting of audit report of the financial statements. Each of these stages has its individual and corroborate role, all being of use, finally, at shaping a reasonable opinion regarding those financial statements, which can be formulated within an audit report. Thus:

- *During the stage on understanding the accountancy and internal control systems* – an efficient approach requires that the auditor has a sufficient understanding on the way the accountancy and internal control systems are conceived and their operation method. The auditor assesses the recording and processing system of transactions performed by the audited agent and whether it can be used as a basis for establishing the financial statements. If the auditor decides he can rely on the internal controls, he will assess these controls and will perform conformity tests upon them.
- *During the stage which involves the setting of the general objectives of an audit* – the auditor will consider the fact that the auditing of the financial statements has to comply with the provisions of Accountancy Law, the enforcement norms of the law and harmonized accountancy norms regarding the economic agent's accountancy, the financial exercise, the financial statements of the economic agent, accountancy principles and rules, approval and signature of the economic agent financial statements, approval of profit distribution, the administrators' report, approval and submission of the economic agent yearly report, publishing of the yearly economic agent report, the general accounts plan, the balance format and the profit and loss account, situation of the treasury flows, situations of the own capital changes.
- *During the stage when the auditor expresses an opinion regarding the image of the financial statements* – he is in charge with creating and expressing of an opinion on the audited financial statements. The opinion can be: *without reserves (unqualified)* and it is expressed when the auditor thinks that the situations provide an accurate image or that they are correctly presented, in all its

significant aspects, according to the identified financial reporting type (standards); *with reserves (qualified)* and it is expressed when the auditor thinks that an opinion without reserves cannot be expressed, but the effect of any misunderstanding with the management or which leads to a limited applicability field is not so significant and comprehensive, so that it could create a contrary opinion or the situation when an opinion cannot be expressed; *contrary opinion* which is expressed when the result of a misunderstanding is so significant and comprehensive for the financial statements, that the auditor comes to the conclusion that a qualified report is not adequate in order to provide information regarding the incomplete or erroneous nature of the financial statements; *the impossibility of expressing an opinion* which occurs when the potential effect of the activity limitation is so significant and comprehensive, that the auditor was not able to obtain sufficient audit results and therefore, he cannot have an opinion regarding the financial statements.

- *During the stage which deals with the conformity with laws and regulations in force* – the auditor has the responsibility of taking into account the legislation and regulations in force, when he audits the financial statements. Therefore, he applies auditing measures and procedures which should provide the finding of errors, deviations and legalities with direct consequences upon the amounts from financial statements or upon the audit results.
- *Audit report* – it is drafted as an audit result performed by an independent auditor upon the financial statements of an entity after the audit evidence obtained as a basis for an opinion regarding the financial statement is reviewed and assessed. This review and assessment implies taking into account of the fact whether the financial statements were drafted observing the accepted general reporting type, such as the International Accountancy Standards, or relevant national practices or standards. It may also be necessary to analyze whether the financial statements comply with the statutory requirements. The report must comprise in a written form a clearly stated opinion on the financial statement, taken as a whole.

The problem which occurs is: "*Does the auditor's opinion expressed in an Audit* Report represent the guarantee of credibility for the financial statements?" The answer at this situation is that "The auditor's *report supports the assessment of financial statements, but it is not a warranty regarding the future viability of the economic agent*". This guarantee, provided that the term is not too optimistic, is assured by the action performed by the auditor, with the purpose of auditing the adequacy degree of the principle of activity continuity, which will be analyzed later.

2. The audit of the adequacy degree of the principle of activity continuity

When auditing the financial statements, in order to guarantee their credibility from the perspective of the future viability of the entity, the auditor takes into consideration the adequacy degree of principle of activity continuity which is at the basis of financial statements drafting, as well as the risk that the principle of activity continuity might not be proper.

From such a perspective, the auditor has the obligation of gathering sufficient and proper audit evidence in order to satisfactorily remove the doubt on the capacity of the economic agent to go on existing in the foreseeable future. He also, decides and reports whether the problem related to the principle of activity continuity was suitably solved.

2.1. The auditor's responsibility regarding the adequacy degree of the principle of activity continuity

The continuity of activity of an entity (within the foreseeable future, generally for a period of time which does not exceed a year after the completion of the period) is stipulated when financial statements are drafted, provided that information about a contrary activity is absent. Accordingly, assets and liabilities are recorded on the basis that the economic agent will be able to collect its assets at recorded values and to pay its debts during ordinary course of business. If the presumption is unjustified, the economic agent may be able to collect the assets at the recorded values and there can be changes regarding the debts values and due dates. Therefore, the values and classification of assets and debts in financial statements may require adjustments.

2.2. The risk of non-declaring the principle of activity continuity

The auditor takes into consideration the risk that the principle of continuity might not be adequate any more. Indices that suggest the non-observance of principle of activity continuity can originate from

financial statements, but as well as from other sources. These indices can have a financial nature, operational ones or others.

a) Financial indices that can be taken into consideration by the auditor:

- Fixed term loans near maturity, without realistic renewal prospects of renewal, reimbursement or excessive reliance upon short term loans to finance long term financial assets;
- Unfavorable key financial indicators;
- Substantial operating losses;
- Arrears or failures to pay dividends;
- Inability of paying the creditors at due date;
- Difficulty in confirming the terms of the loan agreements;
- Change of credit transactions in transactions with payment on delivery for suppliers;
- Inability of obtaining funding for development of essential products or other essential investments.

b) Operational indices:

- Loss of management key members, with no possibility of replacement;
- Loss of key markets, of the franchise, license or of the main supplier;
- Labor difficulties or lack of important suppliers.

c) Other indices:

- Non-compliance with capital requirements or other statutory requirements;
- Pending legal action against the economic agent, which, if successful, may result in legal decisions that could not be met;
- Changes in legislation or of the government policy.

2.3. Adequate audit evidence regarding the foreseeable future of the economic agent

When there is a question about the adequacy degree of the principle of activity continuity, the auditor is obliged to collect sufficient adequate audit evidence in order to satisfactorily try to remove the doubt on the economic agent capacity of keep on working within the foreseeable future. The auditor performs the planned audit procedures (including additional ones or he analyses the previously obtained information) in order to obtain the audit evidence as basis for expressing an opinion on the financial statement.

The relevant procedures in such situations may include:

- Analysis and discussion with management regarding the monetary flow, profit and other relevant proceedings;
- Verification of events after the end of the period for the elements which affect the economic agent ability to continue the principle of continuity;
- Analysis and discussion of the latest available interim financial statements of the economic agent;
- Verification of mandatory lending terms and loan agreements and determination whether any term was unobserved;
- Reading of minutes of general meetings of shareholders, of the board and key committee meetings for any reference to financial difficulties;
- Economic agent lawyer investigation into disputes and complaints;
- The confirmation of existence, legality and requirement of contracts by which the financial support of third parties and affiliated parties is offered or obtained and estimation of the financial capacity of such parties to offer additional funds;
- Consideration of the economic agent position concerning the clients' non-fulfilled orders.

The auditor:

- *Considers* the economic agent capacity of generating information regarding the monetary flow, profit and other relevant forecasts; whether the hypothesis on which the relevant forecast seem appropriate in the given circumstances;
- *Compares* the forecasted data for the recent periods with the real historical data; the forecasted data for the current period with the results obtained until that date;
- *Considers and discusses with the management its plans for future actions* and, namely the liquidation plans for assets, cash loans or debits restructuration, expenses reduction or

delay, capital increase. A special attention shall be given to the projects that may have a significant effect upon the economic agent solvability and the foreseeable future.

The principle of activity continuity refers not only to the current solvability of the economic agents, but also to its capacity of continuing its activity. The situation of liquidities and future funding sources must be analyzed, if the activity generates liquidities or if these have to be brought by the shareholders or obtained by the creditors. In order to establish the principle of activity continuity, the audit activity and the obtained evidence might be extended in order to perform a proper assessment whether the economic agent complies with the principle of activity continuity. The auditor assesses the means by which the administrators ensured that the principle of activity continuity is observed when the financial statements were drawn out and that the financial statement are presented in such a way that they offer an accurate image from the perspective of the principle of activity continuity observance.

Therefore, the auditor discusses with the administrators, examines the proper financial information, and performs special proceedings in order to identify the significant problems concerning the economic agent capacity of having a continuous activity.

The auditor may need to take into consideration and document the following problems:

- Whether the period envisaged by the administrators for evaluation of activity continuity is reasonable, taken into account the client's (economic agent) circumstances and the administrators' need to analyze its capacity of continuing the operational activity within the foreseeable future;
- The systems or other means (conventional or unconventional) for timely identification of the signals regarding future risks and uncertainties the economic agent might confront;
- The budget and/or the forecasted information (especially information regarding the cash flow) produced by the audited economic agent (auditor' client) and the quality of the informational systems used for producing of these information and for their actualization;
- Whether the basic hypothesis on which the budgets and/or forecasts are realistic given the respective circumstances.

The auditor determines and documents the preoccupation degree regarding the economic agent capacity of continuing its activity. In order to assess the adequacy degree, the auditor takes into consideration all relevant information he acknowledged during the audit. The auditor performs a preliminary assessment of the principle of activity continuity. The audit approach greatly depends whether this basis (principle) is suitable or not. If the activity continuity is an essential problem, the auditor considers all the fields that could be affected. In order to determine the credibility and adequacy degree of the principle of activity continuity, the Review Program of Activity Continuity is applied. The following procedures shall be applied, in order to identify the possible problems related to the principle of activity continuity:

- Prognoses of the cash flows, profit and loss account and of the balance (provided it exists) shall be obtained. The cash flow efficiency and evolution shall be analyzed and documented.
- The managers are consulted and the information already obtained during the audit shall be reviewed.
- The below factors shall be analyzed and documented:
  - *Selling orders/loss of important clients;*
  - *The probability that the personnel likely to remain available to the economic agent, as well as the possibility that the economic agent might continue to have access to goods and services necessary to conduct its business;*
  - *The economic agent capacity to adapt itself to new circumstances;*
  - *Financial problems;*
  - *The period for which the economic agent has obtained access to financial-banking capacities etc.*

After the above factors are analyzed, it shall be determined whether the accountancy principle of activity continuity represents a proper basis for drafting of the financial statements:

- If not, it shall be considered whether the statements still offer an accurate image of the economic agent and whether additional information is required for the audit report;
- If so, additions to the audit report shall be prepared.

The auditor prepares a synthesis of the analyzed factors and presents the expressed assessments and opinion regarding the economic agent classification in the principle of continuity and the impact upon

the financial situations. As a conclusion, the auditor states whether he has obtained a reasonable regarding the correct application of the principle of activity continuity during the preparation of the financial statements.

2.4. The conclusion of the audit and reporting

a) The auditor decides whether the problem aroused related to the principle of activity continuity has been properly solved.

The principle of activity continuity can be used for management decisions regarding the future actions, due to its mitigation factors and in such a case, the auditor shall consider whether such plans or other factors need to be presented in the financial situations. If a proper presentation is not performed, the auditor expresses a qualified or contrary opinion, as appropriate.

b) The problem of activity continuity is not solved.

If, according to the auditor reasoning, the problem of activity continuity is not properly solved, he shall consider whether the financial situation adequately describe the main conditions that generate substantial doubts regarding the economic agent capacity to continue to operate in the foreseeable future; he may say that there is a significant uncertainty, if the economic agent will be able to continue its activity and, therefore, it is unable to collect its assets and to reduce its debts during the normal course of activity; he may say that the financial statements do not include adjustments regarding to the retrievability and classification of the values of registered assets or regarding to the classification of debts that may be necessary in case the economic agent is unable to continue its activity.

If the presentation is considered as adequate, the auditor does not express a qualified opinion or a contrary one.

If a proper presentation is performed in the financial statements, the auditor can express an unqualified opinion and he can modify the audit report, by a adding a paragraph with the purpose of emphasizing the problem related to the principle of activity continuity, by focusing on one aspect that has the above mentioned aspects; he is not prevented from expressing an opinion in case of an uncertainty regarding the activity continuity.

If no adequate presentation is performed in the financial situations, the auditor expresses a qualified opinion or a contrary opinion, as appropriate.

c) The principle of activity continuity, considered as inadequate

If based upon the additional proceedings and of the obtained information, including the effect of mitigation circumstances, the auditor's reasoning is that the economic agent is unable to continue its activity in the foreseeable future; the auditor decides that the principle of activity continuity used for preparation of financial statements is not adequate. If the result of the inadequate hypothesis used for the preparation of the financial statement is so significant and comprehensive, so that it has erroneous results, the auditor expresses a contrary opinion.

References:

[1] Boulescu, M. (2007). *Audit and Financial Control*, Second Edition, Publishing House of România de Mâine Foundation, Bucharest.

*** Law no. 26/2010 for modification and completion of Government Emergency Ordinance no. 75/1999 regarding the financial audit activity, the Official Gazette, Part I, no. 145 of 5 March 2007;

*** Government Decree no. 983/2004 for the approval of Organization and Operation Regulation of the Romanian Financial Auditors Chamber, the Official Gazette, no. 634 of 13 July 2004;

*** Order of the Ministry of Finances no. 1802/30.12.2014 for the approval of accounting regulations on the annual and consolidated financial statements, the Official Gazette, no. 963 of 20 December 2014;

*** Decision no. 20/2004 of the Council of Romanian Financial Auditors Chamber for the approval of the Code regarding the Ethic and Professional Conduct in the Field of Financial Audit, drafted by the International Federation of Accountants (IFAC, Edition 2003, the Official Gazette no. 966 of 21 October 2004);

*** Government Emergency Ordinance no. 90/2008 on statutory audits of annual accounts and the consolidated annual financial statements, the Official Gazette no 963 of 30 December 2014.

Influence of the Market Orientation on Business Performance of High-Tech Firms in the Manufacturing Industry: Comparison of Regression Models of "Market Orientation – Business Performance" in the Czech Republic and Germany

Patrik JANGL
Tomas Bata University in Zlin
Faculty of Management and Economics, Czech Republic
jangl@seznam.cz

Abstract

The study deals with relation of market orientation and business performance in the Czech Republic and Germany, including comparison of both countries. Subject of the study was regression model of "market orientation - business performance"; whereas individual relations were tested first and then mutual invariance of the Czech and German model. Casual relation was checked by the help of multiple regression analysis. Measurement of configural, metric and scalar invariance was done by the method of Multigroup Invariance Analysis.The studied statistic sample included 351 high-tech firms from the manufacturing industry, whereof 164 were Czech firms and 187 German. During the testing of market orientation (four dimensions) a twelve-item "modified market orientation scale" (MMOS) was used and business performance (one dimension) was measured by three items. The study showed a significant positive relation between three dimensions of market orientation and business performance only. There was no significant relation in one studied case. On the basis of testing invariance it may be confirmed that both regression models agree in all studied criteria.

Keywords: market orientation, business performance, modified market orientation scale (MMOS), multigroup invariance analysis, configural, metric and scalar invariance, Czech Republic, Germany, high-technology manufacturing companies

JEL Classification: M31, M10

1. Introduction

There is a wide range of studies that prove the influence of market orientation on business performance. However, there has not been done any international comparative analysis of such models in the Czech Republic and Germany so far.Aim of this article was firstly to verify a causal relation between individual parts of market orientation and business performance and then to create a comparative analysis of the Czech and German regression model of "market orientation and business performance" on a sample of high-tech firms in the manufacturing industry. Market orientation in this study is understood as a process of gathering of market information about customers and competitors, sharing and integrating these information within the company and reactions to these information in the form of a strategic actions. The article is traditionally divided into three main parts. The first part explains theoretical points for the given issues, including summary of definitions. Methodology of quantitative research and tested hypotheses are mentioned in the second part. The final part discusses the main results and observations resulting from the research, including summary of the main contributions.

2. Theory and measurement of market orientation and business performance

According to Harrison-Walker (2001) the market orientation is formed of two components (customer and competitor orientation). Each of these components included a four-level process (acquisition of information, organization-wide sharing of information, a shared interpretation of market information and utilization of market information). Karlíček *et al.* (2014, p. 124) define market orientation in the following way "Market orientation can be defined as the company's ability to systematically generate relevant information about current and latent customer needs, spread this information across all company departments and use this information in decision making and subsequent behaviour." On the basis of own extensive researches of the market orientation of high-tech firms in the Czech Republic and Germany was derived a model of market orientation (MMOM), including the modified measurement scale (MMOS) and own definition of market orientation was formulated:"Market orientation is defined as a process of intelligence generation about customers and competitors, intelligence dissemination & integration within the company across teams and responsiveness to market intelligence in the form of a coordinated

action."This definition is not in contradiction with the previous versions of other authors, however it emphasises, except for dissemination of market information, also its integration within working teams and departments in the company. The first part of definition is a "customer intelligence generation" (CUIG). It results from orientation to customers and the firm puts emphasis on understanding the current and future needs of customers. There are involved regular market researches, customer satisfaction analysis, identification of hidden customer wishes, etc. A "competitor intelligence generation" (COIG) is another part of the model. Monitoring of competitors used to be considered "not ethical" in the half of the last century. Nowadays these activities are necessity, particularly in the dynamic high-tech branch. The last two components of the model may be understood as a significant part of interfunctional coordination inside the firm. The third part is a "dissemination & integration" (IDI). Teamwork, sharing information not only formally, but also informally between departments and co-worker plays an important role. Transformation of these information into knowledge seems to be a market advantage. Because the same information is interpreted differently by each management. Not everybody is successful in the present market environment and can adapt himself. It is also related to the last component of the model, called "responsiveness to market intelligence" (RMI). Flexibility plays an important role here. Decisive factor is how quickly is the firm able to realize strategic coordinated action and to satisfy its current and potential customers, and particularly, whether it manages to break through the market sooner than competitors. "Strategy is about making series of decisions that drive corporate action under specific coupling with company's environment and context. Because decisions are actions, so the strategy itself is action, not just a description of action" In the area of traditional strategy, descriptions (information) have replaced action (knowledge), talk has replaced walk. Action and description of action are two very different domains and only rarely the two meet. (Zelený; 2010 in Knápková and Blahová; 2010, p. 61).

Business performance (PERF) can also be viewed from different point of views and authors worked with different models in the past. Some of them concentrated on research of financial performance, others on non-financial performance of firm. However, the most often studied was total performance, comprising financial and non-financial performance. Laukkanen *et al.* (2013) measured business performance in three areas (brand performance, market performance and business growth). Tseng *et al.* (2009) identified five dimensions: competition performance, financial performance, manufacturing capability, innovation capability and supply-chain relationships. In this study business performance was understood as a one-dimensional factor consisting of three items (growth of sales, profitability ROA, market share). An extensive meta-analysis of publications about market orientation and business performance was done by Cano *et al.* (2004). Their work included conclusions of professional scientific articles from 23 countries of the world and various cultural environment. They stated that relation between market orientation and business performance was mostly stronger when using scale MARKOR, rather than MKTOR or other modified measuring scales. Sin *et al.* (2004) studied market orientation and business performance in big Chinese cities (Hong Kong, Beijing, Shanghai, Guangzhou). Oudan (2007) empirically tested market orientation in developing countries (Venezuela, Costa Rica a Trinidad). He found out that firms which implemented market-oriented strategy, proved a higher performance. Market orientation was measured by the help of the world-renowned model MARKOR and business performance was tested by three items (market share, premium growth, profitability per year). Ellis (2006) carried out meta-analysis of 56 studies from 28 countries concerning relation of market orientation and business performance. Stronger influence of market orientation was found out on larger and more developed markets and by using MARKOR measuring scale.

3. Assessing invariance between groups

Generally the following groups are most often compared: men and women, left-wing and right-wing political parties, students of Bachelor's, Master's and Doctor's program, cultural differences in different countries, etc. In this study it is a comparison of two models from two European countries. It is necessary to show that two different measurements are psychometrically equivalent or invariant (Schmitt, 1982 in Meade *et al.*, 2005). Both these terms are freely interchangeable. Authors in professional publications use either term "equivalence" or "invariance", Blunch (2013), Weiber and Mühlhaus (2014) or Keith (2015) mention these tests of invariance (equivalence) – configural invariance, metric invariance, scale invariance, factor covariance invariance, factor variance invariance and the last one is error variance and covariance invariance. This work is limited to measuring the first three invariances. Configural invariance only requires identical factor structure of the model. There are no restrictions on agreement of parameters.

This type of invariance confirms that items in questionnaire measure the same theoretical concept (Anýžová, 2014; Byrne, 2008). Another type is metrical invariance. According to Anýžová(2014) during ascertainment of metrical equivalence must be entered requirements for factor loadings (regression weights) fit of each manifest variable in both groups. According to Byrne (2008, p. 873); Milfont and Fischer(2010, p. 115) in Anýžová (2014, p. 7) metric equivalence confirms that items are viewed and interpreted similarly in both language versions and if respondents hold the same opinion, then the answer will be identical. For scalar invariance, all fit restrictions are left on all factor loadings (regression weights), in which problem with metric equivalence was not identified and fit restrictions of all intercepts of manifest variables in both groups are added (Vandenburg, Lance, 2000, p. 38 in Anýžová, 2014, p.7). If all factor loadings (regression weights) or intercepts in both countries are not the same, we speak about partial equivalence of measurement (Byrne, 2008). Testing equivalences is mainly used in comparison of complex structural models, where more restrictions can be done. Model in regression analysis is a special case. As it is mentioned above, in this work there were tested three levels of invariance, just for illustration: configural, metrical and scalar. The used model is regression analysis with four input variables and one dependant variable. Agreement of models for the Czech Republic and Germany is tested. Order of tested models is described in the following table:

Table 1 Definition of sub-models

MODEL INVARIANCE	DESCRIPTION
Model 1 Configural Invariance	Basis model: the same structure is assumed
Model 2 Metric Invariance	As Model 1 + agreement of regression weights are assumed equal
Model 3 Scalar Invariance	As Model 2 + the intercepts are assumed equal

Source: Own elaboration according Blunch (2013)

Further, for determination of model quality and measurement of invariance are used so called correspondence indices, e.g. TLI (Tucker-Lewis Index), CFI (Comparative Fit Index), RMSEA (Root Mean Square of Approximation) and many others that will not be used in this study. Schumacker and Lomax (2010); Garson (2012); Kline (2011) in their publications mention recommended values for the given indices of global fit (global fit indices): RMSEA<0.08 (for acceptable model fit), RMSEA<0.05 (for good model fit); TLI>0.95 and CFI>0.95 (for a well-fitting model). For equivalence assessment it is true that if Δ CFI > 0.01, then more restrictive model is refused (Cheung, Rensvold, 2002). RMSEA index value should be within RMSEA confidence interval of the previous, more restrictive model and at the same time assumption Δ RMSEA < 0.015 should be satisfied (Cieciuch a Davidov, 2012). Anýžová (2014) also mentions another popular index that can be used during testing invariances of AIC (Akaike information criterion). With Akaike information criterion (AIC) is further assessed a difference of AIC values for restrictive and less restrictive model and after that significance of AIC differences for comparison models is assessed (Anýžová, 2014). Burnham and Anderson (2004) consider differences of two units between AIC values to be small, differences between four up to seven units are distinctive and differences above ten units should lead to the preference of model with a lower AIC value.

4. Methodology

Data were collected during the time period from September 2014 to December 2014. Choice of suitable high-tech firms in the manufacturing industry was carried out in the current Albertina and Hoppenstedt databases according to classification of economic activities CZ-NACE (production of pharmaceutical products and services, production of computers and electronically components, production of consumer electronics and optical instruments,production of measuring, testing, navigation and medical instruments, production of planes and their engines, spaceships and associated equipment).The group of respondents (164 Czech firms) and (187 German firms)consisted particularly of business and marketing managers, or other competent senior employees. Returnability of questionnaires was less than 20% in case of quantitative research. In order to measure market orientation a twelve-item shortened modified scale MMOS was used and level of business performance was assessed on the basis of three items.

There was used Czech version of the scale in the Czech Republic and English version of the scale in Germany (see Supplement). Subjective answers of respondents were recorded on Likert scale from one to seven, where seven expresses an absolute consent of the respondent with statement. Relation between market orientation and performance was analysed by the help of multiple regression analysis in IBM SPSS Statistics program, version 21. Suitability of the used data and assumptions before using the regression analysis were verified in advance. Testing individual invariances was done by Multigroup Invariance Analysis method in IBM SPSS AMOS program, version 22. Table 2 shows a summary of the tested hypotheses within the Czech and German regression model.

Table 2. Hypothesis

TESTING CASUAL RELATION
H_1: Customer Intelligence Generation has a statistically significant influence on business performance.
H_{01}: Customer Intelligence Generation has no statistically significant influence on business performance.
H_2: Competitor Intelligence Generation has a statistically significant influence on business performance.
H_{02}: Competitor Intelligence Generation has no statistically significant influence on business performance.
H_3: Intelligence Dissemination & Integration between staff has a statistically significant influence on business performance.
H_4: Responsiveness to Market Intelligence has a statistically significant influence on business performance.
H_{04}: Responsiveness to Market Intelligence has no statistically significant influence on business
TESTING INVARIANCE
H_5: Regression models "Market Orientation - Business Performance" does not satisfy configural invariance.
H_{05}: Regression models "Market Orientation - Business Performance" satisfy configural invariance.
H_6: Regression models "Market Orientation - Business Performance" does not satisfy metric invariance.
H_{06}: Regression models "Market Orientation - Business Performance" satisfy metric invariance.
H_7: Regression models "Market Orientation - Business Performance" does not satisfy scalar invariance.
H_{07}: Regression models "Market Orientation - Business Performance" satisfy scalar invariance.

Source: Own elaboration

5. Statistical results

a) Multiple regression analysis and descriptive statistics

At first, values of descriptive statistics were calculated and after verifying assumptions for regression analysis was assessed relation between individual components of market orientation and business performance. Total index of market orientation equals to arithmetic mean of all four components.

Table 3 Multiple regression analysis and descriptive statistics (Czech Republic)

MODEL	Unstandardised Coefficients		Standardised Coefficients	t-Value	Results	Arithmetic mean ($\bar{x}$)	Std. deviation	MO rate
-	B	Std. error	Beta	-	-	-	-	[1.0 5.0) (low) [5; 5.5] (medium) (5.5; 7.0] (high)
Constant	1.123*	0.546	-	2.058	-	-	-	-
Customers Intelligence Generation	0.252**	0.095	0.20**	2.643	Reject H_{01}	5.88	0.88	high
Competitors Intelligence Generation	0.058	0.072	0.06	0.812	Accept H_{02}	5.13	1.21	medium
Intelligence Dissemination & Integration	0.233***	0.073	0.24***	3.185	Reject H_{03}	5.12	1.11	medium
Responsiveness to Market Intelligence	0.222**	0.079	0.23**	2.810	Reject H_{04}	4.67	1.13	low
Business Performance (dependent variable); ***(p<0.001); **(p<0.01); *(p<0.05) Model properties: R=0.538;R^2=0.289; Adjusted R^2=0.271; F=16.16*** Note: Estimation of parameters - the least squares method (IBM SPSS Statistics 21)						Total market orientation index: 5.2		

Source: Own elaboration

Table 4 - Multiple regression analysis and descriptive statistics (Germany)

MODEL	Unstandardised Coefficients		Standardised Coefficients	t-Value	Results	Arithmetic mean ($\bar{x}$)	Std deviation	MO rate
-	B	Std. error	Beta	-	-	-	-	[1.0 5.0) (low) [5; 5.5] (medium) (5.5; 7.0] (high)
Constant	1.711***	0.446	-	3.837	-	-	-	-
Customers Intelligence Generation	0.248**	0.078	0.23**	3.187	Reject H_{01}	5.74	0.99	high
Competitors Intelligence Generation	0.070	0.074	0.07	0.942	Accept H_{02}	5.16	1.07	medium
Intelligence Dissemination & Integration	0.191**	0.067	0.21**	2.839	Reject H_{03}	5.03	1.17	medium
Responsiveness to Market Intelligence	0.164*	0.079	0.17*	2.079	Reject H_{04}	4.64	1.08	low
Business Performance (dependent variable); ***(p<0.001); **(p<0.01); *(p<0.05) Model properties: R=0.524;R^2=0.274; Adjusted R^2=0.258; F=17.191*** *Note*: Estimation of parameters - the least squares method (IBM SPSS Statistics 21)						Total market orientation index: 5.14		

Source: Own elaboration

b) Verification of invariance of models

In this chapter configural, metric and scalar invariance of both models were studied in detail. Testing equivalence is based upon analysis of covariance matrix which is depicted in Table 5. Each model is tested against a higher model according to description in Table 1. Null hypothesis postulates that the models do not differ and alternative hypothesis that the models are different, see Tables 2, 6 and 7.

Table 5 - Variance-covariance matrix

Item Code	CUIG (CZ)	COIG (CZ)	IDI (CZ)	RMI (CZ)	PERF (CZ)	Item Code	CUIG (GER)	COIG (GER)	IDI (GER)	RMI (GER)	PERF (GER)
CUIG (CZ)	0.770					CUIG (GER)	0.978				
COIG (CZ)	0.456	1.476				COIG (GER)	0.452	1.150			
IDI (CZ)	0.282	0.280	1.241			IDI (GER)	0.436	0.344	1.380		
RMI (CZ)	0.342	0.634	0.513	1.269		RMI (GER)	0.408	0.578	0.648	1.176	
PERF (CZ)	0.362	0.407	0.490	0.525	1.197	PERF (GER)	0.433	0.381	0.570	0.542	1.180

Note: Czech (CZ) and German (GER) high-tech firms; variances are on a diagonal
Source: Own elaboration

Table 6 Standard sequence of sub-models

Model	χ^2 (df)	$\Delta\chi^2$ (Δdf)	P	CFI (ΔCFI)	RMSEA (90% C. I.)	TLI (ΔTLI)	AIC (ΔAIC)	Comparison	Decision
Model 1	0.000	-	-	1.000	0.000	(-)	80.000	-	Accept
Configural invariance	(0)			(-)	(-)	(-)	(-)		
Model 2	0.113	0.113	99.847 %	1.000	0.000	1.051	72.113	Model 1 vs. Model 2	Accept
Metric invariance	(4)	(4)		(0.000)	(0; 0.018)	(-)	(7.887)		
Model 3	3.721	3.608	60.713 %	1.000	0.000	1.031	65.721	Model 2 vs. Model 3	Accept
Scale invariance	(9)	(5)		(0.000)	(0; 0.018)	(0.020)	(6.392)		

Note: All three models were assessed by maximum likelihood method in IBM SPSS AMOS program, version 22. Values in italic are shown for the sake of completeness and have no sense in regression model.
Source: Own elaboration

Table 6 shows detailed results of Chí-square difference test. The most important output is column P. The column contains the so called significance which may be interpreted as probability of error that alternative hypothesis will be accepted erroneously, although in fact null hypothesis is valid. In this case it is probability of erroneous acceptance of the given invariance validity. Standard limit of significance for acceptance of alternative hypothesis is lower than 5 . Table 6 also contains other selected indices.

Table 7 Multiple correlation coefficients

MODEL	R^2 (ΔR^2)		COMPARISON
	Czech Republic	**Germany**	
Model 1	0.2890	0.3136	-
Configural invariance	(-)	(-)	
Model 2	0.2807	0.3199	Model 1 vs. Model 2
Metric invariance	(0.00837)	-(0.00629)	
Model 3	0.2791	0.3180	Model 2 vs. Model 3
Scale invariance	(0.00154)	(0.00189)	

Source: Own elaboration

Table 7 shows total assessment of agreement between sub-models and data. The table contains values of squared multiple correlation coefficient. The value corresponds to determination coefficient acquired from classic least squares method.

Discussion

Results of descriptive statistics showed a medium-sized market orientation and business performance in the Czech Republic and Germany. Total index of market orientation calculated by arithmetic mean of all parts is surprisingly a bit higher for the Czech high-tech firms $\bar{x}$=5.20 than for German $\bar{x}$=5.14. Total performance of Czech firms equals to $\bar{x}$=5.13 and German $\bar{x}$=5.22 on Likert scale from 1 to 7. It results thereof that the rate of market orientation implementation in the Czech and German high-tech firms seems to be average.Testing casual relation also brought interesting results. A significant relationship among three dimensions of market orientation (customer intelligence generation, intelligence dissemination & integration and responsiveness to market intelligence) and business performance was confirmed on the studies sample in both countries. No statistically significant relationship was found between competitors intelligence generation and business performance in the Czech Republic and Germany. Both monitored countries have clearly very similar results (in more details see Table 3 and 4).

Further, from invariance research result the following findings. In Table 6, column χ^2 shows criterion for testing agreement between model and observed data, and it is a base for column $\Delta\ \chi^2$ that serves for deriving significance (P). Criterion χ^2 is used by all other given measures of the model quality. Model of configural invariance is fully identifiable in case of regression analysis. Number of members of the observed covariance matrix and covariance matrix of the model is the same. That is why criterion χ^2 equals to zero. In order to compare the models, its change between models is more important. For the same reasons consideration of indicators CFI, TLI and RMSEA has no sense. Neither sub-model can be rejected at 5% level of significance. Significance is markedly higher than 5% in both sub-models. Model satisfies both scalar and metric invariance. AIC (Akaike information criterion) evaluates agreement of model and data and also takes size of the model into consideration (number of parameters); it prefers models with smaller number of parameters. The lower AIC values the model gets, the better. Since restricted models have a smaller number of independent parameters, AIC is growing, although agreement rate of the models is always higher in the restricted models than in the compared one. Smaller number of estimated parameters prevailed the growth of agreement rate of the model. The change of AIC it is showed in the column ΔAIC. From this point of view, the best model seems to be scalar invariance that has the smallest number of independent parameters.

Values of the very regression model coefficients do not show much good agreement of data and model. The model explains just about 30% of the variance in the dependent variable. Models for Germany are slightly better than for the Czech Republic. The Table 7 shows that drop of the coefficient is too small, and so the simpler sub-model does not lose exactness. It is confirmed by non-rejection of metric and scalar invariance. Quality of regression model would improve if more input variables were included into the model, in this case e.g. suppliers, technology, etc. Coefficient of determination would be probably better and quality of the model would increase. It cannot be pre-determined how much it would be increased. In addition, the used model particularly specializes in two main market stakeholders, i.e. customers and competitors according to Kotler (2013). That is why modified version of the measuring scale MMOS was used for measurement of market orientation. During simultaneous action of all components of market orientation on business performance it emerged that regression model does not show a significant relation between generation of market information about competitors and business performance both in Czech and German high-tech firms. Such conclusions were independently found out by other authors from different parts of the world. Study of Sin *et al.* (2004) showed very mixed results across the regions in China. There is no significant relation between competitor orientation and business performance in the studied firms in Beijing, there is only a very weak positive relation in Hong Kong and Shanghai, a weak significant relation exists in Guangzhou. Zhou *et al.* (2007) claim, on the basis of questioning 184 hotel managers, that orientation to customers is more efficient in economically more developed markets, whereas orientation to competition is more effective in developing markets. At the same time these two authors confirmed positive and significant relation between orientation to customers and performance in developing markets. On the other hand, competitor orientation and interfunctional coordination are not significant in any observed model. Oudan (2007) measured market orientation by the help of the model MARKOR and used regression analysis in order to prove a positive and significant relation to performance. Laukkanen *et al.* (2013) claim, based upon analysis of 300 Hungarian and 820 Finnish firms, that market orientation has a positive influence on brand performance in both countries (stronger in Finland); surprisingly they did not manage to find significant relation between market orientation and market performance in any country. Cano *et al.* (2004) confirm that choice of measuring instrument plays also an important role. In the past there was proved a positive correlation between subjective and objective measuring, so similar results can be expected. It was also proved that there is a stronger relation when subjective measurement of business performance is used instead of objective measurement. Market orientation of firms is measured exclusively subjectively. The situation is different for business performance. Subjective measurement of business performance was used in the past by Nožička and Grosová (2012) or Oudan (2007), mixed measurement (subjective and objective) was tested by Dauda (2010) and objective measurement of business performance by Jangl and Mikuláštík (2013). Advantages and disadvantages of both measurement types must be thoroughly considered before each decision making which measurement is more suitable. More about advantages and disadvantages of subjective and objective measurement can be found in specialized literature, e.g. Dawes (1999).

Conclusion

The market orientation was described in this study as a process of active collection of market information, their interpretation in the firm and implementation into strategy. It is particularly continuous control of situation on the market, mapping the behavior of competitors, finding out present and future needs of customers, using e.g. data mining, mystery shopping or CRM (Customer Relationship Management). Task of the firm's staff is to arrange, analyze and share precious information in all management levels and in individual sections within the organization structure. Following this step it is necessary for management to transform information into knowledge assets and to take their total importance into consideration before taking action.

The main contribution of this work was to acquaint readers with model of "market orientation - business performance" in the Czech Republic and Germany. Aim of the article was to find out relation between market orientation and business performance and to compare causal models to each other. We managed to prove a positive significant relation between generation of market information about customers, dissemination and integration of this information inside the company and reactions to this information in the form of a coordinated action. Hypotheses H_1, H_3 a H_4 were hereby proved.In this research we did not manage to prove relation between market orientation and business performance, therefore hypothesis H_2 was not confirmed. It generally results from the study of Czech and German high-

tech firms that the market orientation is one of key factors influencing on performance of firms. At the same time we did not manage to prove any differences between regression models "market orientation and business performance" in the Czech Republic or Germany on the sample of high-tech firms in the manufacturing industry. *Tests of sub-models revealed configural, metric and scalar invariance.* It also results from the study that both Czech and English versions of the used measuring scale MMOS and business performance measurement are fully equivalent and the respondents in the Czech Republic and Germany understand the items in the same way. Hypotheses H_5, H_6 a H_7 were hereby confirmed. High-tech branch forms a specific group of firms in which strict assumptions must be observed. These results may be considered as another proof of a positive relation between market orientation and business performance in both countries provided that there are stable conditions on the market and mutual equivalence between the studied models is confirmed.

Acknowledgements

The Author is thankful to the Internal Grant Agency of FaME TBU No. IGA/FaME/2013/029 (Measurement of market orientation of a firm and development of a new model with a focus on contemporary trends in management and marketing) for the financial support of this research.

References

[1] Anýžová, P. (2014). Srovnatelnost Schwartzovy hodnotové škály v mezinárodních datech. *Sociologický časopis*, 50(4):547-580, http://dx.doi.org/10.13060/00380288.2014.50.4.108

[2] Blunch N.J. (2013). Introduction to Structural Equation Modeling Using IBM SPSS Statistics and Amos. (2nd ed.). SAGE Publications Ltd.

[3] Burnham, K.P., Anderson, D.R. (2004). Multimodel Inference: Understanding AIC and BIC in Model Selection. *Sociological Methods & Research*. 33(2):261-304. http://dx.doi.org/10.1177/0049124104268644

[4] Byrne, B.M. (2008). Testing for Multigroup Equivalence of a Measuring Instrument: A Walk through the Process. *Psicothema*, 20(4):872-882.

[5] Cano, C.R., Carrillat, F.A., Jaramillo, F. (2004). A meta-analysis of the relationship between market orientation and business performance: evidence from five continents. *International Journal of Research in Marketing,* 21:179-200. http://dx.doi.org/10.1016/j.ijresmar.2003.07.001

[6] Cieciuch, J., Davidov, E. (2012). A Comparison of the Invariance Properties of the PVQ-40 and the PVQ-21 to Measure Human Values across German and Polish Samples. *Survey Research Methods* 6(1):37-48.

[7] Dauda, Y.A. (2010). Employee's Market Orientation and Business Performance in Nigeria: Analysis of Small Business Enterprises in Lagos State. *International Journal of Marketing Studies*, 2(2):134-143.

[8] Dawes, J. (1999). The relationship between subjective and objective company performance measures in market orientation research: Further empirical evidence. Marketing Bulletin. 10:65-76.

[9] Ellis, P.D. (2006). Market Orientation and Performance: A Meta-Analysis and Cross-National Comparisons. Journal of Management Studies. 43(5):1089-1107.http://dx.doi.org/10.1111/j.1467-6486.2006.00630.x

[10] Garson, D. (2012).Structural Equation Modeling: Statistical Association Publishing, Asheboro.

[11] Harrison-Walker, L.J. (2001). The measurement of a market orientation and its impact on business performance. *Journal of Quality Management*, 6(2):139-172.

[12] Cheung, G.W., Rensvold, R.B. (2002). Evaluating Goodness-of-fit Indexes for Testing Measurement Invariance. *Structural Equation Modeling: A Multi-disciplinary Journal,* 9(2):233-255. http://dx.doi.org/10.1207/S15328007SEM0902_5

[13] Jangl, P., Mikuláštík, M. (2014). The Relationships between Market Orientation and Competitiveness of Companies in Banking Sector. *International Journal of Social, Education, Economics and Management Engineering,* 8(6): 214-218.

[14] Karlíček, M., Chytková, Z., Tyll, L., & Mohelská, H. (2014). Barriers of marketing effectiveness and efficiency within companies: A quality study. *E+M Ekonomie a Management*. 17(4):111-124, http://dx.doi.org/10.15240/tul/001/2014-4-009

[15] Keith, Z.T. (2015). Multiple Regression and Beyond. An Introduction to Multiple Regression and Structural Equation Modeling. New York: Taylor & Francis.

[16] Kline, R.B. (2011). Principles and Practice of Structural Equation Modeling. New York: The Guilford Press.

[17] Knápková, A., Blahová, M. (2010). Effective Strategic Action: From Formulation to Implementation. In Proceedings of the 2010 International Conference on Economics, Business and Management Association Conference. Manila: Institute of electrical and Electronic Engineers (IEEE) Research Publishing, Philippines, 61-65.

[18] Laukkanen, T., Nagy, G., Hirvonen, S., Reijonen, H., Pasanen, M. (2013). The effect of strategic orientations on business performance in SMEs. A multigroup analysis comparing Hungary and Finland. *International Marketing Review*, 30(6):510-535.

[19] Meade, A.W., Lautenschlager, G.J., Hecht, J.E. (2005). Establishing Measurement Equivalence and Invariance in Longitudinal Data with Item Response Theory. *International Journal of Testing*, 5(3):279-300.

[20] Milfont, T.L., Fisher, R. (2010). Testing Measurement Invariance across Group: Applications in Cross-cultural Research. *International Journal of Psychological Research,* 3(1):111-121.

[21] Nožička, J., Grosová, S. (2012). Měření tržní orientace ve vzorku malých a středních inovačních podniků, *Acta Universitatis Bohemiae Meridionales*, 15(1):31-42.

[22] Oudan, R. (2007). Market Orientation. (1st Ed.). VDM Verlag Dr. Mueller e.K.

[23] Sin, L.Y.M., Tse, A.C.B, Yau, O.H.M., Lee, J.S.Y., Chow, R.P.M. (2004). Market Orientation and Business Performance in the PRC: A regional Comparison. *Journal of Global Marketing,* 17(2/3):55-89.

[24] Smith, D.B., Pitta, D.A., Richardson, L. (2007). A Comparison of The Market Orientation of Chinese and US Firms. *International Business & Economics Research Journal*, 6(12):25-38.

[25] Schumacker, R.E.,Lomax, R.G. (2010). A Beginner's Guide to Structural Equation Modeling, New York and London: Taylor and Francis Group, LLC.

[26] Tomášková, E., (2005). Měření tržní orientace a její vliv na podnikový výkon. Brno: Vutium.

[27] Vandenberg, R.J., Lance, Ch.E. (2000). A Review and Synthesis of the Measurement Invariance Literature: Suggestions, Practices, and Recommendations for Organizational Research. *Organizational Research Methods*, 3(1):4-70. http://dx.doi.org/10.1177/109442810031002

[28] Tseng, F-M., Chiu, Y-J., Chen, J-S. (2009) Measuring business performance in the high-tech manufacturing industry: A case study of Taiwan's large-sized TFT-LCS panel companies. *International Journal of Management Science,* 37(3):686-697.

[29] Weiber, R., & Mühlhaus, D. (2014). Eine anwendungsorientierte Einführung in die Kausalanalyse mit Hilfe von AMOS, SmartPLS und SPSS (2nd Ed.), Springer.

[30] Zelený, M. (2010). Strategy as Action: from Porter to Anti-Porter. *International Journal of Strategic Decision Sciences*, 1(1): 1 - 22, http://dx.doi.org/10.4018/jsds.2010103001

[31] Zhou, K.Z., Brown, J.R., Dev, S.Ch., Agarwal, S. (2007). The effects of customer and competitor orientations on performance in global markets: a contingency analysis. *Journal of International Business Studies*, 38: 303-319.

APPENDIX

The Modified Market Orientation Scale MMOS and Business Performance Measurement

CONSTRUCT	ITEMS
Customers Intelligence Generation	1. We systematically collect and evaluate data about satisfaction or non-satisfaction of customers. 2. We have regular meetings with customers in order to learn their future expectations in time. 3. We permanently strive for a deeper understanding of the hidden needs and requirements of customers.
Competitors Intelligence Generation	4. We monitor mutually competing firms in our branch. 5. We perform evaluation of strong and weak points of major competitors. 6. We try to predict a future behavior of competitors.
Intelligence Dissemination & Integration	7. We inform each other about successful and unsuccessful experience with customers across all company departments. 8. In our company we hold a lot of formal and informal talks where we solve present business success, market opportunities or risks. 9. Market information are integrated in this workplace before decisions are made.
Responsiveness to Market Intelligence	10. Our reaction to the competitor's price campaign is very short. 11. Principles of market segmentation control development of new products in our firm. 12. We react immediately if the competition launches intensive advertising campaign aimed at our customers.
Business performance	1. Growth of sales with customers is remarked. 2. Profitability (ROA) is increased year-on-year. 3. Our firm increased its market share over the last year.

Modifikovaná škála tržní orientace (MMOS) a měření firemní výkonnosti(Czech version)

KONSTRUKT	POLOŽKY
Získávání tržních informací o zákaznících	1. Systematicky sbíráme a vyhodnocujeme údaje o spokojenosti či nespokojenosti zákazníků. 2. Pravidelně se setkáváme se zákazníky, abychom včas poznali, co očekávají v budoucnu. 3. Permanentně usilujeme o hlubší pochopení skrytých potřeb a přání zákazníků.
Získávání tržních informací o konkurenci	4. Monitorujeme firmy vzájemně si konkurující v našem odvětví. 5. Provádíme evaluaci silných a slabých stránek u hlavních konkurentů. 6. Snažíme se predikovat budoucí chování konkurence.
Šíření & integrace tržních informací	7. Sdělujeme si informace o úspěšných i neúspěšných zkušenostech se zákazníky napříč všemi odděleními firmy. 8. V naší společnosti probíhá dostatek formálních i neformálních rozhovorů, kde řešíme dosavadní obchodní úspěchy, tržní příležitosti nebo rizika. 9. Tržní informace jsou na tomto pracovišti integrovány před přijetím rozhodnutí.
Reakce na tržní informace - koordinovaná akce	10. Reakce na cenovou kampaň konkurence nám trvá krátkou dobu. 11. Principy tržní segmentace řídí vývoj nových produktů v naší firmě. 12. Okamžitě reagujeme, pokud konkurence spustí intenzivní reklamní kampaň cílenou na naše zákazníky.
Firemní výkonnost	1. Zaznamenáváme růst objemu prodeje u zákazníků. 2. Ziskovost (ROA) se meziročně zvyšuje. 3. Naše firma zvýšila svůj tržní podíl v posledních letech.

Foreign Direct Investment, Oil Prices and Global Financial Crisis: Evidence from Singapore

Koi NYEN WONG
Business School, Sunway University, Malaysia
koinyenw@sunway.edu.my[1]

Soo KHOON GOH
Centre for Policy Research and International Studies
Universiti Sains Malaysia, Malaysia
skgoh@usm.my

Hooi HOOI LEAN
School of Social Sciences, Universiti Sains Malaysia, Malaysia
hooilean@usm.my

Abstract:

Foreign direct investment (FDI) is often cited as an important feature of the Singapore's economy. In addition to its contribution to the city-states' capital formation, it also fosters international trade, technology transfer and yields other spillover effects. Despite Singapore economy is highly internationally linked, it cannot insulate itself against external shocks e.g. the Asian financial crisis, global financial crisis, and oil price shocks, to name a few. This study attempts to ascertain whether the effects of external shocks on the sources of FDI in Singapore are transitory or permanent using the Lagrange multiplier (LM) unit root tests proposed by Lee and Strazicich (2003 and 2004). The empirical evidence reveals that the external shocks had only transitory effects on FDI regardless of the source of the FDI either by region, major investor country or other investor country. The findings provide policy measures on how the government should best respond to shocks that affect FDI in the city-state in the short run.

Keywords: foreign direct investment; unit root; multiple breaks; oil price shock; global financial crisis; Singapore

JEL Classification: E24; F21

1. Introduction

Singapore is popularly known as one of the four Asian Tigers[2] in the region and its remarkable economic success is attributed to the adoption of export-led growth strategy through foreign direct investment (FDI). In retrospect, FDI inflows not only have been an important catalyst for the city-state's industrialization process but also have contributed to the economy in terms of employment generation, gross domestic product (GDP) and international trade (e.g., Kwong, 2001; Ghesquiere, 2007). Owing to its strategic geographical location, excellent infrastructure, high degree of trade openness and liberal investment policy[3], inward FDI is instrumental in transforming the city state into a global centre for financial and business services (see Islam and Chowdhury, 1997; Singapore Economic Development Board, 2004; Cheong and Wong, 2006).According to UNCTAD (2014), Singapore was the third largest destination country of FDI after China and Hong Kong in terms of attracting FDI projects in the Asia Pacific in 2013 (see Table 1). In 2013, the major sources of FDI by region in Singapore comprised Asia[4], Europe[5], and North America[6], which jointly accounted for 69.3% of total inward FDI (see Table 2). On the other hand, Australasia was relatively less important as a source of FDI due to its relatively much smaller share of foreign investments in the country. Moreover, in 2013, both Europe's and North America's

[1] Corresponding author. The authors will like to acknowledge the research grant 1001/CDASAR/816209 from Universiti Sains Malaysia, Penang, Malaysia.

[2] The other three Asian Tigers are Hong Kong, South Korea and Taiwan.

[3] There are no restrictions on foreign investment in Singapore, as the government believes that multinationals have massive resources and international network are able to stimulate international trade.

[4] The major investor countries from Asia were Japan (SGD71.9 billion), Hong Kong (SGD34.6 billion), Malaysia (SGD 27.3 billion), India (SGD24.4 billion), and China (SGD16.4 billion) (Department of Statistics, Singapore).

[5] The major investor countries from Europe were Netherlands (SGD84.4 billion), United Kingdom (SGD58.5 billion), Switzerland (SGD40.2 billion), Norway (SGD 20.8 billion) and Luxembourg (SGD22.8 billion) (Department of Statistic, Singapore).

[6] The major investor countries from North America were United States (SGD11.4 billion) and Canada (SGD6.5 billion) (Department of Statistics, Singapore).

percentage share as sources of FDI in the city-state had decreased from 22.9% and 18.9% in 2012 to 21.8% and 18.8% respectively, while the Asia's percentage share had increased to 28.7% in 2013 from 28.3% in 2012. The bulk of inward direct investments in Singapore from these three main regions were concentrated in the following industries, namely, financial and insurance services, wholesale and retail trade and manufacturing (refer to Table 2).

Table 1. Top 5 Destination countries of FDI in Asia Pacific, 2012 and 2013

COUNTRY	2012 (billion dollars)	2013 (billion dollars)
China	121	124
Hong Kong, China	75	77
Singapore	61	64
Australia	56	50
India	24	28

Source: UNCTAD (2014) World Investment Report 2014: Investing in SDGs: An Action Plan, United Nations, New York and Geneva.

Table 2. Source of FDI in Singapore by region and by major industry, 2012 and 2013

REGION	2012		2013	
	% Share	Top 3 Industry	Percentage Share	Top 3 Industry
Asia	28.3	(1st) FIS (2nd) WRT (3rd) MNF	28.7	(1st) FIS (2nd) WRT (3rd) MNF
Europe	22.9	(1st) FIS (2nd) MNF (3rd) WRT	21.8	(1st) FIS (2nd) MNF (3rd) WRT
North America	18.9	(1st) FIS (2nd) MNF (3rd) WRT	18.8	(1st) FIS (2nd) MNF (3rd) WRT
Australasia	2.6	(1st) FIS (2nd) PS (3rd) WRT	2.4	(1st) FIS (2nd) WRT (3rd) MNF
South & Central America and the Caribbean	24.8	(1st) FIS (2nd) MNF (3rd) WRT	26.0	(1st) FIS (2nd) MNF (3rd) WRT
Other Countries	2.5	(1st) FIS (2nd) RES (3rd) WRT	2.3	(1st) FIS (2nd) RES (3rd) WRT
TOTAL	**100**		**100**	

Source: Singapore Department of Statistics

Notes: FIS denotes Financial&Insurance Services; WRT denotes Wholesale&Retail Trade; MNF denotes Manufacturing; RES denotes Real Estate Activities; PS denotes Professional Scientific&Technical Administrative and Support Services

Apart from transferring resources like capital, technology and management resources to the host economy, the presence of multinational corporations (MNCs) in the city-state could bring other economic benefits to the host economy. For instance, the empirical studies show that inward FDI in Singapore could forge linkages with services trade (Wong et al., 2009); could lead to output growth of the manufacturing sector (Anwar, 2008) as well as manufacturing industries (Jayawickrama and Thangavelu, 2010); could result in employment growth in the manufacturing sector (Wong and Tang, 2011) and, could lead to productivity spill over to local manufacturing firms (Guo and Yuen, 2012).

Despite the city-state's economy is highly internationally linked, there are concerns pertaining to whether the source of FDI in Singapore by region (such Asia, Europe and North America[7]) and country

[7] We use the U.S. as a proxy for North America due to non-availability of data for investor country from Canada from 1980-1989.

(the major investor countries from each region and other investor countries) is vulnerable or resilient to the particular type of external shocks e.g. a surge in oil prices and global financial crisis. By and large, macroeconomic time series including FDI inflows tend to respond to time specific external shocks (see Wong et al. 2009 and Wong and Tang, 2011). A literature survey shows that such empirical study is limited for the case of sources of FDI in Singapore. Hence, the empirical evidence on the vulnerability of the source of FDI in Singapore by region and by major investor and other countries to the different nature of shocks can provide useful policy measures to mitigate the these effects. The aim of this study is to ascertain whether the external shocks have a permanent or transitory effect on FDI in Singapore by region and major and other investor country using advance unit root tests which allow for structural breaks, i.e. the LM unit root test by Lee and Strazicich (henceforth LS) (2003,2004). Our aim is to investigate if the source of FDI in Singapore is found to have a unit root or non-stationarity, then the test statistic suggests that the particular external shock tends to have a permanent effect on the FDI inflows. Otherwise, the effect on FDI inflows is transitory. The findings can provide important policy measures on how the government should best respond to shocks that affect FDI in the city-state.

The remainder of the paper is as follows. Section 2 deals with data sources and measures and is also concerned with the procedure to perform the LM unit root tests. Section 3 reports and discusses the test results. The main conclusions and policy implications can be found in the last section.

2. Data and LM Unit Root Tests

Data

We examine annual FDI flows data by region and by major and other investor countries to Singapore from 1980-2010. Higher-frequency data or data spanning a longer time period would be desirable, but the frequency and sample period are based on the availability of source FDI data, which are obtained from the Department of Statistics, Singapore.[8] All series are measured in real terms using the GDP deflator before they are transformed into natural logarithms. The denominations of all the time-series data are in millions of Singapore dollar.

LM Unit Root Test

It is well documented in time series literature, standard Augmented Dickey-Fuller (ADF) test is not appropriate for variables that may have undergone structural changes and the test statistics could be biased towards non-rejection of the null hypothesis of a unit root with no break (Perron, 1989). To deal with this problem, Zivot and Andrew (henceforth ZA) (1992), Perron (1997) and Lumsdaine and Papell (henceforth LP) (1997) proposed to determine the break point "endogenously" from the data (LS, 2001). The main deficiency of ZA (1992) and Perron (1997) models is that they incorporate only one structural break, which could potentially lead to a loss of information when there are two breaks in the data (LP, 1977).

Therefore, to test for a unit root and allow for structural break(s) under both the null and the alternative hypotheses, we apply the Lagrange multiplier (LM) unit root tests proposed by LS (2003, 2004). In contrast to the ADF test, the LM unit root test is unaffected by structural breaks under the null hypothesis and as a result, it does not suffer from size distortions, and can be more powerful than ADF tests in many cases (Vougas, 2003). The LM unit root test statistic, which is an extension of the Schmidt and Phillips (1992) test, is based on the following equation:

$$x_t = \delta' Z_t + e_t \quad \text{and} \quad e_t = \beta e_{t-1} + \varepsilon_t$$

where Z_t consists of exogenous variables and ε_t is the error term with classical properties. There are two variants with respective to the LM unit root test with one structural break, specifically, Models A and C. The former allows for one structural break in the intercept and can be described by $Z_t = [1, t, D_t]'$, where D_t= 1 for $t \geq T_B+1$, and zero otherwise. T_B is the date of the structural break. The latter allows for one structural break in the intercept as well as the slope (or trend) and can be described by $Z_t = [1, t, D_{1t}, D_{2t}]'$, where $DT_t = t-T_B$ for $t \geq T_B+1$, and 0 otherwise.

[8] The authors would like to thank the Department of Statistics, Singapore for kindly allow us to have access to the FDI data by country and by region.

In addition, there are also two variants in the case of LM test with two structural breaks, which are known as Models AA and CC. The former, which is an extension of Model A, allows for two breaks in the intercept and is represented by $Z_t = [1, t, D_{1t}, D_{2t}]'$ where D_{jt}= 1 for $t \geq T_{Bj}+1$, j=1, 2, and 0 otherwise. On the other hand, Model CC, which is an extension of Model C, incorporates two structural breaks in the intercept as well as the slope and is represented by $Z_t = [1, t, D_{1t}, D_{2t}, DT_{1t}, DT_{2t}]'$, where $DT_{jt} = t - T_{Bj}$ for $t \geq T_{Bj}+1$, j = 1,2, and 0 otherwise.

To choose the unknown break dates, LS (2003 and 2004) follow ZA method by using the so-called minimum *t*-statistic procedure. This procedure estimates the chosen unit root testing equation considering all possible break dates in the trimmed sample and chooses the break date(s) so that the *t*-statistic for the unit root hypothesis is minimized.

3. Results

The results of the standard unit root tests i.e. ADF and PP (Phillips-Perron) tests for the FDI in Singapore time series by region, major investor and other investor countries can be found in Table 3. The lag length (K) of ADF test is selected based on the "general to specific" approach suggested by Hall (1994).[9] Both the test statistics cannot reject the null hypothesis of a unit root for FDI in Singapore by region at 5% significance level except for the U.S.[10] However, both the test statistics show rejection of the unit root null hypothesis for FDI in Singapore by major investor and other countries except Thailand. As highlighted in the previous section, the standard unit root tests could be biased towards non-rejection of a unit root if a structural break is present in the time series.

Table 3. Unit Root Tests

SERIES	ADF	PP
FDI in Singapore by region		
Asia	-0.52 (1)	-2.59
Europe	-2.58 (8)	-1.89
U.S.	-3.93***(4,10)	-5.81***
FDI in Singapore by major investor country		
Hong Kong	-3.52**(3)	-3.07**
Japan	-4.86***(5)	-3.88**
Malaysia	-5.16***(2,4)	-4.46***
Switzerland	-4.79***(1,5)	-4.80***
U.K.	-5.00***(0)	-5.17***
FDI in Singapore by other investor country		
Australia	-3.09**(0)	-3.12**
Germany	-4.79*** (1)	-5.21***
Indonesia	-4.15***(0)	-4.15***
Philippines	-5.26***(1,2,3)	-10.37***
Taiwan	-3.57** (4,5)	-3.77***
Thailand	-0.41 (0)	0.09

Notes: Only constant term has been included in the ADF equation as there is no obvious trend from plotting all country and regional FDI data. The optimum lag (.) is selected based on the general to specific approach. *,** and *** denote rejection of the unit root null at the 10%, 5% and 1% level, based on MacKinnon's (1996) critical values.

In this regard, the LM unit root tests with one structural break in the intercept (i.e. Model A) as well as with one structural break in the intercept and slope (i.e. Model C) were performed and their test results are reported in Tables 4 and 5 respectively. Model A shows that apart from the U.S., the test statistics for FDI in Singapore by region do not reject the null hypothesis. In contrast, if the unit root for FDI in Singapore by major investor and other investor countries are tested, the test statistics appear to reject the

[9] The main advantage of this method is that it is able to produce stable size and higher power than information based method such as Akaike information criterion (Ng and Perron, 1995; Perron, 1997).

[10] Due to the data on cross border direct investment in Singapore by Canada is only available from 1990 onwards, the U.S. is used as a proxy for North America (which constitutes U.S. and Canada) as a source of FDI in Singapore by region.

null hypothesis for Switzerland, U.K., Germany, the Philippines, Taiwan (at the 1% significance level), Hong Kong, Japan, Malaysia (at the 5% significance level). Also, the structural breaks of the major and other FDI investor countries in the city-state correspond to the following shocks (refer to the last column of Table 4). For instance, the structural break in 2000 for Germany as the source of FDI was associated with the crash of the dot-com bubble and the recession that affected the European Union (EU). Similarly, the structural break in 2004 (2007) in Hong Kong (Taiwan) was caused by the sudden rise in oil prices as a result of the rapid growth of global oil demand especially from China in particular (sub-prime loan crisis originated from the U.S.).

With reference to Model C, the unit root null is rejected for the source of FDI by region (except for Asia) and by major investor and other investor countries at 1% significance level. The major investor and other investor countries that experienced the break in the intercept and slope are Hong Kong in 2006, Malaysia in 2004, Switzerland, the U.S. in 2003, U.K. in 2007, Australia in 1997, Germany in 2005 and Taiwan in 2003. The structural breaks that occurred between 2003 and 2007 were associated with Iraq War and the SARS (severe acute respiratory syndrome) that affected Singapore and other parts of Asia in 2003; the sudden rise in oil prices due to rapid growth of global oil demand especially from Asia (China in particularly) in 2004, Hurricane Katrina in 2005 and the global financial crisis in 2007.

According to Sen (2003a), Model C is preferred to Model A especially the former suggests different results. Moreover, the Monte Carlo simulations reported in Sen (2003b) show that Model C tends to yield more reliable estimates of the breakpoint than Model A.

Table 4. Results of LM unit root test with one structural break in the intercept (Model A)

Series	TB	K	S_{t-1}	B_t
FDI in Singapore by region				
Asia	2007	2	-0.6773 (-2.8748)	0.5041** (2.2436)
Europe	1997	0	-0.3858 (-2.6327)	0.2403 (1.0807)
U.S.	1995	0	1.1888*** (-6.5191)	-0.0023 (-0.0126)
FDI in Singapore by major investor country				
Hong Kong	2004	1	-0.9897** (-4.2385)	0.1658** (2.1431)
Japan	1993	0	-0.6602** (-3.7800)	0.1424 (1.1979)
Malaysia	2007	0	-0.6391** (-3.6903)	-0.0041 (-0.0453)
Switzerland	2006	0	-1.1277*** (-6.1227)	-0.0791 (-0.6001)
U.K.	2002	0	-1.0368*** (-5.5869)	0.2753 (0.3763)
FDI in Singapore by other investor country				
Australia	2006	0	-0.4945 (-3.0863)	0.0394 (0.7056)
Germany	2000	1	-1.7852*** (-7.8129)	0.1847*** (3.4788)
Indonesia	2007	0	-0.3840 (-2.6250)	0.0374 (0.6971)
Philippines	2002	0	-1.3095*** (-7.4163)	-0.0152 (-0.8297)
Taiwan	2007	0	-1.3982*** (-8.2085)	-0.1719*** (-6.5775)
Thailand	1993	0	-0.2686 (-2.1209)	-0.0455 (-1.2002)

Notes: TB is the date of the structural break; k is the lag length; S_{t-1} is the LM test statistic; B_t is the dummy variable for the structural break in the intercept. Numbers in the parentheses are t-values. Critical values for the LM test at 10%, 5% and 1% significant levels = -3.211, -3.566, -4.239. *, **and *** denote statistical significance at the 10%, 5% and 1% levels respectively.

Table 5. Results of LM unit root test with one structural break in the intercept and slope (Model C)

Series	TB	K	S_{t-1}	B_t	D_t
FDI in Singapore by region					
Asia	2005	2	-0.8318 (-4.1854)	-0.8741*** (-4.0393)	0.4728*** (2.7947)
Europe	2004	0	-1.1650*** (-6.3607)	-0.0291 (-0.1684)	0.3051*** (2.8936)
U.S.	2003	1	-2.0406*** (-7.3280)	0.1140 (0.6937)	-0.2362*** (-3.1068)
FDI in Singapore by major investor country					
Hong Kong	2006	1	-1.3150*** (-6.9735)	-0.3426*** (-4.2967)	0.3233*** (5.3179)
Japan	2003	0	-1.1893*** (-6.5224)	0.1361 (1.4092)	-0.0306 (-0.7485)
Malaysia	2004	0	-0.9869*** (-5.3153)	0.1981** (2.6653)	0.0231 (0.6273)
Switzerland	2003	2	-2.0205*** (-6.7984)	-0.6426*** (-4.4784)	0.3581*** (4.8772)
U.K.	2007	1	-2.2563*** (-10.4357)	3.2154*** (5.6831)	-2.8589*** (-7.8473)
FDI in Singapore by other investor country					
Australia	1997	0	-1.0551*** (-5.6907)	0.0880* (1.8348)	-0.0917*** (-3.6765)
Germany	2005	2	-2.4045*** (-6.7807)	-0.3921*** (-5.1956)	0.1955*** (5.5892)
Indonesia	2006	0	-1.1922*** (-6.5422)	0.0085 (0.2193)	0.0308 (1.1978)
Philippines	1994	0	-1.3061*** (-7.3880)	-0.0096 (-0.5216)	0.0030 (0.4406)
Taiwan	2003	2	-1.9408*** (-7.2002)	-0.1019*** (-3.5432)	0.0785*** (4.7805)
Thailand	2007	0	-1.5418*** (-9.8786)	-0.0032 (-0.1585)	0.0187 (1.3383)
Critical Values for S_{t-1}					
location of break, λ	0.1	0.2	0.3	0.4	0.5
1% significant level	-5.11	-5.07	-5.15	-5.05	-5.11
5% significant level	-4.50	-4.47	-4.45	-4.50	-4.51
10% significant level	-4.21	-4.20	-4.18	-4.18	-4.17

Notes: TB is the date of the structural break; k is the lag length; S_{t-1} is the LM test statistic; B_t is the dummy variable for the structural break in the intercept. D_t is the dummy variable for the structural break in the slope. Numbers in the parentheses are t-values. Critical values for the LM test statistics are symmetric around λ and (1-λ). Critical values for other coefficients follow the standard normal distribution. *, ** and *** denote statistical significance at the 10%, 5% and 1% levels respectively.

Tables 6 and 7 present the test results based on the LM unit root tests with two structural breaks in the intercept (Model AA) and with two structural breaks in the intercept and slope (Model CC). Relating to Model AA, the unit root null hypothesis is rejected for the source of FDI by region (excluding Europe), by major investor country and by other investor country (excluding Australia, Indonesia and Thailand). Whereas Model CC suggests that the unit root null is rejected for both the source of FDI by region, by major investor as well as other investor countries. Overall, the results in Model CC are preferred to Model AA because the former is the least restrictive and has the advantage of encompassing the latter.

The significant endogenously determined structural breaks for both models are reported in Tables 6 and 7. The breaks for FDI in Singapore by region, viz. Asia (both models), Europe (Model AA) and U.S. (Model CC) are linked to the increase in oil prices in 2003 and 2004, and the global financial crisis in 2007. Pertaining to the significant breaks associated with the FDI in Singapore by major investor and other investor countries, viz. Hong Kong (both models), Malaysia (both models), Switzerland (both models), U.K. (Model CC), Germany (both models), the Philippines (Model CC), Taiwan (both models) and Thailand (Model CC), both the individual and common external shocks that affected the source of FDI are the

Mexican crisis in 1994, the sharp appreciation of the dollar in 1995 and 1996, the Asian financial crisis in 1997 and 1998, the crash of the dot-com bubble in 2000, skyrocketed oil prices due to Hurricane Katrina in 2005 and the global financial crisis in 2007.

Table 8 summarizes the unit root test results whether the impacts of the external shocks on the source of FDI in Singapore are transitory or permanent. Overall, the test statistics cannot reject the null hypothesis of a unit root, suggesting that the external shocks mentioned above had only a transitory effect on FDI in the city-state regardless of the source of the FDI either by region, major investor country or other investor country. The temporary sensitivity of FDI to shocks reveals that (i) The FDI source regions and countries were susceptible to the financial crises and the sharp increase in oil prices, which could adversely affect the growth performance of the parents as well as the subsidiaries of foreign firms operating in Singapore. As a consequence, these temporary adverse shocks could discourage equity capital investment, reinvested earnings and inter-company loans, of which FDI predominantly comprises, during bad times. (ii) The financial crises have a tendency to delay the cross-border direct investments by foreign firms in the host economy. (iii) Singapore has a high degree of trade openness and hence, its major sources of FDI in the economy are vulnerable to external shocks.

Table 6: Results of LM unit root test with two structural breaks in the intercept (Model AA)

SERIES	TB1	TB2	K	S_{T-1}	$B1_T$	$B2_T$
FDI in Singapore by region						
Asia	1993	2004	0	-0.9541*** (-4.7753)	0.1852 (0.9594)	0.6962*** (3.5567)
Europe	1997	2007	0	-0.5940 (-3.2501)	0.1651 (0.8629)	-0.5862*** (-3.0239)
U.S.	2000	2003	0	1.2892*** (-6.7340)	0.2408 (1.2570)	0.1122 (0.6029)
FDI in Singapore by major investor country						
Hong Kong	2004	2006	1	-1.0534*** (-4.6992)	0.1077 (1.3530)	-0.1712** (-2.1662)
Japan	1987	1993	0	-0.7158* (-3.7331)	0.1073 (0.8632)	0.1226 (0.9834)
Malaysia	2000	2005	2	-0.7588*** (-5.3441)	0.2634*** (3.7079)	-0.4186*** (-4.9810)
Switzerland	1993	2005	0	-1.2157*** (-6.2250)	0.2130 (1.5905)	0.4085** (2.6779)
U.K.	1999	2002	0	-1.0738*** (-5.3838)	-0.3550 (-0.4610)	0.1195 (0.1561)
FDI in Singapore by other investor country						
Australia	1994	2006	0	-0.5665 (-3.1430)	-0.0410 (-0.7046)	0.0378 (0.6486)
Germany	1994	2000	1	-1.8248*** (-7.3101)	0.0440 (0.8261)	0.1749*** (3.0738)
Indonesia	1993	2007	0	-0.4304 (-2.6182)	0.0359 (0.6737)	0.0443 (0.7754)
Philippines	1994	1996	0	-1.3293*** (-7.0388)	-0.0002 (-0.0082)	0.0070 (0.3639)
Taiwan	1997	2007	0	-1.5077*** (-8.7495)	0.0572** (2.2839)	-0.1763*** (-6.9012)
Thailand	1993	2007	0	-0.3141 (-2.1583)	-0.0451 (-1.1185)	-0.0192 (-0.4547)

Notes: Critical values for the LM test at 10%, 5% and 1% significant levels = -3.504, -3.842, -4.545. *, ** and *** denote statistical significance at the 10%, 5% and 1% levels respectively.

Table 7. Results of LM unit root test with two structural breaks in the intercept and slope (Model CC)

SERIES	TB1	TB2	K	S_{T-1}	$B1_T$	$B2_T$	$D1_T$	$D2_T$
FDI in Singapore by region								
Asia	1986	2003	0	-1.5510*** (-8.9132)	0.0988 (0.6911)	-0.4526*** (-2.8302)	0.1016 (1.4255)	0.4595*** (5.5601)
Europe	1993	2004	0	-1.3700***	0.2481	-0.0716	0.0128	0.1930*

SERIES	TB1	TB2	K	S_{T-1}	$B1_T$	$B2_T$	$D1_T$	$D2_T$
				(-7.0725)	(1.5918)	(-0.4283)	(0.2014)	(1.9984)
U.S.	2003	2007	1	-2.0482*** (-8.3133)	0.1916 (1.0516)	-1.4431*** (-6.1821)	-0.4441*** (-4.2858)	0.6882*** (4.8753)
FDI in Singapore by major investor country								
Hong Kong	2000	2006	1	-1.7496*** (-10.7777)	-0.1767*** (-3.5810)	-0.3799*** (-6.4605)	0.0438* (1.9633)	0.3469*** (7.1477)
Japan	1999	2003	0	-1.3780*** (-7.1384)	-0.2511** (-2.5612)	0.1171 (1.2581)	0.0794 (1.4803)	-0.0268 (-0.4456)
Malaysia	1994	2003	0	-1.4888*** (-8.1844)	-0.0080 (-0.1322)	-0.0699 (-1.0459)	0.0687** (2.4887)	0.1755*** (4.6191)
Switzerland	1998	2003	2	-2.2169*** (-7.2408)	0.2603** (2.0681)	-0.7198*** (-4.8085)	-0.1804** (-2.7914)	0.6484*** (5.9344)
U.K.	2001	2006	1	-2.5292*** (-12.7594)	0.6430 (1.5865)	3.4584*** (7.1535)	-0.0548 (-0.2770)	-2.9249*** (-8.1966)
FDI in Singapore by other investor country								
Australia	1986	2003	0	-1.2294** (-6.0574)	0.0154 (0.3528)	0.1386*** (2.9345)	0.0009 (0.0393)	-0.0388 (-1.6750)
Germany	1996	2005	2	-2.6740*** (-8.1448)	0.2178*** (4.5466)	-0.4452*** (-6.1436)	-0.1040*** (-4.7041)	0.2728*** (7.2483)
Indonesia	2003	2007	0	-1.6869*** (-11.1309)	-0.0692*** (-3.0328)	-0.0309 (-1.1513)	0.0132 (1.0700)	-0.0147 (-0.6742)
Philippines	1994	2007	0	-1.5062*** (-8.3764)	-0.0151 (-0.9905)	-0.1555*** (-8.1256)	0.0100 (1.6636)	0.0932*** (7.1081)
Taiwan	1995	2000	2	-2.5343*** (-9.6702)	-0.0692*** (-3.2568)	0.1943*** (8.7775)	0.0687*** (5.4547)	-0.1191*** (-7.8520)
Thailand	1996	2007	0	-1.6286*** (-10.0423)	-0.0327* (-2.0162)	0.0013 (0.0618)	0.0137** (2.1496)	-0.0004 (-0.0242)

CRITICAL VALUES FOR THE LM TEST									
λ_2		0.4			0.6			0.8	
λ_1	1%	5%	10%	1%	5%	10%	1%	5%	10%
0.2	-6.16	-5.59	-5.27	-6.41	-5.74	-5.32	-6.33	-5.71	-5.33
0.4	-	-	-	-6.45	-5.67	-5.31	-6.42	-5.65	-5.32
0.6	-	-	-	-	-	-	-6.32	-5.73	-5.32

Notes: λ_j denotes the location of breaks. *, ** and *** denote statistical significance at the 10%, 5% and 1% levels respectively.

Table 8. Summary of all the LM unit root tests

Series	Model A: H_o: Unit Root	Model C: H_o: Unit Root	Model AA: H_o: Unit Root	Model CC: H_o: Unit Root	Conclusion based on the four models: H_o: Unit Root
FDI in Singapore by region					
Asia	Do not reject	Do not reject	Reject	Reject	Reject
Europe	Do not reject	Reject	Do not reject	Reject	Reject
U.S.	Reject	Reject	Reject	Reject	Reject
FDI in Singapore by major investor country					
Hong Kong	Reject	Reject	Reject	Reject	Reject
Japan	Reject	Reject	Reject	Reject	Reject
Malaysia	Reject	Reject	Reject	Reject	Reject
Switzerland	Reject	Reject	Reject	Reject	Reject
U.K.	Reject	Reject	Reject	Reject	Reject
FDI in Singapore by other investor country					
Australia	Do not reject	Reject	Do not reject	Reject	Reject
Germany	Reject	Reject	Reject	Reject	Reject
Indonesia	Do not reject	Reject	Do not reject	Reject	Reject
Philippines	Reject	Reject	Reject	Reject	Reject
Taiwan	Reject	Reject	Reject	Reject	Reject
Thailand	Do not reject	Reject	Do not reject	Reject	Reject

Conclusions

A large part of Singapore's economy is dominated by MNCs, which use the city-state as regional hub for international trade, financial and business services. Hence, apart from fostering international trade and serving as an important regional financial centre, FDI has become an important feature of city-state's economy in terms of the transfer of the best available technology, employment generation and other spillover effects. Despite its economy is highly open to both international trade and capital flows, it cannot insulate itself against external shocks. In the empirical literature, there has not been any attempt to ascertain whether the effects of external shocks on the source of FDI in Singapore are transitory or permanent. In this study, we applied the LM unit root tests proposed by LS (2003 and 2004) on the source of FDI in Singapore by region, major investor and other investor countries. The main advantages of the LM unit root tests over the standard unit root tests are firstly, the structural breaks are endogenously determined from the data, and secondly, the structural breaks could vary by the source of FDI by region, major investor and other investor country.

Our findings suggest that the impacts of the various external shocks on the source of FDI in the city-state are temporary irrespective of the origin of investors i.e. either by region, major investor country or other investor country. The significant break dates identified for the external shocks are closely linked to the Mexican crisis, the Asian financial crisis, the global financial crisis and high oil prices. Since the external shocks and FDI inflows are closely linked in the short run, the Singapore government should take mitigating measures to alleviate the external shocks on FDI inflows. For instance, the devaluation of the Singaporean dollar during the financial crisis period is instrumental in reducing the acquiring cost for and financing of foreign operations in the city-state. These measures to some extent might be able to impede either the cancelled or postponed investment plans by the foreign MNCs. Moreover, the home currency depreciation also tends to increase the nominal competitiveness of existing export-oriented FDI on one hand, and to discourage the outflows of FDI on the other. In addition, the Singapore government should assist the crisis-affected foreign affiliates to gain access to credit facilities so that they would not experience financial difficulties to self-finance their operations or through reinvestments.

References

[1] Anwar, S. 2008. Foreign investment, human capital and manufacturing sector growth in Singapore, *Journal of Policy Modeling*, 30: 447-453, http://DOI:10.1016/j.jpolmod.2007.12.008

[2] Cheong, K.C., Wong, C.K. 2006. *Asia Resurgent: Transformation, Growth and Integration.* Kuala Lumpur: University of Malaya Press.

[3] Ghesquiere, H. 2007. Singapore's Success: Engineering Economic Growth, Singapore: Thomson Learning.

[4] Guo, J.J. and Yuen, Y.L. 2012. Productivity spillovers to local manufacturing firms from foreign direct investment*, Economic Survey of Singapore*, First Quarter 2012, Ministry of Trade and Industry, p. 16-27.

[5] Hall, A. 1994. Testing for a unit root in time series with pre-test data based model selection, *Journal of Business and Economic Statistics*, 12: 461-70, DOI: 10.1080/07350015.1994.10524568

[6] Islam, I. and Chowdhury, A. 1997. *Asia-Pacific Economies: A Survey*, London: Routledge.

[7] Jayawickrama, A., and Thangavelu, S.M. 2010. FDI activities, exports and manufacturing growth in a small open economy: An industry-wise panel data analysis, 4th Joint Economics Symposium of Five Leading East Asian Universities, 28 – 29 Jan 2010, University of Hong Kong, Hong Kong.

[8] Kwong, K.S. 2001. Singapore: Dominance of Multinational Corporations, in K.S. Kwong, L.C. Chau, F.T. Lui and L.D. Qiu (eds), *Industrial Development in Singapore, Taiwan, and South Korea*, London: World Scientific Publishing Co. Pte Ltd, p. 1-55.

[9] Lee, J. and Strazicich, M.C. 2001. Break point estimation and spurious rejection with Endogenous unit root tests, *Oxford Bulletin of Economics and Statistics*, 63: 535-58.

[10] Lee, J. and Strazicich, M.C. 2003. Minimum Lagrange multiplier unit root test with two structural breaks, *Review of Economics and Statistics*, 85: 1082-1089.

[11] Lee, J. and Strazicich, M.C. 2004. Minimum LM unit root test with one structural break, Manuscript, Department of Economics, Appalachian State University.

[12] Lumsdaine, R. and Papell, D. 1997. Multiple trend breaks and the unit root hypothesis, *Review of Economics and Statistics*, 79: 212–8.

[13] Ng, S. and Perron, P. 1995. Unit root tests in ARMA models with data dependent methods for the selection of the truncation lag, *Journal of the American Statistical Association*, 90: 268 -281.

[14] Perron, P. 1989. The great crash, the oil price shock and the unit root hypothesis, *Econometrica*, 57: 1361-1401.

[15] Perron, P. 1997. Further evidence on breaking trend functions in macroeconomic variables, *Journal of Econometrics*, 80: 355–85.

[16] Schmidt, P., Phillips, P.C.B. 1992. LM tests for a unit root in the presence of deterministic trends", Oxford Bulletin of Economics and Statistics, 54: 257–287. http: nlinelibrary.wiley.com/doi/10.1111/j. 1468-0084.1992.tb00002.x/pdf

[17] Sen, A. 2003a. On unit-root tests when the alternative is a trend-break stationary process*, Journal of Business and Economics Statistics*, 21: 174–84.

[18] Sen, A. 2003b. Some aspects of the unit root testing methodology with application to real per capita GDP, Manuscript, Xavier University, Cincinnati, OH.

[22] Wong, K.N. and Tang, T.C. 2011. Foreign direct investment and employment in manufacturing and services sectors: Fresh empirical evidence from Singapore, *Journal of Economic Studies*, 38: 313-330.http://www.emeraldinsight.com/doi/full/10.1108/01443581111152427

[23] Wong, K.N., Tang, T.C. and Fausten, D.K. 2009. Foreign direct investment and services trade: Evidence from Malaysia and Singapore, *Global Economic Review*, 38: 265-276.

[24] Vougas, Dimitrios V. 2003. Reconsidering LM Unit Root Testing, *Journal of Applied Statistics* 30, 7: 727-741.http://www.tandfonline.com/doi/abs/10.1080/0266476032000076010

[26] Zivot, E. and Andrews, D. 1992. Further evidence of the great crash, the oil-price shock and the unit-root hypothesis, Journal of Business and Economic Statistics, 10: 251–70. http://links.jstor.org/sici?sici=07350015%28199207%2910%3A3%3C251%3AFEOTGC%3E2.0.CO%3B2-7

*** UNCTAD, 1994. World Investment Report 1994: Employment and the workplace, *Transnational Corporations*, New York and Geneva: United Nations.

*** UNCTAD, 2014. World Investment Report 2014: Investing in SDGs: An Action Plan, New York and Geneva: United Nations.

*** Singapore Economic Development Board, 2004. *Annual Report 2003/04*, accessed at http://www.sedb.com/edb/sg/en_uk/index/about_us/annual_report_/annual_report_2003.html (Date accessed: February 27, 2013).

Journal of Applied Economic Sciences
Volume X, Issue 4 (34), 2015

Model for Innovation through Information Network Sharing

Luminița PISTOL
Faculty of Marketing and International Business[11], Bucharest
Spiru Haret University, Romania
luminita.pistol@spiruharet.ro

Rocsana TONIS (BUCEA-MANEA)
Faculty of Marketing and International Business, Bucharest
Spiru Haret University, Romania
rocsanamanea.mk@spiruharet.ro

Abstract:

Nowadays the extinction of financial, economic and scientific globalization urges the companies to come up with new methods of accessing information in order to have adequate management which properly meets the market request. This article aims to discuss how innovation influences the firms' profitability while protecting the environment. It also analyses how widely innovation and eco-innovation will contribute to the improvement of the global economy as well as to the environment protection. This should be an aim for every person who wants to breathe clean air, to drink clean water, to spend leisure time in an unpolluted environment, to preserve the nature for future generations. The authors propose a model of innovation through information network sharing, based on the Blue Ocean Strategy.

Keywords: open innovation, environmental innovation, model of innovation, network business ecosystem, Blue Ocean Strategy.

JEL Classification: O3

1. Introduction

The firms have to take into account a sustainable development plan. The profit on short term at any price, affecting the environment is considered a trap because it implies investments, technologies and methodologies that do not support a safe economic development, turning against the company as a boomerang. When the boomerang returns the company will either fail or will have the option to invest in safe technologies and methodologies, providing eco-friendly products and services. On long term, the firms will be the beneficiary of a positive impact and of reducing productivity costs, fulfilling the requirements of global legislation in the field.

In this article we discuss the opportunity for firms to adopt open innovation, eco-innovation in their development process. Firstly, we initiate a literature review and then we propose a model of innovation, based on the Blue Ocean Strategy.

The companies tend to involve both customers and employees in the supply chain and product/service management. The companies open their gates to the environment through blogs, focus groups and markets surveys. Even large companies have understood that innovation does not mean only investing in technology or in very complex laboratory or hiring the best specialists in the field and then waiting for the innovation to emerge. Nowadays innovation should be open and assume inter-firm cooperation in R&D.

2. Methodology

The research in this paper is founded on a literature review and journal articles regarding open innovation, eco-innovation and social-innovation. The authors choose to find out information in a Science Direct database (http://www.sciencedirect.com) that contains a large number of studies on innovation. Our empirical research is improved with an innovation model.

2.1. Open Innovation

"Open innovation is a paradigm that assumes that firms can and should use external ideas as well as internal ideas, and internal and external paths to market, as the firms look to advance their technology" (Chesbrough, 2003)

[11] 46 G Fabricii Str., District 6, Bucharest, Romania

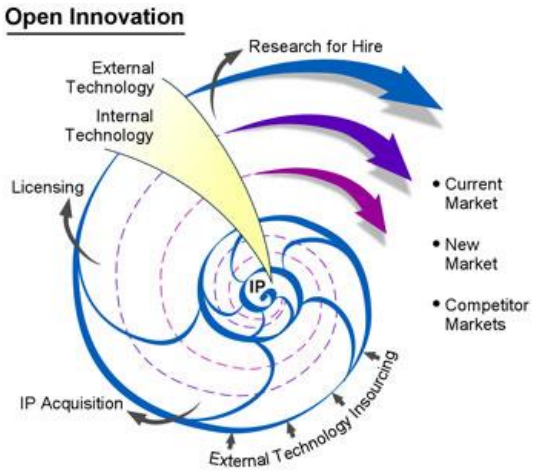
The software interface for open innovation is very similar with a social network (like Facebook) or with a hub, where the users talk about professional themes. The users can ask for information regarding their objective of interest, can comment on a post or find an expert in the field. This interface allows users to form clusters depending on interest and to vote interesting ideas that might be classified by an algorithm (that most voted an idea the most useful or interesting).

In this respect a very good example of network is related to the applied research in the German Fraunhofer model (www.fraunhofer.de), that shortens the ties between academic institutions, research institutions and industry, facilitating the materialization through innovation of the inventions - as finished product of the research and materialization of entrepreneurs innovative ideas, giving them the chance to become more competitive in the global market. Fraunhofer is the largest European organization for applied research, for transfer of technology and information in natural sciences and engineering. Fraunhofer contributes substantially to the transfer of academic depth research results to the industries, thus contributing to the implementation of innovations from industry and technology. Fraunhofer is accepted in the international labor market as a high performer in terms of practical use of research due to the large number of patent applications (such as mp3 format, the air bag, etc.). Fraunhofer's work extends internationally through representative offices and affiliated research centres, and through the collaborative activities of its specialists who provide access to current information, with reference to the stage of technical innovations which contribute to the development of scientific and technical progress. Most staff consists of specialists and scientists, especially engineers, highly qualified. Two-thirds of organization revenues come from contract research paid by industry and publicly funded projects, and a third of organization revenues come from government funds or in the form of institutional funding.

The innovative ideas of the entrepreneurs can become reality with the know-how accumulated in these non-profit entities, such as the Fraunhofer.

2.1.1. How does open innovation work?

Here we go back to the nature, to the logarithmic spiral, described by Jacob Bernoulli, in which the distances between the arms of a logarithmic spiral increase in geometric progression in open innovation. These distances are factors of External Technology Insourcing, Intellectual property Acquisition, Licensing, Internal and External Technology. As the ancient Greeks found the nature lesson is the best, using the π and φ numbers in architecture, so the open innovation process is following the same spiral.



Source: Phisical Science Inc.

Figure 1 – Open Innovation Spiral

Open Innovation has a lot of advantages such as reducing costs in R&D. As the specialty literature reveals, the advantages of open innovation are (www2): reduced costs of conducting research and development, potential for improvement in development productivity, incorporation of customers early in the development process, increase in accuracy for market research and customer targeting, potential for synergism between internal and external innovations, potential for viral marketing (Schutte, 2010)

The disadvantages are: possibility of revealing information not intended for sharing, potential for the hosting organization to lose their competitive advantage as a consequence of revealing intellectual property, increased complexity of controlling innovation and regulating how contributors affect a project, devising a means to properly identify and incorporate external innovation, realigning innovation strategies to extend beyond the firm in order to maximize the return from external innovation. (West, 2006) (Schutte, 2010)

The pillars of the open innovations are:

- Launching a product in an open platform in order to become a tool-kit for everyone that accesses the platform and to be developed further more with new functionality, such as software development kit (SDK), or application programming interface (API) are common examples of product platforms. (Schutte, 2010)
- The most competitive ideas are rewarded during strong competitions.
- Involving customers in the product development cycle, in the design process, in the product management cycle, through interaction with the firms' employees
- Very similar with the first pillar is the model of developing and designing the product in a collaborative way. The difference is made by the control that is still maintained by the hosting organization. Thus the product is developed faster, more correct and with reduced costs. Dr. Henry Chesbrough based his research in the optics and photonics industry on this model for open innovation. (Chesbrough, 2013)
- In the innovation networks, the competitive ideas are rewarded in the form of an incentive.

Open source appropriate technologies are coming to sustain open innovation assisting poverty reduction or sustainable development. (Pearce, 2012) Big companies can put in a common pool their patents, or grant unlimited license use to anybody. Such an example is IBM with its Eclipse platform, where companies are invited to cooperate inside an open-innovation network. (IBM, 2007) Both the experts meant to design and develop software and the open-source adepts need one-another.

2.2. Eco-Innovation

Eco-innovation is a class of manufacturing practices that include source reduction, pollution prevention, and the adoption of an environmental management system (Eiadat, 2008). Some benefits of eco-innovation are presented in the figure below.

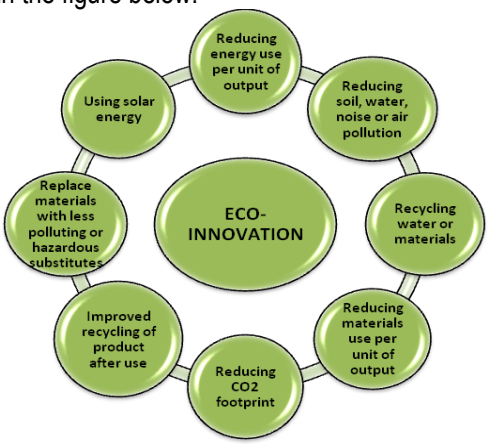


Figure 2 –Eco-innovation benefits

Through eco-innovation firms can improve their profitability reducing waste disposal and raw materials cost and increase product value due to enhanced reputation of the company. Customers demand for environmental-friendly products or services is increasing and answers to regulations that help protect the environment (Yang, 2011). Eco-innovation improves competitiveness and overall business success and brings the sense of feeling good when protecting the environment (Day 2011; Gibbs, 2009; Millard, 2011; von Weltzien Høivik, 2010).

Eco-innovation is easier to be implemented in the network than open innovation is. One example of platform designed for facilitating innovation in SMEs activity is Ecosmes.net. This platform can facilitate the start-up of the product eco-innovation process, but with the time revels that not all the potentialities

have been fully exploited. Ecosmes.net is an example of how ICT tools and online services can support SMEs by disseminating a structured approach for the implementation of all phases of the process and by supplying services that can facilitate eco-innovation (Buttol 2012). This process should be continuously upgraded by involving new sectors and exploiting the positive results of the numerous projects and studies promoted through network, funded by the Horizon 2020 Programme. In the network, case studies and a guide of good practices should be shared. The companies may take into account the European Ecolabel criteria, Energy Using and Related Products implementing measures and environmental policies. The platform may be a beneficiary of semantic web services and tools that support users with machine readable information (Khilwani 2009).

For SMEs development, open innovation is vital. Because they don't have the resources, the expertise and the management experience like old and large companies they have to get together, to develop a business environment network in order to access the latest key information and ideas, to share and test new ideas. In his article (Petra 2013) it is shown that the effect of eco-innovation on firm performance will decrease with firm size. His statements are based on annual account data and survey data applied on 1712 Flemish firms. Although SMEs' managers consider that it is very important to innovate in network and protect the environment at the same time, they are often overwhelmed by current activities and financial problems. But some of SMEs created a competitive advantage providing consumers with eco-friendly products, and improving their image/brand.

In the 90's, the SMEs were considered much less likely than large firms to engage in environmental actions (Merrit 1998), but recent studies have shown the opposite (Darnell, 2010). SMEs are said to be the beneficiary of the solar energy, reducing the cost of the power energy, are said to be implied in producing bio-aliments (like honey, cheese, jam, fruit compote, bio- fruits and vegetable, etc) or developing open source products using open source technology. However, SMEs reap fewer benefits of innovation than the large enterprises.

Because 99% of firms in the European Union are SMEs and provide two-thirds of all private sector jobs (Buttol, 2012), it is very important for the entire economy to help SMEs to respect the eco policy and to become environmentally friendly (Robinson, 2013). The environmental regulations that have a positive impact on the performance of large firms may be detrimental for small firms.Therefore policy makers should consider adapting the stringency of regulations to firm size.

In Romania open SMEs to eco-innovation face the challenges of time and costs needed for an innovation to penetrate the market, the lack of skills and labor market rigidities, training and entrepreneurial spirit. Eco-innovation returns may be observed after long term investment (Robescu, 2010). The SMEs can overcome the high cost of developing an eco-innovation accessing open technology, approaches and information from a business network eco-system funded by European finance, through Horizon 2020 Program.

A research over 581 SMEs and large companies operating on the Romanian market, active in the following sectors: banking, construction, services – tourism, advertising, management, consulting, automobiles, IT, retail, energy, utilities and transportation, oil & gas and telecommunications- confirmed the importance of leadership and visionary management, as well as the role of organizational culture and change management in integrating corporate sustainability. They are motivated by the moral duty and responsibility of businesses for a clean environment, the economic and financial advantages gained on the market, and sustainability as a key element of organizational culture.

The most common eco-innovation activities among responding organizations refer to reducing energy consumption, followed by selective waste collection, the use of clean technologies and the reduction of raw materials usage. On the second place, eco-innovation activities were the reduction of waste resulted in the production process, recycling of materials, optimization of production processes from a technological and organizational point of view, reducing pollutant emissions and the collection and recycling of end-of-life products.

The research highlighted that the engaged firms in eco-innovation activities, do not have a clear evidence of the costs involved, and no precise monitoring of the results. Reporting the results of the efforts to implement the sustainability principles (through eco-innovation or otherwise) is essential for investors, partners, employees and other stakeholders. (Paraschiv 2012)

SMEs vary significantly depending on their mode of growth and strategy. We established empirically three distinct types of SMEs, namely (1) stable independent survivors (2) innovators with continuous growth and (3) networkers with leap wise growth, those who base their activity on open

innovation (Maurya, 2015). SMEs that innovate in the network can benefit from Blue Ocean Strategy model. The strategy it is based on a pattern consisting of four words: Eliminate – Reduce - Raise - Create (ERRC), pattern 'that SMEs create new value and to "unlock a new blue ocean" (Dob 2013).

The principles of Blue Ocean Strategy are (Chan, 2015):

- Creating an uncontested market space limits the reconstruction market;
- Focus on the big picture;
- Overcoming existing demand (by creating new demand);
- The right strategic succession.

The proposed model in Blue Ocean Strategy provides a systematic framework for SMEs controls, a dashboard of strategic and economic control, called Strateco Dashboard, which equips managers with qualitative and quantitative tools to control key competitive success factors (KCSFs), in terms of managing components of value and measuring its financial and economic impact. The authors said that strategy can be improved with operational and quantifiable three constructs: (a) "investment curve", which specifies the actual amount of resources invested in instruments that have an impact on KCSFs, (b) the actual "value" generated by these investment, based on the relative importance attributed by the market to these KCSFs, and (c) the relative "value/price ratio", which has an impact on the market position of the company, based on assumptions about the elasticity of demand and expected competitors' behavior, if necessary (Gandellinia, 2011).

I adapted ERRC pattern for SMEs operating in a virtual business environment (Figure 3).

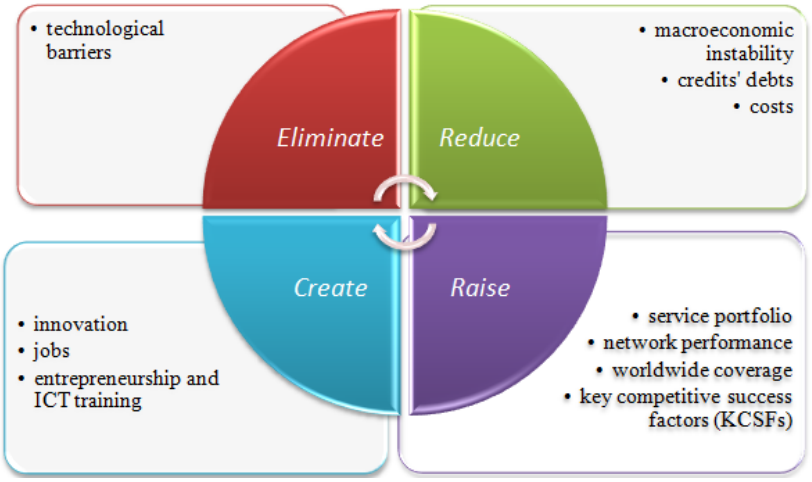


Figure 3 –Blue Ocean Strategy (ERRC) - adaptations *for SMEs operating in a Network Business Environment*

Eliminate- factors for which the competition was big for a long time

- Technological barriers: In the virtual business environment network, for SMEs competing, these barriers no longer exist, if a partner with more cash invests in IT platform.

Reduce - what factors should be reduced well below standard:

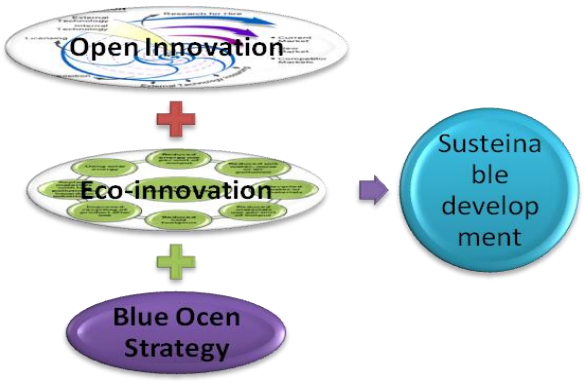
- Macroeconomic instability - choosing the type of activity that is influenced less by the lack of macroeconomic stability;
- Credit - reducing lending effects by accessing of European funds;
- Costs - use cloud computing technology to reduce costs;
- Raise - what factors should augment, well above the standard;
- Portfolio of services: increase and diversification of the portfolio based on consumer needs, behavior and their spending patterns;
- Performance Network: A network of high quality will improve customer satisfaction;
- International Coverage: reaching a large number of populations and acquire new customers online;
- Key competitive success factors: Investment curve, actual "value" generated by investments, and value/price ratio;
- Create - factors inexperienced until now.
- Innovation and innovative business models: business creation network, in which customers from various industries are connected, which allows exploitation of growth opportunities;

- Jobs - creating currently inexperienced new activities;
- Training in entrepreneurship and ICT courses -new innovative teaching methods.

3. Results and discussions

Companies, especially SMEs, should innovate in network of a business eco-system. They should have an open and fare communication that can be facilitated by a governmental institution and very clear policy regarding intellectual property. We imagine a model that follows the entire life cycle of a product/service (awareness and training; analysis; product (re)design; communication/certification) and supply chain. In our model, big companies and state institutions may invest in a performing open innovation platform and in licenses. We have the example of Fraunhofer and IBM, in our paper. All companies that have a new idea of product/service can become a member of eco-system. Within the network, the company will have to obtain the acceptance of an ecological agency. This agency tests how sustainable the idea is. If the idea is eco-friendly, market research is needed. This should be done by a marketing agency within the eco-system. Having in mind the market feed-back, the company tests the feasibility of the idea with a consultant agency. If the result is positive, the inventors in the network and academic researchers may come up with possible solutions of implementations. The best solution will be chosen and the company will collaborate with the inventor to implement the idea. Then the marketing agency has to commercialize the product/service. A supervisor, the governmental partner, takes care that the profit is shared and the patent is protected. The model is detailed in the paper "Network Business Environment for Open Innovation in SMEs" [Țonis, 2015]

This model can be further improved through the integration of Blue Ocean Strategy, described before. The SMEs that develop their activity in a controlled Network Business Environment (NBE) can eliminate at least some of technical barriers, if there are big partners that invest in infrastructure. These SMEs can reduce costs if they use cloud computing technology that seems to be invented and dedicated to SMEs. They can pay only for the services they use, eliminating the problems regarding technical support, being always up to date with new technologies. In this environment the SMEs can easily find consultancy regarding writing projects in order to access European funds. SMEs can improve their portfolio of services, having the technical, financial support and the invaluable consultancy. In the same time these SMEs have international visibility and unlimited potential. In a NBE creativity is the most important feature, because each inventor can propose, discuss and implement new ideas, no matter what talking about innovation and innovative business models, new activities currently inexperienced or new innovative teaching methods.



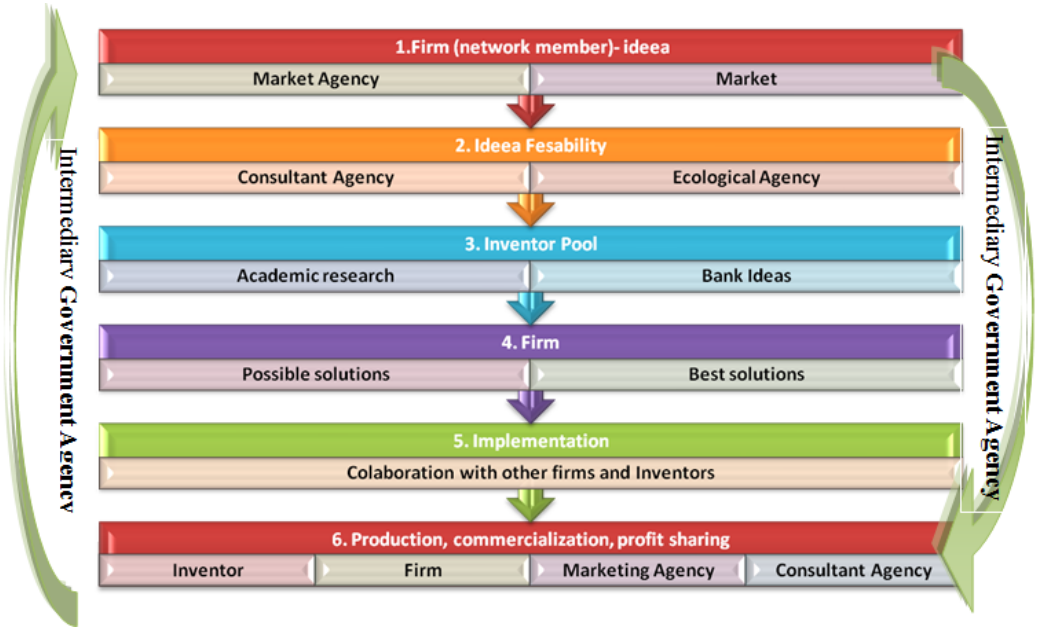


Figure 4 -Innovation model in a network business ecosystem

Conclusions

The article emphasizes the importance of innovation within a Network Business Ecosystem, based on Blue Ocean Strategy, in order to get sustainable development. I have adapted the 4 concepts of Blue Ocean Strategy (ERRC: Eliminate – Reduce - Raise - Create) for SMEs operating in a virtual business environment. The eco-system offers an ICT platform and online services that are the support of business for the entire product/service life cycle. The members of the ecosystem come from different fields: research, marketing, ecology, consultancy, government, inventors and different size companies. Keeping all this in mind the authors have proposed a model of innovation for SMEs in a Network Business Environment.

Acknowledgement

The work has been funded by the Sectoral Operational Programme Human Resources Development 2007-2013 of the Ministry of European Funds through the Financial Agreement POSDRU/159/1.5/S/134398.

References

[1] Buttol Patrizia, Roberto Buonamici, Luciano Naldesi, Caterina Rinaldi, Alessandra Zamagni, Paolo Masoni, (2012) *Integrating services and tools in an ICT platform to support eco-innovation in SMEs*, in *Clean Technologies and Environmental Policy*, 14(2): 211-221, DOI 10.1007/s10098-011-0388-7

[2] W. Chan Kim, Renée Mauborgne - *Blue Ocean Strategy*, Expanded Edition (2015). *How to Create Uncontested Market Space and Make the Competition Irrelevant*, Harvard Business Review Press, ISBN 978-1-62527-449-6, http://www.blueoceanstrategy.com/

[3] Chesbrough, Henry William (2003). *Open Innovation: The new imperative for creating and profiting from technology*, in Boston: *Harvard Business School Press*.

[4] Chesbrough, Henry; Eichenholz, Jason (2013). *Open Innovation in Photonics, SPIE Professional* 8: 24 – 25, DOI: 10.1117/2.4201301.15

[5] Darnall, N., Henriques, I., Sadorsky, P. (2010). Adopting Proactive Environmental Strategy: The Influence of Stakeholders and Firm Size, *Journal of Management Studies*, 47(6): 1072–1094.

[6] Day, G.S., Schoemaker, P.J.H. (2011). *Innovating in uncertain markets: 10 lessons for green technologies*, *MIT Sloan Management Review*, 52(4): 37-45.

[7] Dob Sami (2013). *Blue Ocean Strategy in the Networked Society*, http://www.ericsson.com/thinkingahead/the-networked-society-blog/2013/03/20/blue-ocean-strategy-in-the-networked-society-part-2/

[8] Eiadat, Y., Kelly, A., Roche, F., Eyadat, H. (2008). Green and competitive? An empirical test of the mediating role of eco-innovation strategy, *Journal of World Business*, 43: 131-145.

[9] Gandellinia, G., Venanzib, D. (2011). Purple Ocean Strategy: How to Support SMEs' Recovery, 7th International Strategic Management Conference, *Procedia Social and Behavioral Sciences*, 24: 1–15.

[10] Gibbs, D. (2009). *Sustainability entrepreneurs, eco-entrepreneurs and the development of a sustainable economy*, *Greener Management International*, 55: 63-78.

[12] Jenkins, H. (2009). A business opportunity model, *Business Ethics. A European Review,* 18: 21-36.

[13] Khilwani, N., Harding, J.A., Choudhary, A.K. (2009). Semantic web in manufacturing, *Proc IMechE* Part B, 223: 905–924.

[14] Upendra Kumar Maurya, Prahlad Mishra, Sandip Anand, Niraj Kumar, (2015). Corporate identity, customer orientation and performance of SMEs: Exploring the linkages, *IIMB Management Review,* XX: 1-16, www.elsevier.com/locate/iimb

[15] Merrit, J.Q. (1998). EM into SME won't go? Attitudes, awareness and practices in the London borough of Croydon, *Business Strategy and the Environment,* 7(2): 90-100.

[16] Millard, D. (2011). Management learning and the greening of SMEs: Moving beyond problem-solving, *German Journal of Research in Human Resource Management*, 25(2): 178-195.

[17] Paraschiv, D.M., Nemoianu, E.L., Langă, C.A., Szabó, T. (2012). *Eco-innovation, Responsible Leadership and Organizational Change for Corporate Sustainability*, *Amfiteatru Economic*, Vol. XIV, No. 32.

[18] Pearce, J.M. (2012). The case for open source appropriate technology, *Environment, Development and Sustainability*, 14 (3): 425–431, DOI: 10.1007/s10668-012-9337-9

[19] Andries, P., Ute, St. (2013) *Eco-innovation and Financial Performance: The Moderating Effect of Motives and Firm Size*, *Academy of Management Journal*, doi: 10.5465/AMBPP.2013.11617

[20] Revell, A., Blackburn, R. (2007). The business case for sustainability? An examination of small firms in the UK's construction and restaurant sectors, *Business Strategy and the Environment*, 16(3): 404-420.

[21] Robescu, V-O. (2010). Eco Innovation Practice and Romanian SMEs, *Proceedings of the European Conference on Entrepreneurship & Inn,* 480.

[22] Robinson, S., Hans, A. (2013). Green Innovation in Germany: A Comparison by Business Size, *Journal of International Business Research*, 12(1).

[23] Robinson, S., Stubberud, H.A. (2011a). Social networks and entrepreneurial growth, *International Journal of Management & Information Systems*, 15(4): 65-70.

[24] Robinson, S., Stubberud, H.A. (2011b). *Sources of information and cooperation for innovation in Norway*, *Journal of International Business Research*, 10(2): 79-90.

[25] Robinson, S., Stubberud, H.A. (2012). *Cooperating for Innovation*. European Foundation for Management Development Entrepreneurship Conference, Maastricht, Netherlands, March.

[26] Schutte, Corne; Marais, Stephan (2010). *The Development of Open Innovation Models to Assist the Innovation Process*, University of Stellenbosch, South Africa.

[27] Von Weltzien Høivik, H., Shankar, D. (2010). How can SMEs in a cluster respond to global demands for corporate responsibility, *Journal of Business Ethics*, 101: 175 - 195.

[28] West, J., Gallagher, S. (2006). Challenges of open innovation: The paradox of firm investment in open-source software*, R and D Management*, 36 (3): 319. DOI: 10.1111/j.1467-9310.2006.00436.x

[29] Yang, M.G., Hong, P., Modi, S.B. (2011) Impact of lean manufacturing and environmental management on business performance: An empirical study of manufacturing firms, *International Journal of Production Economics*, 129: 251-261.

[30] Ţoniş Bucea-Manea, R., Catană, M.G., Tonoiu, S. (2015). Network Business Environment for Open Innovation in SMEs, *Applied Mechanics and Materials*, 760: 751-756.

*** IBM, 2007, *Eclipse and Open innovation* (pdf). Eclipse.org. 12 September 2007.

[www1] Phisical Science Inc. https://www.google.ro/search?q=open+innovation&espv=2&tbm=isch&tbo=u&source=univ&sa=X&ei=QZuiU5NgpdPKA5y_gegD&ved=0CCkQsAQ&biw=1366&bih=667#facrc=_&imgdii=_&imgrc=Oz9FqmK05AP5IM%253A%3Bo74zLCUK0ZVlDM%3Bhttp%253A%252F%252Fwww.psicorp.com%252Fimages%252Fopen_innovation.jpg%3Bhttp%253A%252F%252Fwww.psicorp.com%252Fopen_innovation%252F%3B380%3B306

[www2] Wikipedia, http://en.wikipedia.org/wiki/Open_innovation

Poverty and Material Deprivation in the Crisis: Italy and Spain

Tindara ADDABBO
Department of Economics Marco Biagi
University of Modena and Reggio Emilia, Italy
tindara.addabbo@unimore.it

Rosa M.GARCÍA-FERNÁNDEZ
Department of Quantitative Methods for Economics and Business
University of Granada, Spain
rosamgf@ugr.es

Carmen LLORCA-RODRÍGUEZ
Department of International and Spanish Economics
University of Granada, Spain
cmllorca@ugr.es

Anna MACCAGNAN
Department of Economics and Statistics Cognetti de Martiis
University of Torino, Italy
anna.maccagnan@unito.it

Abstract

This paper assesses the impact of the economic recession caused by the global financial crisis on income poverty and deprivation in Italy and Spain to identify the most vulnerable groups and to guide policy makers. We consider the main socioeconomic and demographic characteristics of individuals impacting on their labor market status. The analysis is carried out separately for male and females to detect possible gender differences. Our results show the growth of material deprivation. Furthermore, the higher exposure of females to income poverty and material deprivation is verified in both countries despite of the efforts made to close the gender gaps in their labor markets.

Keywords: unemployment, labor market, income poverty, material deprivation.

JEL Classification: C50; D31; I32.

1. Introduction[12]

The economic downturn brought about a marked and incessant rise of unemployment affecting income of individuals and simultaneously constraining public budgeting. In addition, the measures to overcome the crisis have been directed through the strict control of public spending, especially in Southern countries of the European Union. So, a more disadvantaged population could be in risk of poverty if social support policies are dismantled.

In line with the previous comment, our analysis evaluates the impact of the economic downturn on income poverty[13] and material deprivation[14] (Fusco *et al*. 2011) and identifies the most vulnerable collectives in Italy and Spain considering possible gender differences. For this, we use the European Union Statistics on Income and Living Conditions (EU SILC) surveys referred to 2007 and 2010.

The remainder of the paper is organized as follows. Section 2 compares the selected countries. Section 3 reviews the economic literature on the links between labor market situation and income poverty

[12] Funding from the PRIN09 research project "Measuring human development and capabilities in Italy: methodological and empirical issues" is gratefully acknowledged. Previous versions of this paper have been presented at the European Association for Evolutionary Political Economy (EAEPE) International Symposium: 'The labour market in dangerous currents: between totem and taboos. Theory and policies of flexibility in a global competitive economy', Faculty of Economics, University Roma Tre, Rome, Italy, May 10-11, 2012 and at the International Association for Feminist Economics (IAFFE) 21st Annual Conference, Faculty of Geography and History University of Barcelona, Barcelona, Spain, June 27-29, 2012.We thank the participants to the sessions for their stimulating comments. The usual disclaimers apply.

[13] Those households or individual under the poverty line. In our analysis, those under the 60% of the median equivalent disposable income calculated using the OECD modified equivalence scale to take into account differences in household size and demographic composition.

[14] According to the European 2020 Strategy we define materially deprivation as a household (or individual) that is not able to afford at least three of the basic needs.

and material deprivation. The data, methodology and results will be presented in the later sections. The final section will offer conclusions and highlight policy implications.

2. Selected countries: Italy and Spain

Our study selects the Italian and Spanish economies since they face similar economic policy challenges in the context of the European Union. Both countries have been very detrimentally affected by the economic crisis, suffering a persistent unemployment of a longer duration, which affects the younger population with great intensity. The institutional arrangements that influence their labor supply, utilization and demand and their labor market characteristics include them in the Southern European employment model (Karamessini 2008; Verashchagina and Capparucci 2014). Furthermore, a high degree of inflexibility in wage determination, rigidity in hiring and firing practices (World Economic Forum 2010) and a strong duality between fixed-term and open-ended contracts have been common features of the labor markets in both countries. In addition, both countries record very low achievements in terms of female labor-force participation and similar gender gap indicators according to OECD (2012a). In fact, the gender wage gap is evident in Spain as well as in Italy, although both countries are exceptions to the usual wider wage gap at the top of the earnings distribution. In Italy, the gap is similar throughout the income distribution and in Spain the gap for the top 10 percent wages is smaller, this being a result of self-selection of women into the labor market (De la Rica *et al*. 2008; Olivetti and Petrongolo 2008). The wage gap in Italy is larger for less educated women (Addabbo and Favaro2011) and in both countries the gap is also wider for low earners (sticky floor effect, OECD 2012 b).

Nevertheless, OECD (2012 b) highlighted the significant efforts made by Italy and Spain in order to try to close these gender gaps stressing, especially, the advances achieved in the education of younger women which stand out from other OECD countries. This could have affected the impact of the economic crisis on the female labor force since education acts as a protection factor against unemployment above all for Spanish women: according to OECD (2009 and 2012c) from 2007 to 2010 in Spain the unemployment rate of people with tertiary education more than doubled for men (from 3.8% to 9.6%), while the relative increase among women was not so high (from 5.9% to 11.3%). As regards Italy, the increase in unemployment rates among the better educated did not show big gender differences: it went from 3.1% to 4.4% for men and from 5.2% to 6.6% for women. So, females' exposure to poverty and deprivation could have been reduced compared to that of men, especially in Spain. In fact, job destruction has been more intense for men than for women at the beginning of the crisis since the most initially hard hit branches of activity (construction and manufacturing) were highly masculinized, and the activity rate has decreased for men but increased for women (Bettio *et al.* 2012; Permanyer and Treviño 2013). In addition, there has been an increase in the hours worked by women that was somewhat greater than the reduction in male working hours. This added worker effect of women tends to be persistent according to the evidence from previous crisis (OECD 2012 b, p.119). Therefore, our analysis takes into account these differences in gender by considering the behavior of men and women separately.

We underline important differences between the two countries. The wide use of temporary contracts when hiring young workers and the deep recession of the Spanish economy has resulted in its unemployment rate to stand at more than twice that of the European Union. Furthermore, despite both countries having employment protection systems corresponding to the Mediterranean model characterized by a rather low coverage of unemployment benefits (Sapir 2005); the Spanish unemployment benefit system is more generous than the Italian one, according to OECD data. In fact, the net replacement rate during the first year of unemployment in 2007 was 69% in Spain compared to 37% in Italy. Nevertheless, Italy has higher family, housing and lone parent benefits than Spain though still very low when compared to other European countries. In fact, the Spanish tax-benefit system is one of the least effective in achieving a better distribution of household incomes of those in place in the European Union (Cantó 2013). Thus, the ability of the two systems to palliate the socioeconomic consequences of the crisis may differ too, as is stressed in the empirical sections of this paper.

3. Literature framework

A wide set of economic literature has examined the link between unemployment and poverty (Duncan 1984; Blank and Blinder 1986; Atkinson 1989; Cutler and Kantz 1991; Blank 1993, 1996 and 2000; Blank and Card 1993; Callan and Nolan 1994; Foerster 1994; Juárez 1994 Tobin1994; Danziger and Gottschalk1995; Sen 1997; Romer 2000; Haveman and Schwabish 2000; Gallie and Paugam 2001;

Hauser and Nolan 2001; Freeman2003). In this line, OECD (1997) found that employment status is the most important factor in determining relative income and poverty. Moreover, Kolev (2005) links poverty to unemployment and to job quality and OECD (2007, p. 50-1) pointed out the exposure to poverty that job insecurity, involving alternating periods of employment and non-employment, implies. Furthermore, Pedraza Avella (2012), following Atkinson (1998), stressed that the increase of precarious workers leads to new categories of people under deprivation and social exclusion risk.

The European Commission (2009, p. 16) states that unemployment is a key driver of poverty in Spain and OECD (2009) shows that close to 50% of jobless households in Spain were relatively poor, compared with 37% on average across the OECD. More recent literature on Spanish economy has highlighted that temporary contracts, highly extended in the last decades, increase the poverty and basic deprivation risk in not only the short-term but in the long-term as well (Ayala 2008; Martínez López 2010). Moreover, Ayala *et al*. (2011) and Ayllón (2012) highlighted the educational level and the occupation status in the labour market as determinants of poverty and multidimensional deprivation. In any case, Spanish women have a higher income poverty risk but the basic deprivation shows that young salaried women are more likely to be deprived. A worrying fact is the increase of families with children which suffer simultaneously low income and material deprivation (Ayala 2008). Pérez Mayo (2013) analyzed the impact of economic crisis on regional poverty rates and inequality indices in Spain and concluded that their evolution is strongly linked to the worsening of labour market conditions.

Along similar lines, there has been a decrease in the power of labour income to protect Italian households against poverty, with an increase in the incidence of poverty amongst households with one or two income earners and a decrease in the unemployed headed households (Istat 2012). Living arrangements including members belonging to different cohorts increased in Italy but their ability to reduce the risk of poverty decreased overtime (Istat 2012). In terms of income poverty households, according to the Bank of Italy survey on Household Income and Wealth, incidence of poverty in 2010 was higher amongst individuals living in female headed households, households headed by less educated or jobless people or single, one earner, living in the South of Italy (Montella *et al*. 2012).

This brief review of the literature on the unemployment, poverty and deprivation links clearly shows the significance of the question tackled by our research. It should be pointed out that there is a scarcity of these comparative studies, above all in the cases of Italy and Spain. As far as we are aware, only Addabbo *et al.* (2012) deals with this issue but without tackling gender differences. Both circumstances highlight the important contribution of our paper, which measures the short-term socioeconomic effects of the global financial crisis on poverty and material deprivation in the two mentioned countries carrying out separate estimations for male and female to highlight gender differences in the poverty and material deprivation reaction to the same individual and family. In addition, we take into account the different incidences of unemployment at regional level in the both selected countries to consider the effect of regional labour market status widely accepted by the specialized literature (López-Bazo *et al.* 2002 and 2005; Bande *et al*. 2007 and (2008); Algieri and Aquino 2011; Addabbo 2000; Di Marco and Donatiello 2008; Lombardo 2011; Quintano *et al*. 2011; Verashchagina and Capparucci 2014).

4. The data, the variables and the model

To compare the two selected countries and to take into account the multidimensionality of the costs connected to joblessness we use the European Union Statistics on Income and Living Conditions[15] (EU SILC) surveys on the socioeconomic conditions of Spain and Italy. The EU SILC microdata referred to 2007 and 2010 will then be used to evaluate the poverty and material deprivation status before and during the recession caused by the global financial crisis without the influence of the austerity measures latter taken to address the public budget problems. These surveys allow us to recover information on income and on different dimensions of social exclusion, as well as data on the socio demographic characteristics. The sample is statistically significant and representative of the population at regional level and this allows us to take into account the regional variability in the labour markets within countries widely accepted by the specialized literature, as previously mentioned. Therefore, we will compare the South of Italy (that shows a relative homogeneity in the labour market conditions and a high and increasing heterogeneity with regards to the Centre North of Italy) with the rest of the regions of the country; while in the Spanish

[15] In the Income and Living Conditions Survey, income data refer to the previous year. Hence, in our analysis income data refer to 2006 and 2009, respectively.

case we have grouped the autonomous regions in accordance with the mean of the regional unemployment rates reached since 1999. So, our first group of regions is composed by Navarra, Aragon and La Rioja which had maintained their average unemployment rates in the period at lower than 7%; the second group made up by The Balearic Islands, Madrid, Catalonia, Basque Country and Cantabria (with unemployment rates on average between 7% and 10%), the third one by Castile-La Mancha, Castile-Leon, Valencia, Murcia, Asturias, Galicia and The Canary Islands (with unemployment rates on average between 10% and 14%) and the fourth one by Extremadura and Andalusia which had an unemployment rate on average higher than 17%.

In our analysis of income poverty, the poverty line is defined as 60% of the median equivalent disposable income calculated using the OECD modified equivalence scale to take into account differences in household size and demographic composition. Several measures of income poverty widely used in the specialized literature are analyzed to assess the incidence of poverty (headcount ratio[16]), the average poverty gap (FGT(1) index[17]) and the poverty severity (FGT (2) index[18]).

To study deprivation we have followed the counting approach of Atkinson (2003) which provides a summary of measures of multidimensional poverty (Whelan *et al*. 2012). We use the Eurostat definition of material deprivation as in Guio (2005). Therefore, according to the European 2020 Strategy we define materially deprivation as a household (or individual) that is not able to afford at least three of the following needs: one week holiday a year; keeping the house warm; handling unforeseen expenses; paying the mortgage, bills, deferred payments; protein intake; washing machine; color television; car; telephone. That is, the threshold used is set at three enforced losses or inabilities of these capabilities.

So, descriptive statistics on income poverty and material deprivation indicators will be analyzed in the following section, distinguishing between female and male individuals following Atkinson *et al*. (2002) recommendation. Therefore, the data refer to all individuals aged over 15 in order to take into account the individual employment condition's effect on income poverty and material deprivation.

We will then present the results of multivariate analysis on the likelihood to be income poor or in material deprivation. For this purpose we estimate a probit model which allows us to obtain poverty profiles based on the features of individuals such as their level of education, status in the labor market, region of residence, etc. To do this, we have defined the following dummy variable that measures if a person is poor, or not, according to his or her status.

$$p_i = \begin{cases} 1 & if y_i < z \\ 0 & otherwise \end{cases} \quad (1)$$

where y_i is the annual net equivalent income of the individual *i* and *z* is the poverty line which is equal to 60% of median equivalized disposable income.

The probability that an individual will be poor or in material deprivation is calculated by the Probit model (see Greene 2002)

$$prob(u_i = 1) = \Phi(\mathbf{X}_{i,LFS}\boldsymbol{\beta}) \quad (2)$$

where Φ is the cumulative probability density function of a normal distribution, $\mathbf{X}_{\mathrm{LFS}}$ is the vector of independent variables that affect this probability and β is the vector of coefficients of the probit model.

5. Income poverty and material deprivation: descriptive statistics and multivariate analysis

As Table 1 shows, the incidence of income poverty (headcount ratio) in both countries is larger for female. This relative poverty did not increase for Italy in 2010 with respect to 2007 but it increased in Spain above all for men. Moreover, the average poverty gap (FGT (1) index) and the poverty severity (FGT (2) index) significantly increased for both men and women in Spain with a higher increase in the male case. The tendency of women to be prevalent among the long-term unemployed and the more severe employment destruction for men in the analyzed period are the main reasons for male over-representation among the new unemployed and, therefore, among the new poor (Figari *et al*. 2011).Both

[16] This ratio measures the percentage of people under the poverty line (60 percent of the median of the annual equivalized net income in our study).

[17] This index developed by Foster *et al.* (1984) considers the income deficit with respect to the poverty line and the incidence of poverty.8

[18] This index takes into account the income inequality within the poor group (Foster *et al.* 1984).

countries have been affected by an increase in material deprivation that in 2010 affects 12% and 15% of men aged over 15 respectively in Spain and in Italy and 13% and 16% of women aged over 15 in Spain and Italy. That is, material deprivation levels are higher in Italy despite having lower indicators of income poverty. This is because the differences existing in the construction of the measures on income poverty and on material deprivation. Shocks that change a household's total income, or its equivalence scale factor, largely have a 'mechanical' effect on equivalent income. However, the household can resort to various 'coping strategies' (use of savings and borrowing) to reduce the impact of these shocks on its lifestyle. Moreover, the ability of the two approaches store reflect the 'needs' level of a house hold is a second difference. While income poverty only recognizes 'needs' explicitly incorporated in the equivalence scale, lifestyle deprivation has the potential to reflect a much larger range of 'needs' and situations that affect a household's true standards of living (Devicienti *et al*. 2014).

The results on the trend in the income poverty ratio refer to net income and relative poverty lines. The observed trend changes by using a fixed poverty line as found in OECD (2013) or in Bettio *et al*. (2013). Actually, as OECD (2013) shows income poverty increase from 2007 to 2010 is sensibly higher if poverty is measured with regards to a poverty line fixed at a year before the crisis occurred (2005). One should also take into account the strength of the social security system in protecting individuals against the risk of poverty that appears to be higher from 2007 to 2010 in Italy and Spain than on average EU-27 as data referred to in Bettio *et al.* (2013) show.

Table 1 also includes 95% confidence interval for the Headcount ratio, FGT(1), FGT(2) and the deprivation index (see, among others, Bishop *et al*.1995 and Ortiz Serrano and De Lucas Santos 2010). We can use the confidence intervals to test whether or not poverty and material deprivation change: from 2007 to 2010 within countries and across countries. Moreover, we can test if the changes vary between men and women[19].

Our results show for Spain a significant increase of poverty, according to FGT(1) and FGT(2), and deprivation from 2007 to 2010. This difference remains for men (headcount index, FGT(1), FGT (2) and material deprivation) and women (FGT(1) and FGT(2)) separately. FGT(1) and FGT(2) show significant gender differences in 2007.

Italian data allows us to detect higher poverty rates for women in both years though both, taking into account a relative poverty line, decrease in 2010. FGT (1) is higher for Italian women and it seems not to be affected by the crisis. FGT (2) are similar by gender and do not change significantly over the period analysed. Deprivation rates by gender are similar and show an increasing (though not statistically significant) trend from 2007 to 2010.

In both years Italy shows higher index of deprivation with respect to Spain, whereas for men in 2007 and for both women and men in 2010 poverty rates appear to be higher in Spain.

Table 1. Poverty measures – all individuals aged over 15

2007									
ITALY	M. & F.	L	U	Males	L	U	Females	L	U
Headcount	0.1893	0.1857	0.1929	0.1707	0.1656	0.1758	0.2067	0.2015	0.2119
FGT (1)	0.059	0.0574	0.0606	0.0549	0.0525	0.0573	0.0628	0.0606	0.0650
FGT(2)	0.0337	0.0312	0.0362	0.0339	0.0295	0.0383	0.0335	0.0310	0.0361
Dep. Index	0.12	0.1170	2.6821	0.11	0.1058	2.6542	0.12	0.1158	2.6182
2010									
ITALY	M. & F.	L	U	Males	L	U	Females	L	U
Headcount	0.172	0.1683	0.1757	0.1567	0.1516	0.1618	0.1861	0.1808	0.1914
FGT (1)	0.0555	0.0538	0.0572	0.0505	0.0482	0.0528	0.0601	0.0577	0.0625
FGT(2)	0.0318	0.0299	0.0337	0.0294	0.0265	0.0322	0.034	0.0315	0.0365

[19] The decision rule use with two confidence intervals to make comparisons is: If the two confidence intervals do not overlap we can conclude that there is a difference in the two populations values at the given level of confidence. On contrary, if the two confidence intervals do overlap we cannot conclude that there is a difference in the two populations values at the given level of confidence.

Dep. Index	0.16	0.1564	2.5864	0.15	0.1450	2.4764	0.16	0.1550	0.1650
2007									
SPAIN	M. & F.	L	U	Males	L	U	Females	L	U
Headcount	0.1973	0.1931	0.2015	0.1822	0.1761	0.1883	0.2114	0.2056	0.2172
FGT (1)	0.0618	0.0600	0.0636	0.0581	0.0555	0.0607	0.065	0.0625	0.0675
FGT(2)	0.0328	0.0310	0.0346	0.03101	0.0282	0.0338	0.0344	0.0321	0.0367
Dep. Index	0.095	0.0919	0.0981	0.094	0.0894	0.0986	0.097	0.0928	0.1012
2010									
SPAIN	M. & F.	L	U	Males	L	U	Females	L	U
Headcount	0.2062	0.2017	0.2107	0.2004	0.1939	0.2069	0.2117	0.2053	0.2181
FGT (1)	0.0877	0.0845	0.0909	0.0905	0.0859	0.0951	0.0851	0.0812	0.0890
FGT(2)	0.0905	0.0708	0.0866	0.0869	0.0735	0.1002	0.0709	0.0622	0.0795
Dep. Index	0.13	0.1262	0.1338	0.12	0.1147	0.1253	0.13	0.1248	0.1352

Source: Our own elaboration on EU SILC
Note: Dep. Index: Deprivation Index; M: Males; F: Females

In Tables 2-5 (see Appendix), we show the results of the estimation of probit models on the probability of being income poor (Tables 2 and 3 of Appendix), or in material deprivation (Tables 4 and 5 of Appendix) in the two countries where we consider as the reference group the individuals with primary or lower level of education, living in the Center-North of Italy or in Group 1 region in Spain, and being full-time permanent employed, living as a couple, without children aged less than 18, i.e. the group that is less likely to be income poor.

A first important difference in the factors affecting poverty for the two countries concerns age. Ageing significantly increases the probability of being income poor in Italy and the effect is larger in 2010, whereas it does not significantly affect income poverty in Spain. This can be connected to the larger risk faced by younger individuals in Spain to be without a job or in worse job status. In fact, the contemporary "employment buffers"[20] are young men and women on temporary employment contracts (Bettio *et al*. 2012). In addition, different protection of the retirement system should be taken into account. Italy has enacted several reforms of its public retirement program since 1980 in order to reduce its cost and increase pension contribution rates. So, the calculation of benefits has been changed to a 'contribution base'. By contrast, Spain, despite the demographic and economic pressures it suffers, has not adopted a so deep reform of its retirement system and, from 2004, has increased the minimum pensions above the price index in a range between 34.4% and 27.0% depending on the type of pension. Moreover, the net replacement rate of the Spanish pension system is of 84.5%, whilst the Italian one is of 76.2% (OECD 2011).

In 2007, with respect to living as a couple, the living arrangement that lead to an increase in income poverty in Spain was living in a single parent household for women and being single for men. The reverse was true in Italy: it was living in a single parent household for men and being single for women. In the crisis, the situation changed for Spain where, amongst men, the most likely living arrangement leading to poverty was living in a single parent household. This living arrangement was increasing income poverty risk for women too and more so than before the crisis. In Italy, the increase in the effect of living in a single parent household for women was so serious that this living arrangement was the one more linked to income poverty for females. According to ISTAT (2011), Italian women have severe difficulties in the family and work conciliation. Now, being single and living in a single parent household show a similar effect on Italian men.

A higher education level significantly protects against income poverty for both men and women living in both countries. However, this protecting effect increases in the crisis only for Spain. In this country the job destruction caused by the crisis has affected more intensively the labor-force groups with lowest level of education and skill. It should be taken into account that almost 45 per cent of the Spanish labor-force has only completed the compulsory level of studies and that, despite the advances made in this field,

[20] Called in when demand expands but pushed back when it contracts (Bettio *et al*. 2012).

female labor-force remains with much lesser skill than the male one[21]. Therefore, a great effort should be made to reinforce the Spanish education system and to adapt it to labor market demands and reduce the gender gap.

Turning to the employment condition, working part-time increases the likelihood of being poor in both countries and the effect is similar by gender for temporary part-timers in Spain. On the contrary, the effect is greater for men than for women in Italy with a widening of the difference in the impact for temporary part-timers in 2010. It should be taken into account that part-time work is highly involuntary and that its surge was stronger among men (Bettio *et al.* 2012).

Temporary workers working full-time show a higher probability to be income poor with a larger effect in Spain for women in 2007 and for men in 2010. The effect is now similar for men and women working full time on a temporary contract in Italy but it was significantly higher in 2007 for men. So, the economic crisis has affected the existing gender differences owing to the different intensity of its impact on male and female employment in the selected countries.

As compared to full-time employed on a permanent contract, the labor market condition that is more exposed to the risk of being income poor in both countries is being unemployed. In both countries in both years, although all the unemployed are more exposed to the risk of being income poor, the least exposed to this risk are those who were employees before (actually for 2007 Spanish unemployed women that were previously self-employed did not show a significant coefficient). For Italy, this can be related to the structure of unemployment benefit that has a higher coverage for employees rather than self-employed leading to a different risk of income poverty when unemployment occurs depending on previous employment conditions. In the Spanish case, the increase in poverty occurred also for the unemployed who were previously employees or self-employed. It should be taken into account that the Spanish unemployment protection system, almost entirely focused on passive labour market policies, did not cover the self-employed during the analyzed period, and that its coverage for employees depended on the contribution made to the system in accordance with the previous employment status leaving those workers with a worse job status more exposed.

Moreover, amongst Italian and Spanish individuals, the risk of income poverty significantly increased (especially for women) for those who were unemployed and were never employed before. In 2010, the likelihood of being income poor increases by 55% for women in this unemployment status and by 49% for men in Italy and by 50% and 57% for men and women, respectively, in Spain. This can be related to the higher likelihood that they experienced an increase in the length of unemployment, and to the higher likelihood that they will not be covered by the system of unemployment benefit.

Retirement increases the risk of being income poor in both countries although the effect is greater for males than for females in Spain and in Italy the effect is greater for women than men. In Spain, with certain limitations, the social protection system allows to receive the retirement pension and the widow pension at the same time. This situation is more common among women because of their longer life expectancy. In Italy, the higher effect of retirement condition on women's income poverty is in line with the analysis on gender inequalities at the disadvantage of women in retirement income (Mundo, 2007; Leombruni and Mosca 2012). Other inactivity statuses (excluding retirement) have a higher effect on increasing income poverty. Nonetheless, this effect did not increase with the crisis despite people in this status have lower social protection.

Living in the South of Italy, or in the Group 4 of Spanish regions, that is those with an average unemployment rate higher than 17% since 1999 (Extremadura and Andalusia), increases income poverty. However, this effect was lower in 2010 for southern Italy but higher in the Spanish case. So, territorial fractures have been widened by the onset of the economic recession despite the decentralization of social policies applied above all in the case of Spain.

Let us turn now to the analysis of the factors affecting material deprivation as distinct from income poverty. In Italy, the living arrangement that is more likely to increase material deprivation is living in a household with children, a living arrangement whose effect increased in 2010 and is greater when there are children of pre-school age. In Spain, the material deprivation risk of households with children has also grown with the crisis; but the single parent was the living arrangement more likely to raise material deprivation in 2010, especially for men. It should be highlighted that the social protection in Spain is

[21]Data from Spanish Labour Force Survey (available at http://www.ine.es)

graduated according to the number of children in the household but it establishes a maximum benefit bound.

Unemployment is found to increase material deprivation in Italy and Spain especially if the unemployed individual was previously self-employed without employees. This is a condition that is more likely to occur for non-standard employed (with para subordinate types of contract). In 2010, the likelihood of being in material deprivation increased for all the unemployed in Italy although the effect was still greater for those who were previously self-employed without any employees. This last result repeats in Spain and it is consistent with the literature showing higher probability of social exclusion for non-standard workers including para subordinate type of workers that can be included in this group of workers (Berton *et al*. 2012). On this regard the recent reform proposal of the unemployment benefit system by the Italian new government extending to para subordinate contract holders the eligibility to unemployment benefit could positively contribute in reducing this increase in poverty.

Being chronically ill increases material deprivation in Italy and Spain. However, while in Spain chronic illnesses affected income poverty too, this was not the case for Italy, suggesting that the two concepts do not necessarily overlap. In addition, regional inequalities occur also with regards to material deprivation in both countries. Living in the South of Italy increases the risk of material deprivation in both years leading to an increase by 10% for men and by 13% for women of being in material deprivation in 2010. Nevertheless, in Spain this probability has risen by 3.83% for women and it has been slightly reduced for men.

Conclusions and policy implications

This paper deals with poverty and material deprivation in two Southern European countries that have been deeply hit by the crisis. We compare the risk of income poverty and material deprivation for individuals aged over 15 in the two countries by gender and highlight the impact of different factors by multivariate analysis.

Our findings show the increase of incidence and severity of poverty and the widening of poverty gap in Spain, as well as the growth of material deprivation as a consequence of the economic crisis in both countries. Furthermore, the higher exposure of females to income poverty and material deprivation is also verified in both selected countries.

With special regards to the employment status, we show how unemployment significantly increases the risk of being income poor or materially deprived in the two countries with a larger effect on income poverty for those who found themselves unemployed and not having been employed before. The latter is related to the system of unemployment benefit in the two countries that leads to inequalities in terms of sustainability of unemployment amongst different types of unemployed. So, major reforms of them are necessary to avoid a widening of these clear social fractures in crisis time. Thus, special attention should also be paid to the reinforcement of active policies of employment, which are clearly relegated to a low priority in these Mediterranean social protection models.

Non-standard work is found to increase income poverty and material deprivation in both countries. The effect on income poverty is larger in Italy for part-timers and full-time temporary and for self-employed in Spain. Therefore, additional measures should be adopted to turn these job options into real alternatives to unemployment, as it is wished by Spanish policymakers.

Both countries show heterogeneity in the risk of poverty and material deprivation across regions with a higher probability of income poverty and material deprivation in Andalusia and Extremadura in Spain and in the South of Italy. The inadequacies of social policy decentralization to close or at least prevent the widening of territorial fractures especially in Spain are clearly showed, so they should be reconsidered in order to avoid a higher risk of poverty or material deprivation and to avoid an increase in inequalities across regions.

In addition, our results stress that the demographic and economic challenges faced by the retirement system should take into account the need of preventing the risk of income poverty among the eldest individuals. Moreover, the impact of public budget cuts in the areas related with this age cluster should be considered.

Furthermore, social support to lone parent families and families with children should be improved in both countries to reduce the risk of income poverty and material deprivation of these groups of the population. Moreover, with regards to Spain, the education system should be improved to raise the

qualification level of the labour - force, with the aim of reducing the gender gap, since less skilled workers are more affected by job destruction and, therefore, are more exposed to poverty and material deprivation.

References

[1] Addabbo, T. (2000).Poverty dynamics: analysis of household incomes in Italy. *Labour* (14) 1:119-144. DOI:10.1111/1467-9914.00127

[2] Addabbo, T. Favaro, D. (2011). Gender Wage Differentials by Education in Italy. *Applied Economics*, 43(29): 4589–4605. DOI: 10.1080/00036846.2010.491475

[3] Addabbo, T., García-fernández, R., Llorca-Rodríguez, C., Maccagnan, A. (2012).Poverty and Unemployment: The cases of Italy and Spain. In Parodi, G. and Sciulli, D. (editors), *Social Exclusion. Short and Long Term Causesand Consequences* (AIEL Series in Labour Economics.

[4] Algieri, B., and Aquino, A. (2011).Key Determinants of Poverty Risk in Italy. *Rivista Italiana Degli Economisti*, *16*(3): 411-430. DOI: 10.1427/35764

[5] Atkinson, A.B. (1989). *Poverty and social security*. Harvester Wheatsheaf.

[6] Atkinson, A.B. (1998). Preface. In Atkinson, B.A. and Hills, J. (edit.)*Exclusion, Employment and Opportunity, V-VII*, Centre for Analysis of Social Exclusion-London School of Economics.

[7] Atkinson, A.B. (2003). Multidimensional Deprivation: Contrasting Social Welfare and Counting Approaches. *Journal of Economic Inequality*, 1(1): 51-65.DOI 10.1023/A:1023903525276

[8] Atkinson, A.B., Cantillon, B., Marlier, E., and Nolan, B. (2002).*Social Indicators. The EU and Social Exclusion*. Oxford, Oxford University Press.

[9] Ayala Cañón, L. (coord.) (2008). Desigualdad, pobreza y privación.In Fundación FOESSA, *VI Informe sobre exclusión y desarrollo social en España*. Madrid.

[10] Ayala Cañón, L., Jurado, A., Pérez Mayo, J. (2011).Income poverty and multidimensional deprivation: lessons from cross-regional analysis, *Review of Income and Wealth*, 57(1): 40-60.DOI: 10.1111/j.1475-4991.2010.00393.x

[11] Ayllón, S. (2012). Understanding poverty persistence in Spain. *Series*, DOI 10.1007/s13209-012-0089-4

[12] Bande, R., Fernández, M., Montuenga, V. (2007). Regional disparities in the unemployment rate: the role of the wage setting mechanism in Spain, 1987-1992. *Regional Studies*, 41(2): 235-251. DOI: 10.1080/00343400601099680

[13] Bande, R., Fernández, M., Montuenga, V. (2008). Regional Unemployment in Spain: Disparities, Business Cycle and Wage-Setting. *Labor Economics*, 15(5): 885-914, DOI:10.1016/j.labeco.2007.07.009

[14] Berton F., Richiardi M., Sacchi S. (2012).*The political economy of work security and flexibility: Italy in comparative perspective.* Bristol, Policy Press.

[15] Bettio, F., Corsi, M., D'Ippoliti, C., Lyberaki, A., Samek Lodovici, M., Verashchagina, A. (2013). *The Impact of the economic Crisis on the Situation of Women and men and on Gender Equality Policies*. Luxembourg, Publications Office of the European Union.

[16] Bishop J.A., Chow V., Zheng B. (1995). Statistical inference and decomposable poverty measures. *Bulletin of Economic Research*, 74:329-340. DOI: 10.1111/j.1467-8586.1995.tb00619.x

[17] Blank, R.M. (1993). Why were poverty rates so high in the 1980s? In Papadimitriou, D. and Wolf, E. (eds.), *Poverty and Prosperity in the USA in the Late Twentieth Century*. London, Macmillan.

[18] Blank, R. M. (1996).Why has economic growth been such an ineffective tool against poverty in recent years? In Neill, J. (ed.), *Poverty and inequality, the political economy of distribution*. Kalamazoo, W.E. Upjohn Institute.

[19] Blank, R.M. (2000).Fighting poverty: lessons from recent U.S. history. *Journal of Economic Perspectives*, 14: 3-19. DOI**:** 10.1257/jep.14.2.3

[20] Blank, R.M. and Blinder, A. (1986).Poverty and the Macro Economy. In Danzinger, S. and Weinberg, D. (eds), *Challenging Poverty: what works and what doesn't*. Cambridge, MA, Harvard University Press.

[21] Blank, R.M., Card, D. (1993).Poverty, Income distribution and growth: are still connected? *Brookings Paper on Economic Activity*, 2: 285-339. DOI: 10.2307/2534568

[22] Callan, T. and Nolan, B. (1994). Unemployment and poverty. In Callan, T. and Nolan, B. (eds), *Poverty and Policy in Ireland*.Dublin. *Gill* and *Macmillan*.

[23] Cantó, O. (2013). La capacidad redistributiva del sistema español de prestaciones e impuestos. *Papeles de Economía Española*, 135: 140-152.

[24] Cutler, D., Katz, W. (1991).Macroeconomic performance and the disadvantaged. *Brookings Papers on Economic Activity*, 2: 1-74.

[25] Danziger, S., Gottschalk, P. (1995). *America Unequal*. Cambridge, MA, Harvard University Press.

[26] De La Rica, S., Dolado, J. and Llorens, V. (2008). Ceilings or floors? Gender wage gaps by education in Spain. *Journal of Population Economics,* 21(3): 777-78.

[27] Di Marco, M., and Donatiello, G. (2008). Distibuzione del reddito e rischi di povertà nel Mezzogiorno: I risultati dell'indagine Eu SILC sui redditi e le condizioni di vita'. (Income Distribution and Risks of Poverty in Southern Italy: Evidence from the EU-SILC Survey on Income and Living Conditions. With English summary).*RivistaEconomica Del Mezzogiorno*, *22*(2): 351-402.

[28] Devicienti, F., Gualtieri, V. and Rossi, M. (2014).The persistence of income poverty and lifestyle deprivation: evidence from Italy. *Bulletin of Economic Research,* 66(3): 246–278, DOI: 10.1111/j.1467-8586.2012.00444.x

[29] Duncan, G.J. (1984).*Years of poverty, years of plenty*, Ann Arbor, Michigan, Institute for Social Research.

[31] Figari, F., Salvatori, A., Sutherland, H. (2011). Economic Downturn and Stress Testing European Welfare Systems. In H. Immervoll, A. Peichl, K. Tatsiramos (eds.), *Who Loses in the Downturn? Economic Crisis, Employment and Income Distribution*, Research in Labor Economics, 32: 257-286.

[32] Foerster, M.F. (1994). Family poverty and the labour market. An international comparison of labour market participation and working time arrangements based on analysis of microdata from the Luxembourg Income Study. *Luxembourg Income Study Working Paper Series*, 114, July.

[33] Foster, J., Greer, J., Thorbecke, E. (1984). A class of decomposable poverty measures, *Econometrica,* 52(3**)**: 761–766. DOI: 10.2307/1913475

[34] Freeman, D.G. (2003). Poverty and the Macroeconomy: estimates from U.S. regional data. *Contemporary Economic Policy*, 21: 358-71. DOI: 10.1093/cep/byg017

[35] Fusco, A., Guio, A.C., Marlier, E. (2011). Income poverty and material deprivation in European countries. *CEPS/INSTEAD, Luxembourg, Working Paper* No 2011-04, January 2011.

[36] Gallie, D., Paugam, S. (2001). The experience of unemployment in Europe: The Debate. In Gallie, D. and Paugam, S. (eds), *Welfare Regimes and the Experience of Unemployment in Europe*. Oxford, Oxford Univ. Press.

[37] Greene, W.H. (2002). *Econometric Analysis*, 5th Edition. NJ, Prentice-Hall.

[38] Guio, A.C. (2005). Material deprivation in the EU. *Eurostat, Statistics in focus, Population and social conditions,* 21/2005.

[39] Hauser, R., Nolan, B (2001). Unemployment and Income Poverty. Change over Time. In Gallie, D. and Paugam, S. (eds), *Welfare Regimes and the Experience of Unemployment in Europe*. Oxford, Oxford Univ. Press.

[40] Haveman, R. and Schwabish, J. (2000). Has macroeconomic performance regained its anti-poverty bite? *Contemporary Economic Policy*, 18, October: 415-27. DOI: 10.1111/j.1465-7287.2000.tb00038.x

[43] Juárez, M. (Coord.) (1994).*V Informe sobre la situación social de España*. Madrid, FOESSA.

[44] Karamessini, M. (2008). Still a Distinctive Southern European Employment Model?, *Industrial Relations Journal*, 39(6): 510-531, http://ssrn.com/abstract=1282363 or http://dx.doi.org/10.1111/j.1468-2338.2008.00503.x

[45] Kolev, A. (2005). Unemployment, job quality and poverty: a case study of Bulgaria. *International Labour Review*, 144 (1): 85-114. DOI: 10.1111/j.1564-913X.2005.tb00560.x

[46] Leombruni, R., Mosca, M. (2012). Disuguaglianze di genere tra lavoro e pensione, Paper presented at the Convegno nazionale di studio e confronto 'Redditi, lavoro e famiglie: disuguaglianze e politiche redistributive al tempo della crisi', November 23-24, Modena, Italy Fondazione Gorrieri.

[47] Lombardo, V. (2011). Growth and Inequality Effects on Poverty Reduction in Italy. Rivista Italiana Degli Economisti, 16(2): 241-279.

[48] López-Bazo, E., Del Barrio, T., Artís, M. (2002).The regional distribution of Spanish unemployment: A spatial analysis. *Papers in Regional Science*, 81: 365-389. DOI: 10.1007/s101100200128

[49] López-Bazo, E., Del Barrio, T. and Artís, M. (2005). Geographical distribution of unemployment in Spain. *Regional Studies,* 39: 305-318. DOI: 10.1080/00343400500087034

[50] Martínez López, R. (2010). Pobreza y privación en España en el período 2004-2008: el auge económico al inicio de la recesión. *Documento de Trabajo* 165/2010. Fundación Alternativas.

[51] Montella, M., Mostacci, F., Roberti, P. (2012). Icosti della crisi pagati dai più deboli. *Prospettive Socialie Sanitarie*, 7: 29-32. http://www.lavoce.info (accesed April 3, 2012).

[52] Mundo, A. (2007). Disparità di genere nei redditi da pensione.In Rustichelli Emiliano (ed) (2007), *Esiste un differenziale retributivo in Italia? Illavorofemminiletradiscriminazioni e dirittoallaparità di trattamento*,I Libri del Fondo Sociale Europeo, Isfol, Roma, http://www.lavoro.gov.it/Lavoro/Europalavoro/SezioneEuropaLavoro/DGPOF/ProdottiEditoriali/CollaneEditoriali/LibriFSE/differenzialeretributivo.htm

[53] Pérez Mayo, J. (2013). Crisis económica y territorio: el impacto de la crisis sobre la desigualdad de rentas en las distintas regiones españolas. *Papeles de Economía Española*, 135: 36-48.

[54] Permanyer, I., Treviño, R. (2013). El impacto de la crisis sobre los niveles de renta y el Mercado de trabajo según género y tipología familiar. *Papeles de Economía Española*, 135: 119-135.

[63] Olivetti, C., Petrongolo, B. (2008). Unequal Pay or Unequal Employment? A Cross-Country. Analysis of Gender Gaps. *Journal of Labor Economics,* 26(4): 621-654.

[64] Ortiz Serrano S., De Lucas Santos, S. (2010). Análisis regional de la pobreza para el colectivo de la tercera edad: inferencia clásica vs. técnicas bootstrap. *Estadística Española*, 54: 155-191.

[65] Pedraza Avella, A.C. (2012). Exclusión social y empleo: ¿qué ocurre cuando hay segmentación laboral?.*Sociedad y Economía,* 22: 135-162.

[66] Quintano, C., Castellano, R., Punzo, G. (2011). Measuring Poverty and Living Conditions in Italy through a Combined Analysis at a Sub-national Level. *Journal of Economic and Social Measurement*, *36*(1-2): 93-118. DOI: 10.3233/JEM-2011-0337

[67] Romer, Paul (2000). Poverty and macroeconomic activity. *Federal Reserve Bank of Kansas City Economic Review*, First Quarter, 1-13.

[68] Sapir, A. (2005). Globalisation and the reform of European Social Models. *Bruegel Policy Brief*. Issue 2005/1.

[69] Sen (1997). Inequality, unemployment and contemporary Europe. *International Labour Review*, 136(2): 155-171.

[70] Tobin, J. (1994). Poverty in relation to macroeconomic trends, cycles and policies. In Danziger, S., Sandefur, G., and Weinberg, D. (eds), *Confronting poverty: prescriptions for change*). Cambridge, MA, Harvard University Press.

[71] Verashchagina, A., Capparucci, M. (2014). Living through the crisis in Italy: the labour market experience of men and women. In Karamessini, M. and Rubery, J. (eds.) *Women and Austerity: The economic crisis and the future for gender equality.* New York: Rutledge.

[72] Whelan, C.T., Nolan, B., Maître, B. (2012). Multidimensional Poverty Measurement in Europe: An Application of the Adjusted Headcount Approach.*UCD Geary Institute Discussion Paper Series*, Geary WP2012/11.

*** European Commission (2009). *EU* Employment Situation and Social Outlook. *Monthly Labour Market Monitor*, November.

*** Istat (2011). *Rapporto Annuale. La Situazione del Paesenel 2010*. http://www.istat.it/dati/catalogo/20110523_00/Avvio2010.pdf (accessed March 21, 2014).

*** Istat (2012).*Rapporto annual sulla situazione del paese*, Roma, Istat.

*** OECD (1997). Income distribution and poverty in selected OECD countries. In *OECD. Economic Outlook,* 62, ABI/INFORM Global. Paris, OECD Publishing.

*** OECD (2007). *OECD Economic Surveys: France.* Paris, OECD Publishing.

*** OECD (2009). *Employment Outlook 2009.* Paris, OECD Publishing.

*** OECD (2011). Pensions at a Glance: Retirement-Income Systems in OECD and G20 Countries, http://www.oecd.org/els/social/pensions/PAG

*** OECD (2012a). *Gender Data Browser*. http://www.oecd/gender/equality.

*** OECD (2012b). *Gender Equality in Education, Employment and Entrepreneurship: Final Report to the MCM 2012*. C/MIN (2012)5.

*** OECD (2012 c). *Employment Outlook 2012.* Paris, OECD Publishing.

*** OECD (2013). *Crisis squeezes income and puts pressure on inequality and poverty*. Paris. OECD Publishing, http://www.oecd.org/social/inequality.htm.

*** World Economic Forum (2010).*The Global Competitiveness Report 2010-2011*. Geneva.

APPENDIX

Tables 2-5

Table 2. Probit model on being income poor- Italy

	2007				2010			
	Males		Females		Males		Females	
	Coeff.	M.E.	Coeff.	M.E.	Coeff.	M.E.	Coeff.	M.E.
Age	0.0150***	0.0031	0.00541	0.0013	0.0215***	0.00411	0.0173***	0.0038
	(0.00574)		(0.00432)		(0.00593)		(0.00443)	
Age squared	-0.0002***	-0.00003	-0.0001***	-0.00003	-0.0004***	-0.00004	-0.0003***	-0.00005
	(0.00006)		(0.00005)		(0.00006)		(0.00005)	
Single	0.461***	0.114	0.820***	0.247	0.567***	0.138	0.935***	0.271
	(0.0519)		(0.0394)		(0.0499)		(0.0422)	
Household with children	0.210***	0.0443	0.128***	0.0311	0.290***	0.0579	0.232***	0.0528
	(0.0497)		(0.0465)		(0.0482)		(0.0471)	
Lone parent	0.504***	0.133	0.659***	0.204	0.522***	0.132	1.078***	0.351
	(0.137)		(0.0844)		(0.114)		(0.0742)	
Secondary	-0.345***	-0.0663	-0.287***	-0.0642	-0.31***	-0.0563	-0.247***	-0.0513
	(0.0450)		(0.0418)		(0.0462)		(0.0434)	
High school	-0.679***	-0.124	-0.587***	-0.125	-0.657***	-0.115	-0.506***	-0.102
	(0.0481)		(0.0438)		(0.0481)		(0.0466)	
Tertiary	-1.050***	-0.132	-1.107***	-0.161	-1.018***	-0.119	-0.879***	-0.132
	(0.0821)		(0.0696)		(0.0734)		(0.0694)	
Part time temporary	1.026***	0.323	0.881***	0.289	1.179***	0.374	0.862***	0.271
	(0.141)		(0.105)		(0.159)		(0.123)	
Part time permanent	0.967***	0.300	0.199**	0.0519	0.820***	0.234	0.316***	0.0806
	(0.175)		(0.0987)		(0.151)		(0.0886)	
FT temporary	0.732***	0.207	0.483***	0.141	0.624***	0.162	0.540***	0.152
	(0.0945)		(0.0997)		(0.0740)		(0.0958)	
PT Self-employed	0.957***	0.296	0.884***	0.292	0.801***	0.227	0.734***	0.222
	(0.142)		(0.129)		(0.155)		(0.159)	
FT Self-employed	0.522***	0.130	0.457***	0.131	0.439***	0.101	0.388***	0.102
	(0.0519)		(0.0889)		(0.0506)		(0.0856)	
Unemployed self-empl. with employees before	1.581***	0.541	2.418***	0.765	1.252***	0.404	0.151	0.372
	(0.384)		(0.628)		(0.316)		(0.537)	

Unemployed self-empl. without employees before	1.656***	0.567	1.425***	0.503	1.437***	0.476	1.422***	0.492
	(0.185)		(0.215)		(0.153)		(0.168)	
Unemployed previously employee	1.133***	0.362	0.973***	0.325	1.180***	0.366	1.119***	0.368
	(0.0871)		(0.0969)		(0.0713)		(0.0805)	
Unemployed never employed before	1.362***	0.455	1.360***	0.478	1.494***	0.494	1.597***	0.553
	(0.112)		(0.111)		(0.103)		(0.0971)	
Inactive not retired	0.727***	0.195	0.885***	0.223	0.781***	0.202	0.913***	0.215
	(0.0643)		(0.0647)		(0.0629)		(0.0567)	
Retired	0.490***	0.115	0.605***	0.171	0.373***	0.0802	0.532***	0.139
	(0.0624)		(0.0723)		(0.0640)		(0.0670)	
chronic ill	0.0105	0.00215	0.0285	0.00686	-0.0149	-0.00286	-0.0450	-0.00981
	(0.0397)		(0.0345)		(0.0400)		(0.0357)	
At least one chidl aged less than 6	0.318***	0.0750	0.164***	0.0417	0.334***	0.0751	0.179***	0.0428
	(0.0586)		(0.0536)		(0.0594)		(0.0538)	
At least one child 6-14	0.252***	0.0566	0.147***	0.0369	0.259***	0.0552	0.178***	0.0418
	(0.0475)		(0.0441)		(0.0467)		(0.0433)	
At least one child 15-17	0.269***	0.0620	0.180***	0.0460	0.178***	0.0373	0.155***	0.0367
	(0.0532)		(0.0507)		(0.0528)		(0.0496)	
South	0.711***	0.165	0.612***	0.160	0.640***	0.139	0.533***	0.129
	(0.0321)		(0.0281)		(0.0310)		(0.0285)	
Constant	-1.896***		-1.618***		-2.051***		-2.031***	
	(0.162)		(0.139)		(0.158)		(0.132)	
Observations	21,208		23,183		19,254		20,920	
Pseudo R-squared	0.18		0.17		0.18		0.18	
Robust standard errors in parentheses; M.E.: Marginal Effects;* p<0.01, ** p<0.05, * p<0.1**								

Source: Our own elaboration on EU SILC

Table 3. Probit model on being income poor- Spain

	2007				2010			
	Males		Females		Males		Females	
	Coeff.	M. E.	Coeff.	M.E.	Coeff.	M.E.	Coeff.	M.E.
Age	-0.0076	-0.0014	-0.0066	-0.0013	-0.000124	-0.00003	-0.00147	-0.0004
	(0.0065)		(-0.0046)		(-0.00558)		(0.0044)	
Age squared	0.000122*	0.00002	0.0001	0.0000	0.00002	0.00001	-0.00002	-0.00001
	(0.0001)		(0.00009)		(-0.00006)		(0.00004)	
Single	0.219***	0.0444	0.592***	0.155***	0.281***	0.0750	0.556***	0.171
	(0.0848)		(-0.0583)		(-0.0661)		(0.0503)	
Household with children	0.322***	0.0587	0.203***	0.0407***	0.307***	0.0754	0.295***	0.0781
	(0.0438)		(-0.0399)		(-0.0389)		(0.0382)	
Lone parent	-0.1510	-0.0246	0.914***	0.274***	0.615***	0.189	0.997***	0.347
	(0.1880)		(-0.0797)		(-0.154)		(0.0899)	
Secondary	-0.265***	-0.0439	-0.140***	-0.027***	-0.305***	-0.0676	-0.245***	-0.0591
	(0.0506)		(-0.0405)		(-0.0437)		(0.043)	
High school	-0.400***	-0.0623	-0.348***	-0.062***	-0.560***	-0.113	-0.386***	-0.0889
	(0.0570)		(-0.0471)		(-0.0511)		(0.0488)	
Tertiary	-0.603***	-0.0891	-0.538***	-0.092***	-0.761***	-0.149	-0.769***	-0.164
	(0.0577)		(-0.0505)		(-0.0533)		(0.0535)	
Part time temporary	0.670***	0.172	0.635***	0.172***	0.796***	0.257	0.757***	0.252
	(0.1670)		(-0.0852)		(-0.176)		(0.106)	
Part time permanent			0.385***	0.0937***	0.616***	0.190	0.248***	0.0707
			(-0.0884)		(-0.187)		(0.0897)	
Full Time temporary	0.479***	0.107	0.597***	0.156***	0.539***	0.157	0.294***	0.0849
	(0.0675)		(-0.0774)		(-0.0714)		(0.0828)	
Part Time Self-employed	1.532***	0.502	0.831***	0.245***	1.574***	0.557	1.083***	0.383
	(0.2630)		(-0.1500)		(-0.243)		(0.153)	
FT Self-employed	1.064***	0.291	1.021***	0.311***	1.398***	0.471	1.041***	0.361
	(0.0539)		(-0.0828)		(-0.0568)		(0.0787)	
Unemployed self-empl. with employees before	2.425***	0.774	0.7960	0.2330	1.630***	0.576	1.006**	0.354
	(0.5800)		(-0.5070)		(-0.274)		(0.456)	
Unemployed self-empl. without employees before	1.350***	0.431	0.4540	0.1160	1.555***	0.549	1.146***	0.408
	(0.3120)		(-0.2860)		(-0.18)		(0.249)	
Unemployed previously	0.931***	0.258	0.827***	0.236***	1.006***	0.321	0.773***	0.249

employee								
	(0.0769)		(-0.0736)		(-0.0577)		(0.0624)	
Unemployed never employed before	1.396***	0.448	1.464***	0.492***	1.409***	0.497	1.584***	0.566
	(0.1590)		(-0.1400)		(-0.146)		(0.14)	
Inactive not retired	0.894***	0.232	0.906***	0.202***	0.810***	0.249	0.747***	0.209
	(0.0679)		(-0.0608)		(-0.0686)		(0.0543)	
Retired	0.518***	0.113	0.273***	0.0623***	0.437***	0.118	0.246***	0.0690
	(0.0763)		(-0.0820)		(-0.0729)		(0.0718)	
Chronic ill	-0.0194	-0.0035	0.0328	0.0067	-0.034	-0.00806	0.016	0.00415
	(0.0413)		(-0.0338)		(-0.0378)		(0.0338)	
At least one child aged less than 6	0.0294	0.0054	0.0264	0.0054				
	(0.1010)		(-0.0627)					
At least one child 6-14	0.179**	0.0354	0.0814*	0.0170*	0.325	0.0902	0.458	0.142
	(0.0706)		(-0.0466)		(-0.285)		(0.36)	
At least one child 15-17	0.0331	0.0061	0.0686	0.0143	0.615	0.19	1.070**	0.379
	(0.1150)		(-0.0734)		(-0.431)		(0.453)	
Group 2	-0.0353	-0.0063	-0.0496	-0.0099	0.154***	0.0374	0.166***	0.0437
	(0.0647)		(-0.0513)		(-0.059)		(0.0563)	
Group 3	0.194***	0.0359	0.265***	0.0557***	0.372***	0.0930	0.414***	0.112
	(0.0591)		(-0.0472)		(-0.0561)		(0.0535)	
Group 4	0.417***	0.0871	0.383***	0.0874***	0.634***	0.179	0.554***	0.164
	(0.0636)		(-0.0515)		(-0.0612)		(0.058)	
Constant	-1.667***		-1.696***		-1.674***		-1.515***	
	(0.1760)		(-0.1380)		(-0.159)		(0.141)	
Observations	15,596		18,946		14,552		15,896	
Pseudo R-squared	0.14		0.12		0.17		0.13	
Robust standard errors in parentheses; M.E.: Marginal Effects; *** p<0.01, ** p<0.05, * p<0.1								

Source: Our own elaboration on EU SILC

Table 4. Probit model on deprivation index – Italy

	2007				2010			
	Males		Females		Males		Females	
	Coeff.	M.E.	Coeff.	M.E.	Coeff.	M.E.	Coeff.	M.E.
Age	0.0235***	0.00357	0.0285***	0.00487	0.0151**	0.00307	0.0175***	0.00375
	(3.72)		(4.90)		(2.41)		(3.19)	
Age squared	-0.0003***	-0.00004	-0.0003***	-0.00005	-0.0002***	-0.00003	-0.0002***	-0.00005
	(4.53)		(5.56)		(2.73)		(4.13)	
Single	-0.228***	-0.0354	-0.460***	-0.0803	-0.0798	-0.0163	-0.342***	-0.0736
	(4.27)		(8.85)		(1.58)		(6.76)	
Household with children	0.122	0.0200	0.186***	0.0354	0.324***	0.0769	0.241***	0.0576
	(1.55)		(2.71)		(4.61)		(3.79)	
Lone parent	-0.103	-0.0147	-0.0546	-0.0091	-0.0323	-0.00645	-0.0678	-0.0141
	(1.05)		(0.86)		(0.34)		(1.06)	
Secondary	-0.245***	-0.0351	-0.288***	-0.0453	-0.249***	-0.0484	-0.232***	-0.0469
	(4.81)		(6.45)		(5.23)		(5.31)	
High school	-0.578***	-0.0784	-0.596***	-0.0889	-0.620***	-0.115	-0.566***	-0.109
	(10.56)		(12.14)		(12.45)		(12.12)	
Tertiary	-1.122***	-0.0943	-1.053***	-0.104	-1.003***	-0.126	-1.014***	-0.138
	(13.23)		(13.32)		(13.51)		(14.15)	
Part time temporary	0.792***	0.191	0.438***	0.0965	0.728***	0.209	0.407***	0.106
	(4.42)		(4.00)		(4.29)		(3.20)	
Part time permanent	0.426***	0.0848	0.280***	0.0560	0.712***	0.203	0.175**	0.0409
	(2.69)		(3.27)		(4.59)		(2.17)	
FT temporary	0.363***	0.0686	0.345***	0.0720	0.554***	0.146	0.295***	0.0731
	(4.26)		(3.67)		(7.91)		(3.56)	
PT Self-employed	0.444***	0.0894	0.227	0.0446	0.454***	0.117	-0.190	-0.0366
	(2.73)		(1.62)		(3.06)		(1.25)	
FT Self-employed	-0.0724	-0.0106	-0.140	-0.0220	-0.120**	-0.0233	-0.151*	-0.0298
	(1.23)		(1.50)		(2.16)		(1.77)	
Unemployed self-empl. With employees before	0.468	0.0960	-0.0385	-0.00641	0.865**	0.261	0.260	0.0637
	(0.97)		(0.06)		(2.51)		(0.48)	
Unemployed self-empl. Without employees before	1.045***	0.281	0.688***	0.173	0.980***	0.305	1.059***	0.344
	(4.88)		(3.41)		(5.11)		(6.30)	
Unemployed previously employee	0.651***	0.145	0.651***	0.159	0.944***	0.284	0.665***	0.191

	(8.17)		(7.40)		(13.62)		(8.71)	
Unemployed never employed before	0.526***	0.110	0.637***	0.155	0.907***	0.274	0.699***	0.204
	(4.61)		(6.25)		(9.03)		(7.34)	
Inactive not retired	0.251***	0.0432	0.247***	0.0431	0.340***	0.0790	0.191***	0.0414
	(4.14)		(4.66)		(5.70)		(3.84)	
Retired	0.167***	0.0268	0.0867	0.0153	-0.120*	-0.0236	-0.0380	-0.00803
	(2.69)		(1.38)		(1.93)		(0.62)	
Chronic ill	0.242***	0.0408	0.257***	0.0481	0.178***	0.0385	0.263***	0.0607
	(6.03)		(7.22)		(4.62)		(7.54)	
At least one chidl aged less than 6	0.116*	0.0188	0.135**	0.0247	0.196***	0.0436	0.241***	0.0573
	(1.86)		(2.28)		(3.27)		(4.23)	
At least one child 6-14	0.181***	0.0298	0.164***	0.0300	0.115***	0.0245	0.160***	0.0364
	(3.93)		(3.67)		(2.64)		(3.81)	
At least one child 15-17	0.122**	0.0198	0.0411	0.00718	0.0979*	0.0208	0.158***	0.0362
	(2.34)		(0.76)		(1.89)		(3.22)	
South	0.574***	0.0989	0.578***	0.111	0.465***	0.103	0.533***	0.125
	(17.16)		(18.76)		(14.71)		(18.01)	
Constant	-1.665***		-1.710***		-1.325***		-1.253***	
	(10.34)		(11.43)		(8.38)		(8.94)	
Observations	21208		23183		19254		20920	
Pseudo R-squared	0.13		0.12		0.13		0.11	

Robust standard errors in parentheses; M.E.: Marginal Effects; *** p<0.01, ** p<0.05, * p<0.1

Source: Our own elaboration on EU SILC

Table 5. Probit model on deprivation index- Spain

	2007				2010			
	Males		Females		Males		Females	
	Coeff.	Marg. Eff.	Coeff.	Marg. Eff.	Coeff.	Marg. Eff.	Coeff.	Marg. Eff.
Age	0.00300	0.000404	-0.0193***	-0.0027***	0.00029	0.00005	0.00032	0.00006
	(0.00717)		(0.00544)		(0.00678)		(0.00520)	
Age squared	-0.000107	-0.00002	0.00009*	0.00001*	-0.00005	-0.00001	-0.0001**	-0.00002**
	(0.00008)		(0.00006)		(0.00007)		(0.00005)	
Single	0.0547	0.00763	0.246***	0.0394***	0.175**	0.0333**	0.343***	0.0752***
	(0.0899)		(0.0687)		(0.0759)		(0.0618)	
Hosehold with children	-0.0884*	-0.0119*	-0.0432	-0.00596	0.195***	0.0345***	0.161***	0.0307***
	(0.0464)		(0.0471)		(0.0418)		(0.0411)	
Lone parent	0.387**	0.0680*	0.767***	0.169***	0.664***	0.166***	0.637***	0.165***
	(0.175)		(0.0868)		(0.157)		(0.0910)	
Secondary	-0.265***	-0.032***	-0.276***	-0.0341***	-0.234***	-0.038***	-0.333***	-0.0554***
	(0.0502)		(0.0478)		(0.0495)		(0.0490)	
High school	-0.371***	-0.043***	-0.608***	-0.0660***	-0.495***	-0.071***	-0.504***	-0.0779***
	(0.0567)		(0.0549)		(0.0556)		(0.0565)	
Tertiary	-0.789***	-0.081***	-1.103***	-0.106***	-0.813***	-0.109***	-0.941***	-0.133***
	(0.0676)		(0.0707)		(0.0634)		(0.0658)	
Part time temporary	0.441**	0.0801**	0.364***	0.0636***	0.595***	0.144***	0.132	0.0265
	(0.174)		(0.103)		(0.166)		(0.103)	
Part time permanent	-0.198	-0.0230	0.0157	0.00219	0.435*	0.0972	-0.0760	-0.0136
	(0.312)		(0.0952)		(0.229)		(0.0954)	
FT temporary	0.537***	0.096***	0.153*	0.0232*	0.449***	0.097***	0.144	0.0290
	(0.0622)		(0.0800)		(0.0706)		(0.0876)	
PT Self-employed	0.598	0.120	0.0712	0.0103	0.406	0.0894	0.0806	0.0158
	(0.372)		(0.177)		(0.289)		(0.181)	
FT Self-employed	-0.254***	-0.030***	-0.0628	-0.00831	-0.136*	-0.0218**	-0.238**	-0.0386***
	(0.0789)		(0.104)		(0.0729)		(0.104)	
Unemployed self-empl. with employees before	0.723**	0.154*	0.0299	0.00421	0.858***	0.222***	0.825***	0.225***
	(0.314)		(0.289)		(0.165)		(0.212)	
Unemployed self-empl. without employees before	0.852***	0.191**	0.556**	0.108	0.997***	0.271***	0.841***	0.228***
	(0.278)		(0.272)		(0.152)		(0.199)	
Unemployed previously employee	0.0109	0.00148	-0.0711	-0.00937	-0.104	-0.0171	-0.324	-0.0514*
	(0.289)		(0.272)		(0.155)		(0.201)	
Unemployed never employed before	0.0159	0.00217	0.177	0.0276	-0.498**	-0.062***	-0.205	-0.0337
	(0.329)		(0.298)		(0.208)		(0.237)	
Inactive notretired	0.206***	0.0311***	-0.0282	-0.00387	0.103	0.0186	-0.0345	-0.00640

	(0.0710)		(0.0588)		(0.0730)		(0.0563)	
Retired	0.132	0.0189	-0.107	-0.0139	-0.0202	-0.00346	-0.0301	-0.00554
	(0.0922)		(0.0866)		(0.0896)		(0.0873)	
Chronic ill	0.333***	0.0512***	0.352***	0.0555***	0.177***	0.0322***	0.255***	0.0504***
	(0.0428)		(0.0380)		(0.0431)		(0.0396)	
At least one child aged less than 6	0.0734	0.0104	-0.109	-0.0141				
	(0.102)		(0.0755)					
At least one child 6-14	0.162**	0.0243*	-0.113*	-0.0146**	-0.588	-0.068**	-0.602*	-0.0756***
	(0.0762)		(0.0592)		(0.489)		(0.347)	
At least one child 15-17	0.00971	0.00132	-0.151	-0.0187*			-1.015**	-0.0966***
	(0.102)		(0.0920)				(0.429)	
Group 2	0.221***	0.031***	0.239***	0.0345***	0.289***	0.052***	0.342***	0.0671***
	(0.0629)		(0.0575)		(0.0703)		(0.0657)	
Group 3	0.373***	0.054***	0.335***	0.0496***	0.345***	0.063***	0.404***	0.0805***
	(0.0574)		(0.0538)		(0.0678)		(0.0638)	
Group 4	0.541***	0.092***	0.548***	0.0954***	0.518***	0.108***	0.569***	0.129***
	(0.0636)		(0.0584)		(0.0720)		(0.0675)	
Constant	-1.540***		-0.767***		-1.436***		-1.125***	
	(0.179)		(0.155)		(0.181)		(0.157)	
Observations	15685		18946		14547		15896	
Pseudo R-squared	0.12		0.11		0.12		0.09	
Robust standard errors in parentheses;M.E.: Marginal Effects; *** p<0.01, ** p<0.05, * p<0.1								

Source: Our own elaboration on EU SILC

Oscillations in a Multi-Country Free Trade Model with Endogenous Wealth and Environment

Wei-Bin ZHANG
Ritsumeikan Asia Pacific University, Jumonjibaru 1, Beppu, Japan
wbz1@apu.ac.jp

Abstract:

This study shows economic oscillations due to periodic changes in some parameters in the multi-country economy with endogenous physical capital and wealth accumulation and environmental change proposed by Zhang (2014). The Zhang's model analyses not only inequalities in income, wealth and economic structures among countries, but also differences in environmental changes between countries. The main difference of this study from Zhang's model is that this study treats all the time-independent parameters as time-dependent. This study is interested in time-dependent shocks on the evolution of the economic system. After showing that the dynamics of J - country world economy is controlled by 2J differential equations, we simulate the motion of the model with three countries and carry out comparative dynamic analysis with regard to different time-dependent shocks. In association with different fluctuations in parameters, different economies experience different oscillations.

Keywords: economic fluctuations; exogenous shocks; growth and trade; economic structure; trans boundary pollution; environmental change

JEL Classification: F11; F180

1. Introduction

This study is concerned with demonstrating existence of economic fluctuations under different exogenous shocks. Although economists were interested in demonstrating business cycles in the 1950s and 1960s, a common way employed in the past is to "find out" economic phenomena which can be described by the well-examined equations in physics whose behaviour exhibit oscillations under some exogenous shocks. Since the early 1980s economists have proposed many models which explain mechanisms and phenomena of economic fluctuations. Zhang (1991, 2005, and 2006) shows how modern dynamic analysis can be applied to different economic systems, identifying existence of cycles, regular as well as irregular oscillations, and chaos in economic systems. There are also many empirical studies on economic fluctuations (e.g., Lucas, 1977; Chatterjee and Ravikumar, 1992; Gabaix, 2011; Giovanni, *et al.* 2014; Stella, 2015). This study tries to make another contribution to the literature of economic oscillations by demonstrating economic oscillations due to periodic changes in some parameters in the multi-country economy with endogenous physical capital and wealth accumulation and environmental change proposed by Zhang (2014).

Zhang's model analyses not only inequalities in income, wealth and economic structures between (any number of) countries, but also differences in environmental changes between countries. The model is built on the basis of the Solow model, the Uzawa two-sector model, and the Oniki-Uzawa trade model, and the neoclassical growth model in environmental economics. Moreover, Zhang's approach takes account of pollution both due to production and consumption. In economics dynamic relations between growth and environmental change have been formally analysed since the publication of the seminal papers by Ploude (1972) and Forster (1973).Tsurumi and Managi (2010) identify three effects that are significant for examining dynamics of environmental pollution and resource use: (i) increases in output tends to require more inputs and produce more emissions; (ii) changes in income or preferences may lead to policy changes which will affect production and thus emission; and (iii) as income increases, the economic structure may be changed which will causes changes in the environment. There are different economic factors that may affect environmental change (e.g., John and Pecchenino, 1994; Bravo and Marelli, 2007; Lamla, 2009; Prieur, 2009; Gassebner *et al*. 2011; Lin and Liscow, 2012). Partly due to analytical difficulties in modelling, a few trade growths take account of transboundary pollution. Our study models capital mobility and trade on the neoclassical growth trade model. Early trade models with capital movements are originated by MacDougall (1960) and Kemp (1961). Most of trade models with endogenous capital and/or knowledge in the contemporary literature are either limited to two-country or small open economies (for instance, Grossman and Helpman, 1991; Wong, 1995; Jensen and Wong, 1998; Obstfeld and Rogoff, 1998). This study deals with a global economy with any number of national economies. Our model is based on the trade model by Oniki and Uzawa (1965; see also Deardorff and Hanson, 1978; Brecher *et al*., 2002; Nishimura and Shimomura, 2002; Bold *et al.* 2003; Ono and Shibata, 2005). It should be remarked that none of these models with endogenous capital accumulation contains endogenous environmental changes. This paper generalizes the

model by Zhang (2014) by treating all the time-independent parameters as time-dependent parameters. This study makes Zhang's model more robust in the sense that it takes account of different exogenous time-dependent changes in studying economic business cycles and fluctuations. This paper is organized as follows. Section 2 defines the multi-country model with physical capital and environmental change. Section 3 shows that the world with J economies is described by $2J$ differential equations and also simulates the model. Section 4 carries out comparative dynamics analysis with regards some time-dependent parameters. Section 5 concludes the study.

2. The multi-country trade growth model with environmental change

This paper basically follows Zhang's model (Zhang, 2014) except that all the parameters are time-dependent. The model in this study is far more robust than Zhang's model. We consider a global economy with any number of national economies. The national economies are indexed by $j=1,...,J$. Country j has a constant population, N_j, ($j=1,...,J$). Each national economy consists of one capital goods sector, one consumer goods sector and one environmental sector. The national government financially supports the environmental sector. We follow the Uzawa two-sector growth model in describing the capital goods and consumer goods sectors (Uzawa, 1961; Burmeister and Dobell, 1970; Azariadis, 1993; Barro and Sala-i-Martin, 1995). It is assumed that all the countries produce homogenous capital goods. With regard to trade and determination trade patterns this study extends the Oniki-Uzawa trade model (Ikeda and Ono, 1992). Product of each country's consumer goods (and service) sector is not tradable in the international markets. Households own assets of the economy and distribute their incomes to consume and save. Production sectors use capital and labour. Exchanges take place in perfectly competitive markets. Production sectors pay environmental taxes and sell their product to households or to other sectors and households sell their labour and assets to production sectors. Factor markets work well; factors are inelastically supplied and the available factors are fully utilized at every moment. Saving is undertaken only by households, which implies that all earnings of firms are distributed in the form of payments to factors of production.Let prices be measured in terms of the capital goods and the price of the capital goods be unit. We denote wage and interest rates by $w_j(t)$ and $r_j(t)$, respectively, in the j th country. In the free trade system, we have $r(t)=r_j(t)$. Country j 's capital depreciates at an exponential rate $\delta_{jk}(t)$, which are exogenously time-dependent. Let $p_j(t)$ denote the price of consumer goods. We use subscript index, i, s and e to stand for capital goods sector, consumer goods sector, and environmental sector, respectively. We use $N_{jm}(t)$ and $K_{jm}(t)$ to stand for the labour force and capital stocks employed by sector m in country j.Let $F_{jm}(t)$ stand for the output level of sector m in country j.

The capital goods sectors

The capital goods sector combines labour force and physical capital with constant technology to produce capital goods. The total factor productivity is affected by environment. The production function is taken on the following form:

$$F_{ji}(t)=A_{ji}(t)\Gamma_{ji}(E_j(t),t)K_{ji}^{\alpha_{ji}(t)}(t)N_{ji}^{\beta_{ji}(t)}(t),\ \ A_{ji}(t),\alpha_{ji}(t),\beta_{ji}(t)>0,\ \ \alpha_{ji}(t)+\beta_{ji}(t)=1, \tag{1}$$

where $A_{ji}(t)$, $\alpha_{ji}(t)$, and $\beta_{ji}(t)$ are positive time-dependent parameters. Here, $\Gamma_{ji}(E_j(t),t)$ is a function of the environmental quality measured by the level of pollution, $E_j(t)$, in country j. We require, $d\Gamma_{ji}/dE_j\le 0$. We use $\tau_{ji}(t)$ to stand for the fixed tax rate on the capital goods sector. The marginal conditions of the capital goods sector are

$$r(t)+\delta_k(t)=\frac{\alpha_{ji}(t)\bar{\tau}_{ji}(t)F_{ji}(t)}{K_{ji}(t)},\ \ w_j(t)=\frac{\beta_{ji}(t)\bar{\tau}_{ji}(t)F_{ji}(t)}{N_{ji}(t)}, \tag{2}$$

where $\bar{\tau}_{ji}(t) \equiv 1 - \tau_{ji}(t),\ 0 < \tau_{ji}(t) < 1.$

The consumer goods sectors

The production function of the consumer goods sector is specified as follows:

$$F_{js}(t) = A_{js}(t)\Gamma_{js}(E_j(t), t)K_{js}^{\alpha_{js}(t)}(t)N_{js}^{\beta_{js}(t)}(t),\ \ \alpha_{js}(t) + \beta_{js}(t) = 1,\ \ \alpha_{js}(t), \beta_{js}(t) > 0, \tag{3}$$

where $A_{js}(t),\ \alpha_{js}(t),$ and $\beta_{js}(t)$ are the technological parameters of the consumer goods sector and $\Gamma_{ji}(E_j(t), t)$is a function of the environmental quality. We use $\tau_{js}(t)$ to stand for the fixed tax rate on the consumer goods sector and introduce $\bar{\tau}_{js}(t) \equiv 1 - \tau_{js}(t),\ 0 < \tau_{js}(t) < 1.$ The marginal conditions are

$$r(t) + \delta_{jk}(t) = \frac{\alpha_{js}(t)\bar{\tau}_{js}(t)p_j(t)F_{js}(t)}{K_{js}(t)},\ \ w_j(t) = \frac{\beta_{js}(t)\bar{\tau}_{js}(t)p_j(t)F_{js}(t)}{N_{js}(t)}. \tag{4}$$

Environmental change

Following Zhang (2014), we describe the dynamics of the stock of pollutants as follows:

$$\dot{E}_j(t) = \theta_{ji}(t)F_{ji}(t) + \theta_{js}(t)F_{js}(t) + \theta_j(t)C_j(t) - F_{je}(t) - \bar{\theta}_j(t)E_j(t) + \Omega_j((E_q(t), t)), \tag{5}$$

in which $\theta_{ji}(t),\ \theta_{jx}(t),\ \theta_j(t),$ and $\bar{\theta}_j(t)$ are positive time-dependent parameters and

$$F_{je}(t) = A_{je}(t)\Gamma_{je}(E_j(t), t)K_{je}^{\tilde{\alpha}_{je}(t)}(t)N_e^{\tilde{\beta}_{je}(t)}(t),\ \ A_{je}(t), \tilde{\alpha}_{je}(t), \tilde{\beta}_{je}(t) > 0, \tag{6}$$

where $A_{je}(t),\ \alpha_{je}(t),$ and $\beta_{je}(t)$ are positive time-dependent parameters, and $\Gamma_{je}(E_j(t), t)\ (\geq 0)$ is a function of $E_j(t).$ The term $\theta_{ji}(t)F_{ji}(t)$ means that pollutants that are emitted during production processes are linearly positively proportional to the output level (Dinda, 2005; Gutiérrez, 2008). The parameter, $\theta_{ji}(t),$ means that in consuming one unit of the good the quantity $\theta_{ji}(t)$ is left as waste. Similarly, we interpret $\theta_{js}(t)F_{js}(t)$ the creation of pollutants by the consumer goods sector. The creation of pollutants by consumers is given $\theta_j(t)C_j(t).$ The parameter $\bar{\theta}_j(t)$ is called the rate of natural purification. The term, $K_{je}^{\tilde{\alpha}_e(t)}(t)N_{je}^{\tilde{\beta}_e(t)}(t),$ in $F_{je}(t)$ means that the purification rate of environment is positively related to capital and labor inputs. The function, Γ_{je}, implies that the purification efficiency is dependent on the stock of pollutants. We use $\Omega_j((E_q(t)), t)$ to take account of transboundary pollution (e.g., Copeland and Taylor, 1994, 2003; Ono, 1998; Chao and Yu, 1999; Naito, 2003; Takarada, 2005; Schweinberger and Woodland, 2008; Qiu and Yu, 2009; Abe, *et al*. 2012; Suhardiman and Giordano, 2012). The functions are possibly related to many factors, such as distances between countries and wind directions. We will specify these functions when simulating the model.

Consumer behaviors

We model household behaviour on the basis of the approach proposed by Zhang (1993). This study introduces taxation on wealth income, consumption and wage income (e.g., Rapanos, 1992, 1995). Consumers make decisions on choice of consumption levels of goods as well as on how much to save. Let $\bar{k}_j(t)$ stand for per capita wealth of country j. We have $\bar{k}_j(t) = \bar{K}_j(t)/N_j(t),$ where $K(t)$ is the total wealth held by country

j. We use $\tau_{jk}(t)$ and $\tau_{jw}(t)$ to respectively stand for the tax rates on the wealth income and wage income. Per capita current income from the interest payment $r(t)\bar{k}_j(t)$, and the wage payment $w_j(t)$, is

$$y_j(t) = \bar{\tau}_{jk}(t)r(t)\bar{k}_j(t) + \bar{\tau}_{jw}(t)w_j(t),$$

where $\bar{\tau}_{jk}(t) \equiv 1 - \tau_{jk}(t)$ and $\bar{\tau}_{jw}(t) \equiv 1 - \tau_{jw}(t)$. The per capita disposable income is the sum of the current disposable income and the value of wealth. That is

$$\hat{y}_j(t) = y_j(t) + \bar{k}_j(t). \quad (7)$$

At each point in time,a consumer would distribute the total available budget between saving $s_j(t)$ and consumption $c_j(t)$. The budget constraint is given by

$$\left(1 + \tau_{jc}(t)\right)p_j(t)c_j(t) + s_j(t) = \hat{y}_j(t), \quad (8)$$

where $\tau_{jc}(t)$ is the tax rate on consumption (e.g., Bovenberg *et al*., 2008). The consumers choose two variables, $s_j(t)$ and $c_j(t)$, to maximize the following utility functions

$$U_j(t) = \Gamma_j\left(E_j(t), t\right)c_j^{\xi_{0j}(t)}(t)s_j^{\lambda_{0j}(t)}, \quad \xi_{0j}(t), \lambda_{0j}(t) > 0, \quad (9)$$

where $\Gamma_j\left(E_j(t), t\right)$ is a function related to the environment (e.g., Selden and Song, 1995; Balcao, 2001; and Nakada, 2004), $\xi_{0j}(t)$ is the propensity to consume and $\lambda_{0j}(t)$ the propensity to own wealth. The household maximizes $U_j(t)$ subject to the budget constraint (8). The marginal conditions are

$$p_j(t)c_j(t) = \xi_j(t)\hat{y}_j(t), \quad s_j(t) = \lambda_j(t)\hat{y}_j(t), \quad (10)$$

where:

$$\xi_j(t) \equiv \frac{\rho_j(t)\xi_{0j}(t)}{1 + \tau_{jc}(t)}, \quad \lambda_j(t) \equiv \rho_j(t)\lambda_{0j}(t), \quad \rho_j(t) \equiv \frac{1}{\xi_{0j}(t) + \lambda_{0j}(t)}.$$

We now find dynamics of capital accumulation. According to the definition of $s_j(t)$ the change in the household's wealth is given by:

$$\dot{\bar{k}}_j(t) = s_j(t) - \bar{k}_j(t) - \frac{\dot{N}_j(t)\bar{k}_j(t)}{N_j(t)}. \quad (11)$$

The equation simply states that the change in wealth is equal to saving minus dissaving.

The capital and labour employed by the environment sector

In this study all the tax incomes are spent on the environmental sector. The government's tax income consists of the tax incomes on the production sector, consumption, wage income and wealth income as follows

$$Y_{je}(t)=\tau_{ji}(t)F_{ji}(t)+\tau_{js}(t)F_{js}(t)+\tau_{jc}(t)c_j(t)N_j(t)+\tau_{jw}(t)w_j(t)N_j(t)+\tau_{jk}(t)r(t)\bar{k}_j(t)N_j(t). \quad (12)$$

As there are only two input factors in the environmental sector, the environment sector's budget is

$$\left(r(t)+\delta_{jk}(t)\right)K_{je}(t)+w_j(t)N_{je}(t)=Y_{je}(t). \quad (13)$$

It is assumed that the environment sector employs the labour force and capital stocks for purifying environment in such a way that the purification rate achieves its maximum under the given budget constraint. The environmental sector's behaviour is described by:

$$\underset{\{K_{je}(t),\ N_{je}(t)\}}{\text{Max}} F_e(t) \quad \text{s.t.:} \quad (13)$$

The marginal conditions are: $\left(r(t)+\delta_{jk}(t)\right)K_{je}(t)=\alpha_{je}(t)Y_{je}(t),\ \ w_j(t)N_{je}(t)=\beta_{je}(t)Y_{je}(t), \quad (14)$

where $\alpha_{je}(t)\equiv\dfrac{\tilde{\alpha}_{je}(t)}{\tilde{\alpha}_{je}(t)+\tilde{\beta}_{je}(t)},\ \ \beta_{je}(t)\equiv\dfrac{\tilde{\beta}_{je}(t)}{\tilde{\alpha}_{je}(t)+\tilde{\beta}_{je}(t)}.$

Demand and supply

The demand and supply equilibrium for the consumer goods sector is.

$$c_j(t)N_j(t)=F_{js}(t),\ \ j=1,\ldots,J. \quad (15)$$

We use $K(t)$ to stand for the capital stocks of the world economy. The total capital stock employed by country j, $K_j(t)$, is allocated between the three sectors. Let $\bar{K}_j(t)$ stand for the wealth owned by country j. The assumption of full employment of labour and capital implies:

$$K_{ji}(t)+K_{js}(t)+K_{je}(t)=K_j(t),\ N_{ji}(t)+N_{js}(t)+N_{je}(t)=N_j(t). \quad (16)$$

The total capital stocks employed by the world is equal to the wealth owned by the world. That is:

$$K(t)=\sum_{j=1}^{J}K_j(t)\ =\sum_{j=1}^{J}\bar{k}_j(t)N_j(t). \quad (17)$$

The world production is equal to the world net savings. That is:

$$S(t)-K(t)+\sum_{j=1}^{J}\delta_{jk}(t)K_j(t)=F(t), \quad (18)$$

where: $S(t)\equiv\sum_{j=1}^{J}s_j(t)N_j,\ \ F(t)\equiv\sum_{j=1}^{J}F_j(t).$

The trade balances of the economies are given by:

$$B_j(t)=\left(\bar{K}_j(t)-K_j(t)\right)r(t). \quad (19)$$

When $B_j(t)$ is positive (negative), we say that country j is in trade surplus (deficit). When $B_j(t)$ is zero, country $j's$ trade is in balance.

We built the model. The model is structurally general in the sense that some well-known models in economics can be considered as its special cases. For instance, if the population is homogeneous and environment is constant, our model is structurally similar to the neoclassical growth model by Solow (1956) and Uzawa (1961). Our model is also structurally similar to the Oniki-Uzawa trade model (Oniki and Uzawa, 1965). The model is the same as Zhang (2014) if all the parameters are time-independent. As mentioned before, our approach is also based on some growth models in the literature of environmental economics.

3. The dynamics of the multi-country economy

In order to simulate the model, we now provide a computational procedure for calculating all the variables at any point in time. Before stating the lemma, we introduce new variables $z_j(t)$ by:

$$z_j(t) \equiv \frac{r(t) + \delta_{kj}(t)}{w_j(t)}, \quad j = 1, ..., J.$$

Lemma

The dynamics of the world economy is governed by the following $2J$ dimensional differential equations system with $z_1(t)$, $\{\bar{k}_j(t)\}$, and $(E_j(t))$, where $\{\bar{k}_j(t)\} \equiv (\bar{k}_2(t), \cdots, \bar{k}_J(t))$ and $(E_j(t)) \equiv (E_1(t), \cdots, E_J(t))$, as the variables:

$$\begin{aligned}
&\dot{z}_1(t) = \Phi_1(z_1(t), (E_j(t)), \{\bar{k}_j(t)\}, t),\\
&\dot{\bar{k}}_j(t) = \Phi_j(z_1(t), (E_j(t)), \{\bar{k}_j(t)\}, t), \quad j = 2, ..., J,\\
&\dot{E}_j(t) = \Omega_j(z_1(t), (E_j(t)), \{\bar{k}_j(t)\}, t), \quad j = 2, ..., J,
\end{aligned} \tag{20}$$

in which Φ_j and Ω_j are unique functions of $z_1(t)$, $\{\bar{k}_j(t)\}$, $(E_j(t))$, and t, defined in Appendix. For any given positive values of $z_1(t)$, $\{\bar{k}_j(t)\}$, and $(E_j(t))$, at any point of time, the other variables are uniquely determined by the following procedure: $r(t)$ and $w_j(t)$ by (A2) $\rightarrow$ $p_j(t)$ by (A4) $\rightarrow$ $\bar{k}_1(t)$ by (A19) $\rightarrow$ $K_j(t)$ by (A17) $\rightarrow$ $N_{ji}(t)$ and $N_{je}(t)$ by (A11) $\rightarrow$ $N_{js}(t)$ by (A7) $\rightarrow$ $K_{je}(t)$, $K_{js}(t)$, and $K_{ji}(t)$ by (A1) $\rightarrow$ $\hat{y}_j(t)$ by (A5) $\rightarrow$ $F_{ji}(t)$, $F_{js}(t)$ and $F_{je}(t)$ by the definitions $\rightarrow$ $c_j(t)$ and $s_j(t)$ by (10) $\rightarrow$ $Y_{je}(t) = w_j(t)N_{je}(t)/\beta_{je} \rightarrow$ $K(t) = \sum_j \bar{k}_j(t)N_j \rightarrow \bar{K}_j(t) = \bar{k}_j(t)N_j \rightarrow B_j(t) = (\bar{K}_j(t) - K_j(t))r(t) \rightarrow U_j(t)$ by the definitions.

The lemma provides a computational procedure for illustrating the motion of the economic system with any number of countries. We now simulate the model for a 3 - country economy. We specify the functions dependent on environmental quality as follows:

$$\Gamma_{jm}(E_j(t)) = E_j^{-b_{jm}}(t), \quad \Gamma_j(E_j(t)) = E_j^{-b_j}(t), \quad j = 1, 2, 3, \quad m = i, s, e.$$

We require $b_{ji}(t), b_{js}(t), b_j(t) \geq 0$ and $b_{je}(t) \leq 0$. The transboundary pollution functions are specified as:

$$\Omega_q((E_q(t))) = \sum_{j,\ j \neq q}^{J} \theta_{jq}(t)E_j(t).$$

It is reasonable to require $\theta_{jq}(t) \geq 0$. The transboundary pollution functions imply that a country may be polluted by other countries and the speed is linearly related to the pollutant levels of these countries. We are first

concerned with the case that all the parameters are time-independent. As in Zhang (2014), we specify the parameters as follows:

$$\begin{pmatrix} N_1 \\ N_2 \\ N_3 \end{pmatrix} = \begin{pmatrix} 3 \\ 10 \\ 30 \end{pmatrix}, \begin{pmatrix} A_{1i} \\ A_{2i} \\ A_{3i} \end{pmatrix} = \begin{pmatrix} 1.7 \\ 1 \\ 0.8 \end{pmatrix}, \begin{pmatrix} A_{1s} \\ A_{2s} \\ A_{3s} \end{pmatrix} = \begin{pmatrix} 1.5 \\ 0.9 \\ 0.7 \end{pmatrix}, \begin{pmatrix} A_{1e} \\ A_{2e} \\ A_{3e} \end{pmatrix} = \begin{pmatrix} 1.2 \\ 1 \\ 0.9 \end{pmatrix}, \begin{pmatrix} \alpha_{1i} \\ \alpha_{2i} \\ \alpha_{3i} \end{pmatrix} = \begin{pmatrix} 0.31 \\ 0.31 \\ 0.31 \end{pmatrix}, \begin{pmatrix} \alpha_{1s} \\ \alpha_{2s} \\ \alpha_{3s} \end{pmatrix} = \begin{pmatrix} 0.33 \\ 0.33 \\ 0.33 \end{pmatrix},$$

$$\begin{pmatrix} \lambda_{10} \\ \lambda_{20} \\ \lambda_{30} \end{pmatrix} = \begin{pmatrix} 0.6 \\ 0.55 \\ 0.5 \end{pmatrix}, \begin{pmatrix} b_{1i} \\ b_{2i} \\ b_{3i} \end{pmatrix} = \begin{pmatrix} b_{1s} \\ b_{2s} \\ b_{3s} \end{pmatrix} = \begin{pmatrix} b_{1e} \\ b_{2e} \\ b_{3e} \end{pmatrix} = \begin{pmatrix} 0.1 \\ 0.02 \\ 0.01 \end{pmatrix}, \begin{pmatrix} \bar{\theta}_1 \\ \bar{\theta}_2 \\ \bar{\theta}_3 \end{pmatrix} = \begin{pmatrix} 0.08 \\ 0.12 \\ 0.11 \end{pmatrix}, \begin{pmatrix} \tau_{1k} \\ \tau_{2k} \\ \tau_{3k} \end{pmatrix} = \begin{pmatrix} \tau_{1w} \\ \tau_{2k} \\ \tau_{3k} \end{pmatrix} = \begin{pmatrix} 0.01 \\ 0.02 \\ 0.02 \end{pmatrix},$$

$$\begin{pmatrix} \xi_{02} \\ \tau_{jc} \\ \tau_{ji} \end{pmatrix} = \begin{pmatrix} 0.2 \\ 0.01 \\ 0.01 \end{pmatrix}, \begin{pmatrix} \tau_{js} \\ \tilde{\alpha}_{je} \\ \tilde{\beta}_{je} \end{pmatrix} = \begin{pmatrix} 0.1 \\ 0.4 \\ 0.2 \end{pmatrix}, \begin{pmatrix} b_j \\ \theta_{ji} \\ \theta_j \end{pmatrix} = \begin{pmatrix} 0.01 \\ 0.08 \\ 0.03 \end{pmatrix}, \begin{pmatrix} \delta_{1k} \\ \delta_{2k} \\ \delta_{3k} \end{pmatrix} = \begin{pmatrix} 0.05 \\ 0.04 \\ 0.04 \end{pmatrix},$$

$$\theta_{jq} = 0.01, \quad j \neq q, \quad j, q = 1, 2, 3. \tag{21}$$

Country 1, 2 and $3's$ populations are respectively 3, 10 and 30. Country 3 has the largest population. Country 1, 2 and $3's$ total productivities of the capital goods sectors, A_{ji}, are respectively 1.7, 1 and 0.8. Country 1, 2 and $3's$ total productivities of the consumer goods sectors, A_{js}, are respectively 1.5, 0.9, and 0.7. Country 1, 2 and 3` total productivities of the environmental sector, A_{je}, are respectively 1.2, 1, and 0.9. Country 1 has highest total productivity; country 2 next and country 3 lowest. We call the three countries respectively as developed, industrializing, and underdeveloped economies (DE, IE, UE). We specify the values of the parameters, α_{ji}, in the Cobb-Douglas productions approximately 0.3. We require the tax rates low. We take on the following initial conditions:

$$z_1(0) = 0.12, \quad \bar{k}_2(0) = 3, \quad \bar{k}_3(0) = 2.3, \quad E_1(0) = 10, \quad E_2(0) = 9.5, \quad E_3(0) = 53.$$

Following Zhang (2014) we plot the motion of the variables is in Figure 1. In Figure 1, the global output is

$$Y(t) = \sum_j \{F_{ji}(t) + p_j(t) F_{js}(t)\}.$$

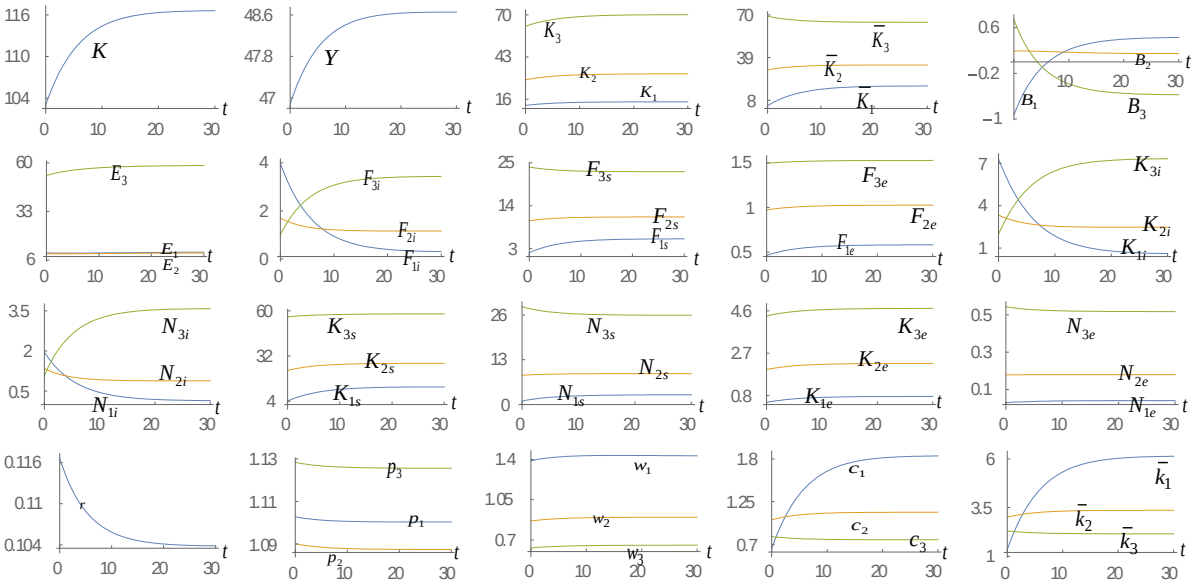


Figure 1. The Motion of the economic system

Zhang (2014) identifies the following equilibrium point.

$$K = 116.6,\ Y = 48.64,\ r = 0.104,$$

$$\begin{pmatrix} E_1 \\ E_2 \\ E_3 \end{pmatrix} = \begin{pmatrix} 10.59 \\ 10.05 \\ 58.66 \end{pmatrix}, \begin{pmatrix} B_1 \\ B_2 \\ B_3 \end{pmatrix} = \begin{pmatrix} 0.43 \\ 0.15 \\ -0.58 \end{pmatrix}, \begin{pmatrix} Y_{1e} \\ Y_{2e} \\ Y_{3e} \end{pmatrix} = \begin{pmatrix} 0.18 \\ 0.48 \\ 1.02 \end{pmatrix}, \begin{pmatrix} p_1 \\ p_2 \\ p_3 \end{pmatrix} = \begin{pmatrix} 1.10 \\ 1.09 \\ 1.13 \end{pmatrix}, \begin{pmatrix} w_1 \\ w_2 \\ w_3 \end{pmatrix} = \begin{pmatrix} 1.43 \\ 0.90 \\ 0.66 \end{pmatrix}, \begin{pmatrix} F_{1i} \\ F_{2i} \\ F_{3i} \end{pmatrix} = \begin{pmatrix} 0.29 \\ 1.16 \\ 3.44 \end{pmatrix},$$

$$\begin{pmatrix} F_{1s} \\ F_{2s} \\ F_{3s} \end{pmatrix} = \begin{pmatrix} 5.52 \\ 11.13 \\ 22.72 \end{pmatrix}, \begin{pmatrix} F_{1e} \\ F_{2e} \\ F_{3e} \end{pmatrix} = \begin{pmatrix} 0.58 \\ 1.03 \\ 1.53 \end{pmatrix}, \begin{pmatrix} N_{1i} \\ N_{2i} \\ N_{3i} \end{pmatrix} = \begin{pmatrix} 0.14 \\ 0.88 \\ 3.59 \end{pmatrix}, \begin{pmatrix} N_{1s} \\ N_{2s} \\ N_{3s} \end{pmatrix} = \begin{pmatrix} 2.82 \\ 8.94 \\ 25.90 \end{pmatrix}, \begin{pmatrix} N_{1e} \\ N_{2e} \\ N_{3e} \end{pmatrix} = \begin{pmatrix} 0.04 \\ 0.18 \\ 0.52 \end{pmatrix}, \begin{pmatrix} K_{1i} \\ K_{2i} \\ K_{3i} \end{pmatrix} = \begin{pmatrix} 0.58 \\ 2.48 \\ 7.34 \end{pmatrix},$$

$$\begin{pmatrix} K_{1s} \\ K_{2s} \\ K_{3s} \end{pmatrix} = \begin{pmatrix} 12.89 \\ 27.48 \\ 58.09 \end{pmatrix}, \begin{pmatrix} K_{1e} \\ K_{2e} \\ K_{3e} \end{pmatrix} = \begin{pmatrix} 0.76 \\ 2.24 \\ 4.71 \end{pmatrix}, \begin{pmatrix} \bar{k}_1 \\ \bar{k}_2 \\ \bar{k}_3 \end{pmatrix} = \begin{pmatrix} 6.13 \\ 3.36 \\ 2.15 \end{pmatrix}, \begin{pmatrix} \hat{y}_1 \\ \hat{y}_2 \\ \hat{y}_3 \end{pmatrix} = \begin{pmatrix} 8.18 \\ 4.58 \\ 3.01 \end{pmatrix}, \begin{pmatrix} c_1 \\ c_2 \\ c_3 \end{pmatrix} = \begin{pmatrix} 1.84 \\ 1.11 \\ 0.76 \end{pmatrix}, \begin{pmatrix} U_1 \\ U_2 \\ U_3 \end{pmatrix} = \begin{pmatrix} 3.28 \\ 1.94 \\ 1.33 \end{pmatrix}.$$

The six eigen values at the equilibrium point are:

$$-0.21,\ -0.19,\ -0.17,\ -0.13,\ -0.11,\ -0.08.$$

The equilibrium point is stable. This conclusion is important as it guarantees that we can effectively carry out comparative dynamic analysis.

4. Comparative dynamic analysis

We now study effects of changes in some parameters on the motion of the economic system. Zhang (2014) shows how the system reacts to a once-for-all change in parameters. This section shows how the system reacts to time-dependent changes in parameters. For convenience we consider the parameters in (21) as the long-term average values. We make small perturbations around these long-term values.

The tax rate on the capital goods sector being increased in the DE

We first study the case when the environmental tax rate on the capital goods sector in the developed economy is fluctuated increased as follows

$$\tau_{1i}(t) = 0.01 + 0.01\sin(t).$$

The simulation result is plotted in Figure 2. The global total product and global wealth are oscillatory due to the DE's fluctuations. The trade patterns are fluctuated. The exogenous shocks also cause fluctuations in the DE's wage rate and price and rate of interest in the global economy. There are structural changes in the DE. The variables in the other two economies are slightly affected.

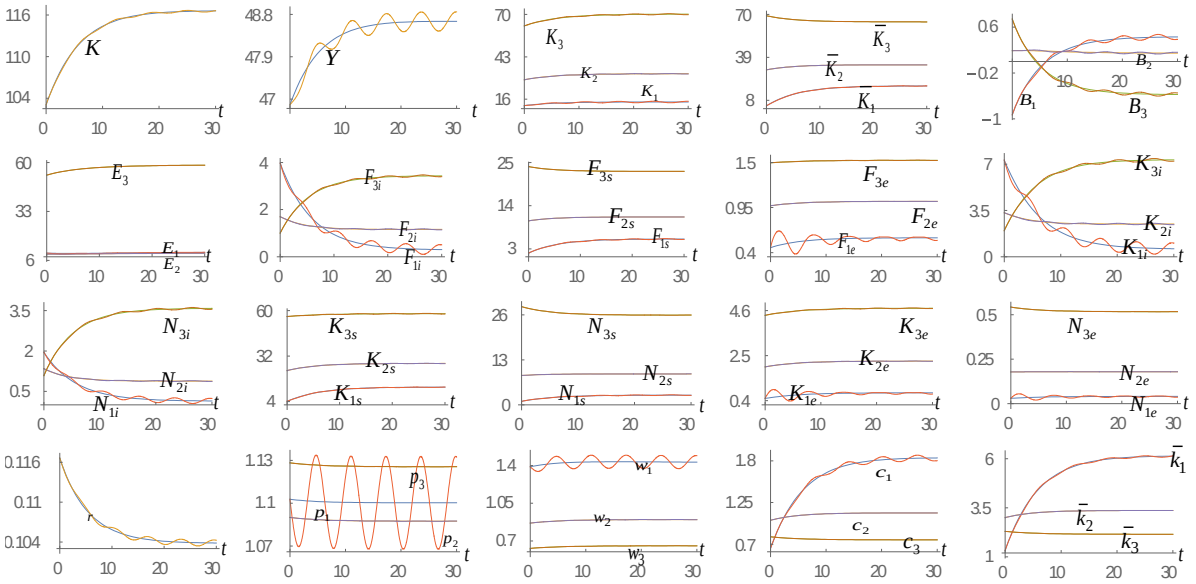


Figure 2. Fluctuations in the tax rate on the capital goods sector in the DE

Fluctuations the DE's total factor productivity of the capital goods sector

We now study what happens in the global economy if the DE's total factor productivity of the capital goods sector fluctuates as follows:

$$A_{1i}(t) = 1.7 + 0.1\sin(t).$$

The simulation result is plotted in Figure 3. The fluctuations affect the global market. Not only the economic structure in the DE but also the economic structures in the other two economies are affected. The global economic product fluctuates violently around its long-term trend value. It can be seen that by the end of the simulation period the output of the DE's capital goods sector is oscillating near zero. The trade patterns between the three economies also experience oscillations. The rate of interest and wage rate and price in the DE fluctuate greatly.

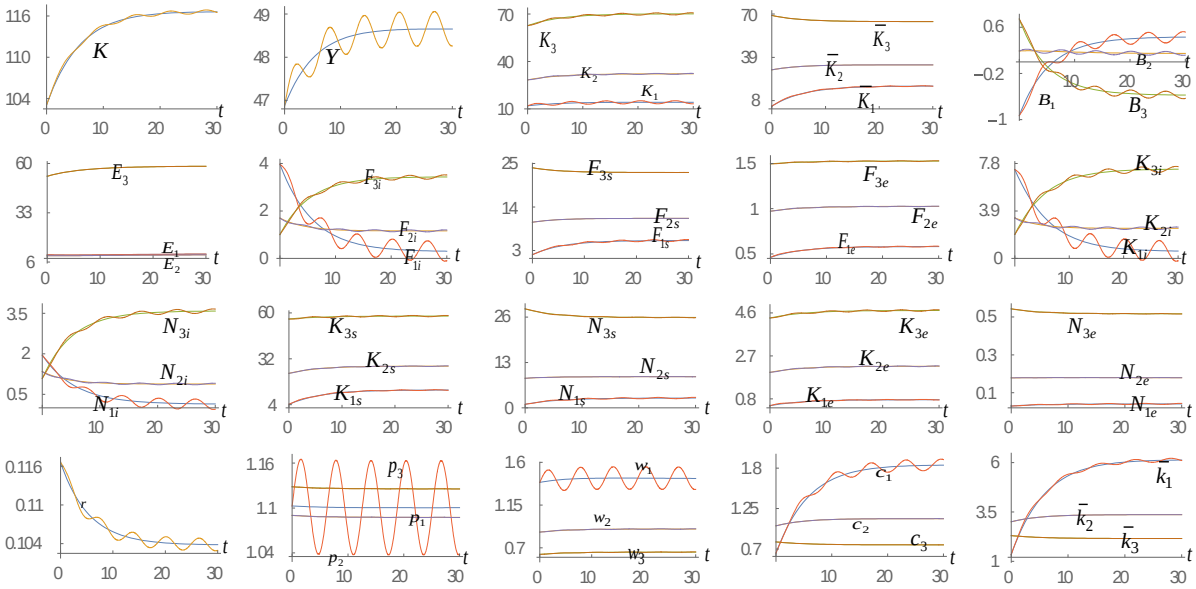


Figure 3. Fluctuations the DE's Total Factor Productivity of the Capital Goods Sector

Fluctuations in the output elasticity of the DE's capital goods sector

We now study what happens in the global economy if the output elasticity of the DE's capital goods sector experiences the following fluctuations

$$\alpha_{1i}(t) = 0.3 + 0.03\sin(t).$$

The simulation result is plotted in Figure 4. The global market is affected by the fluctuations. The economic structures in the three national economies are affected. Similar to the fluctuations in the DE's total factor productivity the global economic product fluctuates violently around its long-term trend value. By the end of the simulation period the output of the DE's capital goods sector is oscillating near zero. The trade patterns between the three economies also experience oscillations. The rate of interest and wage rate and price in the DE fluctuate greatly.

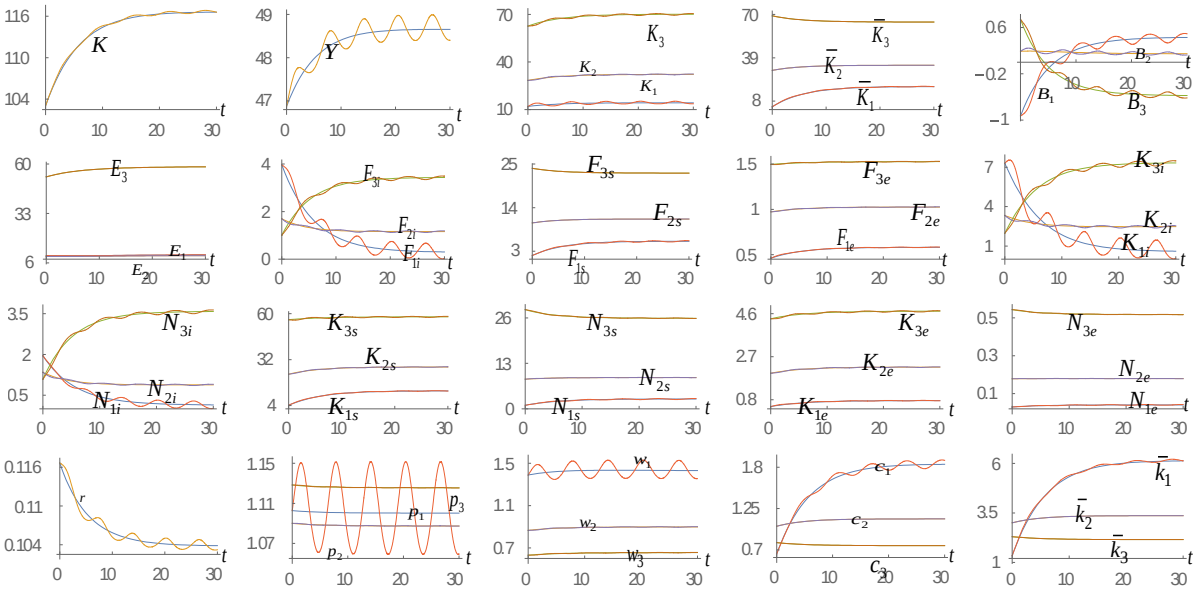


Figure 4. Fluctuations in the output elasticity of the DE's capital goods sector

Fluctuations in the IE's propensity to save

We now examine effects of fluctuations in the IE's propensity to save as follows

$$\lambda_{02}(t) = 0.55 + 0.05\sin(t).$$

The simulation result is plotted in Figure 5. The global wealth and global total output are oscillatory. The amplitudes of the economic oscillations tend to be enlarged as the time passes. The IE experiences economic cycles in the real variables, even though the price of consumer goods and wage rate in the IE are slightly affected. We note that the IE's wealth per capita is slightly oscillatory in comparison with the amplitudes of oscillations in the consumption level of consumer goods.

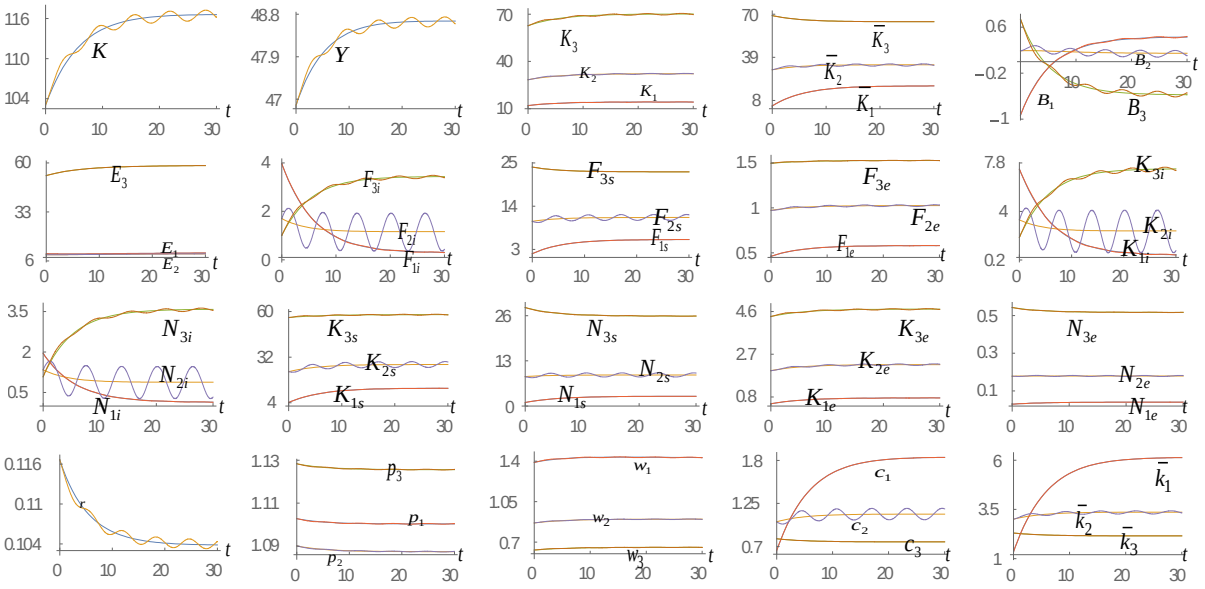


Figure 5. Fluctuations in the IE's propensity to save

Fluctuations in the UE's population

We now examine effects of fluctuations in the UE's population as follows:

$$N_3(t) = 30 + 2\sin(t).$$

The simulation results are plotted in Figure 6. The global wealth and global total output are oscillatory in tandem with fluctuations in the population. The output and inputs of the capital goods sectors in the three economies experience fluctuations. The wages are also oscillator in the three economies. The trade patterns between the three economies fluctuate.

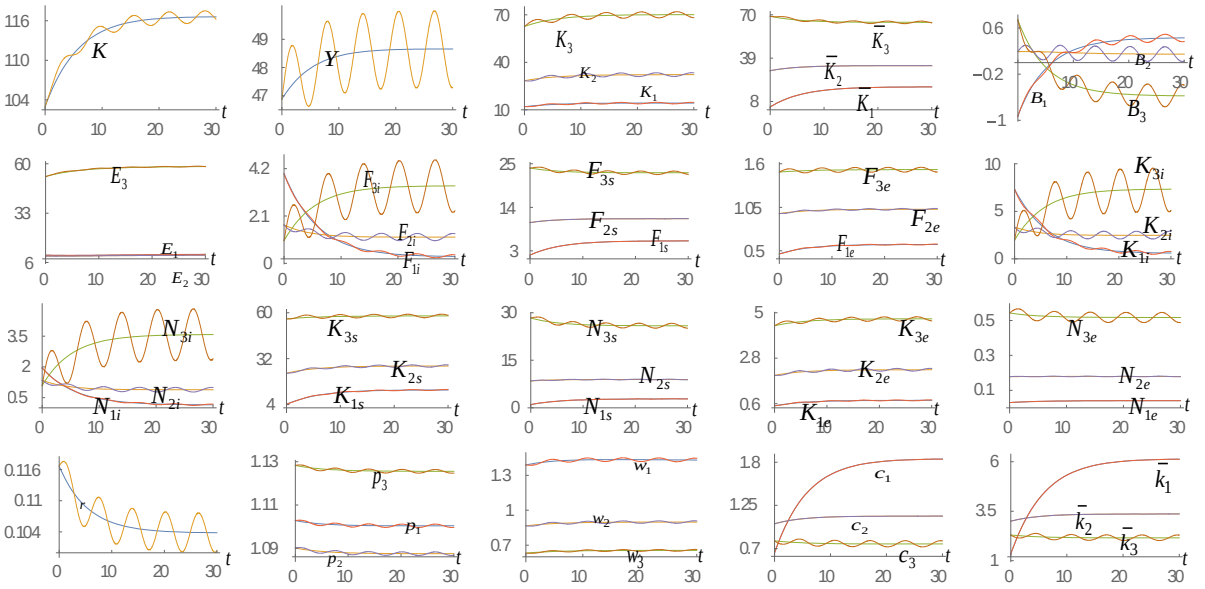


Figure 6. Fluctuations in the UE's population

Fluctuations in pollution impact on the UE's productivity of the capital goods sector

We now examine effects of fluctuations in pollution impact on the UE's productivity of the capital goods sector as follows:

$$b_{3i}(t) = 0.01 + 0.01\sin(t).$$

The simulation results are plotted in Figure 7. The global wealth and global total output are oscillatory. The amplitude of the total output's oscillations is larger than that of the global wealth. The output and inputs of the capital goods sectors in the three economies experience fluctuations. The wages are also oscillator in the three economies. The trade patterns between the three economies fluctuate.

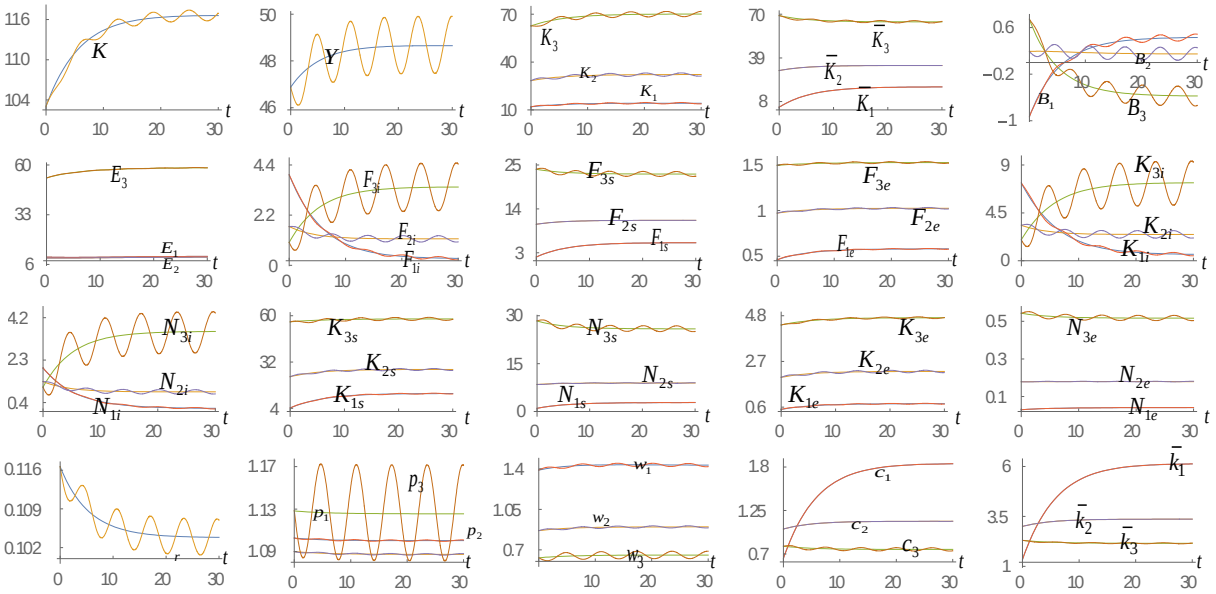


Figure 7. Fluctuations in pollution impact on the UE's productivity of the capital goods sector

Conclusion

This study shows economic oscillations due to periodic changes in some parameters in the economic model proposed by Zhang (2014). Zhang's model dealt with a multi-country economy with endogenous physical capital and wealth accumulation and environmental change. It analyzed not only inequalities in income, wealth and economic structures among countries, but also differences in environmental changes between countries. International exchanges are not only economically, but also environmentally. The study emphasized interdependence among growth, environmental change, and trade patterns. The main different of this model from Zhang's model is that all the time-independent parameters are considered time-dependent. We are interested in time-dependent shocks on the evolution of the economic system. The dynamics of J - country world economy is controlled by $2J$ differential equations.

We also simulated the motion of the model with three countries and carried out comparative dynamic analysis with regard to different time-dependent shocks. We can comprehensively discuss many important issues related to growth and environmental change in a unique manner because our analytical framework contains not only the economic mechanisms for analyzing these issues, but also because we provided the computational procedure to follow the motion of the nonlinear dynamic system. We showed that that in association with different fluctuations in parameters, different economies experience different oscillations. We may extend and generalize the model in different directions. One-sector growth model has been generalized and extended in many directions. There are also different economic models with environmental changes. We may further develop our model along these lines. It is also important to further analyze behavior of the model with other forms of production or utility functions. Another important extension of the paper is to introduce international negotiations about pollution control.

Acknowledgements

The author is grateful for the financial support from the Grants-in-Aid for Scientific Research (C), Project No. 25380246, Japan Society for the Promotion of Science.

References

[1] Abe, K., Sugiyama, Y., Kiyono, K. 2012. International Transfer, Environmental Policy, and Welfare. *The Japanese Economic Review*, 63(2): 204-15, doi: 10.1111/j.1468-5876.2012.00574.

[2] Azariadis, C. 1993. *Intertemporal Macroeconomics.* Oxford: Blackwell.

[3] Balcao, A. 2001. Endogenous Growth and the Possibility of Eliminating Pollution. *Journal of Environmental Economics and Management*, 42(3): 360-73.

[4] Barro, R.J., Sala-i-Martin, X. 1995. *Economic Growth.* New York: McGraw-Hill, Inc.

[5] Bold, E.W., Trask, K., Wang, P. 2003. Factor Accumulation and Trade: Dynamic Comparative Advantage with Endogenous Physical and Human Capital. *International Economic Review*, 44(3): 1041-60.

[6] Bovenberg, A.L., Goulder, L.H., Jacobsen, M.R. 2008. Costs of Alternative Environmental Policy Instruments in the Presence of Industry Compensation Requirements. Journal of Public Economics, 92(5-6): 1236-53. doi:10.1016/j.jpubeco.2007.09.013.

[7] Bravo, G., Marelli, B. 2007. Micro-foundations of the Environmental Kuznets Curve Hypothesis: An Empirical Analysis. *International Journal of Innovation & Sustainable Development*, 2(1): 36–62. DOI: 10.1504/IJISD.2007.016057.

[8] Brecher, R.A., Chen, Z.Q., Choudhri, E.U. 2002. Absolute and Comparative Advantage, Reconsidered: The Pattern of International Trade with Optimal Saving. *Review of International Economics*, 10(4): 645-656, DOI: 10.1111/1467-9396.t01-1-00355.

[9] Burmeister, E., Dobell, A.R. 1970. *Mathematical Theories of Economic Growth*. London: Collier Macmillan Publishers.

[10] Chao, C.C., Yu. E. 1999. Foreign Aid, the Environment, and Welfare. *Journal of Development Economics*, 59(2): 553–64, doi:10.1016/S0304-3878(99)00025-5.

[11] Chatterjee, B.S., Ravikumar, B. 1992. A Neoclassical Model of Seasonal Fluctuations.*Journal of Monetary Economics*, 29 (1): 59–86, doi:10.1016/0304-3932(92)90023-U.

[12] Copeland, B.R., Taylor, M.S. 1994. North–South Trade and the Environment. *Quarterly Journal of Economics*, 109(3): 755–787.

[13] Copeland, B.R., Taylor, M.S. 2003. *Trade and the Environment*. Princeton: Princeton University Press.

[14] Deardorff, A.V., Hanson, J.A. 1978. Accumulation and a Long-Run Heckscher-Ohlin Theorem. *Economic Inquiry*, 16(2): 288-92, DOI: 10.1111/j.1465-7295.1978.tb00288.

[15] Dinda, S. 2005. A Theoretical Basis for the Environmental Kuznets Curve: Turning Point and Public Policy. *Environmental and Resource Economics*, 36(4): 15-34, doi:10.1016/j.ecolecon.2004.02.011.

[16] Forster, B.A. 1973. Optimal Consumption Planning in a Polluted Environment. *Economic Record*, 49(4), 534-45, DOI: 10.1111/j.1475-4932.1973.tb01954.

[17] Gabaix, X. 2011. The Granular Origins of Aggregate Fluctuations. *Econometrica*, 79(3): 733–72.

[18] Giovanni, J. Di., Levchenko, A., Mejean, I. 2014. Firms, Destinations, and Aggregate Fluctuations. *Econometrica*, 82 (4): 1303–40.

[19] Gassebner, M., Lamlay, M.J., Sturmz, J.E. 2011. Determinants of Pollution: What Do We Really Know? *Oxford Economic Papers*, 63(Nov.), 568-95, doi: 10.1093/oep/gpq029.

[20] Grossman, G.M., Helpman, E. 1991. *Innovation and Growth in the Global Economy*. Cambridge, Mass.: The MIT Press.

[21] Ikeda, S., Ono, Y. 1992. Macroeconomic Dynamics in a Multi-Country Economy - A Dynamic Optimization Approach. *International Economic Review*, 33(3), 629-44:DOI: 10.2307/2527130.

[22] Jensen, B.S., Wong, K.Y. (Eds.). 1998. *Dynamics, Economic Growth, and International Trade*. Ann Arbor: The University of Michigan Press.

[23] John, A., Pecchenino, R. 1994. An Overlapping Generation Model of Growth and the Environment. *The Economic Journal*, 104(427): 1393-410, DOI: 10.2307/2235455.

[24] Kemp, M.C. 1961. Foreign Investment and National Advantage. *Economic Record*, 28(81): 56-62, DOI: 10.1111/j.1475-4932.1962.tb01416.

[25] Lamla, M.J. 2009. Long-run Determinants of Pollution: A Robustness Analysis. *Ecological Economics*, 69(1): 135-44, doi:10.1016/j.ecolecon.2009.08.002.

[26] Lin, C.Y.C., Liscow, Z.D. 2012. Endogeneity in the Environmental Kuznets Curve: An Instrumental Variables Approach. *American Journal of Agricultural Economics*, 95(2): 268-74, DOI: 10.1093/ajae/aas050.

[27] Lucas, R.E. 1977. Understanding Business Cycles. *Carnegie-Rochester Conference Series on Public Policy*, 5: 7-29, DOI:10.1016/0167-2231(77)90002-1.

[28] MacDougall, G.D.A. 1960. The Benefits and Costs of Private Investment from Abroad: A Theoretical Approach. *Economic Record*, 27(73): 13-15,DOI: 10.1111/j.1475-4932.1960.tb00491

[29] Nakada, M. 2004. Does Environmental Policy Necessarily Discourage Growth? *Journal of Economics*, 81(3): 249-68, DOI 10.1007/s00712-002-0609-y.

[30] Naito, T. 2003. Pareto-Improving Untied Aid with Environmental Externalities. *Journal of Economics*, 80(2): 161–69, DOI 10.1007/s00712-003-0005-2.

[31] Nishimura, K., Shimomura, K. 2002. Trade and Indeterminacy in a Dynamic General Equilibrium Model. *Journal of Economic Theory*, 105, 244-260, DOI: 10.1007/978-3-642-22397-6.

[32] Obstfeld, M., Rogoff, K. 1998. *Foundations of International Macroeconomics*. Mass., Cambridge: MIT Press.

[33] Oniki, H., Uzawa, H. 1965. Patterns of Trade and Investment in a Dynamic Model of International Trade. *Review of Economic Studies*, 32(1): 15-38.

[34] Ono, T. 1998. Consumption Externalities and the Effects of International Income Transfer on the Global Environment. *Journal of Economics*, 68(3): 255–269, DOI: 10.1007/BF01237195.

[35] Ono, Y. and Shibata, A. 2005. Fiscal Spending, Relative-price Dynamics, and Welfare in a World Economy. Review of International Economics, 13(2): 216-36, DOI: 10.1111/j.1467-9396.2005.00500.

[36] Plouder, G.C. 1972. A Model of Waste Accumulation andDisposal. *Canadian Journal of Economics,* 5(1): 119-25, DOI: 10.2307/133997.

[37] Prieur, F. 2009. The Environmental Kuznets Curve in a World of Irreversibility. *Economic Theory*, 40(1): 57-90, DOI: 10.1007/s00199-008-0351-y.

[38] Rapanos, V.T. 1992. A Note on Externalities and Taxation. *Canadian Journal of Economics*, 25(1): 226-32.

[39] Rapanos, V.T. 1995. The Effects of Environmental Taxes in Income Distribution. *European Journal of Political Economy*, 11(3): 487-501.

[40] Schweinberger, A. G., Woodland, A. D. 2008. The Short and Long Run Effects of Tied Foreign aid on Pollution Abatement, Pollution and Employment: A Pilot Model.*Journal of Environmental Economics and Management* 55 (3): 310–325.

[41] Selden, T.M., Song, D. 1995. Neoclassical Growth, the J Curve for Abatement and the Inverted U Curve for Pollution. *Journal of Environmental Economics and Management,* 29(2): 162-68.

[42] Solow, R. 1956. A Contribution to the Theory of Growth.*Quarterly Journal of Economics*, 70(1): 65-94.

[43] Stella, A. 2015.Firm Dynamics and the Origins of Aggregate Fluctuations. *Journal of Economic Dynamics and Control* (forthcoming).

[44] Suhardiman, D., Giordano, M. 2012. Process-focused analysis in transboundary water governance research. International environmental agreements: politics. *Law and Economics*, 12(3), 299-308, DOI:10.1007/s10784-012-9176-z.

[45] Takarada, Y. 2005. Transboundary Pollution and the Welfare Effects of Technology Transfers. *Journal of Economics*, 85(3): 251–75, DOI: 10.1007/s00712-005-0134-x.

[46] Tsurumi, T., Managi, S. 2010. Decomposition of the Environmental Kuznets Curve: Scale, Technique, and Composition Effects. *Environmental Economics and Policy Studies,* 11(1): 19-36, DOI: 10.1007/s10018-009-0159-4.

[47] Qiu, L.D., Yu, Z. 2009. Technology Transfer and the South's Participation in an International Environmental Agreement. *Review of International Economics*, 17(3): 409–27, DOI: 10.1111/j.1467-9396.2008.00804.x.

[48] Uzawa, H. 1961. On a Two-Sector Model of Economic Growth. *Review of Economic Studies*, 29(1): 47-70

[49] Wong, K.Y. 1995. *International Trade in Goods and Factor Mobility*. Mass., Cambridge: MIT Press.

[51] Zhang, W.B. 1991. *Synergetic Economics*. Springer-Verlag, Heidelberg.

[52] Zhang, W.B. 1993. Woman's Labor Participation and Economic Growth - Creativity, Knowledge Utilization and Family Preference. *Economics Letters*, 42(1): 105-10, doi:10.1016/0165-1765(93)90181-B.

[53] Zhang, W.B. 2005. *Differential Equations, Bifurcations, and Chaos in Economics*. Singapore: World Scientific.

[54] Zhang, W.B. 2006. *Discrete Dynamical Systems, Bifurcations and Chaos in Economics*. Elsevier: Amsterdam.

[55] Zhang, W.B. 2014. Global Economic Growth and Environmental Change. *SPOUDAI Journal of Economics and Business*, 64(3): 3-29.

APPENDIX

Checking the lemma

In the appendix we omit time variable in expressions except where confusion may occur. By (2), (4) and (14)

$$z_j \equiv \frac{r+\delta_k}{w_j} = \frac{N_{jm}}{\overline{\beta}_{jm} K_{jm}}, \quad j=1,...,J, \quad m=i,s,e, \tag{A1}$$

where $\overline{\beta}_{jm} \equiv \beta_{jm}/\alpha_{jm}$. Inserting (A1) in (2), we have:

$$r = \alpha_{jr}\Gamma_{ji} z_j^{\beta_{ji}} - \delta_k, \quad w_j = \alpha_j \Gamma_{ji} z_j^{-\alpha_{ji}}, \tag{A2}$$

when: $\alpha_{jr} = \alpha_{ji}\overline{\tau}_{ji}\overline{\beta}_{ji}^{\beta_{ji}} A_{ji}, \quad \alpha_j = \frac{\beta_{ji}\overline{\tau}_{ji} A_{ji}}{\overline{\beta}_{ji}^{\alpha_{ji}}}.$

From (A2) we obtain:

$$r = \alpha_{jr}\Gamma_{ji} z_j^{\beta_{ji}} - \delta_{jk} = \alpha_{1r}\Gamma_{1i} z_1^{\beta_{1i}} - \delta_{1k}, \quad j=1,....,J.$$

Solve the above equations:

$$z_j\left(z_1,\left(E_j\right)\right) = \left(\frac{\alpha_{1r}\Gamma_{1i} z_1^{\beta_{1i}} + \delta_{jk} - \delta_{1k}}{\alpha_{jr}\Gamma_{ji}}\right)^{1/\beta_{ji}}, \quad j=2,....,J. \tag{A3}$$

We determined r, w_j, and z_j, as functions of z_1 and $\left(E_j\right)$. From (3) and (4), we get

$$p_j\left(z_1,\left(E_j\right)\right) = \frac{\overline{\beta}_{js}^{\alpha_{js}} z_j^{\alpha_{js}} w_j}{\beta_{js}\overline{\tau}_{js} A_{js}\Gamma_{js}}. \tag{A4}$$

Insert (A4) in the definitions of $\hat{y}_j$

$$\hat{y}_j = \left(1+\overline{\tau}_{jk} r\right)\overline{k}_j + \overline{\tau}_{jw} w_j. \tag{A5}$$

Insert $p_j c_j = \xi_j \hat{y}_j$ in (15)

$$\xi_j N_j \hat{y}_j = p_j F_{js}. \tag{A6}$$

Substitute (A5) and $w_j N_{js} = \beta_{js}\overline{\tau}_{js} p_j F_{js}$ in (A6)

$$N_{js} = g_j \overline{k}_j + \overline{g}_j, \tag{A7}$$

where: $g_j\left(z_j,\left(E_j\right)\right) \equiv \left(\frac{1+\overline{\tau}_{jk} r}{w_j}\right)\xi_j \beta_{js}\overline{\tau}_{js} N_j, \quad \overline{g}_j \equiv \overline{\tau}_{jw}\xi_j \beta_{js}\overline{\tau}_{js} N_j.$

Insert (A1) in (16)

$$\frac{N_{ji}}{\overline{\beta}_{ji}} + \frac{N_{js}}{\overline{\beta}_{js}} + \frac{N_{je}}{\overline{\beta}_{je}} = z_j K_j. \tag{A8}$$

From (A7) in (A8) we have:

$$\frac{N_{ji}}{\overline{\beta}_{ji}} + \frac{N_{je}}{\overline{\beta}_{je}} = z_j K_j - \frac{g_j \overline{k}_j}{\overline{\beta}_{js}} - \frac{\overline{g}_j}{\overline{\beta}_{js}}. \tag{A9}$$

From (A7) and the full employment condition we have

$$N_{ji} + N_{je} = N_j - g_j \bar{k}_j - \bar{g}_j . \tag{A10}$$

Solving (A9) and (A10) with N_{ji} and N_{js} as the variables, we have

$$N_{ji} = a_{ji} + \tilde{b}_{ji} \bar{k}_j - \bar{\beta}_j z_j K_j ,$$

$$N_{je} = a_{je} + \tilde{b}_{je} \bar{k}_j + \bar{\beta}_j z_j K_j , \tag{A11}$$

where

$$a_{ji} \equiv \left(\frac{N_j - \bar{g}_j}{\bar{\beta}_{je}} + \frac{\bar{g}_j}{\bar{\beta}_{js}} \right) \bar{\beta}_j , \ \tilde{b}_{ji}\left(z, (E_j)\right) \equiv \left(\frac{1}{\bar{\beta}_{js}} - \frac{1}{\bar{\beta}_{je}} \right) \bar{\beta}_j g_j ,$$

$$a_{je} \equiv -\left(\frac{\bar{g}_j}{\bar{\beta}_{js}} + \frac{N_j - \bar{g}_j}{\bar{\beta}_{ji}} \right) \bar{\beta}_j , \ \tilde{b}_{je}\left(z, (E_j)\right) \equiv \left(\frac{1}{\bar{\beta}_{ji}} - \frac{1}{\bar{\beta}_{js}} \right) \bar{\beta}_j g_j , \ \bar{\beta}_j \equiv \left(\frac{1}{\bar{\beta}_{je}} - \frac{1}{\bar{\beta}_{ji}} \right)^{-1} .$$

Substituting (A1) into (2) and (5) yields

$$F_{ji} = \frac{A_{ji} \Gamma_{ji} N_{ji}}{\bar{\beta}_{ji}^{\alpha_{ji}} z_j^{\alpha_{ji}}} , \ F_{js} = \frac{A_{js} \Gamma_{js} N_{js}}{\bar{\beta}_s^{\alpha_s} z_j^{\alpha_{js}}} . \tag{A12}$$

Inserting (A12) in (12), we have:

$$Y_{je} = \Lambda_{ji} N_{ji} + \Lambda_{js} N_{js} + \tau_{jc} c_j N_j + \tau_{jw} w_j N_j + \tau_{jk} r \bar{k}_j N_j , \tag{A13}$$

where:

$$\Lambda_{ji}\left(z_1, (E_j)\right) \equiv \frac{\tau_{ji} A_{ji} \Gamma_{ji}}{\bar{\beta}_{ji}^{\alpha_{ji}} z_j^{\alpha_{ji}}} , \ \Lambda_{js}\left(z_1, (E_j)\right) \equiv \frac{\tau_{js} A_{js} \Gamma_{js}}{\bar{\beta}_{js}^{\alpha_{js}} z_j^{\alpha_{js}}} .$$

From $p_j c_j = \xi_j \hat{y}_j$ and (A5), we have:

$$c_j = \left(\frac{1 + \bar{\tau}_{jk} r}{p_j} \right) \xi_j \bar{k}_j + \frac{\bar{\tau}_{jw} \xi_j w_j}{p_j} . \tag{A14}$$

Substituting (A14) into (A13) yields

$$Y_{je} = \bar{\Lambda}_j + \Lambda_{ji} N_{ji} + \Lambda_{js} N_{js} + \Lambda_j \bar{k}_j , \tag{A15}$$

where:

$$\Lambda_j\left(z_1, (E_j)\right) \equiv \left(\frac{1 + \bar{\tau}_{jk} r}{p_j} \right) \xi_j \tau_{jc} N_j + \tau_{jk} r N_j , \ \bar{\Lambda}_j\left(z_1, (E_j)\right) \equiv \left(\frac{\bar{\tau}_{jw} \xi_j \tau_{jc}}{p_j} + \tau_{jw} \right) w_j N_j .$$

Insert (A15) in $w_j N_{je} = \beta_{je} Y_{je}$

$$\frac{w_j N_{je}}{\beta_{je}} = \bar{\Lambda}_j + \Lambda_{ji} N_{ji} + \Lambda_{js} N_{js} + \Lambda_j \bar{k}_j . \tag{A16}$$

Substituting (A7) and (A11) into (A16) yields

$$K_j = \bar{\Delta}_j + \Delta_j \bar{k}_j , \tag{A17}$$

where:

$$\overline{\Delta}_j\left(z_1,\left(E_j\right)\right)\equiv\left(\overline{\Lambda}_j+\Lambda_{js}\,\overline{g}_j-\frac{w_j\,a_{je}}{\beta_{je}}+a_{ji}\Lambda_{ji}\right)\left(\frac{w_j}{\beta_{je}}+\Lambda_{ji}\right)^{-1}\frac{1}{\overline{\beta}_j\,z_j},$$

$$\Delta_j\left(z_1,\left(E_j\right)\right)\equiv\left(\tilde{b}_{ji}\Lambda_{ji}+g_j\,\Lambda_{js}+\Lambda_j-\frac{w_j\,\tilde{b}_{je}}{\beta_{je}}\right)\left(\frac{w_j}{\beta_{je}}+\Lambda_{ji}\right)^{-1}\frac{1}{\overline{\beta}_j\,z_j}.$$

Insert (A17) in (17)

$$\sum_{j=1}^{J}\overline{\Delta}_j+\sum_{j=1}^{J}\Delta_j\,\bar{k}_j=\sum_{j=1}^{J}\bar{k}_j\,N_j. \tag{A18}$$

Solving (A18) with $\bar{k}_1$ as the variable we have

$$\bar{k}_1=\varphi\left(z_1,\left(E_j\right),\left\{\bar{k}_j\right\},t\right)\equiv\left(\sum_{j=1}^{J}\overline{\Delta}_j+\sum_{j=2}^{J}\left(\Delta_j-N_j\right)\bar{k}_j\right)\frac{1}{N_1-\Delta_1}, \tag{A19}$$

where $\left\{\bar{k}_j\right\}\equiv\left(\bar{k}_2,...,\bar{k}_J\right)$.

We solve all the variables as functions of z_1, $\left(E_j\right)$, and $\left\{\bar{k}_j\right\}$ by the following procedure: r and w_j by (A2) $\rightarrow$ p_j by (A4) $\rightarrow$ $\bar{k}_1$ by (A19) $\rightarrow$ K_j by (A17) $\rightarrow$ N_{ji} and N_{je} by (A11) $\rightarrow$ N_{js} by (A7) $\rightarrow$ K_{je}, K_{js}, and K_{ji} by (A1) $\rightarrow\hat{y}_j$ by (A5) $\rightarrow F_{ji}$, F_{js} and F_{je} by the definitions $\rightarrow$ c_j and s_j by (10) $\rightarrow$ $Y_{je}=w_j\,N_{je}/\beta_{je}\rightarrow K=\sum_j\bar{k}_j\,N_j\rightarrow\overline{K}_j=\bar{k}_j\,N_j\rightarrow B_j=\left(\overline{K}_j-K_j\right)r\rightarrow U_j$ by the definitions. From this procedure, (A19), (5) and (11), we have:

$$\dot{\bar{k}}_1=\overline{\Phi}_1\left(z_1,\left(E_j\right),\left\{\bar{k}_j\right\},t\right)\equiv\lambda_1\,\hat{y}_1-\varphi-\frac{\dot{N}_j\,\varphi}{N_j}, \tag{A20}$$

$$\dot{\bar{k}}_j=\Phi_j\left(z_1,\left(E_j\right),\left\{\bar{k}_j\right\},t\right)\equiv\lambda_j\,\hat{y}_j-\bar{k}_j,\quad j=2,...,J,$$

$$\dot{E}_j=\Omega_j\left(z_1,\left(E_j\right),\left\{\bar{k}_j\right\},t\right)\equiv\theta_{ji}\,F_{ji}+\theta_{js}\,F_{js}+\theta_j\,C_j-F_{je}-\bar{\theta}_j\,E_j+\Omega_j\left(\left(E_q\right)\right). \tag{A21}$$

Taking derivatives of equation (A19) with respect to t and combining with (A21) implies

$$\dot{\bar{k}}_1=\frac{\partial\varphi}{\partial z_1}\dot{z}_1+\frac{\partial\varphi}{\partial t}+\sum_{j=1}^{J}\Omega_j\frac{\partial\varphi}{\partial E_j}+\sum_{j=2}^{J}\Phi_j\frac{\partial\varphi}{\partial\bar{k}_j}. \tag{A22}$$

Equaling the right-hand sizes of equations (A20) and (A22), we get

$$\dot{z}_1=\Phi_1\left(z_1,\left(E_j\right),\left\{\bar{k}_j\right\}\right)\equiv\left[\overline{\Phi}_1-\frac{\partial\varphi}{\partial t}-\sum_{j=1}^{J}\Omega_j\frac{\partial\varphi}{\partial E_j}-\sum_{j=2}^{J}\Phi_j\frac{\partial\varphi}{\partial\bar{k}_j}\right]\left(\frac{\partial\varphi}{\partial z}\right)^{-1}. \tag{A23}$$

In summary, we proved the lemma.

On the Relationship between Financial Integration, Financial Liberalization and Macroeconomic Volatility

Rajmund MIRDALA
Faculty of Economics, Technical University of Košice, Slovakia
rajmund.mirdala@tuke.sk

Aneta Svrčeková
Faculty of Economics, Technical University of Košice, Slovakia
aneta.svrcekova@tuke.sk

Jozefína Semančíková
Faculty of Economics, Technical University of Košice, Slovakia
jozefina.semancikova@tuke.sk

Abstract

Effects of international financial integration on the volatility of the total output and its main components have been a subject of rigorous academic discussion for decades. Even nowadays recent empirical literature suggests that its long-term benefits on economic growth are associated with spurious and vague side effects in terms of macroeconomic volatility.

This paper examines the relationship between international financial integration and output fluctuation. An analysis was conducted on a large sample of developed and developing countries over the past 40 years. We follow the approach employed by Kose et al. (2003) and use cross-sectional median of financial liberalization to subdivide developing economies into two groups: more financially liberalized (MFL) and less financially liberalized (LFL) economies. Our results indicate that while the volatility of output growth rates experienced a decreasing trend over time, financial integration had a significant contribution to output fluctuations. However, the relationship was stronger in developing countries.

Keywords: financial integration, financial liberalization, output volatility, consumption volatility, capital flows.

JEL Classification: F36, E44, F41, G15.

1. Introduction

Growth and productivity benefits, improved allocation efficiency and international risk sharing represent key incentives that initiated the process of capital flows liberalization in industrial countries since the beginning of 1980s. Many empirical studies and international financial institutions have also supported the introduction of liberalization policies by less developed countries. However, as substantial determinants of the overall speed of capital account liberalization associated with softening of capital controls and restrictions in developing countries has been soon recognized its side effects on macroeconomic stability. According to the recent empirical studies (i.e. Kose *et al.* (2010), Kaminsky and Reinhart (1999), Easterly *et al.* (2000) and Eozenou (2008)) increased volatility of macroeconomic variables induced by international financial integration is the clear implication of fluctuations in capital flows intensified by financial crises.

The analysis of the economic aspects of international financial integration still represents a leading topic in macroeconomics of open economy. This topic enjoyed increased interest in the recent research, especially due to occurrence of large scale of side effects during the current post-crisis period associated with possible negative impact of international financial integration on macroeconomic stability. Moreover, empirical research still provides contrary conclusions on the impacts of international financial integration on economic variables.

Our study examines the influence of international financial integration on the volatility of macroeconomic output and its components. We suggest that the analysis of the relationship between financial integration/liberalization and macroeconomic indicators is crucial due to rich empirical evidence about the existence of a negative correlation between the volatility of macroeconomic variables and the long-term economic growth (i.e. Kose *et al.* (2010), Ramey and Ramey (1995), Dabušinskas, Kulikov, Randveer (2012), Easterly *et al.* (2000), Badinger (2010)) though examined characteristics of this relationship are not clearly argued. However, theory suggests that the negative correlation is based on the increasing uncertainty of future revenues associated with the output and consumption volatility. This is due to the existence of risk aversion, resulting in crowding out investments and a decline in economic growth. Therefore, macroeconomic stability is a strong fundamental pillar for achieving long-term economic growth of a country.

The particular importance of our research is also linked with the indicated long-term decline in the degree of instability of macroeconomic aggregates in both developed and developing economies. This trend is obvious in most of the developed and developing countries. Kose *et al.* (2010), Jermann and Quadrini (2006) and Campbel

(2004) argue that the main reason for this decline is still a subject of further academic discussions. However, the raising capital mobility induced by the trend of international financial liberalization together with general improvement of the economic and institutional environment still represent the key determinants of the examined decreasing trend in macroeconomic volatility.

2. Overview of the literature

Theory does not provide clear conclusions about the impact of financial integration on macroeconomic volatility. According to Obstfeld and Rogoff (1994, 1998) the financial integration in the periods of idiosyncratic production shocks should decrease fluctuations of macroeconomic variables. This effect is preserved by intertemporal consumption smoothing. IMF (2007) and Kose *et al.* (2003) argue that well-developed domestic financial market represents the key assumption of this effect. However, the volatility of macroeconomic variables as a result of the financial integration may be also induced by another transmission channel. According to Baele (2004), IMF (2007), Stavárek, Repková and Gajdošová (2011), Kim (2003), Tytell and Wei (2004) and Pierdzioch (2004) the increase in the international financial assets and liabilities in the country induces an efficient allocation of capital and development of domestic financial markets. It also enhances the quality and responsibility of institutions as well as the efficiency and responsibility of economic policies. All these factors determine the performance of the country. Improved economic performance is associated with a lower economic uncertainty that results in lower fluctuations in output and consumption.

Effects of international capital flows on the volatility of macroeconomic variables are also the subject of academic discussions. Generally, international financial integration is beneficial if the expected benefits from greater international risk-sharing exceed the costs associated with cross-border financial contagion (Fecht, Grüner and Hartmann, 2012). Mirdala (2011a) argues that increasing trend in the financial openness of the country reduces the volatility of output due to lower diversification of the production base of the capital receiving country. However, increased role of comparative advantages and associated structural changes induced by foreign capital inflows increases exposure of the country to the industrial shocks. International financial integration thus reduces the diversification of exports and imports of goods. Low specialization increases vulnerability particularly in middle-income developing countries to certain industrial shocks (i.e. demand shocks). As a result, the volatility of output increases. Obstfeld (1998) argues that effects of international capital flows on macroeconomic stability are determined by the degree of international risk sharing. Higher diversification and risk sharing significantly reduces the volatility of output and consumption. Kose *et al.* (2006) identified other determinants and channels of the relationship between international financial integration and macroeconomic volatility, especially the composition of capital flows. Short-term capital flows have a pro-cyclical effect that increases macroeconomic instability of financially integrated countries. Reinhart and Montiel (1999) and Rodrick and Velasco (1999) supported this idea. Kose *et al.* (2010) further argue that a country´s vulnerability to financial crises depends mainly on the combination of the size of international financial integration and economic policies mix. Inappropriate combinations may result in high fluctuations of economic variables and financial crises. According to Kaminsky and Reinhart (1999), Easterly *et al.* (2000) and Eozenou (2008) the vulnerability of developing countries to financial crises is higher. They suggest that it is especially due to the insufficient size and degree of advancement of their financial sector or the absence of appropriate financial institutions that would be able to solve the problem of instability in short-term capital flows. Larger and more efficient domestic financial sector in the early stages of capital account liberalization clearly determines the overall benefits of capital inflows by reducing the macroeconomic volatility. Shutherland (1996) emphasized other determinants of the effects of international financial integration on fluctuations of macroeconomic variables, i.e. structural characteristics of the domestic production, patterns of specialization and sources of shocks affecting the country.

Kose (2002) argues that the effects of these shocks are more significant in developing countries. According to the IMF (2007) it may be due to the size of the developing countries. Developing countries are generally smaller than developed economies. As a result, the fluctuations in the output in developing countries are transmitted into the business cycles of small open developing markets. Eichengreen and Leblang (2003) and Prasad, Rogoff, Wei and Kose (2004) argue that macroeconomic volatility in developing countries may be reduced provided a progress in financial deepening, improvements in economic and institutional environment, trade and macroeconomic policy of the country etc. According to Frey and Volz (2011) the lack of an appropriate economic, political and institutional environment in developing countries may result in their inability to reduce the macroeconomic volatility. A study by Klomp and Haan (2009) concludes that the political instability and uncertainty increase macroeconomic volatility. Kose *et al.* (2006) provides the same conclusions.

We suggest that the overall improvements in financial development, institutional quality and macroeconomic policies determine the key characteristics of the relationship between international financial integration and macroeconomic stability. However, effects of international financial integration on fluctuation of macroeconomic aggregates are still disputable. It seems that the final effect as the sum of partial effects depends on the initial macroeconomic and microeconomic conditions, ability to benefit from the international risk sharing and diversification, as well as the influence of capital inflows on diversification and specialization of the production base in the capital receiving country. The range of the potential benefits of financial integration also depends on the initial level of financial integration of the country.

The results of empirical studies provide ambiguous results. Bekaert, Harvey and Lundblad (2006) analyzed the effect of stock market liberalization and openness of the capital account on the volatility of the real output and consumption growth rate. Their conclusions suggest that countries with a higher degree of financial integration experienced higher reduction in the volatility of consumption growth rates. The authors analyzed developed and developing countries and conclude that the relationship is weaker for less developed countries. Recent research by Herrera and Vincent (2008) shows the same results. IMF (2007) suggests that the impact of financial integration on the fluctuation of macroeconomic aggregates in developing countries depends on the degree of the advancement of the domestic financial market and the quality of domestic institutions. Their results indicate that countries with less developed financial markets and weak institutional quality are not able to benefit from international risk sharing and reduce the fluctuations in private consumption and output. According to Eozenou (2008) while the higher international financial integration in countries with less developed financial markets increased the volatility of consumption, increase in foreign capital inflows was followed by the decline in consumption volatility. Evans and Hnatkovská (2006) revealed a positive impact of initial levels of financial openness on the consumption and output volatility. On the other hand, the additional increase in financial integration caused a gradual reduction or even a complete loss of the relationship between financial integration and the volatility of total output and its components. The final effect of financial integration is positive and causes the decline in fluctuation of macroeconomic aggregates. These conclusions are supported by Kose *et al.* (2003), who investigated a positive but non-significant effect of financial integration on the volatility of macroeconomic variables when the country crosses a certain level of financial openness. The results of both studies indicate that the certain level of financial openness induces positive effects of financial integration on the stability of output and its components. As a result, approaching the certain level of financial openness seems to be beneficial for the country in terms of macroeconomic volatility.

Finally, the last group of research studies did not confirm a stable relationship between financial integration and macroeconomic fluctuation, e.g., Easterly *et al.* (2000), Razinand Rose (1992), Pappas (2010).Studies highlighted the absence of a significant relationship between openness and the volatility of total output, domestic consumption and domestic investment.

This paper is organized as follows. Section 2 discusses our data and describes employed methodology. Section 3 presents the empirical results of econometric analysis. Section 4 provides concluding remarks.

3. Methodology

International financial integration ($Finope_t$) is the sum of gross international financial assets and international financial liabilities. Data were collected from the External Wealth of Nations published by Lane and Milesi-Ferretti (2006). We employed the methodology introduced by Kose *et al.* (2006) and Lane and Milesi-Ferretti (2006) to construct a foreign direct portfolio equity and debt investments indicator. The debt investments indicator aggregates portfolio debt and other debt investments. Financial derivatives and foreign exchange reserves are excluded due to time series inconsistency. However, the above mentioned indicator does not include total output that is why the size of the economy is not considered. To avoid this obstacle we also calculate relative financial integration as a ratio of total financial integration to total output of the country. To compute the cross-sectional international financial integration average, the relative values of financial integration are employed. The measure of financial liberalization is represented by Chinn-Ito indicator. It represents de jure degree of financial integration ($Finka_{i,k}$).

Macroeconomic volatility is calculated as a standard deviation of the growth rates of selected macroeconomic variables over a 10 year period. To examine the volatility of total output and its components we calculate the standard deviation of total output ($mvgdp_{i,k}$) private consumption ($mvcon_{i,k}$) and final consumption ($mvfcon_{i,k}$) per capita. Data were collected from UNCTAD. Data are calculated in constant prices of 2005 and averaged exchange rates in 2005.Additional measurements of macroeconomic volatility - consumption smoothing

is calculated as the mean of ratios of final consumption volatility to volatility in output of individual countries. A decrease in the indicator represents a successful process of consumption smoothing.

An analysis of the impact of financial integration on macroeconomic volatility is conducted on a large sample of countries over 40 years (1970-2009). Following the classification provided by the International Monetary Fund, we have identified 23 developed and 77 developing countries. In order to examine the effects of international financial integration on macroeconomic volatility more precisely, we have followed the approach employed by Kose *et al.* (2003). The cross-sectional median of financial liberalization (0.3059) enabled us to subdivide developing economies into two groups: more financially liberalized economies (MFL) and less financially liberalized economies (LFL). We have identified 38 countries as MFL and 39 countries as LFL.

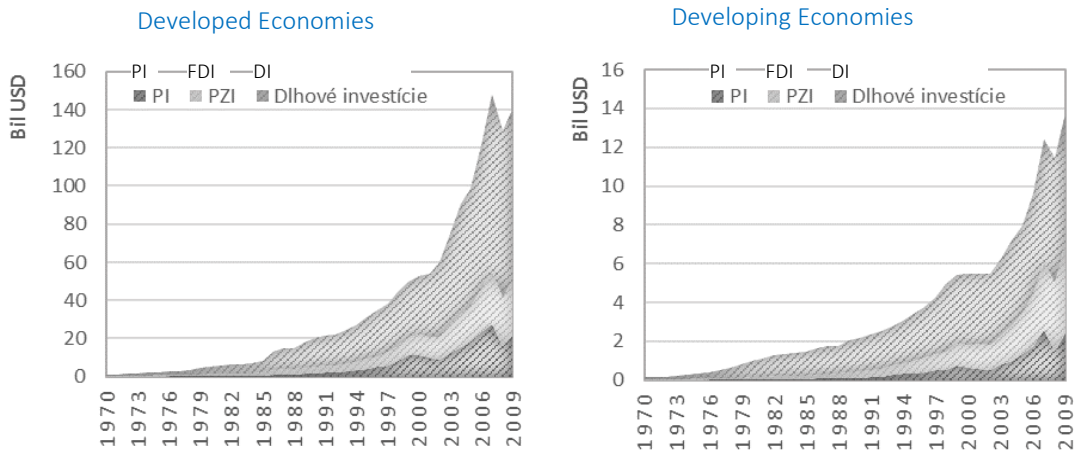
The analysis is based on the Pooling Ordinary Least Square (POLS) model and One-Way Error Component Model (OWEC). Econometric analysis is based on the following regression equations:

$$\sigma_{i,t} = \alpha_i + \beta X_{i,t} + v_{i,t} \qquad i = 1,...,I \quad \text{a} \quad t = 1,...,T$$

where $\sigma_{i,k}$ is the standard deviation of dependent variable (real output or private consumption per capita growth rates during 10 years period), α_0 is group-specific constant term in the regression model, β is a matrix of regression coefficients, X represents the vector of explanatory variables ($Finope_{i,k}$) and ($FinKa_{i,k}$) represents two measures of financial integration; see Section 4 for more details) and $v_{i,k}$ is the error term.

4. Empirical results

The Figure 1 shows the composition foreign capital flows used as a measure of international financial integration divided into foreign direct investments (FDI), portfolio equity investments (PE) and debt investments (DI) for both groups - developed and developing countries. International financial integration is calculated as the sum of gross stock of foreign financial assets and liabilities. We observe an increasing trend in the volume of foreign financial assets and liabilities during the examined period.



Note: PI - portfolio investments, FDI - foreign direct investments, DI - debt investments
Source: Authors' calculations

Figure 1. Financial integration of developed and developing countries (1970-2009)

Examination of the dynamics in international financial integration revealed a significant increase in the intensity of the foreign capital accumulation. This trend is obvious in both groups of countries especially during the last decade at the end of 1990s. The development of international financial links is more significant in developed economies in absolute value. Industrial countries experience an increase in the volume of foreign capital stock by approximately 140 trillion USD. That represents a 170 time increase compared to the initial period. Despite the dominant position of developed countries, a similar increase was observed in less developed countries as well. The volume of international financial assets and liabilities increased about 128.7 times during the period 1970-2009 that represents 19 trillion USD. As a result, the role of developing countries in the international financial system significantly increased. The sharp deepening in international financial integration represents one of the key implications of globalization. This trend is related to the gradual deregulation or even

complete removal of capital restrictions and controls on foreign capital flows. World trade liberalization, the fixed exchange rates easing institutional barriers of international trade and foreign capital flows and financial innovations multiplied by boom in ICT represent other crucial vehicles of the deepening in international financial integration.

Liberalization and deregulation trends are obvious in both developed and developing countries. Economic theory suggests that the capital flows from rich (developed) to poor (developing) countries improves allocation efficiency on the international level. However, Prasad *et al.* (2006) argue that the current trend is reversed since the beginning of 20th century and the foreign capital flows from developing to developed countries. This idea is also supported by United Nations (2011) and Prasad *et al.* (2006). According to Kilian (2007) this trend is the result of the surplus of global savings in oil exporting countries, Asian and South-American developing countries and big financial institutions. Significant accumulation of savings in Persian oil exporting countries, Russia and Venezuela was caused by increasing prices of oil up to 70 USD per barrel. Most of these savings have no real meaning considering their size and low efficiency. Therefore, savings are saved into the financial instruments of developed countries. Another major source of developing capital moved to industrial countries are Asian developing markets. They create a great amount of foreign exchange reserves based on the surplus in foreign trade. Abiad, Leigh and Mody (2009) argue that the capital of developing countries is a significant source of investments into less financially-developed developing countries in the last decade. Gourinchas and Jeanne (2005) also agree with the previous statement. According to Kilian (2007) the reason is deregulation and liberalization of capital and trade accounts balance of payments in developing countries and their development of a domestic financial sector. Other factors include an increase in the quality of institutions, increasing responsibility of macroeconomic policies, etc. that increase the attractiveness of developing countries for foreign investors.

Slowdowns in the volume of financial reserves both in developed and developing countries are linked with financial, banking and economic crises. The first slowdown was caused by the oil price shocks and the banking crisis in the UK (1973-1975) in the 1970s. The decrease in the volume of international financial capital in 1980s resulted from the stock market crisis in 1987 known as “Black Monday”. Another decrease in the volume of international financial assets and liabilities in the1990s was the result of the economic crisis in Latin America, the dot com crisis and the economic depression in 2008.This synchronous decrease shows increased financial risk potential based on the increasing financial links between countries. An increased level of financial integration can accelerate the transfer of financial and economic crises even into countries with a healthy economy. Therefore, financial integration may support fluctuations in the global economic cycle. Glick, Guo and Hutchison (2004) and Kaminsky and Reinhart (1999) provided a supportive evidence for this conclusions as well. Increased international financial integration may be formed only by financial deepening (Mirdala, 2011b). In this case, increased reserves of international financial assets and liabilities would be higher than the output growth while the share of external financial assets and liabilities held in portfolio equity or FDI remains unchanged. International financial integration would increase mainly due to the growth in the volume of debt investments. According to Kose *et al.* (2006) and Lane and Milesi-Ferretti (2006) debt capital is a very unstable source of foreign capital inflows. A high increase of debt (especially short-term) capital would probably induce an increased volatility of macroeconomic aggregates and reduce economic growth.

General trend of increased foreign capital flows was associated with unstable and volatile shares of individual components in both groups of countries during the whole period. Debt investments represents more than a half of the foreign capital stock in developed countries. We have identified two main trends in the development of debt investments. The overall share of debt investments clearly increased during the first half of the analyzed period. The countries experienced more dynamic increase in remaining two components of foreign capital flows resulting in the reduced share of debt investments in the second half of the period. However, this trend was also associated with reduced dynamic in debt investments, particularly during the latest two economic crises of 2000 and 2008.

FDI represents the second most important component of financial integration in developed countries. Despite generally increasing trend in FDI flows during the most of the period its share on the total foreign capital flows decreased over time (18% decline during the whole period). Portfolio equity investments experienced the opposite trend. The share of portfolio equity investments increased by 7% and culminated in 1999.

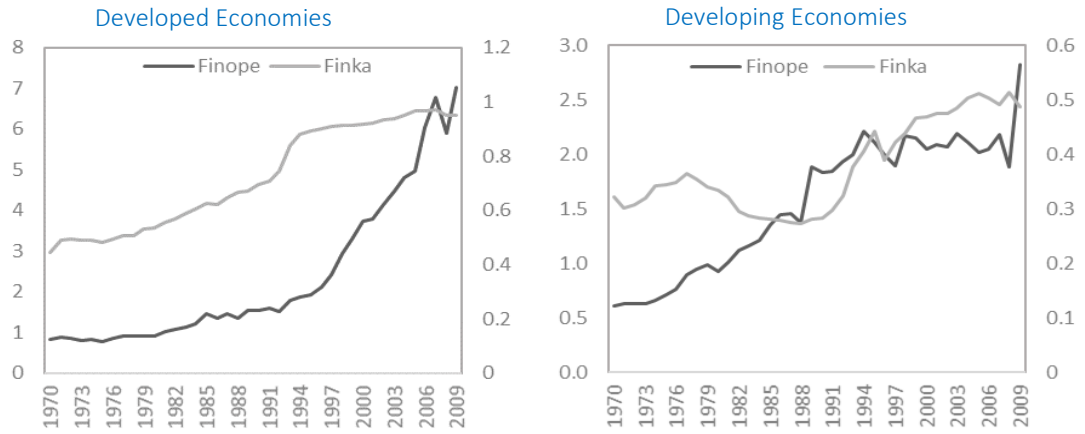
Following our results we assume that the dynamics of international financial integration is driven by a wide variety of determinants suggested by the theory and the process of financial deepening itself has only limited ability to consistently explain some particular deviations in the general trend, i.e. increasing share of portfolio equity investments associated with decreasing trend in debt investments over time. However, financial integration of developing countries induced their high indebtedness in the 1990s. As a result, 75% of foreign capital inflows

consisted of debt investments. At the end of this period we have observed a downward trend of the mean of share of debt investments in this group of countries. This slowdown was caused by the debt crisis in developing countries in the 90s.

FDI shows two main trends: declining share of FDI until the late1990s and then, an increasing trend from the late1990s until 2009. Together with this trend, developing countries enjoyed increased FDI inflows. FDI reached about 29% of total foreign capital stock in developing countries in 2009. At the same time, portfolio investments increased by 14 percentage points. Financial integration of developing countries resulted in increasing contribution of FDI and portfolio equity investments to the total foreign capital inflows while the share of debt investments decreased over time. Declining trend in the share of debt investments in both developed and developing countries should be followed by decreased volatility in macroeconomic variables due to the unstable and mostly short-term nature of the debt capital. An increase in the share of FDI and portfolio equity investments should be associated with reduction in macroeconomic volatility due to their long-term nature and higher stability. The trend of increasing share of FDI and portfolio equity investments is more dynamic in developing countries. Based on the studies of Kose *et al.* (2006) and Lane and Milesi-Ferretti (2007) we expect a more significant decrease in macroeconomic volatility in these countries. Despite generally decreasing share on the total foreign capital flows, debt investments still represents the main component of increased international financial integration. We suggest that a high share of debt capital can reduce the effect of financial integration on macroeconomic stability. The resulting effect depends on the summary of particular effects of the individual components of foreign capital flows.

Relationship between financial liberalization and financial integration

The Figure 2 shows the comparison of the averaged de facto and de jure international financial integration in developed and developing countries. We employ indicators of financial openness $(Finope_{i,t})$, de facto indicator calculated as the average volume of gross international financial assets and liabilities to total output and financial liberalization $(Finka_{i,t})$,de jure indicator representing the level of financial liberalization (average value of the Chinn-Ito indicator).



Note: financial openness, finope (left axis in figures), financial liberalization, finka (right axis in figures)
Source: Authors' calculations

Figure 2. - De Facto and De Jure Financial Integration

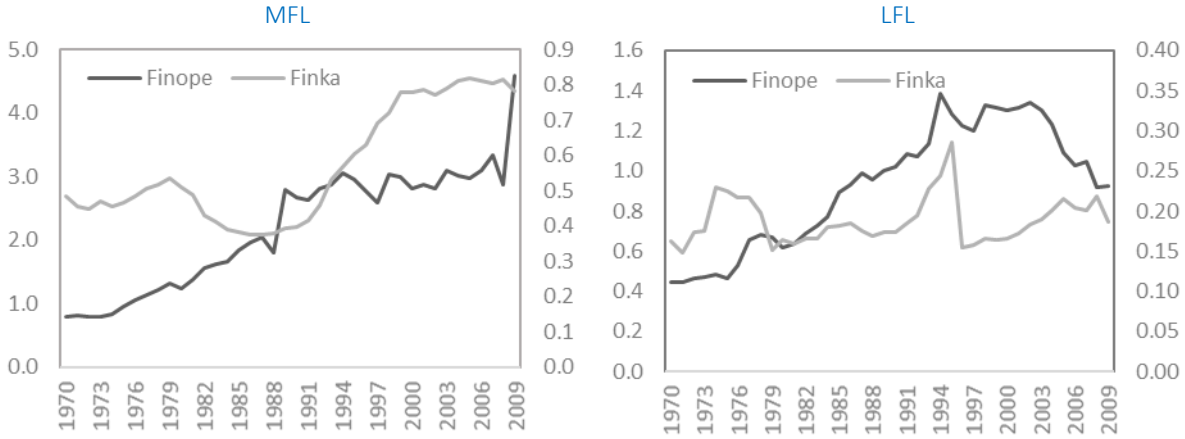
Developed countries are more integrated into the global financial market in comparison with developing countries. The average volume of international financial assets and liabilities of developed countries reached the value equal to their total output at the beginning of 1980s. The volume of foreign capital stock to total output increased from 0.8 to 6.2, i.e. an eight-fold increase since the beginning of analyzed period. It is clear that international financial integration followed a sharp upward trend that was interrupted only during the periods of financial, banking or economic crises. Moreover, results for both de facto and de jure financial integration provide quite similar results suggesting the trend of dynamic financial liberalization in developed countries. The most significant liberalization and deregulation of international financial flows occurred in the late 1990s. Deregulation of capital accounts accelerated a dynamics of de facto financial integration during this period. The de facto

financial openness increased 4.5 times since the 1990s. However, it increased 1.8 times only during the previous period. A slight slowdown in the process of deregulation occurred during the economic crisis in 2008. The study of United Nations (2011) provides a supportive evidence for this suggestion. Many emerging markets and developing countries reacted to the economic crisis of 2008 by reintroducing capital controls and foreign exchange interventions in order to mitigate the adverse effects of the crisis on their economies. It resulted in a decline in real financial capital stock as indicated by *Finope* measure. These results indicate that financial integration is determined by the process of financial liberalization. Developed countries successfully completed the process of financial liberalization by the end of the analyzed period.

Developing countries experienced similar trend of continuous increase in the degree of international financial integration. The volume of foreign capital stock increased from 0.6-fold of total output to 2.85-fold of total output, i.e. a five-fold increase. The de jure indicator representing the degree of financial liberalization increased from 0.32 to 0.58. The increase in international financial liberalization is not as significant as in the case of developed countries. We have observed a significant slowdown in the dynamics of the process of financial liberalization after 1978 as a direct response of developing countries to the oil price shocks. Further increase in the real capital flows was observed even after the reintroduction of restrictions on international capital. The volume of international financial assets and liabilities increased twice during this period. According to Kilian (2007) this trend was caused by capital inflows used for financing public debt caused by adverse changes in the terms of trade due to unexpected oil price rises. Capital inflows in developing countries during this period helped to reduce macroeconomic volatility via intertemporal consumption and output smoothing. Rebirth of the restrictions and regulation imposed on international capital flows occurred after 1990. However, the overall dynamics of de facto financial integration followed after this period did not experience any dramatic changes at all.

Classification of developing countries based on the level of financial liberalization

In this section we followed the approach introduced by Kose *et al.* (2003) to divide developing countries in two groups according to the indicator of de jure financial openness. It seems that financial openness in some developing countries is too low that would skew the average value of the indicator for the entire sample. Considering the values of de facto and de jure indicators we have created three groups of countries. The primary classification is based on the indicator of financial liberalization, i.e. de jure indicator. The first group consists of developed countries. Developing countries are divided according to the cross-sectional median of de jure indicator into more financially liberalized (MFL) and less financially liberalized (LFL).



Source: Authors' calculations

Figure 3. De Facto and De Jure Financial Integration (1970-2009)

International financial integration ($Finope_{i,t}$) measured by the average value of the sum of international financial assets and liabilities is higher in MFL countries (Figure 3). Financial openness of MFL countries increased from 0.78 to 4.6 fold of total output, i.e. a 5.75 fold increase. The rate of increase in the financial openness is similar in both developing and developed countries (6.2 fold increase). International financial

liberalization of MFL countries ($Finka_{i,t}$) increased at 0.3 percentage points, i.e. from 0.5 to 0.8 fold of total output. According to the degree of financial liberalization, MFL countries were significantly closer to the average values of developed countries. We examined a significant slump in the development of the measures of financial integration at the end of the 1970s. It was caused by their action of MFL countries to the economic recession followed by the sharp oil price increase. As mentioned above, according to Kilian (2007), the slow down or even interruption of the trend of financial liberalization didn't have a significant influence on the volume of international capital flows during this period. However, the results of $Finope_{i,t}$ indicator are affected by international capital flows financing public debts during this period (Mirdala, 2011c). Public debts of developing countries experienced a significant increase due to unexpected changes in oil prices and terms of trade.

The size of international financial assets and liabilities in LFL countries doubled during the period 1970-2011. Nowadays, the sum of foreign capital stock (assets + liabilities) is almost equal to total output in this group of countries. However, both developed and MFL countries have already reached this degree of financial openness at the beginning of 1980s. Low volumes of foreign capital flows are caused mainly by a slow progress in the process of financial deregulation. Measured levels of financial liberalization in LFL countries remained approximately the same during the last 40 years.

Deregulation and liberalization of capital accounts in the 1970s was followed by the strengthening of restrictive measures due to adverse economic development at the end of 20th century. This trend represents a direct response to the oil price shocks and the debt crisis of developing countries in the 1990s.However, LFL countries experienced an increasing trend in the international financial integration until the1990s. Following our previous suggestions, it was caused by the strong foreign capital inflows to finance public debts of developing countries. Capital controls and restrictions on foreign capital inflows followed by the debt crisis in developing countries has reverted this trend. As a result, LFL countries experienced a sharp decline in the international financial openness since the introduction of restrictive measures.

We suggest that low level of international financial integration of LFL countries was caused by a slow progress in international financial liberalization[1]. Introduction of foreign capital controls by LFL countries reduced benefits generally expected from international financial integration. Underdeveloped domestic financial markets reduced positive effects from effective allocation of capital, more flexible diversification of domestic production based on comparative advantages, international risk diversification and sharing as well as advancement of domestic financial markets. According to IMF (2007), the inability to share risk among economic agents causes growth of macroeconomic volatility in a country. Ramey and Ramey (1995) argue that the macroeconomic volatility results in the slowdown of economic growth that reduces economic performance of LFL countries even more. The key source of foreign capital inflows in developing countries is represented by debt investments due to generally low economic performance, underdeveloped economic environment and fragile financial system. According to Kose *et al.* (2006) and Lane and Milesi-Ferretti (2006), inflows of debt investments in developing countries may indicate macroeconomic instability. Above mentioned determinants combined with poor economic performance and low quality of institutions forced developing countries into the closed circle that is why insufficient international financial integration reduces growth potential that attracts less foreign investments. However, LFL countries are still exposed to macroeconomic volatility even more than the rest of the world due to more dynamic shifts in financial openness. This is particularly true considering improved general conditions for higher foreign capital inflows in the future.

Estimation of macroeconomic volatility

The Table 1 summarizes the changes in the cross-sectional volatility of macroeconomic aggregates[2] in developed and developing countries[3]. Developed countries experienced lower levels of macroeconomic volatility in comparison with developing countries. Differences are more significant especially in the volatility of consumption. According to IMF (2007), and considering the development of financial liberalization and financial integration (Figure 2), we suggest that lower levels of macroeconomic volatility in developed countries are associated with high degree of financial openness. As a result, developed countries enjoyed more benefits

[1] According to the United Nations Economic Commission for Africa (2008), the process of financial liberalization is the key determinant of the process of international financial integration.

[2] Macroeconomic volatility is measured as the standard deviation of total output, private and final consumption growth rates per capita for the 10 year period.

[3] The classification of countries is based on the IMF classification.

resulting from effective capital allocation, high rate of international risk diversification and sharing[4] and financial deepening. Key implications of higher capital mobility in developed countries are well summarized in Narayan and Narayan (2010). Authors recognized the stable economic growth that contributes to reduced macroeconomic volatility as one of the key indirect effects of increasing international financial integration. Loayza *et al.* (2007) revealed close relationship between the crucial characteristics of macroeconomic volatility and overall macroeconomic development of countries. We suggest that the low output and consumption volatility of developed countries reveals the key characteristics of individual economies represented by more prudential economic policies, low microeconomic rigidities, stronger institutional environment and more developed domestic financial markets. Hausmann and Gavin (1996) provided more supportive empirical evidence of this idea. They suggest that fluctuations of macroeconomic variables are fueled by poor quality of institutions, instable political regimes and less developed financial markets. According to Campbell (2004), positive characteristics of developed countries reduce macroeconomic uncertainty and contribute to lower macroeconomic volatility.

Table 1. Macroeconomic volatility in developed and developing countries

Total Output (Y)/Period	**Total**	**1**	**2**	**3**	**4**
Developed Countries	0.0211	0.0245	0.0191	0.0178	0.0231
Developing Countries	0.0424	0.0522	0.0477	0.0400	0.0299
Private Consumption (C) /Period	**Total**	**1**	**2**	**3**	**4**
Developed Countries	0.0217	0.0284	0.0218	0.0182	0.0183
Developing Countries	0.0648	0.0787	0.0688	0.0588	0.0529
Final Consumption (C+G) /Period	**Total**	**1**	**2**	**3**	**4**
Developed Countries	0.0173	0.0228	0.0167	0.0150	0.0148
Developing Countries	0.0558	0.0676	0.0585	0.0519	0.0454
Consumption Smoothing / Period	**Total**	**1**	**2**	**3**	**4**
Developed Countries	0.8386	0.9679	0.8577	0.9149	0.6141
Developing Countries	1.5358	1.3633	1.3925	1.6501	1.7372

Note: Panel Total (1970-2009), panel 1 (1970-1979), panel 2 (1980-1989), panel 3 (1990-1999), panel 4 (2000-2009).
Source: Authors' calculations

Different macroeconomic characteristics increase exposure of developing countries to domestic shocks induced by weak architecture of their economies causing higher fluctuations of macroeconomic variables. Malik and Temple (2009) suggest that low quality of institutions causes higher instability of macroeconomic variables. Increased macroeconomic volatility is also determined by the frequency and intensity of exogenous shocks. Authors suggest that these shocks are caused by sudden interruptions in capital inflows or unexpected changes in terms of trade. Loayza *et al.* (2007) confirms the high occurrence of terms of trade shocks in developing countries.

We have recognized two key elements for mitigating the fluctuations caused by external disturbances, i.e. risk diversification and sharing and stabilization policies. Kose *et al.* (2009) argues that developing countries do not fully benefit from international risk sharing. It is caused by the improper composition of their foreign capital inflows. The main source of foreign capital inflows in developing countries is represented by debt investments that reduce expected benefits of financial integration from international risk sharing. According to Masten *et al.* (2008) and Norris and Srivisal (2013), financial markets in developing countries are less developed and therefore cannot absorb fluctuations caused by external shocks. Both studies recognized a developed financial market as a convenient vehicle for mitigating the negative effects of real economic shocks. Loayza *et al.* (2007) argue that stabilization policies in developing countries are less effective and their ant cyclical effects are clearly reduced. As a result, developing countries are unable to absorb domestic and external shocks without any discernible increase in the volatility of macroeconomic aggregates. However, significant differences in macroeconomic volatility between developed and developing countries indicate future benefits arising from increased international financial integration in less developed economies.

Developed and developing countries in our sample experienced a consistent decrease in the macroeconomic volatility over time. Despite substantial empirical evidence confirming reduced macroeconomic volatility in both groups of countries, most of authors do not provide clear conclusions about the main causes of this trend. Panel 1 (Table 1) represents our calculations of the real output volatility. Our results confirm a

[4] The higher rate of international risk sharing in developed countries is one of the key reasons for persisting large gap in the volatility of consumption between developed and developing countries.

decreasing trend in the volatility on real output during the whole period. The overall macroeconomic volatility decreased in developed and developing countries by 0.0014 and 0.0223 points respectively. We suggest that better results for developing countries indicate their opportunities that allow for benefit more from increasing international financial integration (suggested also by IMF (2007)).

According to Loayza *et al.* (2007) developing countries experienced more dynamic decrease in macroeconomic volatility due to increased financial integration induced by the general improvement of economic environment, institutional quality, quality of domestic stabilization policies, domestic financial markets and other factors determining the degree of macroeconomic volatility and stability of economic growth. According to Mougani (2012) financial integration positively affects the transfer of technologies, trade openness and the development of domestic financial markets. All these factors stimulate economic growth, intensify poverty reduction and improve the overall economic development of the country.

Therefore, financial integration should support the development of the domestic financial and banking sector. According to Levine and Zervos (1998, 2001), a well-functioning domestic financial and banking sector leads to an increase in liquidity and efficiency and thus provides a vital incentives for stable economic growth, i.e. reduces output fluctuations. These conclusions are indirectly suggested by the IMF (2007). Countries at the beginning of the integration process, characterized by insufficiency and inefficiency of counter-cyclical policies caused by a lower degree of economic development and lower development of the financial sector, are more likely to reduce macroeconomic volatility. The probability to enjoy reduced macroeconomic volatility and thus benefit from financial integration is considerably smaller in developed countries. We suggest that developed countries have already exhausted most of the benefits arising from international financial integration.

A significant decline in macroeconomic volatility of developing countries (0.0258) can be seen in private consumption (Table 1, Panel 2). Developed countries also experienced a meaningful improvement in the volatility of private consumption (0.0101). Obstfeld and Rogoff (1994) suggest that if the volatility of consumption is much higher than it would be under full financial integration in the global economy, then the potential gains from risk sharing are relatively large and a country should integrate more. Following the results for the volatility of consumption in developing countries (0.0529) and developed countries (0.0183) it seems that despite the significant decline in the volatility of consumption there is still considerable space for improvements in developing countries. We assume that developing countries do not fully exploit the opportunities arising from financial integration especially due to insufficient risk diversification and sharing caused by the absence of developed domestic financial markets. This is indicated by the comparison of volatilities of final consumption (0.0454) and total output (0.0299) (Table 1, Panel 4).

The last analyzed period (Table 1, Panel 5) is characterized by weakening of the progressive decline in macroeconomic volatility of developing countries and stable or even increasing trend in macroeconomic volatility of developed countries. The sign of reversal trend is caused by the effects of financial crisis and following economic recession resulting in increased instability of macroeconomic variables in the global economy. However, here the question arises, to what extent the source of this decline originates in the continuous increase in financial integration, it is caused by the other crisis related effects or the combination of both.

Finally, our results indicated mixed consumption smoothing effects in both groups of countries. Despite recent fluctuations of the indicator during first three decades, developed countries managed to smooth their consumption, which reduces the volatility of consumption and real growth. Significant decrease of the indicator during the last decade indicates that consumer behavior in a crisis is characterized by more dynamic reallocation of consumption expenditures. On the other hand, developing countries experienced a persistently increasing trend in the size indicator revealing deterioration in the intertemporal consumption smoothing opportunities especially due to low flexibility of underdeveloped financial markets inducing the existence of thin or missing credit markets.

Classification of developing countries based on the degree of financial liberalization

In the Table 2 we summarize the development of the macroeconomic volatility employing the classification of developing countries into MFL and LFL. Our results indicate higher degree of macroeconomic volatility in MFL countries in comparison with LFL countries that seems to be contrary to the main conclusions revealed by IMF (2007) analysis. We suggest that financial liberalization increases the degree of macroeconomic volatility[5] in developing countries.

Table 2. Macroeconomic volatility in MFL and LFL countries

Total Output (Y)/Period	Total	1	2	3	4
MFL	0.0432	0.0513	0.0504	0.0403	0.0309
LFL	0.0415	0.0530	0.0452	0.0390	0.0290
Private Consumption (C)	Total	1	2	3	4
MFL	0.0695	0.0877	0.0747	0.0607	0.0551
LFL	0.0602	0.0670	0.0631	0.0570	0.0507
Final Consumption (C+G)	Total	1	2	3	4
MFL	0.0587	0.0738	0.0625	0.0516	0.0468
LFL	0.0530	0.0615	0.0545	0.0521	0.0440
Consumption Smoothing	Total	1	2	3	4
MFL	1.5351	1.5238	1.4877	1.4299	1.6989
LFL	1.5364	1.2069	1.2996	1.8648	1.7745

Source: Authors' calculations

Evans and Hnatkovska (2006) and Kose *et al.* (2003) argue that the increasing degree of openness of an economy at the initial stage of financial integration induces increased volatility of consumption and total output. Additional deepening of the financial integration process diminishes influence of financial integration on the volatility of macroeconomic aggregates[6]. Kose *et al.* (2003) argue that the very low financial openness of most of the developing countries operates as the convenient vehicle to preserve macroeconomic stability. As a result, low degree of financial integration of MFL countries seems to be reasonable as it prevents the risks of excessive macroeconomic volatility. Here again we suggest that advantages and gains from financial integration are typically conditional on the country's level of development, i.e. meeting country specific threshold levels for the size of financial market[7], quality of main financial institutions, responsibility of economic policies and effective of policy instruments to cope with sudden distortions in capital flows and terms of trade. We argue that lagging behind individual criteria results in increased levels of macroeconomic volatility in MFL countries.

Key characteristics of the relationship (all countries)

The Figure4 summarizes the relationship between financial integration and macroeconomic volatility based on the regression between de jure and de facto levels of financial integration and the volatility of macroeconomic variables ($mvgdp_{i,t}$, $mvcon_{i,t}$) for both groups of countries - developed countries ($Deved_{i,t}$) and developing countries ($Devng_{i,t}$). We have employed two measures as a proxy for financial integration - de jure level of financial integration ($Finka_{i,t}$) and de facto level of financial integration ($Finope_{i,t}$).

Results for developing countries in both panels indicate that there is a positive relationship between de jure measure of financial integration and macroeconomic volatility. Increasing degree of financial liberalization in developing countries is associated with increased volatility of both output and consumption. The significance of the relationship increases when the volatility of private consumption ($mvcon_{i,t}$) in developing countries is considered. We suggest that financial liberalization of developing countries induces increased macroeconomic volatility. Increased inflows of foreign capital, especially at the initial stages of financial liberalization, operate as exogenous shock inducing increased volatility of domestic demand components. However, while our results correspond to the key outcomes of Evans and Hnatkovska (2006) and Kose *et al.* (2003) who suggest that the initial liberalization of capital flows in developing countries induces increased degree of macroeconomic volatility, they seem to be contrary to the key conclusions of IMF (2007).

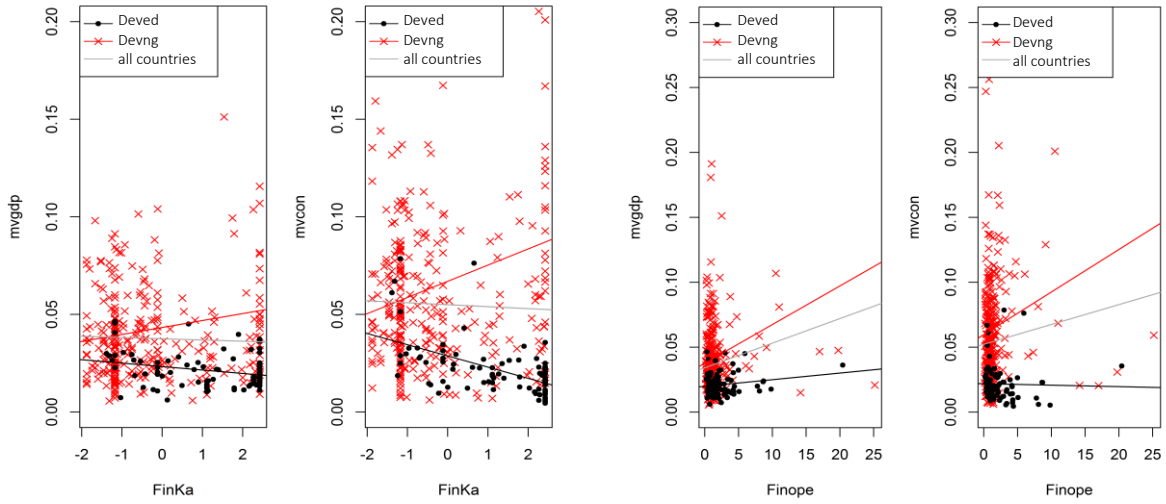
[5] Similar results are also produced from the classification of countries based on the level of financial integration.

[6] Financial openness improves economic environment and stimulates economic growth. As a result, negative effects of financial integration on the fluctuations of output are reduced.

[7] Ineffective financial markets reduce both risk diversification and benefits arising from financial integration.

Reduced macroeconomic volatility is usually observed in countries with proper mix of financial liberalization dynamics and the improvements of favorable economic environment in the country. However, insufficient development of domestic financial markets represents one of the most frequent origins of adverse effects of financial liberalization reducing its gains and benefits. Eozenou (2008), Loayza *et al.* (2007), Evans and Hnatkovska (2006) and Kose *et al.* (2003) provide rich empirical evidence in this area. According to Meyrelles-Filho and Jayme (2010), the liberalization of capital flows in developing countries has negative effect on economic growth due to increasing degree of macroeconomic volatility.

The relationship between de jure level of financial integration (*Finka* $_{i,t}$ indicator used as a proxy) and macroeconomic volatility in developed countries seems to be negative (Figure 4, Panels 1 and 2). The significance of the relationship is even stronger in case of the volatility of consumption[8]. Our results for developed countries correspond to the key outcomes of IMF (2007), arguing that higher financial liberalization in a country provides more opportunities to reduce its macroeconomic volatility. Therefore, we suggest that developed countries, unlike developing countries, benefit more from financial integration. According to Evans and Hnatkovska (2006) and Kose *et al.* (2003), it is due to higher degree of financial liberalization in these countries. According to Loayza *et al.* (2007), the degree of macroeconomic volatility corresponds to economic performance of countries that is why the relationship between financial integration and macroeconomic volatility in developed countries is negative.



Source: Authors' calculations

Figure 4. Relationship between financial liberalization, financial integration and volatility of macroeconomic variables (all countries)

Finally, following our results we suggest that the key determinants of the relationship between financial integration and macroeconomic volatility can be recognized in two areas. First area is characterized by the degree of financial integration. According to IMF (2007), Evans and Hnatovska (2006) and Kose *et al.* (2003), financial integration is more beneficial and less risky if countries have reached certain level of financial liberalization and financial openness. Second area is characterized by the general economic development that can be conventionally characterized by the minimum threshold levels for individual indicators. Despite generally low levels of financial openness (insufficient financial integration), welfare gains from international financial integration are very low or missing at all especially in countries with less-advanced financial markets, poor quality of institutions, irresponsible macroeconomic policies, public sector corruption, political constrains etc.

Examination of the relationship between de facto measure of financial integration (Finope $_{i,t}$ indicator used as a proxy) and the volatility of total output and private consumption in both groups of countries revealed quite different results (Figure 4, Panels 3 and 4).

Generally, deeper financial integration of developed and developing countries was associated with increased volatility of total output. The slope of the regression curve for developed countries is more flat that is why we suggest that increasing financial openness is associated with less dynamic increase in the volatility of

[8] especially due to high international risk sharing

total output. As a result, financial integration of developed countries induces much less distortionary effects on macroeconomic stability than in developing countries.

However, our results of the relationship between financial openness and the volatility of private consumption in developed countries revealed a different picture. Increasing financial openness is associated with reduced volatility of private consumption. Considering that public consumption in developed countries represented less volatile component of the final consumption[9] (Table 2) we suggest that deeper financial integration in developed countries induced higher volatility of investments.

Deeper financial integration of developing countries was associated with more dynamic increase in the volatility of private consumption than indicated by de jure indicator. Here again we highlight reduced ability of less developed countries to reap the benefits arising from deeper financial integration due to economic and institutional constrains.

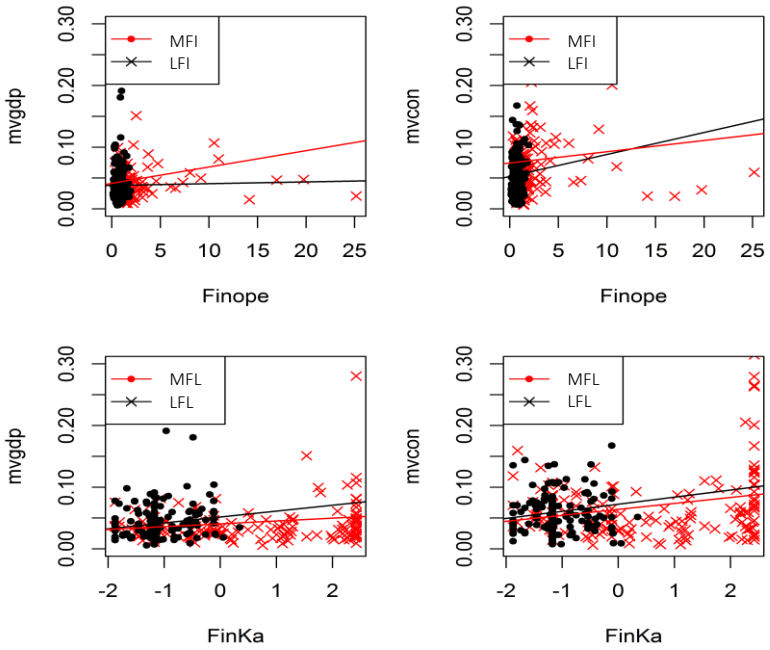
Although the analysis of the relationship between de jure and de facto measures of financial integration and macroeconomic volatility revealed some differences, our results indicate that financial integration induced higher macroeconomic volatility in developing countries.

Key characteristics of the relationship (developing countries)

In this section we analyze the relationship between financial integration and macroeconomic volatility in developing countries. Influence of financial integration on the volatility of output and consumption will be examined on the sample of developing countries divided into MFL (more financially liberalized), LFL (less financially liberalized), MFI (more financially integrated) and LFI (less financially integrated) countries.

Our results are summarized in Figure 5. Following the key outcomes from the previous section we emphasize that deeper financial integration induces higher volatility of both total output and private consumption in developing countries. However, more flat slope of the regression curve in case of MFL countries indicates weakening of the influence of financial liberalization on macroeconomic volatility. This corresponds to the assumption of IMF (2007) suggesting that the gradual increase in financial liberalization reduces excessive macroeconomic volatility. Due to high level of significance of examined positive relationship we emphasize that developing countries are not sufficiently open financially that is the key obstacle for enjoying full benefits and gains from financial liberalization (Evans and Hnatkovska (2006) and Kose *et al.* (2003)). Introduction of liberalization policies at the initial stages of financial liberalization more likely increases macroeconomic volatility. However, additional deepening in financial openness reduces negative effects of financial integration provided that the progress of financial liberalization is accompanied with adequate economic and institutional changes in the countries. Too rapid financial liberalization is likely to prone macroeconomic instability. Following the findings of Loayza *et al.* (2007), we argue that despite the general weakening in the relationship between financial liberalization and macroeconomic volatility, the performance of developing countries still lag behind a global trend. As a result, financial integration process continues to induce the excessive macroeconomic volatility. However, IMF (2007) assumes that financial liberalization improves the efficiency of the functioning of financial markets, improves institutional quality, increases responsibility of macroeconomic policies, reduces corruption and weakens other political restrictions. Decreasing strength of the relationship between financial liberalization and macroeconomic volatility is thus the result of improvements in the overall economic performance and conditions in developing countries although the contribution of financial liberalization to this trend is still more or less disputable. Finally, developing countries seem to be in a vicious cycle. While foreign capital inflows provide growth incentives, rapid financial liberalization induces excessive macroeconomic volatility. Gradually increasing financial openness corresponding to inevitable economic, institutional and political improvements seems the be the only alternative for reaping benefits from financial integration while eliminating negative side effects and preserving macroeconomic stability.

[9] Our results indicate lower volatility of final consumption in comparison with private consumption.



Source: Authors' calculations

Figure 5. Relationship between financial integration and volatility of macroeconomic variables (developing countries)

Deeper financial liberalization allows for improvements in the underlying determinants and induces the weakening of the influence of financial liberalization on macroeconomic volatility. However, different though generally higher volatility of total output and consumption considering low levels of financial openness indicates the differences in preparedness of developing countries for foreign capital inflows. As a result, sudden changes in the volume of foreign capital inflows (deepening in financial integration) are more likely to induce higher macroeconomic volatility and operate as exogenous shock with all its negative effects on macroeconomic stability than a convenient supplementary source of capital.

Our results indicate that financial liberalization and financial openness generally induces an increase in the volatility of output and consumption (Figure 5). The relationship between financial integration and macroeconomic volatility is significantly determined by the degree of financial openness. Higher levels of financial integration allowed developing countries from our sample to reap the benefits of financial integration while maintaining low levels of macroeconomic volatility. This relationship is observable mostly in MFL countries with decreasing influence of financial liberalization (though still positive) on macroeconomic volatility. However, the slope of the regression curve in MFI countries is clearly steeper indicating more volatile development of total output associated with increasing degree of financial openness. We suggest that de jure indicator of financial integration, as more complex measure of financial integration, examines this relationship more precisely considering a wide variety of determinants. Less distortionary effects of financial integration on macroeconomic volatility in MFL in comparison with LFL economies is thus the result of general economic and institutional improvements. However, higher macroeconomic volatility associated with greater degree of financial openness in MFI countries indicates the risks arising from a rapid financial integration process without adequate strengthening of relevant policy frameworks and institutions, as well as broadly favorable domestic economic and financial conditions. Moreover, stability risks may also arise if the driving forces underlying stronger international financial integration reflect global economic imbalances.

One-Way Error Component Model

In this section we employ one-way error component model using panel data considering fixed effects (see section 3 for more details). Results for fixed effect model (FEM) are based on diagnostic test, F-test, Hausman test and significance tests considering individual and time effects. Following our results we suggest that

underlying period had significant (decreasing) influence on the macroeconomic volatility over time. Estimated results are summarized in Table 3.

Table 3. Results of the Fixed Effects Model

Variable	Estimate	Std. Error	t value	Pr(>|t|)
Finope	0.0159	0.0015	10.6389	2.200e-16 ***
Finope*1340	-0.0145	0.0016	-9.0871	2.200e-16 ***
Deved	-0.0236	0.0038	-6.1890	1.527e-09 ***
d1340	0.0192	0.0039	4.9487	1.111e-06 ***
Period 1	0.0353	0.0037	9.5961	2.200e-16 ***
Period 2	0.0277	0.0037	7.3919	1.448e-13 ***
Period 3	0.0160	0.0040	3.9887	6.645e-05 ***
Period 4	0.0094	0.0040	2.3477	0.01889 *

Note: The value1340.808 USD represents cross-sectional median of total output that enabled us to divide developing countries in two groups.
Source: Authors' calculations

Additional diagnostic tests were employed to detect the presence of heteroscedasticity, serial correlation and cross-sectional dependence in time series. Tests revealed the existence of all three characteristics. However, according to Baltagi (2005) tests for serial correlation and cross-sectional dependence are insignificant in models with few time periods. For this reason, we omit these tests. We estimate the robust variance-covariance matrix to remove the heteroskedasticity based on the Arellano estimator (Arellano, 1987). We apply the clustering of various time periods by creating a matrix in order to deal with the cross-sectional dependence among residues. We use the HC1 estimator that is suitable for samples with a small number of observations over time. Regression coefficients of variables and their statistical significance in determining the macroeconomic volatility are summarized in Table 4.

Table 4. Results of Estimators of the Robust Covariance Matrix (Arellano method)

Variable	Estimate	Std. Error	t value	Pr(>|t|)
Finope	0.0159	0.0033	4.7701	2.602e-06 ***
Finope1340	-0.0145	0.0036	-4.0303	6.693e-05 ***
Deved	-0.0236	0.0059	-4.0282	6.752e-05 ***
d1340	0.0192	0.0028	6.9116	1.951e-11 ***

Source: Authors' calculations

Our results confirmed a decreasing trend in macroeconomic volatility over time. This trend is present in both developed and developing countries though it is more obvious in developed countries due to more effective allocation of capital and a higher degree of risk sharing. The degree of macroeconomic volatility is also determined by macroeconomic performance that is clearly higher in developed countries. Higher macroeconomic stability is the result of generally higher responsibility of economic policies, lower microeconomic rigidities and stronger institutional environment. Developed economies have also deeper and more effective financial markets that enable countries to absorb asymmetric shocks caused by the increased volatility of financial flows more effectively. That is why we suggest that the degree of economic development of the country has a significant influence on the relationship between financial integration and macroeconomic volatility. General improvements in the economic and institutional conditions result in the weakening of this relationship. We suggest that positive trends in the economic development are associated with improved efficiency of domestic financial markets and higher quality of institutions that reduce the fluctuations in the total output followed by unexpected exogenous shocks induced by i.e. changes in the dynamics of foreign capital flows.

Conclusion

In the paper we have analyzed the relationship between financial integration and macroeconomic volatility. Our results, supported by the rich empirical evidence of many other studies, indicate that macroeconomic volatility followed decreasing trend over the period of last four decades though developed countries experienced lower degree macroeconomic volatility than developing countries. However, the relationship between financial openness and economic development in developed countries seems to be non-significant. As a result, influence of financial integration on the macroeconomic volatility was disappearing over time. Similarly, the impact of

financial integration of developing countries on macroeconomic volatility decreased with improved economic and institutional conditions. However, the relationship still remained positive which means that deeper financial integration caused excessive macroeconomic volatility.

Despite decreasing strength of the relationship between financial liberalization and macroeconomic volatility the overall contribution of financial liberalization to this trend is still more or less disputable. Developing countries seem to be in a vicious cycle. While foreign capital inflows provide growth incentives, rapid financial liberalization induces excessive macroeconomic volatility. Gradually increasing financial openness corresponding to inevitable economic, institutional and political improvements seems the be the only alternative for reaping benefits from financial integration while eliminating negative side effects and preserving macroeconomic stability.

Reduced macroeconomic volatility is usually observed in countries with proper mix of financial liberalization dynamics and the improvements of favorable economic environment in the country. However, insufficient degree of economic development represents one of the most frequent origins of adverse effects of financial liberalization reducing its gains and benefits in developing countries. Moreover, despite generally low levels of financial openness (insufficient financial integration), welfare gains from international financial integration are very low or missing at all especially in countries with less-advanced financial markets, poor quality of institutions, irresponsible macroeconomic policies, public sector corruption, political constrains etc.

Finally, increasing financial openness of developed countries was associated with reduced volatility of private consumption. Considering that public consumption in developed countries represented less volatile component of the final consumption we suggest that deeper financial integration in developed countries induced higher volatility of investments. We suggest that this channel may be considered as the key obstacle for developed countries to benefit more from financial integration.

Acknowledgement

This paper was written in connection with scientific project VEGA no. 1/0892/13 and 1/0994/15. Financial support from this Ministry of Education's scheme is also gratefully acknowledged.

References

[1] Abiad, A., Leigh, D., Mody, A. (2009), Financial Integration, Capital Mobility, and Income Convergence, *Economic Policy*, 24(58): 241-305.

[2] Arellano, M. (1987), Practitioners' Corner: Computing Robust Standard Errors for Within-groups Estimators, *Oxford Bulletin of Economics and Statistics*, 49(4): 431-434.

[3] Badinger, H. (2010), Output Volatility and Economic Growth. *Economics Letters*, 106(1): 15-18.

[4] Baltagi, B. H. (2005), Econometric Analysis of Panel Data, 3rd Edition, Chichester [u.a.]: Wiley, 2005. ISBN 04-700-1456-3

[5] Baele, L. *et al.* (2004), Measuring Financial Integration in the Euro Area, [ECB, Occasional Paper No. 14/2004], Frankfurt am Main, European Central Bank, 93 p.

[6] Bekaert, G., Harvey, C.R., Lundblad, CH. (2006), Growth Volatility and Financial Liberalization, *Journal of International Money and Finance*, 25(3) 370-403.

[7] Campbell, S. (2004). Macroeconomic Volatility, Predictability and Uncertainty in the Great Moderation: Evidence from the Survey of Professional Forecasters, [FRB, Staff Working Paper in the Finance and Economics Discussion Series No. 52/2004] Washington, Federal Reserve Board, 36 p.

[8] Dabla-Norris, E., Srivisal, N. (2013). Revisiting the Link between Finance and Macroeconomic Volatility, [IMF, Working Paper No. 29/2013] Washington, International Monetary Fund, 35 p.

[9] Dabušinskas, A., Kulikov, D., Randveer, M. (2012). The Impact of Volatility on Economic Growth, [Bank of Estonia, Working Paper No. 7/2012] Tallinn, Bank of Estonia, 18 p.

[10] Easterly, W., Islam, R., Stiglitz, J.E. (2000). Shaken and Stirred: Explaining Growth Volatility, [WB, Macroeconomic Paradigms for Less Developed Countries], Washington, World Bank, 13 p.

[11] Eichengreen, B., Leblang, D. (2003). Capital Account Liberalization and Growth: Was Mr. Mahathir Right?, *International Journal of Finance & Economics*, 8(3) 205-224.

[12] Eozenou, P. (2008). Financial Integration and Macroeconomic Volatility: Does Financial Development Matter?, MPRA Paper No. 12738, 35 p.

[13] Evans, M., Hnatkovská, V. (2006). Financial Integration, Macroeconomic Volatility, and Welfare, *Journal of the European Economic Association*, 5(2-3): 500-508.

[14] Fecht, F., Grüner, H.P., Hartmann, P. (2012). Financial Integration, Specialization and Systemic Risk, [ECB, Working Paper No. 1425/2012], Frankfurt am Main, European Central Bank, 47 p.

[15] Frey, L., Volz, U. (2011). Regional Financial Integration in Sub Saharan Africa- An Empirical Examination of its Effects on Financial Market Development. Proceedings of the German Development Economics Conference, Berlin, No. 29, 38 p.

[16] Glick, R., Guo, X., Hutchison, M.M. (2004). Currency Crises, Capital Account Liberalization, and Selection Bias, [FRB of San Francisco, Working Paper No. 15/2004], San Francisco, Federal Reserve Bank of San Francisco, 34 p.

[17] Gourinchas, O., Jeanne, O. (2005). Capital Flows to Developing Countries: the Allocation Puzzle, [NBER, Working Paper No. 13602/2007], Cambridge, Federal Reserve Bank of San Francisco, 52 p.

[18] Hausmann, R., Gavin, M. (1996). Securing Stability and Growth in a Shock Prone Region: The Policy Challenge for Latin America, [Inter-American Development Bank, Working Paper No. 315/1996], Washington, Inter-American Development Bank, 33 p.

[19] Herrera, S., Vincent, B. (2008). Public Expenditure and Consumption Volatility, [WB, Policy Research Working Paper No. 4633/2008], Washington, World Bank, 23 p.

[20] Jermann, U., Quadrini, V. (2006). Financial Innovations and Macroeconomic Volatility, [NBER, Working Paper No. 12308/2006], Cambridge, Federal Reserve Bank of San Francisco, 33 p.

[21] Kaminsky, G.L., Reinhart, C.M. (1999). The Twin Crises: The Causes of Banking and Balance-of-payments Problems, *American Economic Review*, 89(3): 473-500.

[22] Kilian, L. (2007). Oil Price Shocks, International Risk Sharing and External Adjustment. Vox: CEPR's Policy Portal.

[23] Kim, W. (2003). Does Capital Account Liberalization Discipline Budget Deficit? *Review of International Economics*, 11(5): 830-844.

[24] Klomp, J., De Haan, J. (2009). Political Institutions and Economic Volatility, *European Journal of Political Economy*, 25(3): 311-326.

[25] Kose, M.A., Prasad, E.S., Rogoff, K., Wei, S.-J. (2010). Handbook of Development Economics. Financial Globalization and Economic Policies, Volume 5, Elsevier, Amsterdam, pp. 4283–4359.

[26] Prasad, E.S., Rogoff, K., Wei, S.-J., Kose, M.A. (2004). Financial Globalization, Growth and Volatility in Developing Countries, [NBER, Working Paper No. 10942/2004], Cambridge, Federal Reserve Bank of San Francisco, 67 p.

[27] Kose, M.A., Prasad, E.S., Terrones, M.E. (2003). Financial Integration and Macroeconomic Volatility, [IMF, Working Paper No. 50/2013] Washington, International Monetary Fund, 27 p.

[28] Kose, A., Prasad, E.S., Terrones, M.E. (2006). How do Trade and Financial Integration Affect the Relationship between Growth and Volatility? *Journal of International Economics*, 69(1): 176-202.

[29] Kose, M.A. (2002). Explaining Business Cycles in Small Open Economies: How Much do World Prices Matter?', *Journal of International Economics*, 2002, 56(2): 299-327.

[30] Kose, M.A., Prasad, E.S., Terrones, M.E. (2009). Does Financial Globalization Promote Risk Sharing?, *Journal of Development Economics*, 89(2): 258-270.

[31] Lane, P.R., Milesi-Ferretti, G.M. (2006). The External Wealth of Nations Mark II: Revised and Extended Estimates of Foreign Assets and Liabilities, 1970–2004, [IMF, Working Paper No. 69/2006] Washington, International Monetary Fund, 48 p.

[32] Levine, R., Zervos, S. (1998). Stock Markets, Banks, and Economic Growth, *American Economic Review*, 88(3): 537-558.

[33] Levine, R. (2001). International Financial Liberalization and Economic Growth, *Review of International Economics*, 9(4): 688-702.

[34] Loayza, N.V. *et al.* (2007). Macroeconomic Volatility and Welfare in Developing Countries: An Introduction, *The World Bank Economic Review*, 21(3): 343-357.

[35] Malik, A., Temple, J.R.W. (2009). The Geography of Output Volatility, *Journal of Development Economics*, 90(2): 163-178.

[36] Masten, A.B., Coricelli, F., Masten, I. (2008). Non-linear Growth Effects of Financial Development: Does Financial Integration Matter? *Journal of International Money and Finance*, 27(2): 295-313.

[37] Meyrelles-Filho, S.F. *et al.* (2010). Capital Mobility, Balance of Payments Constraints, and Economic Growth: An Empirical Dynamic Analysis. Curso de Ciencias Economicas da Universida de Federal de Goias-FACE, Discussion Paper No. 16/2010

[38] Mirdala, R. (2011a). *Economic Aspects of Capital Flows Liberalization in the European Transition Economies*, Košice: University Press, Technical University of Košice, 230 p., ISBN 978-80-553-0838-8.

[39] Mirdala, R. (2011b). Financial Deepening and Economic Growth in the European Transition Economies, *Journal of Applied Economic Sciences*, 6(2): 177-194.

[40] Mirdala, R. (2011c). Financial Integration and Economic Growth in European Transition Economies, *Journal of Advanced Studies in Finance*, 2(4): 116-137.

[41] Montiel, P., Reinhart, C.M. (1999). Do Capital Controls and Macroeconomic Policies Influence the Volume and Composition of Capital Flows? Evidence from the 1990s, *Journal of International Money and Finance*, 18(4): 619-635.

[42] Mougani, G. (2012). An Analysis of the Impact of Financial Integration on Economic Activity and Macroeconomic Volatility in Africa within the Financial Globalization Context, [ADB, Working Paper No. 144/2012], Tunis, African Development Bank, 34 p.

[43] Narayan, P.K., Narayan, S. (2010). Testing for Capital Mobility: New Evidence from a Panel of G7 Countries, *Research in International Business and Finance*, 24(1): 15-23.

[44] Obstfeld, M., Rogoff, K. (1994). The Intertemporal Approach to the Current Account, [NBER, Working Paper No. 4893/1994], Cambridge, Federal Reserve Bank of San Francisco, 75 p.

[45] Obstfeld, M. (1998). The Global Capital Market: Benefactor or Menace?, [NBER, Working Paper No. 6559/1998], Cambridge, Federal Reserve Bank of San Francisco, 38 p.

[46] Pappas, A. (2010). Capital Mobility and Macroeconomic Volatility: Evidence from Greece, *The Journal of Economic Asymmetries*, 7(1): 101-121.

[47] Pierdzioch, CH. (2004). Capital Mobility and the Effectiveness of Fiscal Policy in Open Economies, *Journal of Macroeconomics*, 26(3): 465-479.

[48] Prasad, E.S., Rajan, R.G., Subramanian, A. (2006). Patterns of International Capital Flows and their Implications for Economic Development, Federal Reserve Bank of Kansas, Jackson Hole Conference Paper, pp. 119-158.

[49] Ramey, G., Ramey, V.A. (1995), Cross-country Evidence on the Link between Volatility and Growth, *The American Economic Review*, 85(5): 1138-1151.

[50] Razin, A., Rose, A. (1992). Business Cycle Volatility and Openness: An Exploratory Cross-section Analysis, [NBER, Working Paper No. 4208/1992], Cambridge, Federal Reserve Bank of San Francisco, 31 p.

[51] Rodrik, D., Velasco, A. (1999). Short-term Capital Flows, [NBER, Working Paper No. 7364/1999], Cambridge, Federal Reserve Bank of San Francisco, 42 p.

[52] Stavárek, D., Repkova, I., Gajdosova, K. (2011). Theory of Financial Integration and Achievements in the European Union, In Matoušek, R., Stavárek, D. (eds.) *Financial Integration in the European Union. (Rutledge Studies in European Economy),* London: Rutledge, 2012. ISBN 978-0-415-69076-8.

[53] Wei, S.-J., Tytell, I. (2004). Does Financial Globalization Induce Better Macroeconomic Policies?, IMF, Working Paper No. 84/2004 Washington, International Monetary Fund, 40 p.

*** IMF (2007). Reaping the Benefits of Financial Globalization, [IMF, Occasional Paper No. 264/2008] Washington, International Monetary Fund, 52 p.

*** United Nations (2011). Financial Flows to Developing Countries, Chapter 3 in World Economic Situation and Prospects, pp. 69-96.

*** United Nations. (2008). Assessing regional integration in Africa III: Towards Monetary and Financial Integration in Africa, Economic Commission for Africa, Addis Ababa, 293 p., ISBN: 978-92-1-12509-8

Journal of Applied Economic Sciences
Volume X, Issue 4(34), Summer 2015

Improving Welfare in Congo: Italian National Hydrocarbons Authority Strategies and its Possible coopetitive Alliances with Green Energy Producers

David CARFÌ
Department of Mathematics, University of California Riverside, USA
Department of Economics, California State University Fullerton, USA
davidcarfi@gmail.com, david.carfi@ucr.edu

Alessandro ROMEO
Academy of Advanced Scientific Studies, University of Reggio Calabria, Italy
alessandro.romeo988@gmail.com

Abstract:

In this paper we show how the use of David Carfi new coopetitive game model, which considers both collaboration and competition together and simultaneously, can advance the understanding and control of asymmetric R&D alliances between small Green Energy producers and large energy producers by carbon-fuels, in Congo. We consider the literature on asymmetric R&D cooperation and coopetition to propose a model of coopetitive game, which seems particularly suitable for exploring those types of asymmetric R&D alliances involving two energy firms and a venture capitalist in the foundation of a coopetitive Joint Venture. Specifically, we shall consider five players: a large firm (ENI), a small firm (Solar), a venture capitalist, a research joint venture (founded by the first two players) and finally the government of Congo, in which the productions take place. We graphically show that cooperative efforts are required (and beneficial for every player) even if the partners are potentially competitors in the energy market and we shape the common coopetitive payoff space, which they determine during the complex multi-faced interaction. We eventually show that the coopetitive partners can fairly balance their interaction dynamics and that this interaction affects both the value creation and value capture processes, improving the welfare and health conditions of Congo population.

Keywords: access to electricity in Africa, R&D alliances, coopetitive games, deep water project, ENI (National Hydrocarbons Authority), green energy and health.

JEL Classification: C72, D31, E21, G24, L24

1. Introduction: sustainability in the long term

The explosion of the environmental question in the second half of the century has focused the attention of the community on the need of conservation of vital resources for humans. This has meant that companies, in order to meet the new "needs" of customers, are trying to implement more sustainable behavior in the long run.

In particular, the *Corporate Social Responsibility* (CSR) studies the impact caused by operations of the company in society and the environment to which it belongs and with which there is mutual interdependence. The company which implements CSR inside has decided that, in addition to meet the legal obligations imposed by local regulation, also wants to invest in human capital, respecting the environment and the social progress.

Knowing that we live in a closed system in which resources are limited, we must create an economic system that respects the environment and the community: this leads to the creation of the *green economy.* Beyond CSR, even the green economy focuses on impacts caused by businesses to the community.

Eco-friendly technology and scientific knowledge are the key elements that contribute to implement this type of economy. It consists on the use of alternative energy sources, particularly renewable energy, such as solar power, wind power, geothermal, hydropower and biomass. With this type of economy we will also seek to reduce energy consumption and to undertake major strategies to reduce pollution, not neglecting, however, the possibility of obtaining energy efficiency.

2. The use of energy nowadays

The themes of CSR and green economy are very current nowadays in a world where there is a continuous use and sometimes waste of energy. As everybody knows, the energy industry is the set of activities that transform the primary sources (*non-renewable:* mineral oils, natural gas, carbon and uranium; *renewable*: gravity, geothermal, solar, biomass, wind, waves, tides) in energy and transport and distribute them to end users.

As we already know, everything around us works with energy: We use gasoline in cars, gas in kitchens and electricity throughout the rest: lighting, use of household appliances (TV, washing machine, air conditioner, oven) and technological devices such as mobile-phones, tablets and so on but we don't always use these resources optimally.

Non-renewable resources in a few years will no longer be available and so we have to not only use in the best way the resources we have, but we must try to waste less and create more energy by renewable resources. The report by the International Energy Agency (IEA- see sitography [s7]) notes that in 2013 the world energy waste has been estimated at $ 80 billion and counting in 2020, with the increase of the devices, will increase to about $ 120 billion.

Although in some parts of the world there are energy losses, in other parts energy is not available to everyone. Nowadays, about 1.3 billion people (see sitography [s8]) do not have access even to a "basic" consumption of electricity (see Figure 1). Of these 1.3 billion people, about 590 million live in sub-Saharan Africa and over 300 million in India. The lack of electricity makes it difficult to supply drinking water from deep aquifers or the storage of vaccines.

Figure 1 - Share of population with access to electricity
(see sitography [s6])

In Sub-saharan Africa, 620 milion people - two thirds of the population - live without electricity. There (see sitography [s2]) an economic growth of more than 30% is expected by 2040 provided that certain essential measures are carried out:

- An additional 450 billion $ in power sector investment, reducing power outages by half and achieving universal electricity access in urban areas;
- Better management of resources and revenues, adopting robust and transparent procedures that enable more effective use of oil and gas revenues.

3. Italian National Hydrocarbons Authority works in Congo

Since 1968, the big international company *ENI (Italian National Hydrocarbons Authority)* has decided to invest in Republic of Congo in order to help people to get a lot of development and greater social well-being. In order to improve the social-being, ENI decided to bring electricity to those who still live without. In fact, since 2007, ENI has invested in its facility "M'Boundi" in order to minimize gas flaring and turn it into a new model for sustainable energy growth. The gas produced from the field M'Boundi is brought to the Central Electrique du Congo and to the Djeno Power Plant through a pipeline of 55 km (see sitography [s1]). There, the establishment transforms the extracted gas to new energy, which allows them to meet 60% of the national demand for electricity. This energy is distributed to over 300,000 people in the area of Pointe-Noire. In Congo, until 2008, people were often subject to power outages because the electricity was not enough for all the needs of the population and also because there was an old distribution networks which dates back to the sixties. So, ENI decided to help them renewing what had become obsolete.

3.1. Italian National Hydrocarbons Authority activities for local people

In order to provide more welfare to local community have been launched projects (see sitography [s4]) as "Deep Water", "Food Plus Biodiesel", "Kento Mwana" and "Salissa Mwana".

- The first project born thanks to ENI's experience in different areas of the world because has succeeded in developing innovative technologies and methodologies for all phases of: exploration, drilling and production. The used system is the advanced numerical model named "SEBE3" that firstly evaluate the petroleum potential of the area and the risk associated and, secondly identifies the most promising areas that allows them to collect seismic data in order to determine the spatial position of the deep states in three dimensions.
- The Food Plus Biodiesel project, signed in May 2008, defines a collaborative framework for the use of vegetable oils. There, farms produce about 340 thousand tons/year of crude oil. The excess production is used by ENI to produce biodiesel through ENI's proprietary technology Ultra-Bio-Diesel.
- Kento Mwana project (Mother-Child) was launched in 2009 in cooperation with the local Ministry of Health. It seeks to reduce the rate of mother-to-child transmission of HIV virus. Voluntary screening services are offered to pregnant women and, for example, in 2010 over 12,800 pregnant women have been tested for HIV and 518 seropositive women are currently involved in the Kento Mwana project, with a result of less than 1% of HIV mother-child transmission in the couples treated.
- Salissa Mwana project (Let's protect the children) aims to improve healthcare for children in the remote rural areas of the regions of Kouilou, Niari and Cuvette. This is achieved through vaccination programmes against the major diseases and the raising of the population's awareness with regard to prevention.

3.2. The result of the activities

The documents on ENI (Italian National Hydrocarbons Authority) website show that, ENI with its drilling operations and its desire to protect the local community is bringing welfare in Congo. Its good relations with representatives of local communities and authorities, its integrated approach not just to industrial development but also to local and human development (to promote environmental assets in Congo, ENI implemented a procedure to support a UNESCO project for the creation of a geo-park), its dialogue with local populations (listening directly to the population through meetings, periodic dialogue sessions (at least one a month) and updating sessions) and the various associations in the areas clearly indicate the purpose of ENI: The company wants to carry out its activities in Congo in a professional manner, "using" the local community (861 people were employed in Congo at 31 December 2010) delivering there part of the produced richness and implementing ethically and socially responsible culture to ensure that well-being is not only visible in the short term, but especially in the long run conserving future populations.
If we look at financial data from 2010 to 2012 we can see how increased the GDP Per Head, the Life Expectancy at Birth and the Population. Production and consumption has increased over the years and all data analyzed indicates that the policies adopted by ENI are a major factor that is leading to the increase in social well-being of the local community (see Table 1).

Table 1. Background data (see sitography [s4])

Indicators	Measure	2010	2011	2012
Real GDP Growth	% Change Over a Year	8.8	3.4	4.5
GDP per Head	US $ at PPP	1.900	2.055	1.999
Life Expectancy at Birth	Years	56	56	57
CPI Inflation	% Change over a Year Earlier	5.0	2.3	4.2
Population	Millions of Persons	4.0	4.1	4.2

4. Literature review

In this paper we shall use a wide range of scientific literature, especially from coopetitive studies. In particular, we shall present and use fundamental works in coopetition, in Game Theory and applications, in a perspective feasible to represent coopetitive interactions; we shall concentrate on papers regarding the coopetitive game model introduced by D. Carfì and on the asymmetric R&D alliances, because we need to construct models of coopetition in asymmetric R&D alliances using Game Theory. In this section we shall present such complex and wide-range scientific literature.

4.1. Literature on coopetition

Although game-theoretical models are not sistematically applied in coopetition studies, Game Theory has proved to be extremely useful for coopetition analysis. For example, Brandenburger and Nalebuff (1996, pp. 5–8) argued that game theory is useful for understanding coopetitive situations (Stein (2010: p.257) mentioned that Brandenburger and Nalebuff (1996) "explain 'co-opetition' as an approach that intends to explain competition and cooperation in business networks in the spirit of game theory"). Lado *et al.* (1997, p. 113) argued that game theory can explain behavior in the context of interfirm relationships. Clarke-Hill *et al.* (2003) and Gnyawali and Park (2009) explained game theory approach in coopetition situation (however, Clarke-Hill *et al.* (2003) used both cooperation and competition instead of coopetition). Okura (2012, 2009, 2008, 2007), Ngo and Okura (2008) and Ohkita and Okura (2014) explained the advantages of using game theory in coopetition studies. Pesamaa and Eriksson (2010) explained the usefulness of game theory for investigating actors' interdependent decisions. Rodrigues et al. (2011) applied game theory for investigating strategic coopetition. Ghobadi and D'Ambra (2011) summarized the characteristics, strengths and limitations to use Game Theory in coopetition studies. Bengtsson and Kock (2014) pointed out that game theory is one of the research perspectives in coopetition studies. D. Carfi (2012a, 2010a) has defined and applied a new analytical model of coopetitive game, after that he and various collaborators have developed the applicative aspects of the new model in several directions, such as Management, Finance, Microeconomics, Macroeconomic, Green Economy, Financial Markets, Industrial Organization, Project Financing and so on – see, for instance, Carfì and Fici (2012), Carfì and Lanzafame (2013), Carfì, Magaudda and Schilirò (2010), Carfi and Musolino (2015a, 2015b, 2014a, 2014b, 2013a, 2013b, 2013c, 2012a, 2012b, 2012c, 2011a, 2011b), Carfì, Patanè and Pellegrino (2011), Carfì and Perrone (2013, 2012a, 2012b, 2011a, 2011b, 2011c), Carfi and Pintaudi (2012), Carfi and Schilirò (2014a, 2014b, 2013, 2012a,2012b, 2012c, 2012d, 2011a, 2011b, 2011c), Carfì, Musolino, Ricciardello and Schilirò (2012), Carfì, Musolino, Schilirò and Strati (2013), Carfi and Trunfio (2011), Okura and Carfì (2014). Further, secondary but useful, material – which we have analyzed for our general setting – can be found in Asch (1952), Biondi and Giannoccolo (2012), Musolino (2012), Porter (1985), Shy (1995), Stiles (2001) and Sun, Zhang and Lin (2008).

4.2. Literature on coopetitive games

Here, we present an original recent definition of a coopetitive game, in normal form, given by David Carfì. The model can suggest useful solutions to a specific coopetitive problem, defined by the set of strategy profiles at the disposal of the two players and by a set of possible convenient *ex ante* agreements on the common strategy set. This analytical framework enables us to widen the set of possible solutions from purely competitive solutions to coopetitive ones and, moreover, incorporates a solution designed "to share the pie fairly" in a win–win scenario. At the same time, it permits examination of the range of possible economic outcomes along a coopetitive dynamic path. We also propose a rational way of limiting the space within which the coopetitive solutions apply. The basic original definition we propose and apply for coopetitive games is that introduced by Carfi and Schilirò (2014a, 2014b, 2013, 2012a, 2012b, 2012c, 2012d, 2011a, 2011b, 2011c) and Carfì (2012a, 2012b, 2010a, 2009a, 2009b, 2009c, 2009e, 2009g, 2008a). The method we use to study the payoff space of a normal-form game is due to Carfi (2012c, 2011b, 2010b, 2010c, 2009f, 2008d, 2008e, 2008f, 2008g, 2007a, 2006a, 2006b, 2005a, 2005b), Carfi and Musolino (2015a, 2015b, 2014a, 2014b, 2013a, 2013b, 2013c, 2012a, 2012b, 2012c, 2011a, 2011b), and Carfì and Schilirò (2014a, 2014b, 2013, 2012a, 2012b, 2012c, 2012d, 2011a, 2011b, 2011c). Other important applications, of the complete examination methodology, are introduced by D. Carfì and co-authors in Agreste, Carfì, and Ricciardello (2012), Arthanari, Carfì, and Musolino (2015), Baglieri, Carfì, and Dagnino (2010, 2012, 2016),Carfì and Fici (2012), Carfì, Gambarelli, and Uristani (2013), Carfì and Lanzafame (2013), Carfì, Patanè, and Pellegrino (2011). A complete treatment of a normal-form game is presented and applied by Carfì (2012a, 2012b, 2011b, 2010a, 2010b, 2010c, 2009a, 2009b, 2009c, 2009e, 2008a, 2008f, 2008g, 2006a), Carfi and Musolino (2015a, 2015b, 2014a, 2014b, 2013a, 2013b, 2013c, 2012a, 2012b, 2012c, 2011a, 2011b), Carfi and Perrone (2013, 2012a, 2012b, 2011a, 2011b, 2011c), Carfi and Ricciardello (2013a, 2013b, 2012 a, 2012b, 2012c, 2012d, 2012e, 2012f, 2012g, 2012h, 2012i, 2010, 2009) and Carfi and Schilirò (2014a, 2014b, 2013, 2012a,2012b, 2012c, 2012d, 2011a, 2011b, 2011c). Carfi (2008a) proposes a general definition and explains the basic properties of Pareto boundary, which constitutes a fundamental element of the complete analysis of a normal-form game and of a coopetitive interaction. The possible dynamical evolution models of our game theory framework could be developed by using the methodologies and tools introduced and exploited in Carfi (2009d, 2008b, 2008c, 2007b, 2007c, 2006c, 2006d, 2004a, 2004b, 2004c, 2004d, 1999), Carfi and Caristi (2008) and Carfi and Cvetko-Vah (2011).

4.3. Literature on asymmetric R&D alliances

We can find a wide range of studies focusing on the collaboration among competitors (Brandenburger and Nalebuff, 1996, 1995; Padula and Dagnino, 2007). The literature focuses on coopetitive tension in vertical alliances, considering to integrate complementary resources within the value net (Nalebuff and Brandeburger, 1996. In particular, the majority of the existing game theory literature in R&D strategy setting concentrates on the inter-organizational level and uses noncoperative games which help to determine optimal R&D expenditure, optimal timing of entry for new products into market, but do not provide any information about how much power the different player have in a given setting. This explains why the cooperative games are becoming much more used in R&D settings although they use the less-familiar characteristic-function language. In other words, cooperative games represent a tool to better understand how competition unfolds among players.

4.4 Other scientific connections

More generally, without citing other literature, our paper reveals connected with numerous research fields, such as: Access to Electricity in Africa, R&D Alliances, Altruism in Economic Interactions, Bio-fuels, Chemicals in Congo, Coopetitive Games and Coopetition, Deep Water project, Economic Growth of Open Economies, Electric Utilities, Energy Producers, ENI (National Hydrocarbons Authority), Externalities, Food Plus Biodiesel project, Green Energy, Health, Joint Ventures, International Investments, Kento Mwana project, Natural Resources, No Energy-waste, Normal-form Games, Non-zero Sum Game, Salissa Mwana project, Welfare.

5. Why we have to create a new economic model

The research carried out over the internet bring out that ENI, while trying to implement a green behavior in the Congo area, does not always give benefits to the local population. A news article (see sitography [s5]) reports the fact that on July 1st, 2013 the "Perro Negro 6" (one of the six Saipem offshore platforms) sank in the Atlantic Ocean. The incident has created missing and injured people, and of course, the loss of self-lifting means built in Indonesia in 2009.

Another article (see sitography [s3]) reports the news that ENI has received complaints for the creation of bio-fuels in Congo. There, deforestation is taking place in order to continue the palm oil production. This will not bring benefits to the local population, who are likely to suffer damage to the environment and human health caused by the extraction of oil, and a new push towards the use of non-renewable sources for energy production in developed countries. All this background is to emphasize that ENI, although want to bring well-being for the local community, not always succeeds in it, and for this reason should move towards a greener way of doing things.

For this reason, we create an economic model that could create long-term benefits in the Congo area.

6. The economic model

Assumption 1. We assume that, to achieve its goals, ENI, our 1st player, is forming horizontal alliances (that is energy-energy alliances), instead of acquiring new scientific knowledge, with a small (but research-oriented and highly efficient) Solar firm, our 2nd player.

Assumption 2. The Solar firm (2nd player) is engaged in the discovery, development, creation of energy generated entirely from renewable sources.

Assumption 3. To cope with global competitive pressures, ENI is allying in triad with another mid-size or small-size energy firm (our Solar) and with a venture capitalist (let us call VC or Cap), our 4th player (which we won't consider one of our principal players, because of its elementary actions and simple payoffs) in order to spin out a new energetically development program into a new renewable joint venture firm (we call RJV, research joint venture), our 3rd player.

6.1. Semi-quantitative description of the payoffs

At the end of this R&D alliance, the benefits for the three partners can be summarized as follows:

- *ENI* buys a certain amount x of energy from *RJV* and gains from the selling of the product x on the *Market*;
- *Solar* firm produces energy 100% safe and renewable, and gains by selling a quantity *z* to *RJV*;
- *Solar* firm cannot, by contract, sell in the *Market* for a certain amount of time;

- *RJV* gains by selling x of the *Solar* production to ENI and $z - x$ of the energy on the Market;
- *Cap* receives from *ENI* (at time 2) the capitalization k' of its initial investment *k* (money given to *ENI* at time 1);
- *MarketICongo* gains from the sunk costs k of *RJV*, from the research-costs *y* of *Solar* and it gains a value *bz* by improving energy production.

6.2. The contract

Assumption 4. ENI purchases energy from RJV, and shares profits of time 2 with Solar, according to a percentage pair (q, 1 - q). This percentage pair will be determined by using the game itself, and not a priori.

Assumption 5. Solar firm cannot, by contract, sell in the Market for a certain amount of time.

Assumption 6. Sharing pair (q, 1 - q) will be deduced by a feasible Kalai-Smorodinsky bargaining solution in a coopetitive transferable utility context.

7. The formal construction of the game model

Axiom 0. We consider a five-player game. The players are:

1. *ENI* (or *LF*, large firm);
2. *SL* (or *SF*, small firm);
3. the 3rd player is the *RJV* (Research Joint Venture) constituted by *ENI* and *SL*;
4. *VC* (venture capitalist);
5. *Market*.

We distinguish between principal players and side players, principal players are *LF* and *SF*: side players are *RJV*, *VC* and the *Market* (civil society).

7.1. Strategies

Axiom 1.1 (strategies of the 1st player). Any real number x represents the production that ENI decides to buy (x in [0,1]) from the Research Joint Venture founded by ENI and SL.

Axiom 1.2 (strategies of the 2nd player). Any real number y represents investments for research and service production (y in [1,3]) employed by SL, we assume that an investment in research of at least 1 is needed for creating the 100% renewable energy.

Axiom 1.3 (strategies of the 3rd player - coopetitive strategies of the first two players). Any real z represents production of the RJV (z in [1,2]), decided together by ENI and SL.

Axiom 1.3' (coopetitive strategies of the first two players). We shall use the strategy z of the 3rd player as a cooperative strategy of the couple (LF, SF) in a coopetitive game.

Axiom 1.4 (strategies of the 4th player). The number k represents the loan that VC decides to offer to the ENI (the strategy set of VC is reduced to the singleton {k}).

Axiom 1.5 (strategies of the 5th player). Any real z represents the production of the RJV (z in [1,2]), that the Market decides to buy: we assume, by classic microeconomic assumption, that this z coincides with production of the RJV (z in [1,2]), decided together by ENI and SL.

7.2. Payoffs

Axiom 2.1. The payoff function of *ENI* is defined by:

$$f_1(x, y, z) = (p - p')x - k' - ay,$$

where: px - the profit from selling x at price p in the *Market*;
p'x - the cost to buy x from *RJV* at price p';
k' - the sunk costs faced by *ENI* itself;
ay - the extra-payment to *SL* for research and development y (a > 1).

Axiom 2.2. The payoff function of *BT* is defined by:

$$f2(x,y,z) = p''z + ay - y - F,$$

where: p"z - the payment received from *RJV* selling the product z;

ay - extra-payment for research y, a >1, received from *ENI*, y is the investment in research;
F - the fixed cost to produce energy, this cost is not afforded by *RJV*, which pay only the variable cost.

Axiom 2.3. The payoff function of the RJV is defined by:

$$f3(x,y,z) = p'x + p(z - x) - cz - p"z,$$

where: *p'x - the profit from selling x at price p' to ENI;*
p(z – x) - the profit from selling z - x at price p > p' on the Market;
cz - the variable cost for the production of z, faced by SL and paid by RJV;
p"z - the payment paid to SL to buy the product z, with p > c + p".

Axiom 2.4. The payoff function of *VC* is defined by:

$$f4(x,y,z) = k' – k$$

where: *k' represents the money which 1st player has to give back to VC;*
k is the number that represents the loan that VC decides to offer to the ENI.

Axiom 2.5. The payoff function of the Market is defined by:

$$f_5(x,y,z) = - p(z - x) + cz + k – px + y + bz,$$

where: *px - the cost from buying x at price p from LF;*
p(z – x) - the cost from buying (z – x) at price p from RJV;
cz - the indirect gain from the production of z, faced by SL and paid by RJV;
y - the indirect gain coming from the research activity of SL;
k - the indirect gain coming from the foundation of RJV;
bz - the social indirect gain (beneficial effects) coming from the use of the quantity z of the new renewable energy.

The following Figure 2 shows the formal situation.

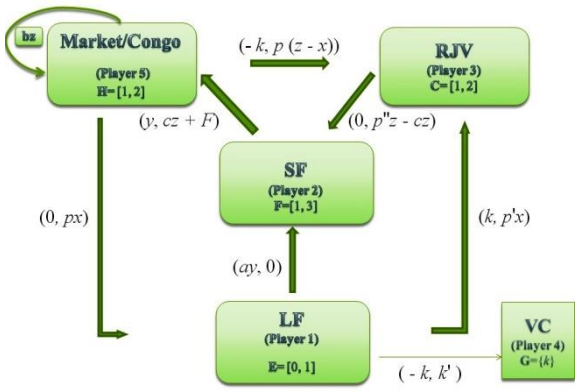


Figure 2 – Formal representation of the game

7.3. Economic interpretation

Axiom 9. In this model we have three formal players interacting together and one player, the venture capitalist *VC*, acting only at the beginning of the interaction and at its end.

Axiom 10. We assume that:

- our 1st player is a Large Firm (*LF*) (in our study case, it is the *ENI*) that, in order to develop new renewable energy, decides to form an horizontal alliance with a Small Firm (*SF*) (in our case, it is the *SL*), our 2nd player, operating in the same sector (energy).
- 1st and 2nd player, in order to cooperate, constitute a Research Joint Venture (*RJV*), our 3rd player. The *RJV* is financially supported by the *VC*, our 4th player, at the level of initial costs, and it supports *SF*, at the level of variable costs.

Axiom 11. The 2nd player produces a quantity *z* (decided together by 1st and 2nd player) of energy and sells it to the *RJV*, at price p" (fixed by contract). When the research of the *RJV* of the good (in our case the energy)

has already begun, then the production of renewable energy is conducted by 2nd player and the Large Firm decides the amount x of production to buy from the *RJV*.

Axiom 12. The revenue of *LF* is given by the difference between the sale price p'x and the purchase price *px*, of the quantity x of production bought by the *RJV* at price p':

- To begin the *RJV* research, the *VC* offers a financial support C to *RJV*, to cover the initial sunk costs.
- After the cooperative production of 2nd player is started, the 1st player pays the capitalized sunk costs k'>k to the *RJV*, in order to compensate the *VC* and to conclude the participation of the *VC* in the game.
- Moreover, at the beginning of the *RJV*, 1st player funds directly the researches of the small firm *SF*: by a sum ay, for any investment *y* in research of the 2nd player, with a > 1.

Axiom 13. When, cooperatively, 1st player and 2nd has decided the quantity z that the 2nd player has to produce and sell to *RJV*. Revenues for the 2nd player are equal to p"z, where p" is the unit price at which 2nd player sells to *RJV*, and z is the quantity of production. The cost is represented by the investment for research and is equal to y.

Axiom 14. For the Research Joint Venture revenues are calculated as:

$$p'x + p(z - x)$$

where: - p'x is the profit from selling x at price p' to *LF* and $p(z - x)$ represents the profit from selling $(z - x)$ at price $p > p'$ on the market.

Axiom 15. Lastly, we assume that the cost *cz* for the production of z (by the second player) is paid by the RJV and so the costs for the RJV are equal to:

$$cz + p''z,$$

where: - cz is the cost of z (paid by *RJV* to 2nd player);
- p"z is the payment given to the small firm for the product z;
- k' is a positive constant for the *RJV* because the sunk costs are paid by the 1st player.

Solution. We propose a model in which the sharing-pair (q, 1 – q) is determined by a Kalai-Smorodinsky coopetitive solution.

7.4. Recapitulation

1. x production, in million of units, decided by the 1st player to buy from joint venture firm (RJV) in [0, 1];
2. y money, in million $, for research and service production invested by the 2nd player [1, 3];
3. z production, in million of units, decided by both players 1st and 2nd (together) of the *RJV*, with constraint [1, 2];
4. $f_1(x,y,z) = (p - p')x - k' - ay$,
   where: - $(p - p')x$ is profit from selling x at price p in the market and buying x at price p' from *RJV*;
   - k' = (1 + i)k is the capitalized sunk cost k, invested by the *VC* into the *RJV*;
   - ay is the extra-payment for research to the 2nd player (a >1).
5. f2(x, y, z) = p"z + ay - y - F,
   where: - p"z is payment received by *RJV* for the product z;
   - ay is extra-payment for research y (a >1) received by *ENI*;
   - F is the fixed cost of the production.
6. f3(x, y, z) = p'x + p(z – x) – cz – p"z,
   where: - p'x is profit from selling x at price p' to the 1st player;
   - p(z – x) represents profit from selling z – x at price p > p' in the *market*;
   - cz is the production cost of z faced by *SL* and paid by *RJV*;
   - p"z is the payment received by *RJV* for the product z, we assume p > c + p".
7. f4(x,y,z) = k' - k,
   where: - k' represents the money which 1st player has to give back to VC;
   - k is the number that represents the loan that *VC* decides to offer to the *ENI*.
8. f5(x,y,z) = - p(z - x) + cz + k – px +y + bz,
   where: - px is the cost from buying x at price p from *LF*;
   - p(z – x) is the cost from buying (z – x) at price p from *RJV*;
   - cz is the indirect gain from the production of z, faced by *SL* and paid by *RJV*;
   - y is the indirect gain coming from the research activity of *SL*;
   - k is the indirect gain coming from the foundation of *RJV*;

- bz is the social indirect gain (beneficial effects) coming from the use of the quantity z of the new renewable energy.

8. Numerical sample

For sake of simplicity, we fix the structure constants of the game as it follows:
- p = 9 $/unit is the price of the product fixed by all players at which RJV sells to the consumers;
- p' = 3 $/unit is the price of the product fixed by all players at which RJV sells to the 1st player;
- k' = 1 mln $ represents sunk costs paid by the 1st player to the VC;
- a = 2.5 (pure number) is extra-payment for a monetary unit employed in the research, paid by LF to SF;
- p'' = 2 $/unit is the price of product, which RJV has to pay to 2nd player;
- c = 1 $/unit is the marginal cost of the product faced by the 2nd player and paid by the RJV;
- F = 1 mln $ is the fixed cost of the production, paid by SF.

8.1. Strategies

We assume that any real number x, in the canonical unit interval *E*:= U = [0, 1] is a possible level of production purchased by 1st player from RJV, considered in million unit; any real number y, in the interval *F*:= [1,3] is an amount of money for research and service production employed by 2nd player, considered in million $. We illustrate (Figure 3) the graph of game's bi-strategy space R relative to the first two players.

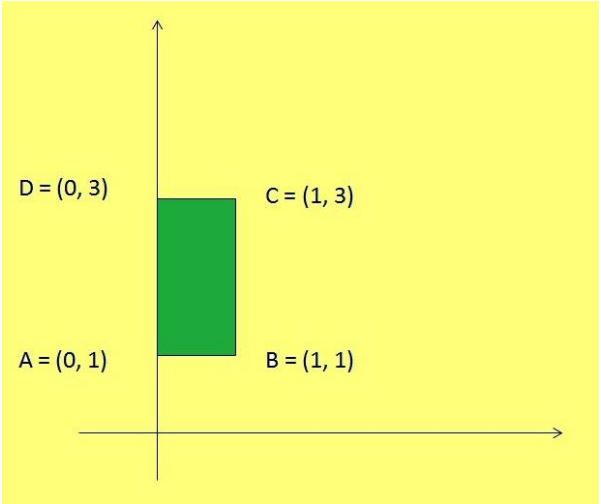


Figure 3 – Bistrategy space R

Measure units of strategy sets E and F. We assume that the measure units of the two intervals *E* and *F* are different: the unit 1 in *E* represents the maximum possible production (in million unit) which 1st player could buy from RJV and the unit 1 in *F* is the minimum possible amount of money (in million $) which allows to produce the 1st unit of energy and the quantity 3 in *F* is the maximum possible amount of money (in million $) for research and service production employable by 2nd player, obviously these two units are totally different.

8.2. Payoff functions

The payoff function of the firm one is the function f_1 of the space S: = $E \times F \times [1, 2]$ into the real line, defined by:

$$f_1(x, y, z) = (p - p')x – k' – ay,$$

for every triple (x, y, z) in S, where p is a positive real number representing the price of the product fixed by all players at which *RJV* sells to the consumers, p' is the price of the product fixed by all players at which *RJV* sells to the 1st player, k' represents sunk costs of the 1st player paid to VC and a'' is the extra-payment for a monetary unit employed in the research, paid by 1st to 2nd player.

We have fixed p = 9, p' = 3, k' = 1 and a = 2.5; we have:

$$f_1(x, y, z) = 6x – 2.5y – 1.$$

The payoff function f_2 of the 2nd player is the function from S into the real line, defined by:

$f_2(x, y, z) = p''z + ay – y - f,$

for every triple (x, y, z) in S, where p' is the unit price of the product which RJV has to pay to 2nd player and ay is the extra-payment for the research y received by 1st player. We have fixed p" = 2, f = 1 and c = 1, so we have:

$f_2(x, y, z) = 2z + 1.5y – 1.$

8.3. Payoff function of the coopetitive game

We so have builded up a coopetitive gain game G = (f, >) with payoff function f given by:

$f(x, y, z) = (6x – 2.5y – 1,\ 1.5\ y + 2z – 1) =$

$= (6x – 2.5y – 1, 1.5\ y – 1) + (0, 2z)$,for every triple (x, y, z) in the compact S.

8.4. Study of the game G = (p, >)

Note that, fixed a cooperative strategy z in the interval [1, 2], the game G(z) = (p(z), >) with payoff function p(z), defined on the rectangle R (*product of E and F*) by p(z)(x, y) = f(x, y, z) is the translation of the game G(0) by the vector:

$v(z) = z(0, 2),$

so that we can study the game G(0) and then we can translate the various information of the game G(0) by the vector v(z), where z varies in the interval [1, 2].

So, let us consider the game G(0) and let:

$g(x,y) := f(x,y,0) = (6x – 2.5y – 1, 1.5\ y – 1)$

its payoff function. To graph the payoff space g(R), we transform all the vertices of the bi-strategy rectangle R by the function g.

The transformation of segment [A, B] is segment [A', B'],

where: A':= g(A) = g(0, 1) = (-3.5, 0.5)

and

B':= g(B) = g(1, 1) = (2.5, 0.5)

The transformation of segment [B, C] is segment [B', C'],

where: C':= g(C) = g(1, 3) = (-2.5, 3.5)

The transformation of segment [C, D] is the segment [C', D'],

where: D':= g(D) = g(0, 3) = (-8.5, 3.5)

The transformation of segment [A, D] is the segment [A', D']. In the following figure (Figure 4), we show the payoff space g(R).

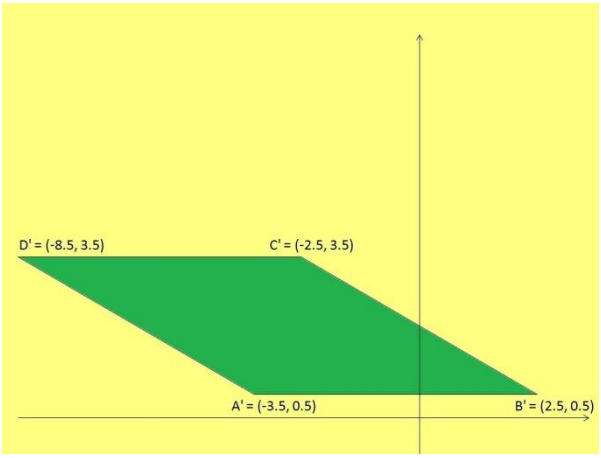


Figure 4 – Representation of the payoff auxiliary game G.

8.5 Payoff space and Pareto boundary of the coopetitive game G

Pareto boundary of the payoff space of the z-section game G(z). The Pareto boundary of the payoff space of the z-section game G(z) is the segment [B', C'] translated by the vector

v(z) = (– 2, 0) + (0, z), for all strategy z in C.

Payoff space of the coopetitive game G. The payoff space of the coopetitive game G, the image of the payoff function f, is the union of the ordered family of payoff spaces $(imp(z))_{z \in C}$, that is the convex envelope of points A', B', C', D' and of all their translations by the vectors

v(z) = (– 2, 0) + (0, z), for every z in 2U. In the following figure (Figure 5) we represent it.

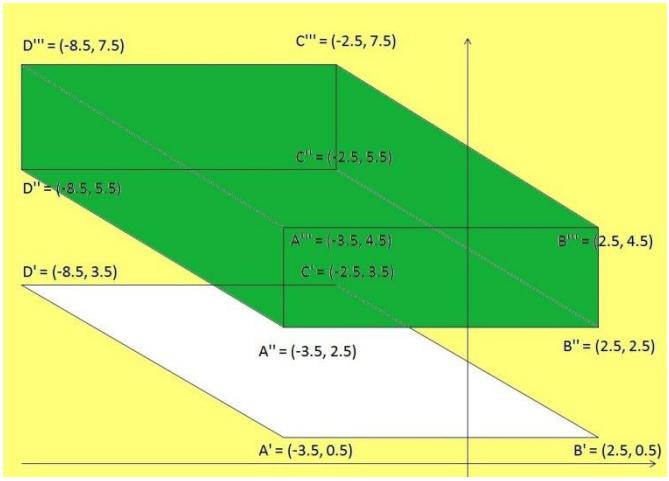


Figure 5 – Payoff space of the game G.

8.6. Trajectory of the Pareto boundary

We show in the following figures the construction of the coopetitive trajectory of the Pareto boundary of G(0), in two steps (see Figure 6 and Figure 7), just to clarify the procedure.

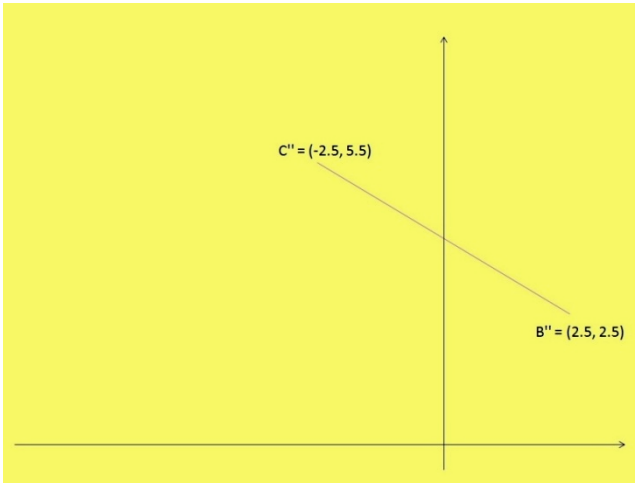


Figure 6 – First step.

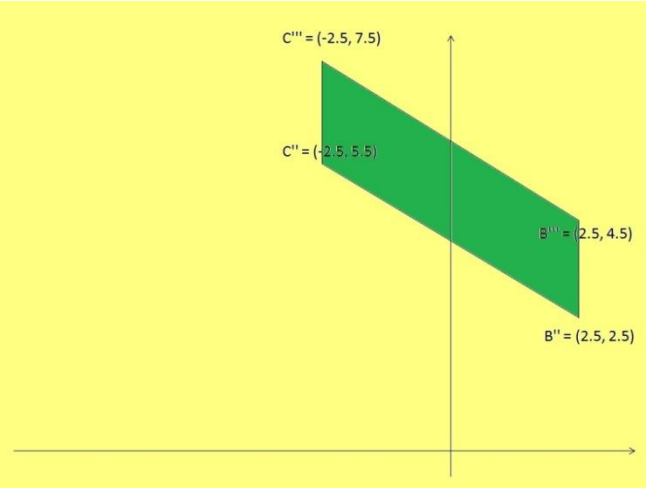


Figure 7 – Final step: [C", B"] + [1,2](0,2).

8.7. The Pareto maximal boundary of the payoff space f(Q)

The Pareto maximal boundary of the payoff space f(*Q*) of the coopetitive game G, where Q denotes the strategy space of the game Cartesian product of the strategy rectangle *R* and of the interval *2U*, is the segment [B"',C"'], where the point B"' is the translation B' + v(2) and the point C"' is the point C' + v(2). In the above figures, it is the segment [(0, 4.5), (-5, 7.5)].

8.8. Solutions of the model

Purely coopetitive solution. First of all, we have the Nash equilibrium of G(0), it is C with corresponding payoff C". The coopetitive Nash path is the segment [C", C"']. We have a unique *purely coopetitive payoff solution* at the point C"' (solution obtained by *cooperating on the set C,* of *cooperative strategies*, and competing *à la Nash* on the bi-strategy space *R*). This purely coopetitive payoff solution C"' is obtained by the triple strategy (C, 2); this triple strategy can be considered as the best Nash equilibrium payoff of the coopetitive game G. Note that this purely coopetitive solution does not realize the maximum collective gain, because the maximum collective gain of our game G is obtainable at the point B"'.

Super-cooperative solution without the third player. We can reach a solution maximizing the collective profit for both players by a super-cooperative agreement, i.e., an agreement which imposes to cooperate both on the shared strategy set *C* and on the usual strategy rectangle *R.*

Maximum-collective solution. When the two players, 1st and 2nd, decide to cooperate on the entire parallelepiped *S,* they have to find the maximum collective gain solution (if any) and to share fairly this profit. The maximum collective gain of the game is attained *G* is obtained at triple strategy at
(B, 2) with payoff B"' (2.5, 4.5).

How to share the pie fairly? One way would be to share the maximum collective profit (2.5 + 4.5 = 7) by using a Kalai-Smorodinsky method (see Figure 8). When we have a *bargaining problem* (*P*, t), where *P* is a Pareto boundary in the Cartesian plane and t is a point of the plane (the threat point of the problem) which is the infimum of the Pareto boundary P (see Figure 8). The *Kalai-Smorodinsky solution* of the problem (*P*, t) is the point (if any) at the intersection between *P* and the segment [t, s], where s is the least upper bound of the Pareto boundary *P*.

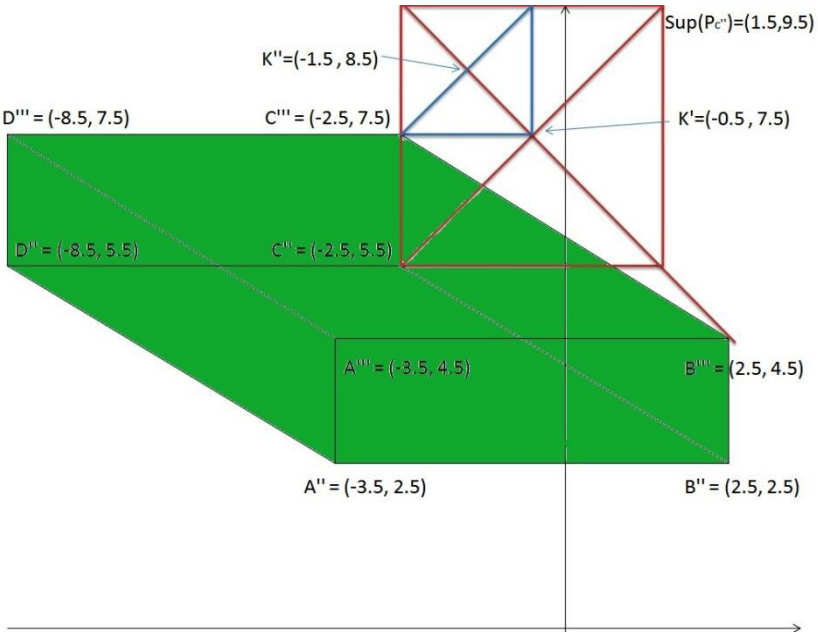


Figure 8 – Super-cooperative solution determined by the sup of G(0)

We determine our bargaining solution K' as the solution of the problem (*P*, t), where *P* is the maximum collective gain line and t is the Nash equilibrium payoff of the game, that is the point C'' = (-2.5, 5.5) which is also the conservative b-value of the game G(0). So we obtain a win-win solution, in the sense that our solution K' will be better than the initial Nash payoff for both players. K' is at the intersection between the line of maximum collective profit *P* (red line on the figure) and the line passing through the threat point C'' = (-2.5, 5.5) and the least upper bound (1.5, 9.5) of the part of maximum collective gain line which lies beyond t.

By intersecting x + y = 7 and y = x + 8 we obtain k' = (-0.5, 7.5). Analogously, by intersecting x + y = 7 and y - x = 10 we obtain k'' = (-1.5, 8.5).

*Super-cooperative solution with the 3rd player***.** Now we analyze the super-cooperative solution of G also considering the *RJV*. We have:

$f_3(x, y, z) = p'x + p(z – x) – cz – p''z$.

We remind that p = 9, p' = 3, p'' = 2 and c = 1, so that:

$f_3(x,y,z) = 3x + 9(z – x) – z – 2z = 6z – 6x$.

At the point (1, 1, 2), the point of maximum collective gain, we have:

$f_3(1, 1, 2) = 6$.

Considering the payoff of RJV as a part of the collective gain of the first two players, we have a total gain to share equal to 6 + 7 = 13. Analogously to what we have done before, to share the pie fairly, we consider the line:

C'' + *R* (1,1) = (-2.5, 5.5) + *R* (1,1) ,

Whose equation is Y = X + 8. Now we need the intersection between the line of maximum collective profit and the above line; that is we have to solve the system:

(X + Y = 13 and Y - X = 8),

so we get the point K''' = (2.5, 10.5); in percentage terms, the point K''' is an allocation of the maximum profit corresponding to 19.23% and 80.76%.

Acknowledgements

The authors wish to thank Dr. Eng. Alessia Donato and Dr. Dania Panuccio for their valuable help in the preparation of the paper.

Conclusions

In this paper, we have shown how the use of D. Carfì new coopetitive game definition, which considers both collaboration and competition together and simultaneously, may advance the understanding and control of asymmetric R&D alliances, those between small (and/or young) firms and large (e.g. Multinational Enterprises).

The results of the mathematical study have proved that we can find more solutions that are advantageous both for the company and for the community, such as:

- Purely coopetitive solutions;
- Super-cooperative solutions without the 3rd player;
- Super-cooperative solutions with the 3rd player;
- Maximum-collective solutions.

Our contribution is twofold. Firstly, we have explained the living condition in Republic of Congo and what ENI has already done there to improve social and health conditions. Secondly, we have shown how game theory normal-form and extensive-form games can be used in coopetition studies to increase health conditions of people and to improve welfare in a particular area which was not very developed or industrialized until the actions taken by ENI. So, we encourage ENI and other large energy companies to look more closely at the model to understand that compete is not always the right way to "get rich" and to create wealth.

From an Economic point of view, we are sure that the competition is not the right way to have success. Energy enterprises should decide not to "fight" with other big energy companies to grab a good share of the market, but they have to cooperate to reach the maximum collective gain, for them and for the social communities. Indeed, it's important, for a world looking to the future, to study which is the best combination of richness for enterprises and welfare for the community. Our study, as it is presented, is completed and fully applicable. It can be surely implemented by other scholars and entrepreneurs interested in the energy field, and/or in living conditions of Africa and/or in green energy resources.

Surely, the model can be improved by widening the points of view, for example by studying not only a part of the region, but taking care of the entire Africa or using other innovative energy resources, that - during time - could be discovered.

If we want to live in good conditions, we'll have to be more "smart" and more "green" to save our life and our future and so we hope that enterprises should think the same to increase world conditions and welfare. Nowadays, we also need that ENI and other energy companies should use more renewable energy sources, in order to use less primary resources; so we're looking to stimulate more interest on these global issues.

References

[1] Agreste, S., Carfì, D., Ricciardello, A. (2012). An algorithm for payoff space in C^1 parametric games, *APPS | Applied Sciences*, Balkan Society of Geometers, 14: 1-14. http://www.mathem.pub.ro/apps/v14/A14-ag.pdf.

[2] Arthanari, T., Carfì, D., Musolino, F. (2015). Game Theoretic Modeling of Horizontal Supply Chain Coopetition among Growers, *International Game Theory Review,* World Scientific, 17(2). https://dx.doi.org/10.1142/S0219198915400137.

[3] Asch, S. E. (1952). *Social Psycology*, Englewood Cliffs, Prentice Hall.

[4] Baglieri, D., Carfì, D., Dagnino, G. (2016).Asymmetric R&D Alliances: A Multi-Dimensional Coopetitive Approach, *International Studies of Management and Organization* (in press).

[5] Baglieri, D., Carfì, D., Dagnino, G. B. (2012). Asymmetric R&D Alliances and Coopetitive Games, *Advances in Computational Intelligence: 14th International Conference on Information Processing and Management of Uncertainty in Knowledge-Based Systems, IPMU 2012, Catania, Italy, July 2012, Proceedings, Part IV*, Springer-Verlag, Berlin Heidelberg, pp. 607-621. Ed. by S. Greco, B. Bouchon-Meunier, G. Coletti, M. Fedrizzi, B. Matarazzo, and R.R. Yager. https://dx.doi.org/10.1007/978-3-642-31724-8_64.

[6] Baglieri, D., Carfì, D., Dagnino, G. (2010).Profiting from Asymmetric R&D Alliances: Coopetitive Games and Firms' Strategies, *Proceedings of 4th Workshop on Coopetition Strategy "Coopetition and Innovation", Montpellier, France, June 17-18, 2010*.

[7] Bengtsson, M., Kock, S.(2014). Coopetition - Quo Vadis? Past Accomplishments and Future Challenges, *Industrial Marketing Management*, 43(2): 180-188.

[8] Biondi, Y., Giannoccolo, P (2012). Complementarities and Coopetition in Presence of Intangible Resources: Industrial Economic and Regulatory Implications, *Journal of Strategy and Management*, 5(4): 437-449.

[9] Branderburger, A.M., Nalebuff, B.J. (1996). *Coopetition*, New York, Currency Doubleday.

[10] Brandenburger, A. M., Nalebuff, B.J. (1995). The Right Game: Use Game Theory to Shape Strategy, *Harvard Business Review*, 64: 57-71, July-August.

[11] Carfi, D. (2012a). Coopetitive Games and Applications, Advances *and Applications in Game Theory*, J. Macmillan, India, pp.128-147. Ed. by R.K. Mishra, S. Deman, M. Salunkhe, S.B. Rao, and J. Raveendran.

[12] Carfi, D. (2012b). Payoff space for C^1 games, *APPS | Applied Sciences, Monographs 9 (Topics in Game Theory)*, pp. 74–89. http://www.mathem.pub.ro/apps/mono/A-09-Car.pdf.

[13] Carfi, D. (2012c). *Fondamenti di Teoria delle Decisioni, vol. 1, Teoria dei preordini e applicazioni.* Antipodes. http://www.antipodes.it/prodotti/scheda-prodotto.asp?id=23.

[14] Carfi, D. (2011a). Financial Lie groups, *Proceedings of the International Conference RIGA 2011*, Bucharest University, Bucharest. Also available as MPRA Paper 31303 at http://mpra.ub.uni-muenchen.de/31303/.

[15] Carfi, D. (2011b). *Topics in Game Theory*. Il Gabbiano.

[16] Carfi, D.(2010a).Amodel for Coopetitive Games, *MPRA Paper 59633*. http://mpra.ubuni-muenchen.de/59633/.

[17] Carfi, D. (2010b). *Topics in Game Theory*. Il Gabbiano.

[18] Carfi, D. (2010c). *Decision-Form Games*. Il Gabbiano.

[19] Carfi, D. (2009a).Complete study of linear infinite games, *Proceedings of the International Geometry Center - Prooceding of the International Conference "Geometry in Odessa 2009", Odessa, May 25-30, 2009*, 2(3): 19-30. http://d-omega.org/category/books-and- papers/.

[20] Carfi, D.(2009b). Decision-Form Games, *Communications to SIMAI Congress - Proceedings of the 9th Congress of SIMAI, the Italian Society of Industrial and Applied Mathematics, Roma (Italy), September 15-19, 2008*, 3(307): 1-12. Ed. by E. De Bernardis, G. Fotia, and L. Puccio. https://dx.doi.org/10.1685/CSC09307.

[21] Carfi, D. (2009c). Differentiable Game Complete Analysis for Tourism Firm Decisions, *Proceedings of the 2009 International Conference on Tourism and Workshop on Sustainable Tourism within High Risk Areas of Environmental Crisis*, pp. 1-10. Also available as MPRA Paper 29193 at http://mpraub.uni-muenchen.de/29193/.

[22] Carfi, D.(2009d).Fibrations of financial events, *Proceedings of the International Geometry Center - Prooceding of the International Conference "Geometry in Odessa 2009", Odessa, May 25-30, 2009*, 2(3): 7-18. http://d-omega.org/2010/05/04/proceedings-of- theinternational-geometry-center-vol-2-3/. Also available as MPRA Paper 31307 at http://mpra.ub.uni-muenchen.de/31307/

[23] Carfi, D. (2009e). Payoff space in C^1-games, *APPS Applied Sciences*, Balkan Society of Geometers, 11: 35–47, http://www.mathem.pub.ro/apps/v11/A11-ca.pdf

[24] Carfi, D. (2009f). *Fondamenti di Teoria delle Decisioni vol. 1 – Teoria dei preordini e applicazioni.* Il Gabbiano.

[25] Carfi, D. (2009g). Globalization and Differentiable General Sum Games, P*roceedings of the 3rd International Symposium "Globalization and convergence in economic thought", Bucharest, December 11-12, 2009*. București: Editura ASE.

[26] Carfi, D. (2008a). Optimal Boundaries for Decisions, *AAPP Physical, Mathematical, and Natural Sciences,* 86(1): 1-11. https://dx.doi.org/10.1478/C1A0801002

[27] Carfi, D. (2008b). Superpositions in Prigogine's approach to irreversibility for Physical and Financial applications, *AAPP | Physical, Mathematical, and Natural Sciences*, 86(Supplement N.1 THERMOCON '05): 1-13. https://dx.doi.org/10.1478/C1S0801005

[28] Carfì, D. (2008c). Structures on the space of financial events, *AAPP | Physical, Mathematical, and Natural Sciences*, 86(2): 1-13. https://dx.doi.org/10.1478/C1A0802007

[29] Carfì, D. (2008d). *Fondamenti di Teoria delle Decisioni, Volume 1 – Teoria dei preordini e applicazioni.* Il Gabbiano.

[30] Carfì, D. (2008e). *Fondamenti di Teoria delle Decisioni, Volume 2 – Teoria delle Lotterie e applicazioni.* Il Gabbiano.

[31] Carfì, D. (2008f). *Fondamenti di Teoria delle Decisioni, Volume 3 - Giochi in Forma Decisionale.* Il Gabbiano.

[32] Carfì, D. (2008g). *Fondamenti di Teoria delle Decisioni, Volume 4 – Giochi in Forma Normale.* Il Gabbiano.

[33] Carfì, D. (2007a). *Elementi di Matematica Applicata, Volume 1 - Teoria dei preordini e applicazioni.* Il Gabbiano.

[34] Carfì, D. (2007b). Dyson formulas for Financial and Physical evolutions in S'n, *Communications to SIMAI Congress*, 2: 1-10. https://dx.doi.org/10.1685/CSC06156

[35] Carfì, D. (2007c). S-Linear Algebra in Economics and Physics, *APPS | Applied Sciences*, 9: 48-66. http://www.mathem.pub.ro/apps/v09/A09-CA.pdf

[36] Carfì, D.(2006a). *Elementi di Teoria dei Giochi.* Il Gabbiano.

[37] Carfì, D. (2006b). *Teoria delle Decisioni: Spazi preordinati e Lotterie finite.* Il Gabbiano.

[38] Carfì, D. (2006c). An S-Linear State Preference Model, *Communications to SIMAI*, 1: 1-4. https://dx.doi.org/10.1685/CSC06037

[39] Carfì, D. (2006d). S-convexity in the space of Schwartz distributions and applications. *Rendiconti del Circolo Matematico di Palermo*, 77(Series II).

[40] Carfì, D. (2005a). *Matematica per l'Economia e applicazioni.* Il Gabbiano.

[41] Carfì, D. (2005b). *Teoria delle Decisioni: Teoria dei preordini, Teoria dei Giochi, Teoria delle Lotterie.* Il Gabbiano.

[42] Carfì, D. (2004a). Geometric aspects of a financial evolution, *Atti della Reale Accademia delle Scienze di Torino,* 138: 143-151.

[43] Carfì, D. (2004b). S-bases and applications to Physics and Economics, *Annals of Economic Faculty, University of Messina*, pp. 165-190.

[44] Carfì, D (2004c). S-linear operators in quantum Mechanics and in Economics, *APPS | Applied Sciences*, 6(1): 7-20. http://www.mathem.pub.ro/apps/v06/A06.htm.

[45] Carfì, D. (2004d). The family of operators associated with a capitalization law, *AAPP | Physical, Mathematical, and Natural Sciences*, 81-82: 1-10. https://dx.doi.org/10.1478/C1A0401002.

[46] Carfì, D. (1999). *Metodi matematici della Fisica, dell'Ingegneria e dell'Economia. Azzeramento.* Armando Siciliano Editore.

[47] Carfì, D. Caristi, G., (2008). Financial dynamical systems, *Differential Geometry - Dynamical Systems,* 10: 71-85. http://www.mathem.pub.ro/dgds/v10/D10-CA.pdf.

[48] Carfì, D., Cvetko-Vah, K (2011). Skew lattice structures on the financial events plane, *APPS| Applied Sciences*, 13: 9–20. Balkan Society of Geometers. http://www.mathem.pub.ro/apps/v13/A13-ca.pdf.

[49] Carfì, D., Fici, C. (2012). The government-taxpayer game, *Theoretical and Practical Research in Economic Fields,* 3(1(5), Summer 2012): 13–26. http://www.asers.eu/journals/tpref/tpref-past-issues.html.

[50] Carfì, D., Gambarelli, G., Uristani, A. (2013). Balancing pairs of interfering elements, *Zeszyty Naukowe Uniwersytetu Szczecińskiego 760 Finanse, Rynki Finansowe, Ubezpieczenia,* 59 (2013): 435–442. http://www.researchgate.net/publication/259323035_Balancing_pairs_of_interfering_elements.

[51] Carfì, D., Lanzafame, F. (2013). A Quantitative Model of Speculative Attack: Game Complete Analysis and Possible Normative Defenses, *Financial Markets: Recent Developments, Emerging Practices and Future*

Prospects, Nova Science, Chap. 9. Ed. by M. Bahmani-Oskooee and S. Bahmani. https://www.novapublishers.com/catalog/product_info.php?products_id=46483.

[52] Carfi, D., Magaudda, M., Schilirò, D. (2010). Coopetitive Game Solutions for the eurozone economy, *Quaderni di Economia ed Analisi del Territorio*, Quaderno n. 55/2010, pp. 1–21. Dipartimento DESMaS "V.Pareto" Università degli Studi di Messina, Il Gabbiano. http://mpra.ub.uni-muenchen.de/26541/1/MPRA_paper_26541.pdf.

[53] Carfi, D., Musolino, F. (2015a). A Coopetitive-Dynamical Game Model for Currency Markets Stabilization, *AAPP | Physical, Mathematical, and Natural Sciences,* 93(1): 1-29, 2015. https://dx.doi.org/10.1478/AAPP.931C1.

[54] Carfi, D., Musolino, F. (2015b).Tax Evasion: a Game Countermeasure, *AAPP | Physical, Mathematical, and Natural Sciences* (to appear).

[55] Carfi, D., Musolino, F. (2014a). Dynamical Stabilization of Currency Market with Fractal-like Trajectories, *Scientific Bulletin of the Politehnica University of Bucharest, Series A-Applied Mathematics and Physics* , 76(4): 115-126, 2014. http://www.scientificbulletin.upb.ro/rev_docs_arhiva/rezc3a_239636.pdf.

[56] Carfi, D., Musolino, F. (2014b). Speculative and Hedging Interaction Model in Oil and U.S. Dollar Markets with Financial Transaction Taxes, *Economic Modelling*, 37: 306-319. https://dx.doi.org/10.1016/j.econmod.2013.11.003.

[57] Carfi, D., Musolino, F. (2013a). Credit Crunch in the Euro Area: A Coopetitive Multi-agent Solution, Multicriteria and Multiagent Decision Making with Applications to Economic and Social Sciences*: Studies in Fuzziness and Soft Computing*, Springer Verlag, Berlin Heidelberg, 305: 27–48, Ed. by A. G. S. Ventre, A. Maturo, Š. Hošková-Mayerová, and J. Kacprzyk. https://dx.doi.org/10.1007/978-3-642-35635-3_3.

[58] Carfi, D., Musolino, F. (2013b). Game Theory Appication of Monti's Proposal for European Government Bonds Stabilization, *APPS | Applied Sciences*, Balkan Society of Geometers, 15: 43-70. http://www.mathem.pub.ro/apps/v15/A15-ca.pdf.

[59] Carfi, D., Musolino, F. (2013c). Model of Possible Cooperation in Financial Markets in Presence of Tax on Speculative Transactions, *AAPP | Physical, Mathematical, and Natural Sciences*, 91(1): 1-26. https://dx.doi.org/10.1478/AAPP.911A3.

[60] Carfi, D., Musolino, F. (2012a), A coopetitive approach to financial markets stabilization and risk management, *Advances in Computational Intelligence, Part IV. 14th International Conference on Information Processing and Management of Uncertainty in Knowledge-Based Systems, IPMU 2012,* Catania, Italy, July 9-13, 2012, Proceedings, Part IV, Springer Berlin Heidelberg, 300: 578-592 of Communication in Computer and Information Science. Ed. by S. Greco, B. Bouchon-Meunier, G. Coletti, M. Fedrizzi, B. Matarazzo, and R. Yager. https://dx.doi.org/10.1007/978-3-642-31724- 8_62.

[61] Carfi, D., Musolino, F. (2012b). Game Theory and Speculation on Government Bonds, *Economic Modelling*, 29(6): 2417-2426. https://dx.doi.org/10.1016/j.econmod.2012.06.037

[62] Carfi, D., Musolino, F. (2012c). *Game Theory Models for Derivative Contracts: Financial Markets Stabilization and Credit Crunch, Complete Analysis and Coopetitive Solution.* Lambert Academic Publishing. https://www.lap-publishing.com/catalog/details//store/gb/book/978-3-659-13050-2/game-theory-models-for-derivative-contracts

[63] Carfi, D., Musolino F. (2011a). Fair Redistribution in Financial Markets: a Game Theory Complete Analysis, *Journal of Advanced Studies in Finance*, ASERS Publishing House, 2(2(4)): 74–100. http://asers.eu/journals/jasf/jasf-past-issues.html

[64] Carfi, D., Musolino, F. (2011b). Game Complete Analysis for Financial Markets Stabilization, *Proceedings of the 1st International On-line Conference on Global Trends in Finance*, pp. 14–42, ASERS. Publishing, http://www.asers.eu/asers_files/conferences/GTF/GTF_eProceedings_last.pdf

[65] Carfi, D., Musolino, F., Ricciardello, A., and Schilirò, D., (2012), Preface: Introducing PISRS, *AAPP | Physical, Mathematical, and Natural Sciences,* 90 (Supplement N.1, E1 (2012): PISRS Proceedings (Part I)): 1-4. Ed. by D. Carfi, F. Musolino, A. Ricciardello, and D. Schilirò. https://dx.doi.org/10.1478/AAPP.90S1E1

[66] Carfi, D., Musolino, F., Schilirò, D., and Strati, F. (2013). Preface: Introducing PISRS (Part II), *AAPP | Physical, Mathematical, and Natural Sciences,* 91(Supplement N.2, E1 (2013): PISRS Proceedings (Part II)). Ed. by D. Carfì, F. Musolino, D. Schilirò, and F. Strati. https://dx.doi.org/10.1478/AAPP. 91S2E1

[67] Carfi, D., Patane, G., Pellegrino, S., (2011), Coopetitive Games and Sustainability in Project Financing, *Moving from the Crisis to Sustainability: Emerging Issues in the International Context*, pp. 175–182. Franco Angeli. http://www.francoangeli.it/Ricerca/Scheda_libro.aspx?CodiceLibro=365.906

[68] Carfi, D., Perrone E., (2013), Asymmetric Cournot Duopoly: A Game Complete Analysis, *Journal of Reviews on Global Economics*, 2: 194-202. https://dx.doi.org/10.6000/1929-7092.2013.02.16

[69] Carfi, D., Perrone, E., (2012a), Game complete analysis of symmetric Cournout duopoly, *MPRA Paper 35930*, University Library of Munich, Germany. http://mpra.ub.uni-muenchen.de/ 35930/

[70] Carfi, D., Perrone, E., (2012b), *Game Complete Analysis of Classic Economic Duopolies*. Lambert Academic Publishing, https://www.lap-publishing.com/catalog/details//store/ru/book/978-3-8484-2099-5/game-complete-analysis-of-classic-economic-duopolies

[71] Carfì, D., Perrone, E., (2011a), Asymmetric Bertrand Duopoly: Game Complete Analysis by Algebra System Maxima, *Mathematical Models in Economics,* ASERS Publishing House, pp. 44–66. http://www.asers.eu/asers-publishing/collections.html. Also available as MPRA Paper 35417 at http://mpra.ub.uni-muenchen.de/35417/

[72] Carfi, D, Perrone, E., (2011b), Game Complete Analysis of Bertrand Duopoly, *Theoretical and Practical Research in Economic Fields*, ASERS Publishing House, 2(1(3)): 5-22. http://www.asers.eu/journals/tpref/tpref-past-issues.html

[73] Carfì, D., Perrone, E., (2011c), Game Complete Analysis of Bertrand Duopoly, *Mathematical Models in Economics*, ASERS Publishing House, pp. 22–43. http://www.asers.eu/asers-publishing/collections.html

[74] Carfi, D., Pintaudi, A., (2012), Optimal Participation in Illegitimate Market Activities: Complete Analysis of 2 Dimimensional Cases, *Journal of Advanced Research in Law and Economics,* ASERS, 3(1(5) Summer 2012): 10–25. http://www.asers.eu/journals/jarle/jarle-past-issues.html

[75] Carfi, D., Ricciardello, A. (2013a). An Algorithm for Dynamical Games with Fractal-Like Trajectories, *Fractal Geometry and Dynamical Systems in Pure and Applied Mathematics II: Fractals in Applied Mathematics. PISRS 2011 International Conference on Analysis, Fractal Geometry, Dynamical Systems and Economics, Messina, Italy, November 8-12, 2011 - AMS Special Session on Fractal Geometry in Pure and Applied Mathematics: in memory of Benoit Mandelbrot,Boston, Massachusetts, January 4-7, 2012* - AMS Special Session on Geometry and Analysis on Fractal Spaces, Honolulu, Hawaii, March 3-4, 2012. 601: 95–112 of Contemporary Mathematics. American Mathematical Society. Ed. by D. Carfi, M. Lapidus, E. Pearse, and M. Van Frankenhuijsen. https://dx.doi.org/10.1090/conm/601/11961

[76] Carfi, D., Ricciardello, A. (2013b). Computational representation of payoff scenarios in C^1 families of normal-form games, *Uzbek Mathematical Journal*, 1: 38–52.

[77] Carfi, D., Ricciardello A. (2012a). Algorithms for Payoff Trajectories in C^1 Parametric Games, *Advances in Computational Intelligence: 14th International Conference on Information Processing and Management of Uncertainty in Knowledge-Based Systems*, IPMU 2012, Catania, Italy, July 2012, Proceedings, Part IV, Springer-Verlag, Berlin Heidelberg, pp. 642–654. Ed. by S. Greco, B. Bouchon-Meunier, G. Coletti, M. Fedrizzi, B. Matarazzo, and R.R. Yager. https://dx.doi.org/10.1007/978-3-642-31724-8_67

[78] Carfì, D., Ricciardello, A. (2012b). An algorithm for Payoff Space in C^1-Games, *APPS | Applied Sciences, Monographs* 9 *(Topics in Game Theory),* pp. 104–129. http://www.mathem.pub.ro/apps/mono/A-09-Car.pdf

[79] Carfi, D., Ricciardello, A. (2012c). Decision-form Games, *APPS | Applied Sciences, Monographs* 9 *(Topics in Game Theory),* pp. 6–22. http://www.mathem.pub.ro/apps/mono/A-09-Car.pdf

[80] Carfi, D., Ricciardello, A. (2012d). Mixed Extensions of Decision-form Games, *APPS | Applied Sciences, Monographs* 9 *(Topics in Game Theory)*, pp. 61–72. http://www.mathem.pub.ro/apps/mono/A-09-Car.pdf

[81] Carfi, D., Ricciardello, A. (2012e). Non-Reactivity in Decision-form Games, *APPS | Applied Sciences, Monographs* 9 *(Topics in Game Theory)*, pp. 23–39. http://www.mathem.pub.ro/apps/mono/A-09-Car.pdf

[82] Carfi, D., Ricciardello, A. (2012f). Reactivity in Decision-form Games, *APPS | Applied Sciences, Monographs* 9 *(Topics in Game Theory)*, pp. 40–60. http://www.mathem.pub.ro/apps/mono/A-09-Car.pdf

[83] Carfì, D., Ricciardello, A. (2012g). Study of a game with concave utility space, *APPS | Applied Sciences, Monographs* 9 *(Topics in Game Theory)*, pp. 90–102. http://www.mathem.pub.ro/apps/mono/A-09-Car.pdf

[84] Carfi, D., Ricciardello, A. (2012h). The payoff trajectories in C^1 parametric games, *APPS | Applied Sciences, Monographs* 9 *(Topics in Game Theory)*, pp. 130–145. http://www.mathem.pub.ro/apps/mono/A-09-Car.pdf

[85] Carfi, D., Ricciardello, A. (2012i).*Topics in Game Theory (Applied Sciences – Monographs).* Balkan Society of Geometers, http://www.mathem.pub.ro/apps/mono/A-09-Car.pdf

[86] Carfi, D., Ricciardello, A. (2010). An algorithm for payoff space in C^1 Games, *AAPP | Physical, Mathematical, and Natural Sciences*, 88(1): 1-19. https://dx.doi.org/10.1478/C1A1001003

[87] Carfì, D., Ricciardello, A. (2009). Non-reactive strategies in decision-form games, *AAPP | Physical, Mathematical, and Natural Sciences*, 87(2): 1-12. https://dx.doi.org/10.1478/C1A0902002

[88] Carfi, D., Schilirò, D. (2014a). Coopetitive Game Solutions for the Greek Crisis, *Design a Pattern of Sustainable Growth, Innovation, Education, Energy and Environment*, ASERS Publishing. Ed. by D. Schilirò. http://www.asers.eu/asers-publishing/books.html.

[89] Carfi, D., Schilirò, D. (2014b). Improving Competitiveness and Trade Balance of Greek Economy: A Coopetitive Strategy Model, *Journal of Applied Economic Sciences*, 9(2(28)): 211-220.

[90] Carfi, D., Schilirò, D. (2013). A Model of Coopetitive Games and the Greek Crisis, *Contributions to Game Theory and Management (Collected papers presented on the Sixth International Conference Game Theory and Management, St. Petersburg, Russia, June 27-29, 2012)*, Saint Petersburg State University, 6: 35–62. Ed. by L. Petrosyan and N. Zenkevich. http://www.gsom.spbu.ru/files/upload/gtm/sbornik2012_27_05_2013.pdf

[91] Carfi, D., Schilirò, D. (2012a). A coopetitive Model for the Green Economy, *Economic Modelling*, Elsevier, 29(4): 1215 -1219. https://dx.doi.org/10.1016/j.econmod.2012.04.005

[92] Carfi, D., Schilirò, D. (2012b). A Framework of coopetitive games: Applications to the Greek crisis, *AAPP | Physical, Mathematical, and Natural Sciences*, 90(1): 1-32. https://dx.doi.org/10.1478/AAPP.901A1

[93] Carfi, D., Schilirò, D. (2012c). A Model of Coopetitive Game for the Environmental Sustainability of a Global Green Economy, J*ournal of Environmental Management and Tourism* , ASERS Publishing House, 3(1 (5), Summer 2012): 5-17. http://www.asers.eu/journals/jemt/jemt-past-issues.html

[94] Carfi, D., Schilirò, D. (2012d). Global Green Economy and Environmental Sustainability: A Coopetitive Model, *Advances in Computational Intelligence, 14th International Conference on Information Processing and Management of Uncertainty in Knowledge-Based Systems, IPMU 2012, Catania, Italy, July 9-13, 2012, Proceedings, Part IV*, Springer Berlin Heidelberg, 300: 593-606 of Communication in Computer and Information Science. Ed. by S. Greco, B. Bouchon-Meunier, G. Coletti, M. Fedrizzi, B. Matarazzo, and R. Yager. https://dx.doi.org/10.1007/978-3-642-31724-8_63

[95] Carfi, D., Schilirò, D., (2011a), Coopetitive Games and Global Green Economy, Moving *from the Crisis to Sustainability: Emerging Issues in the International Context*, Franco Angeli, pp. 357–366. http://www.francoangeli.it/Ricerca/Scheda_libro.aspx?CodiceLibro=365.906

[96] Carfi, D., Schilirò, D. (2011b). Crisis in the Euro Area: Coopetitive Game Solutions as New Policy Tools, *Theoretical and Practical Research in Economic Fields*, 2(1(3)): 23-36. http://www.asers.eu/journals/tpref/tpref-past-issues.html

[97] Carfi, D., Schilirò, D. (2011c). Crisis in the Euro Area: Co-opetitive Game Solutions as New Policy Tools, *Mathematical Models in Economics*, ASERS Publishing, pp. 67–86. http://www.asers.eu/asers-publishing/collections.html.

[98] Carfi, D., Trunfio, A. (2011). A Non-linear Coopetitive Game for Global Green Economy, *Moving from the Crisis to Sustainability: Emerging Issues in the International Context*, Franco Angeli, pp 421-428. http://www.francoangeli.it/Ricerca/Scheda_libro.aspx?CodiceLibro=365.906

[99] Clarke-Hill, C., Li H., and Davies B. (2003). The Paradox of Co-operation and Competition in Strategic Alliances: Towards a Multi-Paradigm Approach, *Management Research News*, 26: 1-20.

[100] Ghobadi, S., D'Ambra, J. (2011). Coopetitive Knowledge Sharing. An Analytical Review of Literature, *Electronic Journal of Knowledge Management*, 9(4): 307-317.

[101] Gnyawali, D.R., Park, B.J.R. (2009*). Co-opetition and Technological Innovation in Small and Medium-Sized Enterprises: A Multilevel Conceptual Model, Journal of Small Business Management*, 47(3): 308-330.

[102] Lado, A.A., Boyd, N.G., Hanlon, S.C. (1997). Competition, Cooperation, and the Search from Economic Rents: A Syncretic Model, *Academy of Management Review*, 22(1): 110–141.

[103] Musolino, F. (2012). Game theory for speculative derivatives: a possible stabilizing regulatory model, *AAPP| Physical, Mathematical, and Natural Sciences,* 90 (SUPPLEMENT N.1 (2012): PISRS Proceedings (Part I)): 1-19. https://dx.doi.org/10.1478/AAPP.90S1C1

[104] Ngo, D.D., Okura, M. (2008). Coopetition in a Mixed Duopoly Market, *Economics Bulletin*, 12(20): 1-9.

[105] Ohkita, K., Okura, M. (2014). Coopetition and Coordinated Investment: Protecting Japanese Video Games' Intellectual Property Rights, *International Journal of Business Environment*, 6(1): 92-105.

[106] Okura, M. (2012). An Economic Analysis of Coopetitive Training Investments for Insurance Agents, *Advances in Computational Intelligence: 14th International Conference on Information Processing and Management of Uncertainty in Knowledge-Based Systems, IPMU 2012, Catania, Italy, July 2012, Proceedings, Part IV*, Springer-Verlag, Berlin Heidelberg, pp. 571–577.

[107] Okura, M. (2009). Coopetitive Strategies to Limit the Insurance Fraud Problem in Japan, *Coopetition Strategy: Theory, Experiments and Cases*, Routledge, London, pp. 240–257. Ed. by Dagnino, G.B., and Rocco, E.

[108] Okura, M. (2008). Why Isn't the Accident Information Shared? A Coopetition Perspective, *Management Research*, 6(3): 219-225.

[109] Okura, M. (2007). Coopetitive Strategies of Japanese Insurance Firms: A Game-Theory Approach, *International Studies of Management and Organization*, 37(2): 53-69.

[110] Okura, M. Carfi, D. (2014). Coopetition and Game Theory, *Journal of Applied Economic Science*, 9(3(29)): 457-468.

[111] Padula, G., Dagnino, G.B. (2007). Untangling the Rise of Coopetition, *International Studies of Management and Organization*, 37(2): 32-53.

[112] Pesamaa, O., Eriksson, P.E. (2010). Coopetition among Nature-based Tourism Firms: Competition at Local Level and Cooperation at Destination Level, *Coopetition: Winning Strategies for the 21st Century*, Edward Elgar Publishing, Massachusetts, pp. 166–182. Ed. by Yami, S, Castaldo, S., Dagnino, G. B., and Le Roy, F.

[113] Porter, M. (1985). *Competitive Advantage. Creating and Sustaining Superior Performance*, Free Press, New York.

[114] Rodrigues, F., Souza V., Leitao, J. (2011). Strategic Coopetition of Global Brands: A Game Theory Approach to 'Nike + iPod Sport Kit' Co-branding, *International Journal of Entrepreneurial Venturing*, 3(4):435-455.

[115] Shy, O. (1995). *Industrial Organization: Theory and Applications*, MIT Press, Cambridge, Massachusetts.

[116] Stein, H.D. (2010). Literature Overview on the Field of Co-opetition, *Verslas: Teorija ir Praktika*, 11(3): 256-265.

[117] Stiles, J., (2001). *Strategic Alliances*, in *Rethinking Strategy*, Sage Publications, London. Ed. by H.W. Volberda, T. Elfring.

[118] Sun, S., Zhang, J., Lin, H. (2008). Evolutionary Game Analysis on the Effective Co-opetition Mechanism of Partners within High Quality Pork Supply Chain, *Service Operations and Logistics, and Informatics*, *2008, IEEE/SOLI 2008. IEEE International Conference on*, pp. 2066-2071.

Sitography

[s1] http://rethinkenergy.eni.com/en/eni-in-congo

[s2] http://www.abo.net/oilportal/interview/view.do?contentId=2326286

[s3] http://www.aefjn.org/index.php/370/articles/the-activities-of-eni-in-congo-brazzaville.html

[s4] http://www.eni.com/en_IT/world-eni/index.shtml

[s5] http://www.saipem.com/site/home/press/by-year/articolo6324.html

[s6] http://www.slideshare.net/internationalenergyagency/141013-africa-energyoutlookslides

[s7] http://www.worldenergyoutlook.org

[s8] http://www.worldenergyoutlook.org/resources/energydevelopment/

APPENDIX 1

Conservative analysis

Recalling that the payoff vector function *f* is given by:

$f(x, y, z) = (6x – 2.5y – 1, 1.5 y – 1),$

for every profile strategy (x, y, z), we want to calculate the conservative bi-value of the initial game. In order to obtain this initial bi-value, we shall calculate the bi-value for the shadow game G. The bi-value is

$v^{\#} = (v_1^{\#}, v_2^{\#}),$

where:

$v_1^{\#} = \sup_{x \in E} \inf_{y \in F} (6x - 2.5y - 1) = \sup_{x \in E} (6x - 8.5) = -2.5$

$v_2^{\#} = \sup_{y \in F} \inf_{x \in E} (1.5y - 1) = 3.5$

Our conservative bi-value is our $v^{\#} = (-2.5, 3.5) = C'$

Journal of Applied Economic Sciences
Volume X, Issue 4(34), Summer 2015

Financial Efficiency, Competitiveness and Profitability of Islamic Banks

Hadhek Zouhaier
Higher Institut of management of Gabès, Tunisia
hzouhair2000@yahoo.fr

Abstract:

The aim of our study was to determine the relationship between the level of financial efficiency, competitiveness and profitability of Islamic banks. To our knowledge, no research on Islamic banks has tried to accurately assess the role played by financial efficiency (costs, profits, capitalization and liquidity) on the profitability of Islamic banks. We were able to achieve these objectives through an empirical study on a sample of 29 selected Islamic banks targeted to have a good representative sample over a period of eight years from 2005 to 2012.

Keywords: profitability of Islamic banks, efficiency of Islamic banks, competitiveness of Islamic banks, panel data model.

JEL classification: G2, G21, C33.

Introduction:

Like any emerging industry, as it has grown, Islamic Finance has faced new challenges and fined answers to many questions. To assert the position it has managed to conquer so far and continue its development, it still has yet challenges. It is banking that were most in the securities since the first oil boom of the 1970s and the emergence of Muslim centers as a financial superpower. Islamic finance principles, however, are based on Islamic economic theory and to understand the former, the knowledge of the latter is required.

Far from remaining a mere fad, it has also freed from niche industry status to become an important cog in the financing channels of these economies. Efficiency can determine respectively the competitive behavior of Islamic banks, contrary to earlier theories which proved the negative aspect of non-competitive, market power and the non-bank efficiency, respectively. The efficiency approaches require that the most efficient banks are expected to earn more profits which respectively allow them to gain more market share and making it less competitive market (Demsetz, 1973) and (Peltzman 1977). For the banking sector the question also arises whether the market power allows the bank to have a better efficiency. The outstanding feature of this market is the dangerous presence of asymmetric information that leads to moral hazard and adverse selection. These effects make the sensitive bank to economic conditions. To reduce the effects of information asymmetry, the bank must make more efforts, which are expensive for the analysis and monitoring of various projects to fund. Or, it may be subject to additional costs if and only if it has market power and is not constrained by competition.

Therefore, a competitive Islamic banking market and / or less concentrated prevents the decrease of information asymmetry and can have negative effects on the efficiency of banks. The aim of our work is therefore to determine the relationship between the level of efficiency and profitability of Islamic banks.

Our goal is to measure and analyze the Islamic banking financial efficiency; on the other hand we try to explore the impact of the latter on the profitability of the banks. To our knowledge, no research on Islamic banking has tried to specifically assess the role played by financial efficiency (cost, profit, capitalization and liquidity) on Islamic banking profitability. We will meet the objectives from an empirical study on a sample of 28 Islamic banks selected a targeted way to have a good representative sample over a period of 8 years from 2005 to 2012.
In the first part, we start in the first chapter, the theoretical basis for Islamic finance. In this section, we present the basic principles of Islamic finance and financing techniques adopted in Islamic banks.

Subsequently, in the second chapter we present the theories relating to the profitability and efficiency of Islamic banking. And based on a literature review, we unroll the highlighting of the issue between efficiency and Islamic banking profitability and we end this chapter by presenting the links between these two phenomena and different strategies to be adopted by these banks to ensure their survival and continue to operate with mixed success.

At the empirical framework, we first present the operational framework and context of the study; in the following we present the variables and assumptions. Then in the following sections; 3 models of our study and the statistical tests used. Finally, we represent the estimated results with their interpretations.

1. Literatures Review

1.1 Financial efficiency and profitability of Islamic banks

Because contrasting theoretical conclusions, the question of whether the beneficial effect of bank efficiency on profitability is empirical. However, while many studies have attempted to characterize the determinants of efficiency, few have analyzed the relationship between profitability and efficiency.

A profitability requirement in the banking sector is relevant for at least two reasons. First, Grigorian and Manole (2002) using the non-parametric method found that market concentration has a positive effect on the efficiency cost of banks. In contrast, Fries and Taci (2005) based on the parametric method show that the market power improves cost efficiency of banks, but the result is weakly significant.

Then, and reversing the direction of the study, Demsetz (1973) and Peltzman (1977) in their studies, have shown that the efficiency can determine the competitive behavior of banks. According to them, the companies or the most efficient banks are expected to earn more profits, allowing them to have more market share, hence the move towards a less competitive market. In addition, Gondat-Larrade and Lepetit (2001) wanted to study bank efficiency, and nature of relationship between the level of concentration and profit. Their work on the banks of the countries of Central and Eastern Europe over the period 1992 to 1996 show that this relationship is positive. Indeed, they show that the most efficient banks can't have more market share, which calls into question the assumption their efficiency. Indeed, the notion of efficiency allows for market share, only in countries whose banking markets are concentrated or competitive according to their interpretations.

Berger, Hunter and Timme (1993) noted that if the banks are efficient, so we expect improved profitability, better and greater intermediation of funds, will be the best price and quality service to consumers, and greater safety and soundness and efficiency and savings that are applied to the improvement in imports of capital to absorb risk. However, the opposite applies to inefficient intermediaries, with an additional risk industry rescue operations financed by taxpayers if significant losses are supported.

Therefore, the efficiency of banks improves the overall economy that affects the well-being of society as a whole. The efficiency of banks is influenced by various factors such as the size, region, competition, technology inputs and outputs, network characteristics, the form of ownership, changes in regulation and management characteristics.

Carvallo and Kasman (2005) noted that the liberalization of financial markets worldwide, the increasing use of advanced technology and the information revolution have put competitive pressure on bank business nationally and internationally. This competitive pressure is particularly important for banks in emerging markets because they are the main financial intermediaries to channel savings and investment. In this context, competitive advantage is strengthened if banks can operate effectively mobilizing their profitability.

Theoretically, profitability is relevant because it ensures that the production costs are minimized and at the same time it approves effectiveness (Nickell, 1996). Increased profitability could force banks to operate more efficiently to survive. It forces banks to produce products and provide services that are required by customers. If they can deliver services effectively and with the required cost, there is no reason why they can't make more profits.

The debate between theory and practice raises many questions and ambiguities, the lack of research on the impact of the financial efficiency of bank profitability remains among the most difficult questions to answer especially when it s' is a lack of data for the case studies, or failure of specific assumptions for the theoretical case. Work on Islamic banks in particular is a bet to never neglect not only by complementarity of research but mostly by necessity of development and the survival of the entire system. To say that Islamic banks are forced to make a tradeoff between efficiency and profitability or even between efficiency and cost efficiency benefit is only challenges to solve.

1.2 Arbitrage profitability/efficiency:

Islamic banks will face new competition, imposing a better cost control. This seems all the more crucial that the recent evolution demonstrates the close relationship between the ability to reduce intermediation margins and improving the productivity of business assets. It hangs, as in most sectors of the economy, the benefits of a real effective profitability in the financial sector and the market power that provide Islamic banks reside in the efficiencies, providing better products quality, increased technological innovation and information system in order to alleviate the problems of adverse selection and moral hazard, streamlining procedures and improving resource allocation and other diversified strategies naturally lead to a better mastery of the cost price, respectively, and therefore improved profit.

Without doubt, the restoration of profitability of credit institutions is as much to be expected from a change in the rules and conditions of competition between banks, which would increase the efficiency gain, as continued restructuring efforts and internal reorganization, which would normally have the effect of increasing the efficiency cost. While several studies have shown us the negative relationship between the two forms of efficiency, it is not even necessary to have competitors to be profitable or seek to be (Koenif, 2004). Customer loyalty and win new markets or reduce its cost preserving quality are all manifestations of the profitability of a bank.

Behind a very broad definition, profitability thus covers very different realities. Two distinct goals can be identified in the context of the pursuit of cost: effectiveness and efficiency. The effectiveness is to seek to achieve given objectives regardless of committed resources. Efficiency implies the achievement of objectives minimizing its committed resources. Banks and businesses in general often seek efficiency but sometimes only want effectiveness.

The leaders of a bank prior are interest in favoring the search for efficiency. However, in many circumstances, they must accept being than effective in achieving their strategic objectives in the medium and long term. Based on the management philosophy, this tension between efficiency and effectiveness is actually due to the different time horizons which are facing the strategist. In the short term, it is best to ensure efficiency at all levels of the bank ultimately increase profits. However, the long-term efficiency requires leaders to make heavy investments and eventually to locate in a foreign country, embarking on a new market, innovation, etc. But practically, to ensure the growth of a bank this implies high costs that limit short-term efficiency to favor efficiency.

Similarly a bank that constantly seeks efficiency waive renew its assets or to innovate and thus deprive a long-term efficiency. Profitability therefore takes a clever choice between seeking efficiency and search for effectiveness.

1.3 Literature on Islamic banking competitiveness

Competitive conditions in the banking sector are relevant for at least two reasons. First, the degree of market power can carry serious implications for financial stability. (Keeley 1990).

Many studies have shown that the competitiveness encourage moral hazard in the banking sector (Hellmann, Murdock and Stiglitz, 2000; Jimenez, Lopez and Saurina, 2007), although a reverse trend provide theoretical predictions and empirical evidence the power of the market could lead to higher bank risk (Stiglitz and Weiss, 1981; Stenbacka Koskela, 2000; Boyd and Nicolo, 2005; Schaeck, Cihak and Wolfe, 2009).

Second, competitive conditions are likely to affect bank performance and efficiency (Berger and Mester, 2003), and equity funding levels (Schaeck & Cihak, 2007). The concept of competitive banking was first applied to conventional banks before it is applied to Islamic banks. In this context, the identification of factors of competitiveness was the issue of several studies on the banking sector in several countries. However, rarely are interested studies to examine the competitive power of Islamic banks against conventional banks.

Rare also are studies that have focused on the study of Islamic Banking Competitiveness factors operating side by side with conventional banks. According to economic theory, most studies support the idea that the market structure affects bank performance. In this context Haron (1996) examines the effects of competitive and some other external factors on the profitability of Islamic banks.

Banks are classified into two groups according to the market in which they operate. He noted that Islamic banks in the competitive market gained more than those who operate in a monopolistic market. Evidence has also been proven to support the hypothesis that the loss of profit sharing principle practiced by Islamic banks is advantageous to depositors and banks.

In contraste, Abdul Majid and Sofian (2008) examine the structure of the Islamic banking market in Malaysia during 2001-2005 and evaluates the degree of competitiveness using the H.Panzar and Rosse Statistics (1987). Their study rejects the criterion of monopoly market structure or perfect competition which means that Islamic banks in Malaysia have won their turnover in the state of monopolistic competition.

2. Methodology

2.1 Description of the study sample

Our study is based on 28 Islamic banks[10], most of which are in the MENA region. Our study extends over a period of eight consecutive years of 2005 to 2012. We will use unbalanced panel data or 231 observations. To

[10] See the Table1 in the appendices.

study the effect of competitiveness and the efficiency on the profitability of Islamic banks, we use financial statements (balance sheet, ratios: capital ratio, liquidity ratio, ratio of operations and assets ratio and equity etc.) collected from the base BankScoop 2012. In addition, we use the World Bank to collect the macroeconomic indicators as inflation index.

2.2 Presentation of variables and measures

We explain the choice of these variables based primarily on literature and identifying indicators of their measurement.

Definition and measurement of the independent variables:

- *Return on Average Assets (ROAA).* Net income after taxes as a percentage of the book value of the average total assets. It can be defined as an evaluation indicator of the profitability of a bank's assets. Otherwise, the return on average assets (ROA) states that the bank can do with what it has. Generally, it is used by companies, banks and other financial institutions such an assessment to determine their performance. Being calculated at end of period, return on average assets does not reveal all the ups and downs. Rather, just an average of the period.
- *Return on Average Equity (ROAE).* Net profit after taxes as a percentage of the book value of total equity. Return on average equity (ROAE) refers to the performance of a bank on an exercise. This report is an adapted version equity performance, which measures the profitability of a bank. Estimate the average return on equity can provide a more accurate picture of the profitability of a bank, especially in situations where the capital value has changed significantly over the year.
- *Net Interest Margin (NIM).* Interest income on loans and security investments less interest expense on deposits and other emissions debt divided by total assets of a bank. Net margins vary considerably across sectors and even within the same sector, largely in bank; this indicator is a reflection of the pricing strategy adopted. Some banks take a low-margin, high-volume strategies while others take a high margin, low volume strategies. While the ideal is to get the best of both - high margins and volume student- it is usually impossible.

Samad and Hassan 1999; Sarker, 1999; Bashir, 1999; Yudistria, 2003; Al-Jarrah and Molyneux, 2003; Hussein, 2004). Most of these studies used return on assets (ROA), return on equity (equity), the Net Interest Margin (NIM) and other traditional financial indicators to assess the financial and economic situations of Islamic banks; a few studies comparing profitability (Samad and Hassan 1999). However, there are other studies that used frontier approach (Al-Jarrah and Molyneux 2003; Hussein, 2004 and Brown and Skully, 2005). While only a few studies that address the overall cost, income and efficiency benefit of Islamic banks (Yudistria, 2003; Hassan 2005).

Definition and measurement of the independent variables:

- *Cost to Income Ratio (CTIR).* Net income ratio measures the overhead or operating costs of the bank as a percentage of income before provisions generated. The significant cost component of this report is wages. It is an indicator used in the banking industry which is the ratio of operating expenses (staff costs, depreciation, amortization and provisions on tangible and intangible assets, other external services) divided by net banking income. It measures the operating efficiency of a bank.
- *Non Interest Expenses Ratio (NIER*). The ratio of expenses without interest and overhead costs as well as the provisions of the average value of assets as a pourcentage of total income. This ratio is a measure of financial efficiency and is determined based on information from a bank using specifically the financial statements that determine gross income.
- *Other Operating Income (OPIR)* is calculated by dividing other operating income by the average value of the assets. The higher the ratio, the greater the ability of the organization to generate profits.
- *The Recurring Earning Power (REP).* It measures the ability of a bank to generate profits from the conduct of its operations. The power of the profit is used to analyze stocks to determine if the bank behind it is worthy of investment. With a power greater long-term benefit is an indication that the stock may be a good investment. Stock is designated by the various contracts and transactions are it long term or short term.
- *Total Equity to Total Asset (EA).* This is a capitalization ratio. The ratio of equity to total assets is an efficiency indicator that takes into account the Islamic banking solvency. It is determined on the basis of information from banking operations of the balance sheet. The term solvency refers to the ability of Islamic banks to pay all its debts if it were otherwise manage its operations. The equity ratio specifically measures the amount of equity compared to total assets. It is calculated by dividing the net asset value by the total assets. It is calculated as a percentage; a ratio of less than 70% will put the bank at risk and can lower its borrowing capacity.

- *Net Loans to Total Asset (LA).* This is a capitalization ratio and bank financing. It measures the financial leverage by calculating the proportion of equity and bank debt is used to finance its assets. This ratio is measured as follows: equity / net lending capital. The total equity capital covers the total reserves, the total share capital and treasury shares. Net loans include loans to individual credit institutions, net customer loans and loans of group companies.

- Inflation, consumer prices (annual %) (INF). Inflation as measured by the index of consumer prices reflects the annual percentage change in the cost to the average consumer of acquiring a basket of goods and services which can be fixed or changed at specified intervals, like every year.

Looking at the financial efficiency of a bank, these indicators are based on the owner to determine how the different aspects such as production, finance, marketing, *etc*., affect and generates a gross income.

2.3 Hypotheses of the study

Given the literature outlined above for links that may existed between different measurement of efficiency and competitiveness of Islamic banks on one hand and the profitability of the banks on the other hand we can advance the following assumptions for our econometric study to be conducted in the following:

H1: *Cost efficiency approximated by the two CTIR and NIER ratios positively affect Islamic banking profitability*.

H2: *Efficiency profit approximated by the two OPIR and REP ratios affect positively the Islamic banking profitability*.

H3: *The capitalization ratio EA has a negative effect on the Islamic banking profitability.*

H4: *The liquidity ratio has a positive effect on Islamic banking profitability.*

H5: *The inflation rate as a proxy for the macroeconomic environment affects positively the Islamic banking profitability.*

The table below shows the results of the descriptive analysis of the variables used in this research:

Table 1. Descriptive statistics

	Mean	Standard deviation	Minimum	Maximum
CTIR	57.699	39.367	3.506	342.082
NIER	4.379	5.570	0.249	38.55
NIM	8.738	29.988	-9.418	324.757
OPIR	2.313	1.896	-0.164	11.37
ROAA	2.140	2.753	-6.087	26.517
ROAE	12.575	13.131	-52.052	81.974
REP	2.824	4.768	-23.295	28.056
EA	19.780	17.781	2.35	90.258
LA	50.452	17.493	0.062	89.502
INF	5.522	5.085	-4.863	22.020

Statistical results emerged from the above table on descriptive statistics of the dependent variables and independent variables in our sample; we show that during the period 2005-2012:

- Islamic banks have an operating efficiency (CTIR) averaged 57,699. This net income ratio (cost to income ratio) varies between 3,506 and 342,082. This result shows that there is a significant difference in the effectiveness of a sample which is 39, 367 value.
- Score of Non Interest Expenses Ratio (NIER) banks is 4.379. This score ranges between 0.249 and 38.55. The standard deviation shows 55.70 showing that charges no interest and overhead as well as the provisions of the average value of assets as a pourcentage of total income, are dispersed to the various Islamic banks.
- The Net Interest Margin Middle among Islamic banks is 8,738. It varies between 9,418 and 324,757. This result proves that net margins vary considerably in banks for a large value of 29,988. This indicator shows that the pricing strategies adopted in these Islamic banks are too dispersed.

- The variable Other Operating Income (OPIR), which is calculated by dividing other operating income by the average value of assets, has an average of 2.313 and a dispersion medium low compared to other variables, in 1,896. However, this indicator is between -0,164 and 11.37. The higher the ratio, the lower the bank's ability to generate profits.
- The average return on total assets is 2.140. This accounting performance of banks (ROAA) is between -6,087 and 26,517. With a standard deviation of 2.753. This result proves that the profitability of assets of Islamic banks is not usually too dispersed.
- The return on average equity (ROAE) has an average of 12,575 between 52,052 and 81,974. The net profit after tax as a percentage of the total book value of equity provided a more accurate idea on the profitability of a bank, especially in situations where the capital value has changed significantly over the year. It has a standard deviation of 13.131 considerably high giving an idea about the existing dispersion in our sample. The total score Equity to Total Asset (EA) is 19,780. This score fluctuates between 2.35 and 90,258. The total equity relative to total assets is specified by means of a standard deviation higher than 17,493 which proves the dispersion in the capitalization of Islamic banks.
- The Net Loans to Total Asset variable (LA) of Islamic banks exudes an average of 50,452 which ranges between 0,062 and 89,502. This score shows that there is a significant gap of net loans to total assets of 17,493 value. Inflation as measured by the index of consumer prices releases an average of 5.522 with a standard deviation of 5.085.

3.3 Variable correlation analysis

Before conducting the regression analysis, we found it appropriate to examine the autocorrelation of variables to detect harmful levels of multi-colinearity and therefore retain in the same model as uncorrelated variables. We present below the results generated by the correlation matrix of the variables:

Table 2. Correlation Matrix

	CTIR	NIER	NIM	OPIR	ROAA	ROAE	REP	EA	LA	INF
CTIR	1.0000									
NIER	0.3103	1.0000								
NIM	0.0910	0.8823	1.0000							
OPIR	0.1701	0.1845	-0.0583	1.0000						
ROAA	-0.1831	0.1751	0.1983	0.1741	1.0000					
ROAE	-0.5513	-0.1274	-0.0011	0.0682	0.3368	1.0000				
REP	-0.1920	-0.1748	-0.0972	-0.0515	0.2844	0.1343	1.0000			
EA	-0.0945	0.3254	0.3421	-0.0578	0.2806	-0.2141	0.0897	1.0000		
LA	-0.2366	-0.5781	-0.4656	-0.2580	-0.1616	0.1907	0.1828	-0.2003	1.0000	
INF	0.0842	0.1966	0.1743	-0.0140	0.1177	-0.1035	0.1037	0.2774	-0.3297	1.0000

The results of the correlation matrix show that the correlation coefficients vary from -0.5781 to 0.8823. The coefficients are all below 0.5 except for the NIER and NIM which has a coefficient of 0.8823. This means there is no autocorrelation problem. For this, we will introduce all the variables in our model except for NIER variable.

3.4 Results

Our study is carried out on a sample of 29 banks observed over eight years (2005 to 2012). We can use econometric panel data models when we perform the test specification data generating process. Therefore, we propose in the first test specification simple linear models and then we present the testing of individual effects.

3.4.1 Specification tests

We will use the test specification (also called test of homogeneity Fisher) to justify or reject the null hypothesis of a perfectly homogeneous structure against the hypothesis of the presence of individual effects in panel data.

The first step is to check whether the individual effects specific to Islamic banks are significantly different, that is to say the heterogeneity test of our model between 29 Islamic banks. This hypothesis can be verified by testing Fischer presented as follows: under the assumption of homogeneity of firms H_0: $\mu_i = \mu$; i =1…29, the model is with common effects, whereas under the contrary hypothesis H_1: heterogeneity, the estimated model is a model with individual effects.

Table 3: The homogeneity test

Models	Statistical value of F	P-Value	Type of effect
ROAA	2.37	0.0003	Effet Individuel
ROAE	5.30	0.0000	Effet Individuel
NIM	23.65	0.0000	Effet Individuel

In our study, the F statistic gives off a probability of less than 1% (p-value = 0.003). We concluded, thus, in the presence of individual effects to the SOP model. (Even interpreting for the ESOP model and NIM (p-value = 0.000)). The specification of the above model implies that the individual effects describing the bank efficiency can be retained. To capture the individual effects we can use a within estimator. This estimator measures the change in each case. We can model the effects of random: varying around a mean. We assume most often they follow the normal distribution. We consider that the error of the model is composed of specific common error to observation i, t and error from the random intercepts.

We must now move on to the study of individual effects.

3.4.2 The Hausman test

We must now choose which model best suited to our data. The Hausman test is a test specification for determining whether the coefficients of the two estimates (fixed and random) are statistically different. The idea of this test is that, under the null hypothesis of independence between the errors and the explanatory variables, both estimators are unbiased, so the estimated coefficients should differ slightly.

If the result of this test shows a p-value greater than 5% we must choose the random effects model. So we choose the fixed-effects model if the test shows a p-value less than 7%.

Table 7: The Hausman specification test

Models	khi2 test	Probability	Model specification	Estimator
ROAA	12.87	0.0753*	Modèle à effets fixes	Within
ROAE	50.77	0.0000	Modèle à effets fixes	Within
NIM	-25.88	!	!	!

Note: * Significance at the 10% level ** Significance at the 5% level, ***significant at the 1%.

The results of the Hausman test in the table above show that the effects are fixed for the three models since the probability (p-value) is less than 10%. According to the test results, we opted for the fixed effects model (Within estimator) for our three models, and we rejected the null hypothesis of no correlation between the individual effects and the explanatory variables

3. 5 Presentation of results:

Our goal is to determine the association between competitiveness and efficiency. The table shows the results of the estimation of fixed effects models.

Table 8: Results of the fixed effect estimates

		ROAA	ROAE	NIM
CTIR	**Coef**	-0.0066618	0.1482076	-0.0282216
	(t)	-1.22	7.72	-0.93
	P> |1|	0.225	**0.000***	0.353
NIER	**Coef**	-0.1214041	-0.1649255	-1.330685
	(t)	-0.93	-0.36	-1.93
	P> |1|	0.354	0.720	**0.055*****
OPIR	**Coef**	0.4304849	2.064609	0.2317612
	(t)	3.52	4.80	1.08
	P> |1|	**0.001***	**0.000***	0.282
REP	**Coef**	0.1478765	0.0280479	-0.6390008
	(t)	3.94	0.21	-4.28
	P> |1|	**0.000***	0.832	**0.000***
EA	**Coef**	0.025728	-0.1887345	-0.0266234
	(t)	0.98	-2.06	-0.25
	P> |1|	0.326	**0.041****	0.801
LA	**Coef**	-0.027707	-0.0206357	-0.4512086
	(t)	-1.50	-0.32	-1.80
	P> |1|	0.134	0.750	**0.074*****
INF	**Coef**	0.820692	0.4074685	30.24499
	(t)	1.88	2.65	4.29
	P> |1|	**0.062*****	**0.009***	**0.000***
CONS	**Coef**	2.026977	19.38157	
	(t)	1.59	4.32	
	P> |1|	0.114	**0.000**	

Note: * Significance at the 10% level ** Significance at the 5% level, ***significant at the 1%.

The results emerged from regression of three models that measure the Islamic bank profitability (ROAA, ROEA and NIM models), we note that:

- The impact of cost efficiency on profitability of Islamic banks:
- The cost efficiency ratio CTIR has a negative impact on the return on equity ROEA. That is, if CTIR increases by 1%, return on equity down 0.14%.
- The ratio of expenses without interest and overhead costs as well as the provisions of the average value of assets as a percentage of total income, affects the performance of the net margin negatively. With other words, if the NIER increases by 1% net margin decreased by 1.33%.
- The results of the fixed effect showed that the efficiency ratio profit OPIR has a positive and significant effect on the average return on assets and equity. Indeed; if other operating costs increased by 1% of assets the yield increases of 0.43% and the return on equity increases by 2.06%. As against this relationship is reversed in the case of the Recuring earning power (REP). All variables are not significant. In other words, no significant impact reached between the capacity for renewal of stock of the Bank and its profitability.
- The regression results show that the EA ratio has a negative impact on the average return on equity. This result shows that the assets of Islamic banks vary more in proportion as the change in equity.
- The ratio of equity / net lending emerges a negative relationship with net margin of banks. In other words, if the LA ratio increased by 1%, the net margin of the banks down 0.074%. Of course, this result is not proven with the return on assets and average equity.
- The regression results show a positive impact of macroeconomic variable INF in the three estimated models. Indeed; if inflation increases by 1%, the return on assets increased by 0.82%, return on equity increases by 0.41% and net margin also increased by 30.24%.

Thus, the regression results emphasize the close relationship between financial efficiency (cost, profit, capitalization and liquidity) and the Islamic bank profitability, but with a significant degree of specific and targeted analyzes for the various aspects of the operation Islamic banks and the significance of the proposed ratios.

3.6 Interpretation of results:

- Taking into account the previous results. We conclude that the cost efficiency of Islamic banks around the relationship between operating expenses and operating income (CTIR) has a negative impact on equity returns.

Indeed; analyzing the results of the Islamic bank, focusing on the section long term debt / equity formulated by Islamic funds, share capital, profit, profit to purify and reserves. From the result, when the operating expenses and operating income (CTIR) increases to a value of 1%, this lowers the profitability of Islamic banks of 0.14%.

- In addition, this same type of efficiency approximated by other charges (NIER) has the same effect on the net interest margin (NIM). Over these charges is increasing the margin of the bank down.

Obviously the NIM is a reflection of the pricing strategy adopted by Islamic banks which means income on loans and security investments less expenses on deposits and other emissions debt divided by total assets of a bank. However, fixed operating costs that the financial institution has to undergo, is of all allowances for doubtful accounts provided, non-interest expenditures which include employee salaries and benefits, equipment and real estate rental property taxes, provisions for loan losses and the costs of professional services.

- Theoretically, cost control should lead to greater profitability. Indeed; cost control results in a cheaper financing, and thus serve with cheapest price (usually in relation to competitors), which enables to gain more customers and thus greater market share, which leads to maximization of profits and thus higher profitability.
- However, in reality this relationship is reversed. Indeed, what is most important, a strong confidence from depositors. This presence almost unlimited of funds' availability from banks allows them to lead an offensive strategy in boosting profitability in the market. Profitability is not only a factor but it becomes a result of bank behavior.

However, the advantage of Islamic banks is not limited to availability of resources almost without limits and a strong presence in the market; it is also characterized by organizational, operational, cognitive strengths that should make them more efficient and less vulnerable to economic changes. Compared to other sectors, the greatest feature of this market is the considerable presence of asymmetric information that leads to moral hazard and adverse selection. To reduce the effects of information asymmetry, the bank must make more efforts, which are expensive for the analysis and monitoring of projects for funding. Or, it may be subject to additional costs if and only if it has market power and is not constrained by competition.

In addition, entrepreneurs are reluctant to selection and monitoring of projects by banks. Because this process is time consuming, hence the loss of profit opportunities for firms. Similarly, entrepreneurs often do not want to reveal the true creditworthiness of their projects. Accordingly to these, because the passenger-clandestine problem that exists in the banking market, banks will not dare apply selection for fear of losing their customers.

If we assume that banks can't distinguish between a new applicant and one that has been rejected by another bank, then the rejected applicants, good or bad, will continue to apply for loans from other banks. The more a bank on the market, plus the poor quality firms will likely to be funded.

If, however, banks have the option of applying the selection, the average quality of the loan portfolio decreases with increasing the number of banks on the market. The argument is based on the imperfection of the selection of technology that could be loosely characteristics of the debtor. With a certain probability of good quality contractors could be identified as bad, and vice versa. Therefore, many factors that prevent the reduction of information asymmetry and may have negative effects on the efficiency of banks. These results are also confirmed by Dell'Ariccia (2000), Shaffer (1998) and Lapteacru, (2011).

To study the effect of the efficiency gain on Islamic banking profitability, it is necessary to focus on the link of the OPIR variable and the variable measuring economic Profitability of the bank. OPIR variable positively affects profitability average equity and assets. In other words, mobilizing other operating income (paid banking services such as cash foreign exchange, offering consultations and financial expertise, hire safes, and especially the wealth management clients) the profitability of average assets of the bank, therefore, whether current assets (cash, Mousharaka financing or credit sales as Istisna, Murabaha and Salam,…etc.) or fixed assets (participation Mousharaka, buildings, diminishing Mousharaka) improves automatically.

In addition, the return on equity is also improving is to say Islamic funds, share capital, profit, profit to purify and reserves. The empirical evidence in this case, strengthens the view that banks have diversifiable products tend to have distinctive business models. Indeed; banks are diversifying their product lines also face different competitive landscape. For maximizing profitability bankers are trying to choose a product mix improving their returns on the market, thus gaining a competitive advantage. This result is confirmed by Maali (2005) who found that Islamic banks offering Islamic financial products Shariah compliant are most positioned in the market and have a higher competitive position than conventional banks.

- The regression results show that the capitalization or financial leverage (ability to increase profits through debt) EA has a negative impact on the average return on equity. However, as previously explained. Any increase in the equity ratio to total assets of 1% led to a decline in performance of that equity of 0.18%. This reflects that the assets of Islamic banks vary more in proportion as the change in equity.

In contrast, if the return on shareholders' equity decline (such as profits or reserves) the debts must increase to compensate, either short-term debt (Quard Hasan, investment accounts PSIA) or long debt term (Islamic funds, share capital). So the bank in this case must be careful to his solvency or ability to repay these debts explained by the ratio (EA). This result confirms those of (Flamini *et al.,* 2009) (Athanasoglou *et al.,* 2005) and (Berger, 1995).

- Similarly, the ratio (LA) has a negative impact on the profitability of the bank's net margin (NIM) .In fact; the liquidity ratio (LA) provides a measure of income sources. The loans form a large component of the productive assets of the bank and they have expected to have a positive effect on profitability

Even so, the empirical result proves otherwise. In this case where the investment of the bank rose sharply and especially investments Mousharaka who are long-term projects and participatory which require large amounts. If it increases, this negatively affects the LA ratio, explained that Zakat, for example (which is part of revenue sources) is an ethical principle of Islam, which is intended primarily to help the poor and the needy and not to improve the financial and economic performance. This is also confirmed by Danesh (2007).

A rational monetary policy positively affects the profitability of banks. Indeed, profitability is measured as the difference between profit rates and real interest rates. But the real interest rate equals the nominal interest rate, which is subtracted from the rate of inflation. Hence the high inflation causes low real interest rates and as a result a higher profitability rate coinciding with the leverage that characterized a period of history where the rate of inflation was very high which made the very high bank profitability rate at the time.

In addition, it is a verification of the theoretical rule suggests that if inflation is high, often it is associated with a higher cost and a higher income. It is expected that if income increases more than the cost, inflation will have a positive impact on profits. However, there will be a negative correlation if costs rise faster than income. Most studies have found a positive relationship between the inflation rate and profitability. Among these works we can mention that of Vong Hoi (2009).

Conclusion

The aim of our study was to determine the relationship between the level of financial efficiency, competitiveness and profitability of Islamic banks. To our knowledge, no research on Islamic banks has tried to accurately assess the role played by financial efficiency (costs, profits, capitalization and liquidity) on the profitability of Islamic banks. We were able to achieve these objectives through an empirical study on a sample of 29 selected Islamic banks targeted to have a good representative sample over a period of eight years from 2005 to 2012. Empirical investigations as part of this research lead to the following results:

- Cost efficiency approximated by the two CTIR and NIER ratios positively affect Islamic banking profitability.
- Efficiency profit approximated by the two OPIR and REP ratios affect positively the Islamic banking profitability.
- The capitalization ratio EA has a negative effect on the Islamic banking profitability.
- The liquidity ratio has a positive effect on Islamic banking profitability.
- The inflation rate as a proxy for the macroeconomic environment affects positively the Islamic banking profitability.

References

[1] Abdul Majid, M.Z., Sufian, F. (2008). Market Structure and Competition in Emerging Market: Evidence from Malaysian Islamic Banking Industry, MPRA Paper No. 12126.

[2] Abreu M., Mendes, V. (2002). Commercial bank interest margins and profitability: evidence from E.U countries, 23: 121-167.

[3] Ahmad, W., Luo, H. (2010). Comparison of Banking Efficiency in Europe: Islamic Versus Conventional Banks, *International Finance Review,* 11: 361–389.

[4] Al-Jarrah, I. Molyneux, P. (2003). Efficiency in Arabian banking. Paper presented at the International Conference on Financial Development in Arab Countries, Abu Dhabi, UAE.

[5] Ariss, R.T (2010). Competitive conditions in Islamic and conventional banking: A global perspective, *Review of Financial Economics*, 19: 101–108.

[6] Bashir, A. (2000). Assessing the Performance of Islamic Banks: Some Evidence from the Middle East 1993-1998, Papier présenté à la 8*ème* Conférence de l'Economic Research Forum (ERF), Amman, Jordanie, novembre. www.erf.org.eg

[7] Bashir, M. A-B. (2003). Determinants of Profitability in Islamic Banks: Some Evidence from the Middle East, *Islamic Economic Studies*, 11(1).

[8] Bashir, M. (1999). Risk and profitability measures in Islamic banks: The case of two Sudanese banks. *Islamic Economic Studies*, 6(2): 1–24.

[9] Beck, T., Demirgüç-Kunt, A., Merrouche, O. (2010). Islamic VS. Conventional Banking: Business Model, Efficiency and Stability, The World Bank Development Research Group Finance and Private Sector Development Team, Policy Research Working Paper 5446.

[10] Berger, A.N., Humphrey, D.B. (1997). Efficiency of financial institutions: International survey and directions for future research, *European Journal of Operational Research,* 98: 175–212.

[11] Berger, A., Mester, J.H. (2003). Explaining the Dramatic Changes in Performance of U.S. Banks: Technological Change, Deregulation, and Dynamic Changes in Competition, *Journal of Financial Intermediation*, 12: 57-95.

[12] Berger, A.N, Mester, J.H. (1997). Inside the Black BOX: What Explains Differences in the Efficiencies of Financial Institutions?, *Forthmrning*, *Journal of Banking and Finance*, Vol. 21.

[13] Demerguç-Kunt, A., Huizinga, H. (2001). Financial Structure and Bank Profitability1990-1997, in Asli Demirguç-Kunt and Ross Levine (eds.), Financial Structure and Economic Growth: A Cross-Country Comparison of Banks, Markets, and Development, Cambridge, MA: MIT Press.

[14] Demsetz, H. (1973). Industry Structure, Market Rivalry and Public Policy, *Journal of Law and Economics*, 16(1): 1 - 9.

[15] Ftiti, Z, Nafti, O., Sreiri, S. (2013). Efficiency of Islamic Banks during Subprime Crisis: Evidence of GCC Countries, *Journal of Applied Business Research*, 29(1).

[16] Gondat-Larralde, C., Lapetit, L. (2001). The impact of market structure and efficiency on bank profitability: An Empirical Analysis of Banking Inductries in Central and Eastern Europe, in: Financial and ponetary integration in the Europe. Convergence between the European Union and Central and Eastern Europe, eds. Dickinson D.G and A.W. Mulineux.

[17] Grigorian, D., Manole, V. (2002). Determinants of Commercial Bank Performance in Transition: An Application of Data Envelopment Analysis, IMF Working Paper 02/146.

[18] Halkos, G.E., Salamouris, D.S. (2004). Efficiency measurement of the Greek commercial banks with the use of financial ratios: A Data Envelopment Analysis approach, *Management Accounting Research*, 15(2): 201-224.

[19] Haron, S. (1996). Competition and Other External Determinants of the Profitability of Islamic Banks, *Islamic Economic Studies*, 4(1): 39–59.

[20] Hasan, H. (2004). Measuring efficiency of Islamic banks: criteria, methods, and social priorities, *Review of Islamic Economics*, 8(2).

[21] Hassoune, A. (2002). Islamic Banks' Profitability in an Interest Rate Cycle, International Journal of Islamic Financial Services, 4(2), online at http://www.iiibf.org/journals/journal14/vol4no2art2.pdf

[22] Hassan, M.K. (2005). The Cost, profit and X-Efficiency of Islamic banks. *Economic Research Forum*, 12th Annual Conference, 19th – 21st December 2005, Cairo, Egypt.

[23] Hassan, M.K., Bashir, A-H. (2005). Determinants of Islamic banking profitability, in M. Iqbal and R. Wilson (eds), Islamic Perspectives on Wealth Creation, Edinburgh University Press, Edinburgh.

[24] Hellmann, T.F., Murdock, K.C., Stiglitz, J.E. (2000). Liberalization, moral hazard in banking, and prudential regulation: Are capital requirements enough?", *American Economic Review*, 90(1): 147-165.

[25] Hussain, N.H., Hussin, A., Shaari, M.S. (2012). Efficiency and Profitability of Islamic Banking in Malaysia, *Journal of Applied Sciences Research*, 8(11): 5226 - 5241.

[26] Hussein, K.H. (2004). Banking efficiency in Bahrain: Islamic versus conventional banks, Islamic Development Bank, Islamic Research and Training Institute, Research, Paper, No. 68.

[27] Iqbal and Mirakhor, (2006). An Introduction to Islamic finance: Theory and Practice, Wiley Finance, Singapore: John Wiley *et* Sons (Asia), p 177.

[28] Kamaruddin, B.H., Safa, M.S., Mohd, R. (2008). Assessing production efficiency of Islamicbanks and conventional bank Islamicwindows in Malaysia, Munich Personal RePEc Archive, MARA University of Technology, Paper No. 10670.

[29] Keeley, M. (1990), Deposit Insurance, Risk, and Market Power in Banking. *American Economic Review*, 80: 1183-1200.

[30] Martens, A. (2001). La finance Islamique: Fondements, théorie et réalité", *L'Actualité économique,* 77(4): 475-498.

[31] Miller S., Noulas, A. (1996). The Technical Efficiency of Large Banks Production, *Journal of Banking & Finance*, 20(3): 495 - 509.

[32] Molyneux, P., Thornton, J. (1992). Determinants of European bank profitability 1986-1989: A note, *Journal of Banking and Finance*, Vol. 16.

[33] Nickell S.J. (1996). Competition and Corporate Performance, *Journal of Political Economy*, 104(4): 724-746.

[34] Obeid, C.M.H (2011). Evaluating the Productive Efficiency of Islamic Banking in GCC: A Non- Parametric Approach, *International Management Review*, 7(1).

[35] Peltzman, S. (1977). The gains and Losses from Industrial Concentration, *Journal of Law, and Economics*, 20(3): 229-263.

[36] Rozzani, N., Rahman, R. (2013). Camels and Performance Evaluation of Banks in Malaysia: Conventional Versus Islamic. *Journal of Islamic Finance and Business Research*, 2(1): 36 – 45

[37] Said, A. (2013). Risks and Efficiency in the Islamic Banking Systems: The Case of Selected Islamic Banks in MENA Region, *International Journal of Economics and Financial Issues,* 3(1): 66-73.

[38] Sahut, J-M, Mili, M., Ben Krir, M., Teulon, F. (2015). Factors of Competitiveness of Islamic Banks in the New Financial Order, *Ipag Business School Working Papers Series* 2015-625.

[39] Samad, A., Hassan, M.K. (1999). The performance of Malaysian Islamic bank during 1984-1997: An exploratory study. *International Journal of Islamic Financial Services, 1*(3):1-14.

[40] Sarker, M.A. (1999). Islamic banking in Bangladesh: Performance, problems, and prospects, *International Journal of Islamic Financial Services,* 1(3): 15-35.

[41] Sghaier, A., Belaid, M.B. (2011). Etude sur l'efficience bancaire: cas des banques islamiques en Malaisie, *Euro Mediterranean Economics and Finance Review*, Vol 6, Second Quarter.

[42] Short, B.K. (1979). The Relation between Commercial Bank Profit Rates and Banking Concentration in Canada, Western Europe and Japan, *Journal of Banking and Finance*, Vol. 3.

[43] Stiglitz J., Weiss A. (1981). Credit Rationing in Markets with Imperfect Information, *American Economic Review,* 71(3): 393 - 410.

[44] Sufian, F. (2007). The efficiency of Islamic banking industry in Malaysia Foreign vs domestic banks, *Humanomics*, 23(3): 174-192.

[45] Tobin, J. (1984). On the Efficiency of the Financial System, *Lloyds Bank Review*, 153: 1-15.

[46] Viverita, (2011). The Determinants of Net Interest Margin in the Indonesian Banking Sector, *Social Science Research Network,* SSRN Electronic Journal 08/2011; DOI: 10.2139/ssrn.1917367

[47] Yudistira, D., (2004). Efficiency in Islamic Banking: an Empirical Analysis of Eighteen Banks, Islamic Economic Studies, 12(1).

*** World Islamic Banking Competitiveness Report 2011-12, A Brave New World of Sustainable Growth, Ernst & Young.

APPENDICES

Table 1: List of banks

BANK	COUNTRY
Bank Mellat	Tehran Iran
Bank Saderat Iran	Tehran Iran
Bank Tejarat	Tehran Iran
Parsian Bank	Tehran Iran
Bank Sepah	Tehran Iran
Bank Keshavarzi-Agricultural Bank of Iran	Tehran Iran
Bank Refah	Tehran Iran
Bank of Industry and Mine	Tehran Iran
Export Development Bank of Iran	Tehran Iran
Albaraka Banking Group B.S.C.	Manama Bahrein
Kuwait Finance House	Manama Bahrein
Shamil Bank of Bahrain B.S.C.	Manama Bahrein
Islamic Coopérative Development Bank	Khartoum Soudan
Al Baraka Bank Soudan	Khartoum Soudan
Al Shamal Islamic Bank	Khartoum Soudan
Qatar Islamic Bank SAQ	Doha Qatar
Qatar International Islamic Bank	Doha Qatar
Jordan Islamic Bank	Amman Jordan
Jordan Dubai Islamic Bank	Amman Jordan
Shamil Bank of Yemen & Bahrain	Sana 'a Yémen
Islamic Bank of Yemen for Finance & Investment	Sana' a Yemen
Faisal Islamic Bank of Egypt	Cairo Egypte
Al Baraka Bank Egypt SAE	Giza Egypte
Albaraka Bank Tunisia	Tunis Tunisie
Banque Al Wava Mauritanienne Islamique-BAMIS	Nouakchott Mauritanie
First Habib Modaraba	Karachi Pakistan
Islamic Development Bank of Brunei Bhd BANDAR SERI	Begawan Breuni
Islamic Development Bank	Jeddah Saoudite
Kuwait Finance House	Safat Kuwait

Journal of Applied Economic Sciences
Volume X, Issue 4(34), Summer 2015

Tendencies toward Venal Behavior and Social Norms

Matúš KUBÁK
Technical University of Košice, Faculty of Economics, Slovak Republic
matuskubak@gmail.com
Radovan BAČÍK
University of Prešov in Prešov, Faculty of Management, Slovak Republic
radovan.bacik@unipo.sk
Alexandra ANTALÍKOVÁ
University of Prešov in Prešov, Faculty of Management, Slovak Republic
alexandra.antalikova@gmail.com

Abstract:

We carry out a framed corruption experiment in the Slovak Republic, considering actions and social norms and the relationship between these two. Experiment follows modified experimental design firstly proposed by Cameron et al. (2009). Obtained data set shows that economic agents, thus human beings do not achieve subgame perfect equilibrium. Using logistic regression, we investigate the impact of the social norms on venal behavior of economic agents, who can act as a briber, bribee, or of someone who is negatively affected by corruption and is given an opportunity to report it.

Keywords: corruption, experimental economics, logistic regression.

JEL Classification: C91, D73, H39

1. Introduction

Corruption is the social phenomenon considered as the main threat to the democracy. Corruption is with the human species from the early beginning, in every establishment and in every place. Corruption endangers functionality of the market economy, economic and social development (Fisman and Svensson, 2007; Meon and Sekkat, 2005), economic competition, social stability, social equity (Jong-Sung and Khagram 2005) and weakens moral foundations of society. Corruption constrains access of citizens to public services, lead to lack of trust toward institutions, increase anarchy and indifference (Svensson 2003, Shleifer and Vishny 1993; Treisman 2000, Burki 1999). Research shows that corrupting negatively influence also efficiency of the courts (Treisman 2000), application of law (Uslaner, 2005), political institutions (Lederman, Loayza and Soares, 2005), liberalization of trade (Goldsmith, 1999), education, (Shleifer and Vishny, 1993) and economic growth (Ades and Di tella, 1999; Svensson, 2005; Mauro, 1995).

Among the most serious impact of corruption, we include the waste of public resources, transformation of long run investment to less corrupted areas, non-effective allocation of resources as an impact of non-transparent economic environment (Tanzi and Davoodi, 1998; Reinnika and Svensson, 2003), market deformation and overcharging of goods and services.

2. Literature review

Institutional mechanisms to fight corruption have been reviewed and tested by several economic experiments (Abbink, Irlenbusch and Renner, 2002; Barr and Serra, 2009; Abbink, 2004; Büchner, Freytag, González and Güth, 2008; Schikora 2011 etc.).

Experimentators are trying to observe and define factors that influence corruption. One of the very often studied factors is a culture, as this one influences institutions and social norms. Under social norms definition we understand informal rules, which exist above values and consciousness and which are driving the interaction between economic agents (Drobak, 2006; Bicchieri, 2010). Economists recognize the culture as a set of norms and beliefs that are driving relations and actions between subjects (Barr and Serra, 2010). Even if the issue of measuring corruption via the culture is not developed science, the relation between culture and corruption is evident (Serra 2006; Barr and Serra, 2010, Lipset and Lenz, 2000; Banuri and Eckel, 2012; Husted, 1999; Cameron, Chaudhuri, Erkal, Gangadharan, 2009; La Porta, Lopez-de-Silanes, Shleifer, and Vishny, 1997; Fisman and Miguel, 2007; Lambsdorff, 2006; Treisman 2000). Heinrich *et al.* (2006) proved that altruistic motives and punishment decreasing payoffs are correlated. Marlowe *et al.* (2008) showed that big societies punish non cooperative and unfair behavior more than small societies in order to restore social norms. Barr and Serra (2010) demonstrated that in corrupted societies subjects have tendencies to corrupt more that in non-corrupted

societies. Fishman and Miguel (2007) showed that social norms are to some extent persistent in time and thus economic agents carry them in case of emigration, or when working abroad. Treisman (2000) and Serra (2006) demonstrated that countries with high number of Protestants are less corrupted. In India, they are speaking about corruption just when bribee asks higher bribe than is usually asked (Wade, 1982). Husted (1999) develops theory upon Hofstede´s four dimensions of culture (power distance, individualism - collectivism, uncertainty avoidance, masculinity – femininity) that corruption diminishes uncertainty in trade and thus, countries, where risks averse individuals prevail are more prone on corruption. Husted showed that masculine countries with big power distance and which are risks averse are most corrupted.

Swamy *et al.* (2001) proved that countries with high rate of women in leading position are less corrupted. Banuri and Eckel (2012) introduced term corruption norms, under which they understand specific form of social norm, which drive economic agents toward corrupted practices and influence their beliefs about other subject`s willingness to corrupt.

Other topics related to corruption are clientelism and nepotism. Economic experiments in field of nepotism and clientelism prove that human beings have tendencies toward these practices. Brandts and Sola (2007) using trust game proposed by Berg *et al.* (1997) point that in the trust game, close friends send higher amounts between them even if it is not most effective in term of payoffs. Banuri and Eckel (2012) demonstrated nepotism during an economic experiment with subjects from the USA and Pakistan. Thus, even in cases, when cooperation with own ethnic group member was not the best choice in term of economic efficiency, subjects in the USA have been choosing in 44 % member of own ethnic group. In Pakistan, this rate was even higher, and it was 65%.

The aims of this study are:

- to map social norms of individuals in the context of corruption;
- to observe behavior of subjects in situation, when venal behavior is available and full anonymity is assured;
- to run further analysis on the obtained data and match social norms to individuals´ real behavior.

In this paper, we present an economic experiment which simulates possible corrupt environment. Existing measures of corruption perceptions such as World Bank Governance Diagnostic Survey, Transparency International's Corruption Perception Index etc. typically come from surveys. There are two problems with such measures. First of all, it is not always clear that respondents have the same understanding or criteria for judging a particular question. Secondly, in a survey respondents have little incentive to answer truthfully, and may be unwilling to answer sensitive questions in the presence of an interviewer. In our experiment we provide financial incentives designed to elicit a subject's true tendencies toward corrupt behavior and do this in an anonymous environment. We use economic experiment that allows us to observe behavior of economic agents in the role of briber (private citizen), bribee (public official) and in the role of someone, who is negatively affected by corruption and is given an opportunity to report it (other member of society). As mentioned above, it is difficult to measure corruption. Economic experiment allows simulating corrupted environment and makes possible to observe behavior of subjects, economic agents. Taking into account the nature of corruption, it is difficult to collect empirical data. Design of experiment is inspired by Cameron *et al.* (2009), but payoff functions and strategy method are different for purpose of most effective use of experimental sample. Moreover, we study the impact of awareness and attitudes toward corruption on inclination of economic agents toward such behavior.

Paper is organized as follows: third chapter describes materials and methods. Experimental design is described in the fourth chapter. Fifth chapter is devoted to the description of questionnaire. Results and discussion can be found in sixth part. Final, sevnth chapter comprise conclusion.

3. Materials and methods

The laboratory experiment was conducted in 2014 at the Faculty of Management, University of Prešov in Prešov, Slovak Republic. Subjects were asked during the classes of Microeconomics whether they are willing to participate in an economic experiment. Usually, subjects are addressed via an advertisement on a webpage of university and via flyers distributed on university campus. Due to the fact, that possibility to corrupt, or to be corrupted can occur all at once, we decided not to invite subjects on economic experiment, but we only allowed them to refuse to participate in an experiment that is already in progress. This can simulate a real environment, where public procurement, selection of suppliers, public tender or other action where the possibility to corrupt or possibility to be corrupted can occur. However, students were told that if they do not want to participate on experiment, there is a classroom where the standard class of microeconomics is run. Yet, no student renounced to participate in experiment.

At the beginning of each session the subjects were seated at the desks, asked to remain quiet and follow the instructions which were distributed in paper form in envelops. Questions were answered in private after the participant raised his/her hand. At the end of each session, which lasted approximately 30 minutes, subjects were paid according to their decision. On average, they were given 2 Euros. We kept low payoff on purpose, to study mere inclination of economic agents toward corruption, where payoff, thus profit from corrupt behavior is fairly low. Once the experiment was finished, subjects were asked to answer short questionnaire, which was focused on their overall awareness of corruption and their attitudes toward corruption in real life situation. Questionnaires were in envelopes on the students' desk and were marked by the same number as was printed on the card signed by supervisor, where subjects marked their decision. Doing so allowed us to match decision card with questionnaire for the purpose of further analysis. Answers of subjects in questionnaire served in logistic regression as input variables to explain their behavior. There were conducted 10 sessions with 10 to 18 subjects. In total, 150 students participated on the experiment. Participants were students of different fields of study at the Faculty of Management.

4. Experimental design

Experimental design simulates real-life situation, in which three subjects come into interaction. The experiment uses modified experimental design first introduced by Cameron *et al.* (2009). Subjects have been assigned the role of a bribe proposing/not proposing *private citizen*, a bribe accepting/not accepting *public official*, or bribery reporting/not reporting *other member of society*. Participants should identify themselves with the role that was given ti them and make decisions in the same way as if it was a real-life situation. This authenticity of behavior during experiment and real life behavior was stimulated with financial incentives.

The money earned during the experiment is called payoff. The payoff is calculated in an experimental currency EMU – Experimental Monetary Unit. At the end of the experiment it was converted into cash in Euro. Exchange rate was 1 € for 50 EMU. At the beginning of the experiment, participants received card with number signed by supervisor. This number corresponded to the number of subjects' answer sheet in order that no one could associate subjects' behavior to their personality and fully anonymity was satisfied. All of the decisions subjects did and the information they provided are treated as confidential.

As mentioned above, in experiment, three individuals interact: a *private citizen*, a *public official* and *other member of society.*

Those assigned the role of the *private citizen* make up their minds whether or not to offer a bribe to the *public official*. The *public* official has to decide whether they would be willing accept a bribe if one is offered, or to refuse it. The *other member* of *society* decides whether they would report corruption if a bribe is offered and accepted.

Each individual begins with 100 EMU. If corruption occurs (i.e. a bribe is offered, accepted and not reported) the *private citizen* and *public official* gain 50 EMU each, and the *other member of society* loses 20 EMU. If corruption occurs and is reported, the *other member of society* loses 50 EMU, and the *private citizen* and *public official* lose the 50 EMU they would had gained thanks to venal behavior.

To summarize:

- If the *private* citizen chooses to offer a bribe, the *public official* chooses to accept a bribe if offered, and the *other member of society* chooses not to report corruption, the *private citizen* ends with 150 EMU, the *public official* ends with 150 EMU, and the *other member of society* ends with 80 EMU.
- If the *private* citizen chooses to offer a bribe, the *public official* chooses to accept a bribe if offered, and the *other member of society* chooses to report corruption, the *private citizen* ends with 100 EMU, the *public official* ends with 100 EMU, and the *other member of society* ends with 50 EMU.
- In all other cases (for example if a bribe is offered, but not accepted, or if the official would have accepted a bribe but none was offered) , the *private citizen* ends with 100 Points, the *public official* ends with 100 Points, and the *other member of society* ends with 100 Points. Decision tree with respective payoffs is shown in Figure 1.
- We assume that in perfect subgame equilibrium of the game a rational, payoff maximizing, *other member of society* doesn't report corruption. Knowing so, the *public official* accepts bribe and the *private citizen* offers the bribe.

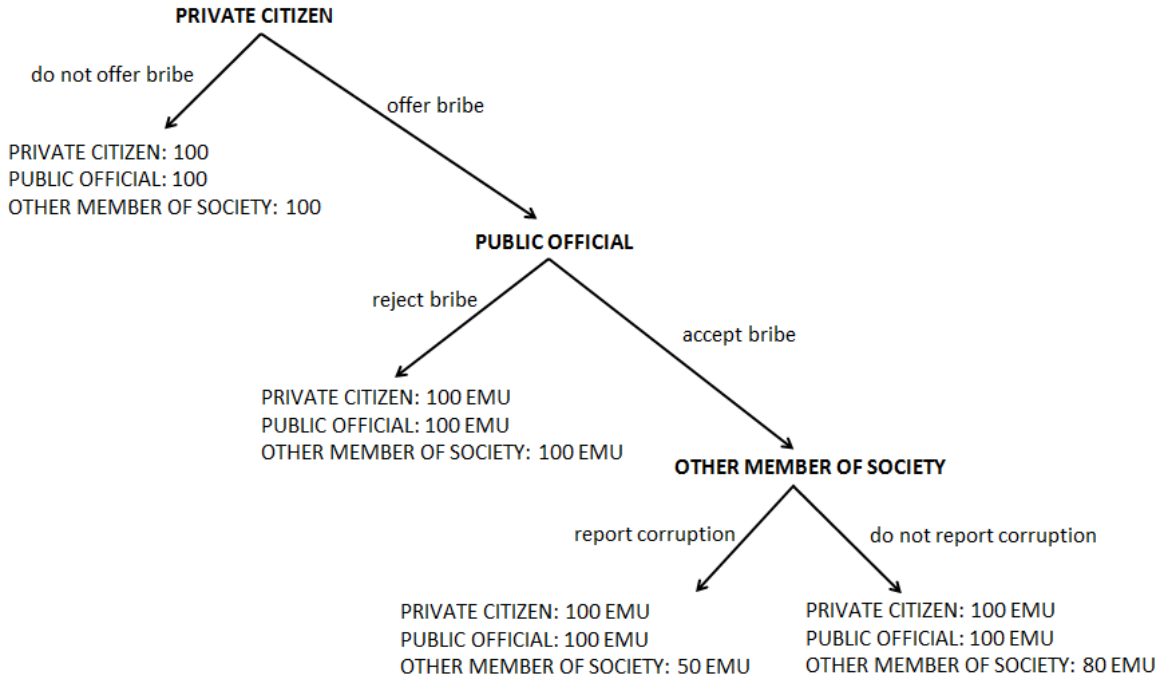


Figure 1 – Decision tree

5. Questionnaire

Questionnaire aimed to elicit participants´ overall awareness of corruption and their attitudes toward corruption. First set of questions was focused on corruption and its impact on various areas of life. Questions and percentage occurrence of answers concerning areas of life are presented in Table 1.

Table 1 - Corruption and areas of life

How seriously do you think corruption is affecting different areas of life in Slovakia?	Considerably	I do not know	Weakly
Political life (grand corruption, electoral corruption)	97	1	2
Business environment (judicial corruption, clientelism)	73	24	3
Culture and social values (systematic corruption)	23	54	23
Personal life (petty corruption, nepotism)	22	24	54

Eyeballing Table 1 allows us to say that subjects are most skeptics in terms of grand corruption, electoral corruption, clientelism and judicial corruption. On the other hand, subjects do not feel endangered by petty corruption and nepotism.

Second set of questions was focused on petty corruption, which can occur in everyday life. Questions and percentage occurrence of answers concerning petty corruption are presented in Table 2.

Table 2 – Petty corruption

	Common activity	I do not know	Rare activity
Do you think that in case of health care services, bribery is a common activity in Slovakia?	95	4	1
Do you think that in the domain of the labor market, bribery is a common activity in Slovakia?	95	5	0
Do you think that police corruption is common activity in Slovakia?	88	10	2

Table 2 reports inconsistency in statements of subjects. Here they confirm that corruption in domain of health care services, police corruption and nepotism is a common activity in Slovakia. Over and above, Table 2

shows that petty corruption in Slovak republic is serious problem. Third set of question was aimed to elicit subjects´ attitudes toward justifiableness of corruption. Questions and percentage occurrence of answers concerning excusableness of corruption are shown in Table 3.

Table 3 – Justificableness of corruption

Do you think that any of the following actions can be excused?	Never	Rarely	Always
Skipping the waiting list at the office by providing the bribe to an official	31	57	12
Accepting a bribe in connection with the performance of work	41	53	6

Table 3 brings fairly interesting fact. Subjects in Slovakia do not condemn venal behavior in actions. The most frequent answer is Rarely, thus corruption is not understood as a crime, but rather as malfeasance.

Fourth set of questions as focused to study participants´ general knowledge about ranking of Slovak republic in terms of Corruption Perception Index (abb. CPI) and in terms of Gross Domestic Product (abb. GDP). In 2013, Slovakia ranked 61st place in terms of CPI in Transparency International survey and 63th place in terms of GDP in World Bank ranking. Table 4 shows answers to questions about CPI and GDP.

Table 4 - General knowledge about ranking of Slovak republic in terms of CPI and GDP

In your opinion, in 2013, Slovakia ranked which place in the Corruption Perception Index published by Transparency International?							
1st-20th	21st-140th	41s-60th	61st-80th	81st-100th	101st-120th	121st-140th	141st-175th
2%	5%	7%	20%	25%	21%	15%	5%
In your opinion, in 2013, Slovakia ranked which place in terms of Gross Domestic Product in World Bank ranking?							
1st-20th	21st-140th	41s-60th	61st-80th	81st-100th	101st-120th	121st-140th	141st-160th	161st-192nd
2%	4%	7%	9%	11%	13%	16%	18%	20%

Table 4 reals that subjects´ knowledge about the ranking of Slovakia in terms of CPI and GDP is weak. Only 20% of individuals selected that Slovakia is in interval 61st to 80th in CPI ranking and only 9% selected that Slovakia is in interval 61st to 80th in GDP ranking. Interesting fact is, that Slovaks consider situation of the country is considerably worse.

6. Results and discussion

Among 150 participants of experiment 115 were females and 35 were males, thus our sample was not perfectly balanced in terms of gender. This distribution of subjects is caused by representation of genders within students of managerial fields of study.

6.1 Results for private citizens

Among 50 subjects in the role of *private citzens*, up to 31 subjects (62%) would not offer a bribe, despite the fact that the opposite decision would increase their payoff. Among these, 28 were women and only 3 were men. 38% of subjects proposed a bribe, where 15 were females and 4 were males. We observe that one third of the participating women offered a bribe, while one half of participating males proposed a bribe. Although is our experimental sample formed predominantly by females, we can conclude, that males are more prone to venal behavior than females. Table 5 depicts logistic regression results for *private citizens,* where dependent variable is two possible strategies of subjects in the role of *private citizen:* 1 - offer bribe, 0 – do not offer bribe.

Table 5 - Multinomial Logit - *Private Citizen*

Dependent variable: offer bribe/do not offer bribe	*Coefficient*	*Std. Error*	*z*	*p-value*	
Constant	-9,48714	3,98409	-2,3813	0,01725	**
Gender	-1,98846	1,1645	-1,7076	0,08772	*
Business	-1,26012	0,965986	-1,3045	0,19207	
Culture	1,26016	0,607426	2,0746	0,03803	**

Personal life	0,767269	0,512662	1,4966	0,13449	
Health Care	1,87418	1,18308	1,5842	0,11316	
CPI	0,509228	0,348517	1,4611	0,14398	
GDP	0,549889	0,260885	2,1078	0,03505	**
Mean dependent variable	0,380000	S.D. dependent variable		0,490314	
Log-likelihood	-24,16261	Akaike criterion		64,32522	
Schwarz criterion	79,62140	Hannan-Quinn		70,15009	
Number of cases 'correctly predicted' = 36 (72,0%)					
Likelihood ratio test: Chi-square(7) = 18,0812 [0,0116]					

Table 5 indicates that:

- Females are less prone to offer bribes.
- By those respondents who think that corruption does not affect the cultural life and social values, there is a greater chance of bribe proposing.
- Those who think that Slovakia ranked higher score in terms of GDP, thus think that Slovakia is in the interval from 81st to 192nd, are more prone to engage in bribery.

6.2 Results for public officials

Fifty subjects were assigned the role of *Public Officials*. 38 (76%) out of them would not accept a bribe, while 12 (24%) out of them would accept a bribe. Among all, 8 females and 4 males would accept bribe, whereas 30 females and 8 males would not accept bribe. Table 6 depicts logistic regression results for PUBLIC OFFICIALS, where the dependent variable is two possible strategies of subjects in role of *Public Officials*: 1 – accept bribe, 0 – reject bribe.

Table 6 - Multinomial Logit - *Public Official*

Dependent variable: accept bribe/reject bribe					
	Coefficient	*Std. Error*	*z*	*p-value*	
Constant	-2,01508	3,06634	-0,6572	0,51108	
Culture	-2,22295	0,985893	-2,2548	0,02415	**
Personal life	1,63835	0,676458	2,4220	0,01544	**
Excusableness of bribe proposing	-1,98268	1,02542	-1,9335	0,05317	*
Excusableness of bribe accepting	1,0656	0,870279	1,2244	0,22079	
CPI	0,762466	0,407	1,8734	0,06102	*
GDP	-0,199459	0,23978	-0,8318	0,40550	
Mean dependent variable	0,240000	S.D. dependent variable		0,431419	
Log-likelihood	-20,27375	Akaike criterion		54,54750	
Schwarz criterion	67,93166	Hannan-Quinn		59,64426	
Number of cases 'correctly predicted' = 43 (86.0%)					
Likelihood ratio test: Chi-square(6) = 14,5605 [0,0240]					

Table 6 indicates that:

- We assume that among respondents who think that corruption insignificantly affects the culture and social values the chance of accepting a bribe is reduced.
- The same can be held for respondents who think that skipping the waiting list by reason of bribery should not be tolerated.
- Respondents who state that their personal life is not affected by corruption have a higher tendency to accept a bribe.
- Respondents who think that Slovakia is among the countries with the highest levels of corruption are more prone to accepting a bribe.

6.3 Results for other members of society

Among 50 subjects that were assigned the role of the *Other Member of Society*, 32 individuals chosen to report corruption, which represents 64% of the whole sample. These decided to report bribery despite the fact

that their decision reduced their monetary payoffs. Opting for corruption reporting was made by 22 females and 10 males. Thus, 18 individuals, where 12 were females and 6 were males decided to do not report corruption. Table 7 shows logistic regression results for *Other Member of Society*, where the dependent variable is two possible strategies of subjects in the role of *Other Member of Society*: 1 – report corruption, 0 – do not report corruption.

Table 7 - Multinomial Logit - *Other Member of Society*

Dependent variable: report corruption/do not report corruption					
		Coefficient	*Std. Error*	*z*	*p-value*
Constant		0,477175	2,60328	0,1833	0,85456
Culture		-1,059	0,590753	-1,7926	0,07303 *
Personal life		0,451535	0,473842	0,9529	0,34063
Police corruption		-1,67455	1,13018	-1,4817	0,13843
Excusableness of bribe proposing		1,13312	0,648768	1,7466	0,08071 *
CPI		0,293535	0,235605	1,2459	0,21281
GDP		-0,185608	0,253787	-0,7314	0,46456
Mean dependent var	0,640000	S.D. dependent var			0,484873
Log-likelihood	-28,86974	Akaike criterion			71,73949
Schwarz criterion	85,12365	Hannan-Quinn			76,83625
Number of cases 'correctly predicted' = 36 (72.0%)					
Likelihood ratio test: Chi-square(6) = 7,60233 [0,2687]					

Here the Likelihood ratio test p value is greater than 0.05, thus we cannot reject H_0: $\theta = \theta 0$, thus interpretation of coefficients is needless.

Aknowledgement

Research reported in this paper was supported by VEGA 1/0726/14.

Conclusion

Based on our analysis, we can conclude, that majority of individuals in our sample do not achieve subgame perfect Nash equilibrium. In total, only 38% of individuals proposed bribe, 24% of individuals accepted proposed bribe and even up to 64% of individuals reported corrupt behavior, when this occurred. On the other hand, these numbers are not far from experiments in which monetary reward was fairly higher. We showed that individuals are willing to increase their wealth at the expense of others also in the situation, when only 2 Euros are in the stake.

Summary arising from the social norms mapping part indicates that individuals are quite skeptical, mainly in terms of grand corruption, electoral corruption, judicial corruption and clientelism. Above 88% of respondents think that bribery is a common activity in Slovakia in the domain of health care services, labor market and police corps. The oddest-looking finding of our analysis is that only 31% of young people in Slovakia think that bribe proposal can be never excused. Remaining 69% stated that bribe proposal can be rarely or always excused. Further, only 41% of respondents stated that bribe accepting can be never excused. Remaining 59% expressed, that bribe accepting can be rarely, or always excused.

Concerning answers of subjects about the situation of Slovak Republic in Corruption Perception Index and World Bank ranking based on Gross Domestic Product, findings are following: 66% of respondents think, that situation of Slovakia is worse than the real situation is; and 78% think that position of Slovakia based on Gross Domestic Product value is worse than the reality.

The results of regression analysis revealed that females are less prone to venal behavior than males in terms of bribe proposing. Also, bribery is enhanced by deteriorating estimate about position of Slovakia in World´s bank ranking based on Gross Domestic Product value. Bribe accepting behavior is enhanced by attitudes of individuals toward excusableness of bribe proposing. More one thinks the bribery is excusable, more he/she is prone behavior. Also, worse one thnink the position of Slovakia is in the Corruption Perception Index, more prone he/she is to venal behavior. We failed to determine determinants of corruption punishing behavior, because of statistical insignificance of the model.

References

[1] Abbink, K., Irlenbusch B., Renner E. (2002). An Experimental Bribery Game. *Journal of Law, Economics, and Organization*, 18(2): 428-54. DOI: 10.1093/jleo/18.2.428

[2] Abbink, K. (2004). Staff rotation as an anti-corruption policy: an experimental study. *European Journal of Political Economy*, 20: 887–906. DOI: 10.1016/j.ejpoleco.2003.10.008

[3] Ades, A., Di Tella, R. (1999). Rents, Competition, and Corruption. *American Economic Review*, 89 (4): 982-993. DOI: 10.1257/aer.89.4.982

[4] Banuri, S. Eckel, C. (2012). The Effects of Sanctions on Bribery: US versus Pakistan. CBEES Working Paper Series 09-01

[5] Banuri, S., Eckel, C. (2012). The Effects of Short-Term Punishment Institutions on Bribery: US versus Pakistan, CBEES Working Paper Series 11-05.

[6] Banuri, S., Eckel, C. (2012). Nepotism in traditionalist societies: US versus Pakistan, Unpublished manuscript.

[7] Barr, A., Serra, D. (2010). Corruption and culture: An experimental analysis, *Journal of Public Economics*, 194: 862-869. DOI: 10.1016/j.jpubeco.2010.07.006.

[8] Berg, J., Dickhaut, J., McCabe, K. (1995). Trust, reciprocity, and social history. *Games and Economic Behavior*, 10: 122-142. DOI: 10.1006/game.1995.1027

[9] Bicchieri, C. (2010). Social norms. *The Stanford Encyclopedia of Philosophy*, Stanford University Press.

[10] Brandts, J., Sola, C. (2010). Personal Relations and their Effect on Behavior in an Organizational Setting: An Experimental Study. *Journal of Economic Behavior and Organization*, 73(2): 246-253. DOI:10.1016/j.jebo.2009.09.005

[11] Büchner, S.A. Freytag, González, L., Güth, W. (2008). Bribery and Public Procurement: An Experimental Study. *Public Choice*, 137: 103–117. DOI: 10.1007/s11127-008-9315-9

[12] Cameron, L., Chaudhuri, A., Erkal, N., Gangadharan, L. (2009). Propensities to engage in and punish corrupt behavior: Experimental evidence from Australia, India, Indonesia and Singapore. *Journal of Public Economics*, 93(7-8): 843-851. DOI:10.1016/j.jpubeco.2009.03.004

[13] Drobak, J. (2006). *Norms and the law*, New York, NY: Cambridge University Press.

[14] Fisman, R., Svensson, J. (2007). Are corruption and taxation really harmful to growth? Firm level evidence. J*ournal of development economics,* 83(1): 63-75. DOI: 10.1016/j.jdeveco.2005.09.009

[15] Fisman, R., Miguel, E. (2007). Corruption, norms, and legal enforcement: Evidence from diplomatic parking tickets. *Journal of Political Economy,* 115: 1020-1048. DOI: 10.1086/527495

[16] Goldsmith, A. (1999). Slapping the Grasping Hand: Correlates of Political Corruption in Emerging Markets. *American Journal of Economics and Sociology*, 58(4), 865–883. DOI: 10.1111/j.1536-7150.1999.tb03398.x

[17] Henrich, J., Ensminger, J., McElreath, R., Barr, A., Barrett, C., Bolyanatz, A., Cardenas, J. C., Gurven, M., Gwako, E., Henrich, N., Lesorogol, C., Marlowe, F., Tracer, D., Ziker, J. (2010). Markets, Religion, Community Size, and the Evolution of Fairness and Punishment. *Science*, 327: 1480-1484. DOI: 10.1126/science.1182238.

[18] Husted, B. (1999). Wealth, Culture, and Corruption. *Journal of International Business Studies*, 30(2): 339-60. DOI:10.1057/palgrave.jibs.8490073

[19] Jong-Sung, Y., Khagram, S. (2005). A comparative study of inequality and corruption. American Sociological Review, 70: 136-157. DOI: 10.1177/000312240507000107

[20] Lambsdorff, J.G. (2006). Causes and consequences of corruption: what do we know from a cross-section of countries? Rose-Ackerman, 2nd Edition, International Handbook on the Economics of Corruption. Edward Elgar, Cheltenham, UK, pp. 3–51.

[21] Lambsdorff, J.G., Frank, B. (2007). Corrupt Reciprocity - an Experiment. University of Passau discussion paper.

[22] La Porta, R., Lopez-de-Silanes, F., Shleifer, A., Vishny R.W. (1997). Trust in large organizations. *American Economic Review*, 87 (2), 333-338. DOI: 10.3386/w5864

[23] Lederman, D., Loayza, N., Soares, R. (2005). Accountability and corruption: political institutions matter. *Economics and Politics*, 17(1), 1–35. DOI: 10.1111/j.1468-0343.2005.00145.x

[24] Lipset, S.M., Lenz, G.S. (2000). Corruption, Culture, and Markets. L.E. Harrison and S.P. Huntington, eds., Culture Matters: How Values Shape Human Progress, New York, Basic Books.

[25] Mauro, P. (1995). Corruption and growth. *Quarterly Journal of Economics*, 110: 681-712. DOI: 10.2307/2946696.

[26] Marlowe, F.W., Berbesque, J.C., Barr, A., Barrett, C., Bolyanatz, A., Cardenas, J.C., Ensminger, J., Gurven, M., Gwako, E., Henrich, J., Henrich, N., Lesorogol, C., McElreath, L., Tracer, D. (2008). More Altruistic Punishment in Larger Societies. *Proceedings of the Royal Society,* B 275: 587-592. DOI: 10.1098/rspb.2007.1517

[27] Méon, P. G., Sekkat, K. (2005). Does Corruption Grease or Sand the Wheels of Growth. *Public Choice*, 122, 69-97. DOI: 10.1007/s11127-005-3988-0.

[28] Reinikka R., Svensson, J. (2004). Local capture: Evidence from a central government transfer program in Uganda. *The Quarterly Journal of Economics*, 119(2):679-705. DOI: 10.1162/0033553041382120.

[29] Schickora, J. T. (2011) Bringing the Four-Eye-Principle to the Lab. Munich discussion paper

[30] Serra, D. (2006). Empirical determinants of corruption: a sensitivity analysis. *Public Choice,* 126: 225–256. DOI: 10.1007/s11127-006-0286-4.

[31] Shleifer, A., Vishny, R.W. (1993). Corruption. *Quarterly Journal of Economics,* 108: 599-617. DOI: 10.2307/2118402

[32] Svensson, J. (2003). Who must pay bribes and how much? Evidence from a cross section of firms. *Quarterly Journal of Economics,* 118, 207-230. DOI: 10.1162/00335530360535180

[33] Swamy A., Knack S., Lee Y., Azfar, O. (2001). Gender and corruption. *Journal of Development Economics*. 64: 25–55. DOI: 10.1016/S0304-3878(00)00123-1

[34] Tanzi, V., Davoodi, H. Corruption, Public Investment, and Growth. *The Welfare State, Public Investment, and Growth, Selected Papers from the 53rd Congress of the International Institute of Public Finance, (Springer Japan, 1998),* 41-60. DOI: 10.1007/978-4-431-67939-4_4

[35] Treisman, D. (2000). The causes of corruption: a cross-national study. *Journal of Public Economics*, 76: 399-457. DOI: http://dx.doi.org/10.1016/S0047-2727(99)00092-4

[36] Treisman, D. (2007). What have we learned about the causes of corruption from ten years of cross-national empirical research? *Annual Review of Political Science*, 10: 211–244. DOI: 10.1146/annurev.polisci.10.081205.095418

[37] Uslaner, E.M. (2010). *Corruption, Inequality, and the Rule of Law - The Bulging Pocket Makes the Easy Life. ISBN: 9780521145640, 360 pages.*

[38] Wade, R. (1982). The System of Administrative and Political Corruption: Canal Irrigation in South India. *Journal of Development Studies*, 18 (3): 287-328. DOI: 10.1080/00220388208421833

*** Transparency International, The corruption perceptions index (2013). https://issuu.com/transparency international/docs/cpi2013_brochure_single_pages?e=2496456/5813913

*** World Bank, World Bank Governance Diagnostic Survey, (2013). http://web.worldbank.org/ WBSITE/ EXTERNAL/WBI/EXTWBIGOVANTCOR/0,,contentMDK:20726148~pagePK:64168445~piPK:64168309~the SitePK:1740530,00.html.

JOURNAL of Applied Economic Sciences

ISSN 2393 – 5162 ISSN - L 1843-6110