STUDIA UNIVERSITATIS
BABEŞ-BOLYAI

OECONOMICA

2/2017

STUDIA
UNIVERSITATIS BABEŞ-BOLYAI
OECONOMICA

2/2017

August

EDITORIAL OFFICE OF OECONOMICA: Teodor Mihali str. no. 58-60, s. 251, 418655 Cluj-Napoca,
Phone: 0040-264-41.86.52, oeconomica@econ.ubbcluj.ro, http://studiaoeconomica.reviste.ubbcluj.ro/

YEAR **(Volume 62) 2017**
MONTH **August**
ISSUE **2**

Studia Universitatis Babeş-Bolyai Oeconomica

2

EDITORIAL OFFICE of **Studia Universitatis Babeş-Bolyai Oeconomica**
Teodor Mihali str. no. 58-60, s. 251, 400591 Cluj-Napoca,
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STUDIA UNIVERSITATIS BABEŞ-BOLYAI OECONOMICA
VOLUME 62, ISSUE 2, 2017, pp. 3-19
DOI: 10.1515/subboec-2017-0006

THE ROLE OF EU INNOVATION POLICIES IN THE SUSTAINABLE DEVELOPMENT OF THE ENERGY SECTOR

Olesea SIRBU
Academy of Economic Studies of Moldova, Republic of Moldova

Rodica CRUDU
Academy of Economic Studies of Moldova, Republic of Moldova

Augustin IGNATOV[*]
Academy of Economic Studies of Moldova, Republic of Moldova

Abstract: In the present conditions when the demographic pressure upon the environment is higher than ever, the humanity faces the challenge of sustainability. Namely the sustainability of human activities is important and nothing can assure it better than sustainable energy supplies. The European Union is the leading global power in terms of adjusting its policies to increase innovation to assure a sustainable growth of its energy sector as a key to an advanced economic system. The present research focuses on the impact of European Union policies on the sustainable development of its energy sector by analyzing quantitatively and qualitatively various indicators intended to offer a throughout insight. The results obtained focus on the identification of the main innovation paradigms; the description of the main modern environmental challenges, especially in the energy domain; the determination of the relation between innovation and energy sustainability, and its analysis at the level of European Union.

JEL classification: H50, Q20, Q40, Q50;

Keywords: sustainable economic development; renewable energy; greenhouse gas emissions; recycling; energy efficiency; R&D expenditure

[*] Corresponding author. Address: Centre for Studies in European Integration, Academy of Economic Studies of Moldova, Banulescu-Bodoni 61 street, MD-2005, Chișinău, Republic of Moldova, E-mail: augustin1ignatov1@gmail.com

1. Introduction

One of the biggest challenges the humanity has ever faced is: to meet the growing needs of world's population without increasing the anthropic pressure upon the environment. Thus, billions of dollars are yearly allocated to re-think the present global economic system. A special attention is given to the modernization of the energy sector, cleaner and more sustainable energy being the key for a more secure future. The European Union is ahead of all global powers in terms of re-structuring its economic potential through innovation driven processes to meet the sustainability goals. Taking into account these conditions, the main aim of the present paper is: to identify the relation between the EU's expenditures on innovation and the development of its energy sector, which is the main driver of socio-economic sustainability. The objectives to be achieved by the research include the analysis of the main paradigms driving innovation; the most important challenges of EU's energy sector; the initiatives to tackle them; the identification of the relation between innovation and sustainable development and the provision of relevant conclusions.

Despite the multitude of materials available on this subject, the present paper comes to evaluate the efficiency of European R&D expenditure by assessing its effects upon innovation and energy sustainability.

2. Literature review

To most effectively explore the issues related to the EU innovation policies and the sustainability of its energy sector a subset of literature has been selected to identify the best which is the motivation to innovate and what are the socio-economic benefits of innovation. Moreover, it is proposed to point out which are the existing impediments hampering the progress of the EU's energy market.

Thus, as far back as 2001, Williams stated that the industrialized countries, including most of the EU states, need radical changes in their energy systems in order to address effectively the multiple economic, social, environmental, and insecurity challenges posed by conventional energy. In such a way, fundamental policy changes are required to increase the attention given to the energy sector's sustainability since it is the core to progressive economic development. Costantini and Crespi (2009) underline that innovation in the energy sector for most of industrialized countries, especially for the European Union ones, is crucial because energy technologies allow enhancing the countries' competitive economic advantages improving their capacities to face higher economic competition without increasing the pressure upon the environment and climate. Ragwitz et al (2009) says that policies promoting technological innovation in the energy area lead to a continuous and sufficiently fast reduction of the energy technologies' development costs. However, the implementation of these policies is only relevant when having a proper international cooperation framework intended to create larger markets providing increased possibilities to exploit economies of scale and accelerate research and development in this area. In such a way, it is necessary to remark that in order to make the energy sustainable through innovation the proper innovation should be sustainable. It is essential to produce a more systematic and detailed account of the complete range of measures and means used to support policies (at national and local levels) aimed at promoting green innovations and in fact create a market with growing demand for innovation (Hamdouch and Depret, 2012).

The European House “Ambrosetti” (2015) in its research for Enel, stated that the key to energy sustainability in the European Union is a well-balanced energy market regulation. It makes sure that investments are based on long-term market considerations and price signals. Being one of the largest energy companies of Europe, Enel pays increased attention to new technologies as they contribute to increase the energy security by reducing import dependency and exposure to the volatility of fossil fuel prices and it also brings significant air pollution and health co-benefits. Yet, it is mentioned that the energy innovation investments in the EU will not reach the full potential unless the disparities among countries are eradicated and is not completed the formation of the unique energy market (Prandecki, 2014). The consolidation of the EU energy market including the development of common innovative infrastructure projects would enhance the competition in the field encouraging the growth of competitiveness which will result in lower price and higher quality (Costa-Campi et al, 2013). Moreover, the consolidation should take into account the flexibility dimension which is important to create favorable preconditions to enhance its sustainability. In such a way, the European Union policies should focus on the demand side rather than supply to fully embrace the benefits of sustainable energy sources (Gaventa et al, 2015). Once the European Union’s energy market is consolidated the increased competition among different stakeholders would create enhanced demand for innovation products leading reduced costs, including the environmental ones and maximized benefits (Szulecki et al, 2016). General Electric (2016) pointed up that in order to raise the efficiency of the EU energy sector a robust and resilient market is needed. It is inferred that €2 trillion of investment is required to build and upgrade the European energy infrastructure in the following decade. Achieving this level of investment requires the public and private sectors working together to find the best technologies and solutions, creating a framework for long-term investment.

The improvement of energy sustainability should not be regarded as an isolated process. It should consider all the economic areas as only in this way it will be possible to build efficient economic structures capable of facing the present time economic challenges. The EU stresses this imperative condition as since the implementation of Lisbon Strategy, the innovative activity and innovation has been linked to entrepreneurship, social cohesion and liberalization (Gajewski, 2017). Moreover, it should not be diminished the role of concentrating financial and research resources in technology and capital equipment innovation which are the main drivers of both manufacturing growth and aggregate economic growth (United Nations Industrial Development Organization, 2015). Ćetković and Buzogány (2016) as well as Reinaud et al (2016) marked that capital investment in energy generation capacities and storage across the European Union must rely on well-defined strategies and policies to avoid the situation of technological replication. The divergent positions of EU members in this regard could lead to financial restraints and energy market distortions.

Concluding the section it could be mentioned that the literature reviewed in this paper defines the overall problem and underlines some of the most important motivations to innovate in the energy sector (for instance the increase of competitiveness in the growing global change), the benefits which could be obtained (including lower environmental cost of energy and higher output) and the impediments (irregularities

in policies across the EU countries and lack of unique energy market). However, further research is needed to more clearly assess and quantify the interconnection between innovation and sustainability of European energy sector by describing the dominant innovation paradigms and policy considerations.

3. Methodology

The methodology of the present research is based on qualitative and quantitative analyses of data regarding innovation and energy sustainability of the European Union. In this way, it is possible to have a comprehensive insight upon the research matter and therefore reach relevant conclusions.

Qualitative information regards the innovation and sustainable development initiatives and policies, strategies and methods through which the European Union aspires to reach its objectives in innovation and energy areas. The qualitative analysis is performed through the prism of investigating the general framework of innovation and its paradigms. Then, the present research intends to clarify the conceptual interface between innovation and sustainable energy identifying the main tangential aspects of relevance for the researched matter. Afterwards, it is proposed to be covered the most demanding challenges of the European Union energy sector which serve as significant push factors for investing in innovation and pay increased attention to sustainable economic development. Subsequently, it is possible to examine the main directions of the EU's innovation and sustainable energy initiatives marking their importance in the general framing.

Quantitative data refers to innovation inputs and indicators of sustainable energy development outputs. Thus, inputs are generally presented through R&D spending while outputs through selected energy sustainability indicators including the share of renewable energy in the gross final energy consumption; level of greenhouse gas emissions; energy efficiency; waste recycling capacities (Wilson, 2012). Quantitative analysis is performed by assessing the European Union's innovation performance in relation with the GDP expenditure on research and development. In such a way, it is possible to analyze the relation between innovation and the sustainability of the EU energy sector by considering two dimensions a) some isolate effects of R&D expenditures on crucial clean energy technologies and b) the general impact of R&D expenditures upon the economic competitiveness of European Union countries. The first dimension is evaluated through assessing the correlation between the EU countries' GDPs shares allocated towards R&D and the shares of renewable energy in the total consumption balance. Also, it is rated the correlation between GDPs shares allocated to R&D and the quantity of greenhouse gas emissions of the European Union countries. The second dimension is exemplified through establishing the correlation between GDPs shares allocated to R&D and the level of energy intensity of the EU economies (GDP per oil kg). Likewise, it is determined the correlation between, also, the EU countries' GDP shares allocated to R&D and the material recycling (kg per capita).

In this way, it is possible to clarify whether it is connection between R&D expenditure and innovation at the EU level, and if so how innovation shown through R&D affects specific sustainable energy directions and the general sustainability of the EU's economies.

4. Innovation and the main related paradigms

Innovation is an important part of human civilization due to which the humans came to dominate the world. The issue of innovation is one of the most debated among scientific, business and politic environments representing a determinant priority for the decision making factors. Researchers during the study of innovation have determined several paradigms. In the present paragraph it is shortly presented some of the main ones to have a fundamental background on which the further research is built. Mahdjoubi (2009) grouped the paradigms of innovation based on the principles of evolutionary economics starting from the primitive to advance. In the first stage the innovation was mostly determined and provoked by trial and error invention represented by individual characters and lack of systematization. The next stage is called systematic innovation which was in vogue during the second half of 19th and the beginning of 20th centuries. Yet, this is relative as different regions of the world industrialized unevenly. Systematic innovation is driven by system approaches to invention which is created and promoted mainly in universities and research centers. The R&D paradigm of innovation is closely linked to "cold war", when the two leading super-powers, the communist USSR and capitalist USA, got involved in so called "arms' race" (Plous, 1993). Despite the world was on the verge of extinction, the global society benefited from many inventions including the internet. A different paradigm of innovation is represented by technology and market development integration the main feature of which is represented by the invention on the base of which a whole new market is created, for example the market of modern cellphones. Last point is defined by the user created content innovation when the consumer directly participates in the creation of new products, the possibility widely exploited through modern IT technologies (Mahdjoubi, 2009).

Chesbrough (2003) propose two innovation paradigms and namely those of open and close innovation. Open innovation is a relatively new concept which describes the possibility of firms and individuals to market freely their inventions and ideas to others, while close innovation promotes inventing only for the own use of the entity or individual. The concept of open innovation is connected to user and cumulative innovation, know-how trading, mass, crowdsourced and distributed innovation.

The social driven innovation (Khan, 2017) includes the inventing processes conducted to solve certain societal needs, it does not necessarily presuppose profit. The scopes of innovation in this case are attained through group or individual activism, virtual volunteering, microcredit facilities, or distance learning possibilities. Another recent innovation paradigm relates to innovation network ecosystems. Its main feature is the presence of a centric ecosystem on the base of which it is performed the cross organizational innovation. The degree of openness in this case is much higher as compared to open innovation due to almost no influence of organizational structures upon trading innovation (Curley and Salmelin, 2013).

All the previous mentioned paradigms do not presuppose strict division in time and space and can overlap or co-exist. The distinction is made only with the purpose of making evident the features characteristic either for an epoch or company, or saying in other words the dominant tendencies and attitudes regarding innovation processes. By specifying the previous paradigms it is intended to underline the various aspects driving or stimulating innovation which should be taken into account in order to have efficient and effective approaches to developing respective policies.

5. Clarifying the conceptual interface between innovation and sustainable energy

The Brundtland Commission has defined sustainable development as the *"development that meets the needs of the present without compromising the ability of future generations to meet their own needs* (IISD, 2017). The key word from this citation is "needs". The greatest need of the human civilization in the 21st century is the need for energy. Namely, energy is the input powering every kind of economic activity people are involved in. Presently, energy is determined by fossil fuels which have multiple advantages including: relatively accessibility; safety; stability; abundancy and ease in exploiting.

Although many would argue regarding these benefits, the majority agrees that fossil fuels are not sustainable as the resources are limited, environmental impact highly negative and even hazardous and they are unevenly distributed across the globe. Indifferently of our attitude towards fossil fuels, it is a fact that modern civilization needs oil, gas and coal until there is no counterbalancing alternative. The situation is alarming, the problem of energy sustainability is worsening in the conditions of expanding world's population and, respectively, growing human hunger for energy supplies. Therefore, it is an imperative condition to underline that the sustainable energy is the solution, having low impact upon the environment and human health and being characterized by manageable collateral effects (Boie et al, 2014).

The modern energy challenge of human civilization could only be tackled through innovating and changing approaches to innovation to maximize the benefits offered by modern technologies. Sustainability of energy supplies could be assured either by identifying alternative sources or through developing technologies of capturing greenhouse gases. Moreover, rationalization of use and optimization of polluting processes should also be taken into account. Thus, it can be noticed that it is a direct link between innovation and energy sustainability (Nidumolu et al, 2009). By innovating, human civilization is able to identify new solutions to the current and future challenges including in the energy sector.

The paradigms which have been covered in the previous paragraph express the various methodologies people have developed in solving widely different issues. There is a wide range of factors which should be taken into account when developing innovation policies as to identify the most influential levers to be used. Furthermore, as innovation in the energy sector to be lucrative, it should have efficient paths of implementation on the markets as to replace the present technologies. Therefore, the markets are able to change the current economic system which puts enormous pressure upon the planet. The advanced markets of energy supplies will quickly replace the obsolete ones, thus stimulating the sustainable development of the human civilization.

6. Most demanding challenges of European Union's energy sector

Presently, politicians, experts and scientific researchers agree that the energy sector of the European Union and of the world as a whole should innovate to be capable of effectively riposting to the current energy challenge. Despite the multitude of energy threats, some of them are most dangerous menacing the EU and world's security and prosperity. The extent to which these threats menace the global security is

the most relevant indicator determining stakeholders to undertake right actions and search for best. The most debated and evident challenge of the European and world's energy sector regards the current economic dependency on the fossil fuels and especially oil-gas resources. The global oil-gas economic vulnerability is constantly rising. This problem not only includes the negative environmental effects but also the fluctuating price connected to foreign policy issues of most politically unstable regions of the world which are reach in these resources. Besides this threat, the dependency of some European Union states and EU neighboring countries on just one source perils the socio-politic and economic stability in the region. The next energy threat which needs innovation to be solved regards the huge investment costs in developing and maintaining the infrastructure functional to assure high quality services to consumers, constant generation power and not affected environment. Moreover, at the level of the European Union there are also problems referring to industrial discrepancies among the member states. Yet, the EU is succeeding to reduce them by its cohesion programmes (Crudu and Ignatov, 2016a).The last issue menacing the EU energy security has rather a global impact. The present scale greenhouse gas emissions, the rise in the energy demand of constantly growing global population and growing global temperature can cause irreversible processes which can inevitably bring the globe to an edge (Gallagher et al, 2006).

7. The European initiatives on innovation and sustainable energy development

The most important programme of the European Union establishing the priorities for sustainable development of its energy sector is the EU 2020 strategy. The main goal is to promote a more resource efficient, greener, and more energy competitive economy. It provides strategic guidelines to develop new efficient processes and technologies to reduce the fossil fuels dependency and increase the diversification of energy supplies for European consumers. A determinant point of the strategy is put on EU innovation networks and smart ICT grids which are invited to develop new energy sources taking into account the present issues of environmental degradation and bio-diversity loss (European Commission, 2010).

A special attention is offered towards keeping the present European leadership in green economic technologies, despite the fact that the global competition from China, USA and Japan is rising fast. European Union intends to maintain and improve the positions in the green economy through the use of high end technologies and re-adjusting its energy infrastructure to cover the present energy needs with minimum impact upon the climate and environment. The EU stakes on 60 billion EUR less imports of gas and oil by 2020 which besides additional savings provide higher energy security. It is necessary to remind that the quantitative goal of the EU regarding its sustainable energy development resumes to at least 20% of all energy consumption to be covered by renewable sources by the 2020. Furthermore, it supposes to reduce the greenhouse gas emissions by 20% as compared to 1990, or even 30% given the right conditions. Also, Europe 2020 intends to achieve a 20% increase in the energy efficiency in the same period (European Commission, 2011).

The Europe 2020 strategy aims to reach the goals of sustainable energy development by realising the following flagship initiatives in the area of energy including *Resource efficient Europe* and *An industrial policy for the globalisation era.* It is necessary to underline that the strategy was adopted in 2010 as an initiative of the

European Commission to boost economic development of the community. Besides the sustainable development, Europe 2020 emphasized the role of innovation in modern society and set as a target for the member countries to invest at least 3% of their GDP into R&D, stimulating especially the participation of private sector in this process (European Commission, 2010). The Europe 2020 strategy was preceded by Lisbon strategy (Lisbon Agenda) which determined the main European Union development objectives during the 2000-2010. According to this document, sustainable energy development was prioritized. Energy security was established as a directive of the community, special attention being given to the greenhouse gas emissions control and the development of renewable energy (Gajewski, 2017).

When speaking about EU initiatives on innovation it is a must mentioning the Horizon 2020 programme which was established in 2014 with the general purpose to foster innovation related activities in the member countries. Nearly 80 billion EUR funding has been allocated by the European Union till 2020 to reach the goals of this programme, not considering the money provided by the private sector. The Horizon 2020 is the financial instrument of implementing the flagship initiative of Europe 2020 strategy *Innovation Union*. The Horizon 2020 programme includes 10 sections covering a wide range of areas including innovation in ecologic related issues, industrial processes and SMEs (Crudu and Ignatov, 2016b). The overall benefits expected, as a result of implementation of the Horizon 2020 initiative, are the following: higher economic development; lower unemployment; more efficient scientific activities; higher competitiveness of the industrial sector; cleaner and more protected environment. The Horizon 2020 programme should assure the European Union a breakthrough in technology and innovation fields stimulating the consolidation of a unique EU market for knowledge and research (Crudu and Ignatov, 2016b).

Besides the above mentioned initiatives of the European Union on innovation and sustainable development of its energy sector, there are several other projects either undertaken at the EU institutional level or at the national one. For instance, the Energy 2020 strategy is established since y. 2010 and is intended to foster the consolidation of internal energy market, make more efficient energy management, and stimulate the infrastructure development (European Commission, 2011). Moreover, the Commission has consolidated efforts in assuring energy security for the member states by elaborating the European Energy Security Strategy (European Commission, 2015). The document includes major actions undertaken to consolidate energy solidarity among members, moderate energy demand, increase energy production, invest in further development of energy technologies and improve the national coordination. There are also other initiatives of the EU to assure either maximization of energy efficiency and minimisation of environmental impact or improve the energy technologies, including through the actions CEPHEUS (ultra-low energy housing), SAVE (energy saving), ALTENER (new and renewable energy sources), STEER (transport) (European Commission, 2017). The EU is also participating at various international clean energy initiatives. Thus, through the Fusion for Energy, the European Union participates at ITER (International Thermonuclear Experimental Reactor) programme (ITER, 2016). It is also necessary to underline that besides all R&D efforts, the European Union intends to create a unique energy market which will comprise all EU member states. This fact is going to provide additional economic opportunities because of lower prices for energy supplies, more stable provision and increased security and independence from external factors conditions which are imperative for sustainability.

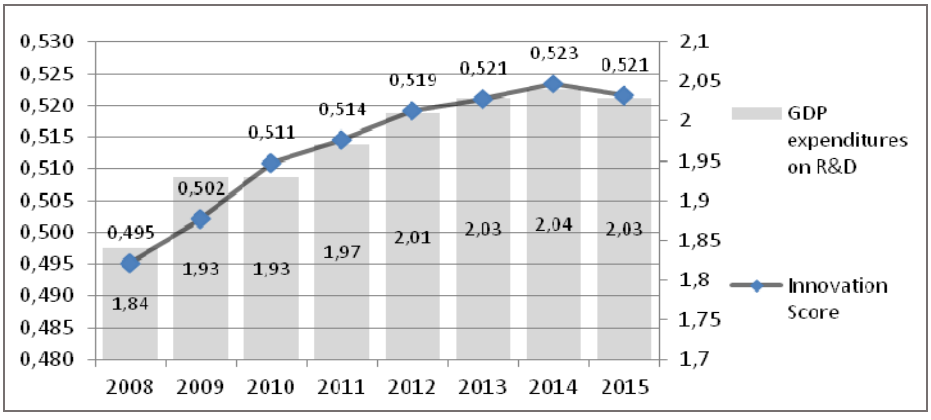
8. The European Union innovation performance and its relation with the GDP expenditure on research and development

Measuring innovation performance is a challenge intriguing many academics, business representatives, policy decision makers and investors. Fortunately, the European Commission developed the European Innovation Scoreboard intended to evaluate the innovation competitiveness of the EU member countries through analysing relevant areas. The indicator allows comparing the evolution of innovation across EU and some of neighbouring countries underlining both the weaknesses and strengths reported by the states. The index is complex comprising 8 base directions on which the overall performance is determined including: human resources; research systems; availability of financing; firms' investments; entrepreneurship networks; intellectual assets; main innovators and respectively the economic effects resulting from the innovation activity.

Based on the information provided in the figure 1, it can be observed that the innovation score reported by the European Union, on average, within the period of 2008 to 2015 has constantly increased except for the last year. At the same time it can be noticed that the value of GDP expenditures on R&D increased also in dynamics from 1.84% to 2.03%. It is important to underline that there is a strong correlation index of 0.97 between the innovation score reported by the European Union on average and the volume of GDP spent on R&D.

This fact allows inferring that the increase of the GDP expenditures on R&D will stimulate the progress in the innovation field with at least the same rate as there is almost perfect correlation between these two variables. Thus, the EU goal to reach at least 3% of GDP to be allocated towards research and development related processes and activities will certainly improve the innovation performance of the community. Therefore, if the European Union intends to keep up with the increasing global competition, it is a must to develop policies motivating both the private and public sector to allocate more financial resources to innovation to strengthen its economic potential.

Fig. 1: The Innovation Index of the European Union and EU share of GDP expenditure on R&D



Source: Drafted by the authors based on data provided by the European Commission (EUROSTAT) (2008-2015)

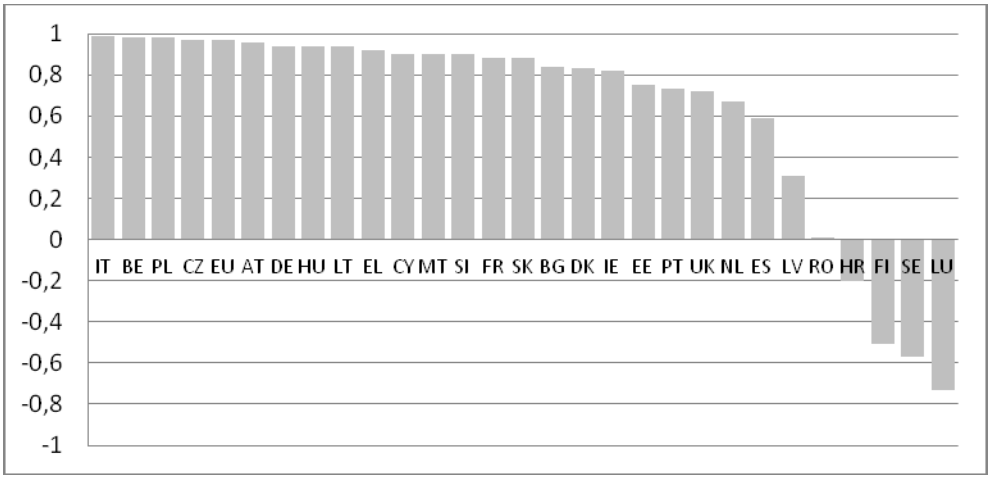
9. Analysing the relation between innovation and the sustainability of EU energy sector

Energy innovation is the totality of all processes which lead towards the improvement of relating technologies which enhance the resource efficiency, quality of services and assure sustainability by lowering economic, political and environmental risks in the energy sector. In this paragraph it will be analysed the interconnection between innovation and several indicators related to sustainable development. The relation is assessed by covering two most relevant dimensions such as: first, some isolate effects of R&D expenditures on crucial energy technologies; second, the general impact upon the economic competitiveness assessed through the general stability of the energy prices, energy connected infrastructure and future development prospective. In this way it is assured a comprehensive understating of the impact of innovation upon the economic sustainability of the European Union.

9.1 Some isolate effects of R&D expenditures on crucial clean energy technologies: A. renewable energy generation capacities; B. energy related green-house gases emissions

A. It has been performed the correlation analysis between the GDP share allocated towards R&D and the share of renewable energy in the total EU consumption balance (figure 2). Consequently, it has been received an almost perfect correlation of 0.97 at the level of the European Union. By far the vast majority of countries recorded strong positive correlation ranging between Italy, 0.99, and UK, 0.72. Only eight countries out of 28 registered lower correlations than 0.72 while just 4 of them reported negative correlation (figure 2). It is necessary to mention that the data-sets comprise the period of 2004-2015.

Fig. 2: Summary of the correlations between GDPs share allocated towards R&D and the share of renewable energy in the total consumption balance

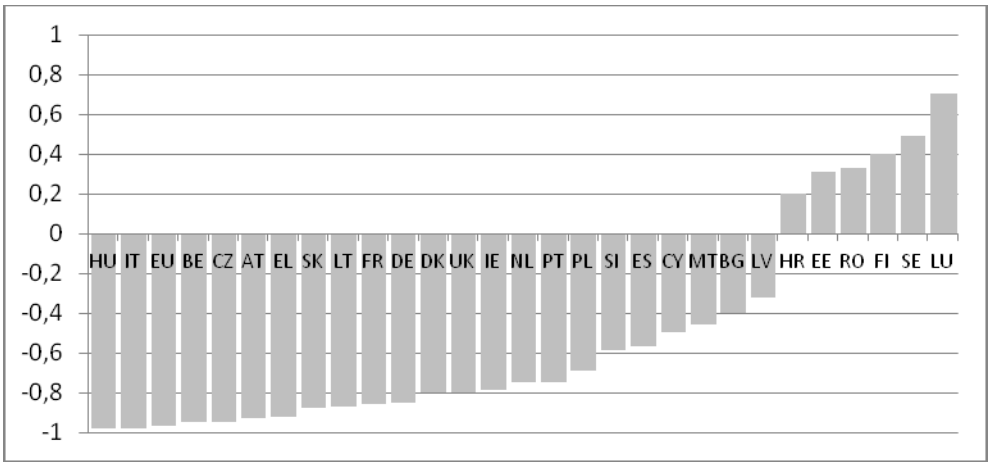


Source: Designed by the authors based on own calculations. Data sources: European Commission (EUROSTAT) (2004-2015)

B. An important indicator of sustainable energy is a lower quantity of greenhouse gases emissions poured into atmosphere as a result of at least the same level human activity. Therefore, it is an imperative task to analyse the relation between the R&D spending and the volume of pollutants released into the air, in this case the stronger the negative correlation the more favourable is effect of the R&D expenditure on lowering the level of greenhouse gases emissions.

The results summarising the correlations are provided in the figure 3. It could be underlined that the general correlation at the communitarian level is -0.97. This almost perfect negative correlation means that the higher the EU GDP spending on R&D activities the lower is the level of greenhouse gas emissions released by the EU into the atmosphere. In such a way, the European Union's intention to allocate at least 3% of GDP to R&D will have a positive impact upon the energy sustainability. As it can be also observed in the figure 3 the vast majority of European Union countries registered a strong negative correlation between R&D spending and the level of greenhouse gases emissions, starting with Hungary, -0.98, and finishing with Slovenia, -0.59. Only six countries out of 28 registered positive correlation, a discrepancy from the other countries which can be explained by the national policies' peculiarities and differing economic structures. On overall, it can be remarked the positive effects of European Union's energy and innovation policies on the reduction of greenhouse gases emissions.

Fig. 3: Correlation between GDPs share allocated to R&D and the quantity of greenhouse gas emissions of the European Union countries



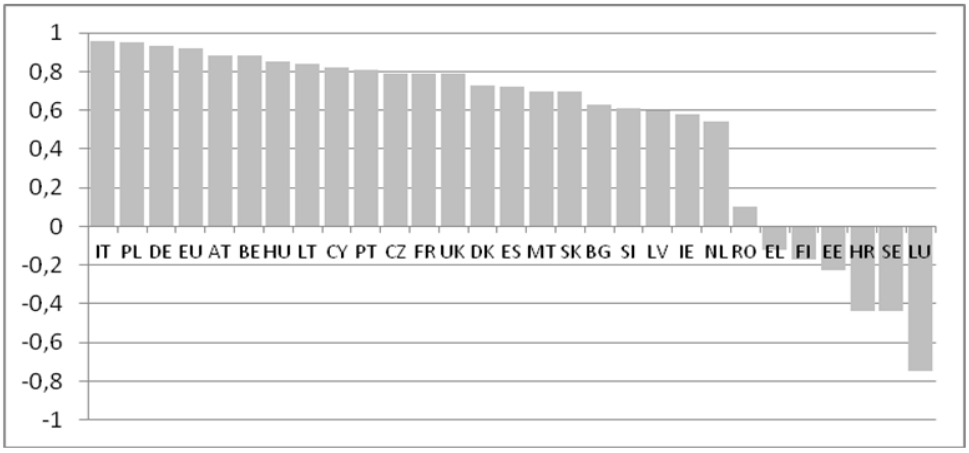
Source: Designed by the authors based on own calculations. Data sources: European Commission (EUROSTAT) (2004-2015)

9.2 The general impact of R&D expenditures upon the economic competitiveness of European Union countries: A. Energy intensity of economy (GDP per oil kg); B. Material recycling (kg per capita)

A. Energy intensity is one of the most relevant indicators of economic efficiency. It is also relevant when speaking about sustainable development as succeeding in producing more welfare from less or the same quantity of energy consumed means

progress, the pressure upon the environment being decreased. According to the figure 4, it can be underlined that there is strong correlation between R&D spending and the level of economic energy intensity. Thus, it can be remarked that the overall EU correlation index is 0.92 which proves the necessity to allocate more funding for innovation as to improve the energy intensity of the community. Moreover, at the national level the vast majority of countries register either strong or medium strong correlations starting with Italy, 0.96, and finishing with Netherlands, 0.54. Only seven countries out of 28 report either weak positive correlation or negative one.

Fig. 4: Correlation between GDPs share allocated to R&D and the level of energy intensity of EU economies (GDP per oil kg)

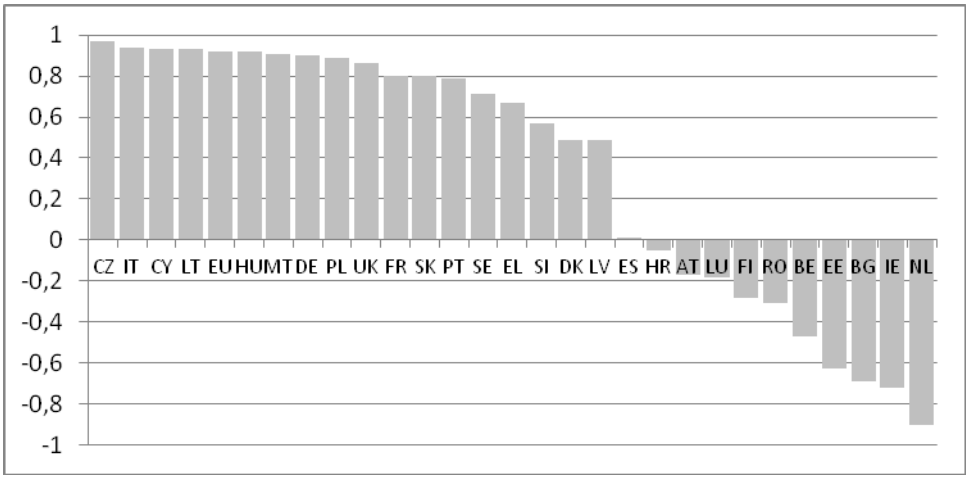


Source: Designed by the authors based on own calculations. Data sources: European Commission (EUROSTAT) (2004-2015)

In this way, it can be stated that the policies promoted at the level of the European Union as well as at the national one had favourable impact upon overall energy intensity of the community's member countries.

B. Material recycling is one of the most important indicators of sustainable economic development and has direct connection with the minimisation of energy waste. The idea is based on the fact that making a product from recycled materials always consumes much less energy as when making it from raw materials as many production stages are omitted. According to EIA (2017) it will require 95% less energy to make new aluminium cans from recycled ones than producing them from aluminium ores. Besides this, by recycling it is reduced the environmental pressure. For instance, by recycling a ton of used paper it can be saved 17 trees. Also, for making paper from recycled materials 50% less water is involved in the production process. Therefore, this indicator is fundamental and is must to be analysed to have a deeper comprehension of how efficient is the effect of EU innovation policies upon the sustainability of its energy sector.

Fig. 5: Correlation between GDPs share allocated to R&D and material recycling kg per capita



Source: Designed by the authors based on own calculations. Data sources: European Commission (EUROSTAT) (2004-2015)

By analysing the figure 5, it can be underlined that the allocation of additional R&D funding will have a positive effect upon the overall European Union performance in recycling materials. So, the general correlation at the European level between these indicators is 0.92 (strong). At the level of EU member countries the vast majority of states (17 out of 28) record strong or medium strong correlation between R&D expenditure and the material recycling per capita.

In such a way, the EU policies in the innovation area are beneficial for the enhancement of its economic potential taking into consideration the needs of sustainability. The European Union by innovating set up higher sustainability standards regarding the promotion of energy efficiency and economic competitiveness minimising the negative effects of socio-economic activity upon the environment and human health. Therefore, it is an imperative obligation to direct further efforts in maximising energy intensity and recycling capacities in order to reduce economic waste.

10. Conclusion

The investments the community has made into R&D during the researched period on overall stimulated innovation performance of the European Union. Thus, taking into consideration the results of the present research it can be concluded that innovation initiatives and policies promoted by the European Union in the period of 2004-2015 have shown a highly favourable impact upon the sustainable development of its energy sector. These initiatives made the EU the leading global power in terms of sustainable development and environmental protection setting high standards for the world as a whole.

The evolution of sustainability of European energy sector was assessed through correlating R&D investments with I) the share of renewable energy in gross final energy consumption; II) level of greenhouse gas emissions; III) energy efficiency;

IV) waste recycling capacities (Annex 1). As the summary of correlations shows (Annex 1), the enlargement of investments into research and development at the community level as well as at the level of EU countries stimulated the sustainability and development of European energy sector. In this regard, the intention of the European Union to reach at least 3% of GDP allocated towards R&D expenditure by 2020 (Europe 2020 strategy) is expected to stimulate even greater the energy sustainability of the EU.

The success of the European Union in assuring sustainable development of its energy sector is reached through comprehensive approach towards the energy issue. In this way, there have been developed initiatives to minimise material and energy waste, improve energy efficiency, and enhance renewable energy capacities. The EU progress in this matter is an indicator of improving socio-economic competitiveness neither damaging nor worsening the quality of the environment. The European Union is a pace ahead of all other global powers in developing a new generation of economy based on sustainability.

Finally, it is important to mention that a limiting factor of the present research was the difficulty in qualitatively assessing the heterogeneity of European Union member countries in terms of innovation and energy sustainability. It occurs as a result of countries' geographical position and the complexity of their economic structure. Thus, some of the EU countries are more dedicated towards developing sustainable energy technologies in the wind area (Netherlands or Denmark) while other could exploit the geo-thermic potential (Italy) or bio-energetic one (Romania). Also, it is necessary to point out that the correlation as a quantitative method of analysis could not be quite precise and relevant in individual cases, nevertheless, in most of time it shows the general trend and direction the fact which could be used in developing policies and strategies.

There are plenty of theoretical and practical applications for the results of this research such as designing future energy & innovation strategies and activity frameworks. Still, it is important to develop further studies taking into consideration the multitude of other aspects of this policy area and in more detail discuss particular features. Therefore, this paper encourages future research on the issues related to innovation and energy sector of the European Union as this fact will provide additional insight and provoke discussions leading to better understanding of the matter.

Generally, one fact is sure, in the future the attention the EU is paying to innovation related processes and sustainability of its energy sector will increase. This fact is fuelled both by the external factors including the global competition raise and internal ones such as the increase in the complexity of related market demand.

Annex 1: Summary of correlations*

Correlation	I	II	III	IV
Austria	0,96	-0,93	0,88	-0,17
Belgium	0,98	-0,95	0,88	-0,47
Bulgaria	0,84	-0,40	0,63	-0,69
Croatia	-0,20	0,20	-0,44	-0,05
Cyprus	0,90	-0,50	0,82	0,93
Czech Republic	0,97	-0,95	0,79	0,97
Denmark	0,83	-0,80	0,73	0,49
Estonia	0,75	0,31	-0,23	-0,63
EU	0,97	-0,97	0,92	0,92
Finland	-0,51	0,40	-0,17	-0,28
France	0,88	-0,86	0,79	0,80
Germany	0,94	-0,85	0,93	0,90
Greece	0,92	-0,92	-0,12	0,67
Hungary	0,94	-0,98	0,85	0,92
Ireland	0,82	-0,79	0,58	-0,72
Italy	0,99	-0,98	0,96	0,94
Latvia	0,31	-0,32	0,60	0,49
Lithuania	0,94	-0,87	0,84	0,93
Luxembourg	-0,73	0,70	-0,75	-0,18
Malta	0,90	-0,46	0,70	0,91
Netherlands	0,67	-0,75	0,54	-0,90
Poland	0,98	-0,69	0,95	0,89
Portugal	0,73	-0,75	0,81	0,79
Romania	0,01	0,33	0,10	-0,31
Slovakia	0,88	-0,88	0,70	0,80
Slovenia	0,90	-0,59	0,61	0,57
Spain	0,59	-0,57	0,72	0,01
Sweden	-0,57	0,49	-0,44	0,71
UK	0,72	-0,80	0,79	0,86

Source: Designed by the authors based on own calculations
*Grey colour indicates correlations which express a favourable impact of innovation related expenditures on energy sustainability indicators

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STUDIA UNIVERSITATIS BABEŞ-BOLYAI OECONOMICA
VOLUME 62, ISSUE 2, 2017, pp. 20-41
DOI: 10.1515/subboec-2017-0007

THE EFFECT OF EXCHANGE RATE MOVEMENTS AND ECONOMIC GROWTH ON JOB CREATION

Chama CHIPETA[*]
North-West University, South Africa

Daniel Francois MEYER
North-West University, South Africa

Paul-Francois MUZINDUTSI
University of KwaZulu Natal, South Africa

Abstract: Job creation is at the centre of economic development and remains a source of sustenance for social and human relations. The creation of a job-enabling economic environment is imperative in promoting social and economic cohesiveness in the macro and microeconomic environment. Any shocks to the economy, particularly those of exchange rate shocks and changes in economic growth, may negatively affect the labour market and job creation. This study made use of quarterly observations, from the first quarter of 1995 to the fourth quarter of 2015, to investigate the effect of the real exchange rate and economic growth on South Africa's employment status. South Africa, a developing country, was selected as a case study due to its high unemployment rate that is still increasing. The Vector Autoregressive (VAR) model and multivariate co-integration techniques were used in assessing the impact and responsiveness of employment to the real exchange rate and real economic growth in South Africa. Findings of this study revealed that employment responds positively to economic growth and negatively to the real exchange rate in the long-run. The short-run displays a positive relationship between real economic growth and employment, while the relationship between employment and the real exchange rate is also negative. However, the effect of economic growth in creating jobs is not significant enough in stimulating job creation in South Africa, as indicated by results in variance decomposition. Movements in the exchange rate exerted a significant short and long-run negative effect on employment dynamics; implying that a depreciation of the rand against the U.S. dollar is associated with decrease in overall employment. Exchange rate stability is thus important for economic growth and job creation in South Africa. The study provided further recommendations on promoting job creation in South Africa and other developing countries.

JEL classification: E65, O11, O55

Keywords: Economic Growth (GDP), Employment, Exchange Rate, Job Creation, South Africa.

[*] Corresponding author. Address: Vaal Campus, North-West University, South Africa, E-mail: daniel.meyer@nwu.ac.za

1. Introduction

Globally, unemployment has caused negative long-run social and economic impacts affecting most developing and emerging nations (ILO, 2016). The effect of unemployment on the society and the corporate environment is such that the premise of the functioning of firms is dependent on aggregate demand assumed by the labour market and consumer demand for goods and services (Michaillat & Saez, 2015). Thus, the displacement of workers or shocks to the labour market, particularly by price or exchange rate shocks, and any hostile changes in economic growth, may restrict consumption and cause business failures due to consumption being positively related to disposable income (Liu *et al.*, 2015).

An economy's ability to create jobs is imperative in terms of the measurement of its macro-economic performance (Abdel-Moneim, 2015). As such, job creation remains crucial and integral to economic development and welfare (Hull, 2009). In the midst of an appropriate mobilisation of the labour market and human resources, job creation remains a key concept within spheres of corporate advancement and human development (Keller, 2015). The creation of jobs is essential for the improvement of the lives of people and the eradication of poverty (Bergh & Zanker, 2013). Employment forms the basis on which the underpinnings of human development are shaped (UNDP, 2015). Improvements in the standards of living and quality of life thus serve as the primary objective of economic development policy (Loots, 1998). Attesting to the country's social and economic imbalances, South Africa has encountered its share of high unemployment rates (World Bank, 2016). This includes low levels of job creation and growth in the current decade, despite the inception of the 1994 social and economic transformations (Mahadea & Simson, 2010). Disparities in the country's growth, including a depreciating and highly volatile exchange rate, have similarly proved deleterious for economic growth and employment (Rusike, 2016).

A quarterly trend analysis of the growth movements of South Africa's employment, exchange rate and gross domestic product (GDP) shows highly fluctuating trends in the country's exchange rate. Recent performance of the currency (Rand – ZAR) indicates an ongoing depreciation against the United States Dollar (USD) particularly during the 2015 to 2016 period, where the local currency depreciated to R15.98 per USD dollar in February 2016 (Deloitte, 2016). This poor performance of the local currency was associated by sluggish economic growth where real GDP slowed to 1.3 percent in 2015 compared to 2014's growth of 1.5 percent (IDC, 2016). The first quarter of 2016 reported South Africa's heightened unemployment rate of 26.7 percent (StatsSA, 2016). This instability and highly fluctuating trend resulted in low levels of job creation or employment growth.

Amongst other factors, this study focuses on GDP and the exchange rate movements affecting South Africa's level of job creation. In light of the impact of the macroeconomic setting on job creation (Gill, 2013), stability in economic variables tends to promote a job-enabling environment with optimal traits of human and social relations (Mpofu, 2015). Further debate on the causality between South Africa's economic growth and employment has stirred much concern across the academic environment (Biyase & Bonga-Bonga, 2015).

In assessing the impact of movements in the exchange rate, there is limited empirical analysis of this factor conducted in South Africa, while the existing evidence provides conflicting results as to the exact interactions between the appreciation and

depreciation of the currency and the country's employment or job creation. Ngandu (2008) asserts that an appreciation of the exchange rate promotes employment growth, while results by Bhorat *et al.* (2014) dispute this notion as their results found a depreciation to be in favour of employment creation. The conflicting results from empirical studies among different developing countries calls further research on this topic.

Despite low levels of economic growth experienced during the period 2008-2016 (Lipton, 2013), South Africa has enjoyed relatively high employment rates, particularly from the years 1994 to pre-financial crises, if compared to other sub-Saharan countries (Laubscher, 2013). However, the country's attempts to create jobs have not resulted in a significant decrease in unemployment (Hendriks, 2016). Furthermore, the currency is consistently under pressure and has been depreciating during the years, resulting in increased labour costs and production costs. It remains unclear as to whether the aforementioned factors significantly promote a social and economic platform suitable for the establishment of a job-enabling environment within South Africa. It is evidently important to analyse how South Africa's employment rate responds to changes in these factors. This study therefore examines short- and long-run interactions between the mentioned economic variables namely, exchange rate, economic growth, and job creation in South Africa.

2. Literature Review

Klein *et al.*, (2002) and Fujita & Nakajima, (2016) encapsulate the trends and movements in the labour market using the flow approach to the labour market. This approach classifies the labour market's net employment within two main categories, consisting of *worker flows* and *job flows*. Worker flows suggest that workers are either employed or unemployed, or moving between jobs under conditions of supply-side events in the labour market's labour-force entry (Burgess *et al.*, 2000); whereas the movement or mobility of workers in switching or searching for jobs is driven by incentives of better wages or working conditions, or changes in any attributes pertaining to career development (Davis *et al.*, 2005). Developments in job creation or job losses, however, are captured under job flows, reflecting firms' demand for labour in the labour market based on demand-side events (Klein *et al.*, 2002). For the purpose of this study, the focus is placed on establishments of job flows in assessing trends and movements within job creation. Bonner *et al.* (2011) and Fujita and Nakajima (2016) define job creation as the aggregate increase in employment across all establishments following their start-up period to the point of expansion. Similarly, Klette and Mathiassen (1996) assert that job creation is the change in the level of employment of all establishments that intensifies employment.

While employment-related indicators play a prominent role in understanding the overall macro-economic performance (Kapsos, 2006), they also indicate the dimension of challenges faced by job flows (Martins & Takeuchi, 2013). Consequently, uncertainties or unforeseen shocks to job flows may affect job creation dynamics (Riegler, 2014). As a result, labour markets in global economies, particularly developing countries, are faced with perpetual challenges in making provision for sustainable and decent jobs (Meyer, 2014). Davis *et al.* (2006) emphasises the use of high-quality job-related indicators in obtaining precise flows in the labour market to avoid "spurious

entry and exit" results: implying that broken links may over-exaggerate movements in job creation. Growth is a crucial determinant of job flows and employment (Tattara & Valentini, 2004), as it promotes labour productivity resulting in gains in employment growth (Kapsos, 2005).

Economic theory asserts that fluctuations in the exchange rate, resulting in foreign goods and domestic price changes, may affect the reallocation of resources within economic sectors (Alexandre *et al.,* 2011). Thus job flows tend to be highly sensitive to changes in relative prices and exchange rate fluctuations, as trade liberalisation (openness) is accompanied by extreme demand volatility and shocks to firms (Haltiwanger *et al.*, 2004). A depreciation in the exchange rate increases or promotes the growth of local jobs in the manufacturing and non-manufacturing sectors (tradable sectors) (Yokoyama *et al.*, 2015). Therefore, maintaining exchange rate stability implies controlling a country's level of unemployment (Chimnani *et al.*, 2012). Literature (Bhorat *et al.*, 2014; Huang & Tang, 2015) suggests that it is plausible for an appreciation in the exchange rate to be detrimental to employment growth in tradable sectors such as the manufacturing sector. Domestic exports become more expensive relative to foreign exports in the face of an appreciation of the domestic currency. As such, demand for tradable sectors' exports decreases, whereas this effect is stronger for export reliant industries. Inversely, currency appreciation is beneficial to non-tradable sectors as it are expected to increase output and employment for net importers of inputs. In essence, a depreciation is beneficial to tradable sectors, whist an appreciation proves detrimental. Impacts of an appreciation of the domestic currency result in a positive employment effect for non-tradable sectors, whist a depreciation negatively affects non-tradable sectors. This study consequently compares the changes in aggregate employment growth to changes in the real exchange rate and GDP growth.

2.1 Job creation and economic growth

Callen (2008) and Tjukanov (2011) define gross domestic product (GDP) as a monetary measurement of a country's value of all final goods and services produced within a specific period. Okun's Law points out that increased output corresponds with higher employment, exhibiting a positive correlation between GDP and employment (Guisinger *et al.,* 2015). Increased GDP inhibits the growth of the unemployment rate (Okun, 1962). The broad consensus on economic growth is that it remains a job driver and an essential macro-economic facet for promoting a job-enabling environment (Altman, 2003; Chili, 2000). It thus serves as a general prerequisite in securing a job-enabling social and economic platform. Nevertheless, Schmid (2008) maintains that the measure of job creation depends on the direction of economic growth resulting from either extensive or intensive growth. Under the extensive growth strategy, increased growth is accompanied by an expansion of inputs, encompassing an increase in the labour force and capital accumulation. However, extensive growth is liable to diminishing marginal returns in the long-run (Allen, 1986). Intensive growth is thereby accompanied by increased growth in aggregate output per increase in each input (Irmen, 2005).

Despite South Africa's periods of increased economic growth since the year 1994, the country's high unemployment rate serves as an indication of the "jobless growth" dilemma (Leshoro, 2013). Amidst increased international economic integration

and globalisation, Altman (2003) responds to disparities in the conventional "job-enabling growth" dynamics by highlighting that South Africa's employment and investment multiplier effects are limited by the country's supply constraints within its production structure, as it is mainly capital-intensive. For this reason, the country's growth is not labour absorbing as it relies on intensive rather than extensive growth within the mentioned production structure (Altman, 2003). Countries with highly protective labour markets display a low responsiveness of employment to changes in economic growth. As such, these countries often exhibit higher levels of unemployment rates as a result of strict labour laws (Sögner & Stiassny, 2000). Therefore, it follows that the reaction of employment to GDP in these countries is weak. The question remains as to whether South Africa experiences job-enabling growth or growth accompanied by joblessness. Keynes (1937) emphasises that equilibrium is present where full-employment exists, particularly, where changes in investment and savings translate into changes in aggregate demand, thereby affecting the level of GDP. Hence, alterations in GDP due to fluctuations in aggregate demand regulate employment levels (Leshoro, 2013). Such an impact is also dependent on each country's prevalent type of economic growth, whether extensive or intensive, as it differs accordingly in each country (Herman, 2011).

Studies conducted by Funlayo (2013), and Sodipe and Ogunrinola (2011), assessing the relationship between employment and economic growth in Nigeria by means of the Johansen vector-error correction model, found a positive relationship between employment and economic growth. Further findings by Herman (2011) on the assessment of employment effects of economic growth on countries in the European Union (EU) suggest a significant, but yet low responsiveness of employment towards economic growth dynamics in each of the EU countries. The author further highlights that the low employment responsiveness resonates from the different employment intensity of an "economic growth process" at the EU level, particularly those in Central and Eastern EU. The type of economic growth, either extensive or intensive growth, may explain the rhythm of employment intensity. Employment effects on economic growth may additionally be determined labour market characteristics and labour flexibility in the EU.

Furthermore, based on the Toda-Yamamoto technique of causality during the periods 2000 to 2012, Leshoro (2013) established that economic growth Granger causes employment in South Africa, while causality from employment to economic growth was non-existent. Further studies by Biyase and Bonga-Bonga (2015) using a structural vector autoregressive model during the years 1970 to 2008, assessing the responsiveness of South Africa's employment rate to economic growth, suggested a weak or non-responsive reaction of employment to GDP growth, justifying the existence of jobless growth in the country. On the other hand, co-integration results by Vermeulen (2015) revealed a long-run co-integrating relationship between the variables whilst Granger causality test results suggested that employment is driven by economic growth. Similarly, Habanabakize and Muzindutsi (2015) found that the economic growth, measured by aggregate expenditure, has significant positive long-run effect on the job creation in South Africa.

2.2 Job creation and exchange rate movements

The exchange rate serves as an important price factor in the economy (Klein & Shambaugh, 2012). Gourinchas (1999) defines this as a measurement of the price of a country's domestic currency relative to a foreign basket of goods or prices. While

developing countries are mostly subjected to exchange rate volatility, Ozturk (2006) defines such volatility as the risk resulting from unanticipated shocks in the exchange rate. Van der Merwe and Mollentze (2010) categorise measurements of exchange rate under nominal and real exchange rates. Fluctuations in a nation's currency or exchange rate exert changes in domestic production costs (Ngandu, 2008). Nucci and Pozzolo (2010) state that the exchange rate affects the labour market based on channels of appreciation and depreciation of currencies. Estimates by Ribeiro *et al.* (2004) suggest that the effect of exchange rate on gross job flows is uneven; as such, an appreciation of the currency exchange rate will lead to a decrease in total job growth.

Employment or job flows are influenced by exchange rate movements based on three possible channels (Campa & Goldberg, 2001). These firstly include increased import penetration via demand shocks caused by increased competitiveness of local output markets. Secondly, export orientation, via increased sectoral focused export, resulting in competitiveness shocks. Lastly, the use of imported inputs also does, where changes in input costs result in variations in costs and prices (depreciation in the domestic currency raises the costs of factors of production). The extent of openness of a country's industry is another determining factor in terms of which any changes in the real exchange rate affect an industry's level of employment or job creation (Klein *et al*, 2003). In addition, the magnitude of the response of the labour market to exchange rate movements relies on market and regulatory forces (Burgess & Knetter, 1998). Belke and Kaas (2004) argue that extreme volatility in a country's exchange rate is likely to discourage firms from employing more workers. As employment and investment decisions are characterised by high levels of irreversibility in the face of rigid corporate structures, the cost of reversing the decision to hire a worker is high (Erdal, 2001). Literature also suggests that changes in the real exchange rate and trade liberalisation/international openness (tariffs and non-tariff obstacles) have a direct effect on the flow or rate of job creation, including the pace at which jobs are destroyed (Klein *et al.,* 2002).

Further analysis by Kim (2005) of Korea's industries in terms of the exchange rate and its effect on employment revealed a positive response of employment to exchange rate shocks, while industries with low or moderate exposure to foreign trade maintained a negative correlation. Subsequently, a study by Alexandre *et al.* (2010) suggested that sectors with low levels of technological development are more open to foreign trade and thus more sensitive to exchange rate movements; as a result, such sectors experience a sizable amount of job destruction in the face of changes in the exchange rate. Studies by Chen and Dao (2011) showed a contraction of China's tradable and non-tradable sectors as a result of an appreciation of the country's exchange rate. Similarly, a significant effect of the exchange rate and employment levels were observed in Ghana's manufacturing sector, such that a depreciation in Ghana's currency inhibited the level of job creation (Mensah *et al.*, 2013). Moreover, Alexandre *et al.* (2011) noted that employment in technology driven sectors is relatively resistant to movements in the real exchange rates.

Ngandu (2009) analysed the effect of movements in the exchange rate on employment in South Africa using the computable general equilibrium model (an economy-wide approach). The study revealed that an appreciation in the ZAR tends to shift employment from tradable sectors such as manufacturing to non-tradable sectors. Where an appreciation in the exchange rate increased demand and spending in non-

tradable sectors, it however decreased foreign demand in tradable sectors resulting from increased export prices. Nonetheless, the study asserts that the country still experiences increased aggregate employment as non-tradable sectors absorb lost jobs in tradable sectors. Mpofu (2013) assessed the impact of real exchange rate movements on South Africa's manufacturing sector using Autoregressive Distributed Lag (ARDL) during the period 1995 to 2010. The results revealed that a depreciation in the exchange rate results in employment growth in the manufacturing sector. Whereas results by Bhorat *et al.* (2014) based on the years from 1975 to 2009 revealed a strong negative impact where an appreciation of the local currency (ZAR) resulted in decreased employment in the tradable sector, while having no effect on non-tradable sectors.

3. Methodology

3.1 Data description

The study follows a quantitative approach based on a dataset of 80 quarterly observations of total non-agricultural employment, GDP in ZAR value at constant prices and the real exchange rate movements of the ZAR versus the US dollar (USD). Adjustments for inflation of both GDP and the exchange rate were made to obtain real values. The data was derived from the South African Reserve Bank (SARB) starting from the first quarter of 1995 to the fourth quarter of 2015. The starting sample period is affected by the change in South Africa's economic and political system and the exclusion of the effects of the apartheid regime's economic embargo.

3.2 Model specification

In determining the interactions of the selected variables with employment, the general function of the study is expressed as follows:

$$LEMP = f\,(LREXCH,\ LGDP) \tag{1}$$

Where: LEMP is the natural logarithm of the level of employment, LREXCH is the natural logarithm of the real exchange rate and LGDP is the natural logarithm of the real gross domestic product. All variables were converted to their natural logarithms for the adjustment of any likelihood of scale effect and to estimate growth or elasticities. In the function of employment, Equation (1), there is a likelihood of the dependent variable being affected by endogenous and exogenous lags resulting from its past associations and those of independent variables. The Vector Autoregressive model (VAR) is thus used in regressing the multivariate relationships into a finite-order structure as suggested by Sims (1980). The VAR model forms a starting point for further analysis such as co-integration, impulse response and variance decomposition analyses and causality tests (Muzindutsi & Maepa, 2014; Niyimbanira, 2015). The VAR model from the aforementioned function in Equation (1) is expressed as follows:

$$LEMP_t = \alpha_1 + \Sigma_{j=1}^{k}\beta_{1j}LEMP_{t-\mathrm{j}} + \Sigma_{\mathrm{j}=1}^{\mathrm{k}}\lambda_1 LREXCH_{\mathrm{t-j}} + \Sigma_{\mathrm{j}=1}^{\mathrm{k}}\gamma_{1j}LGDP_{t-\mathrm{j}} + u_{1t} \tag{2}$$

$$LREXCH_t = \alpha_2 + \Sigma_{j=1}^{k}\beta_{2j}LEMP_{t-\mathrm{j}} + \Sigma_{j=1}^{k}\lambda_2 LREXCH_{t-\mathrm{j}} + \Sigma_{j=1}^{k}\gamma_{2j}LGDP_{t-\mathrm{j}} + u_{2t} \tag{3}$$

$$LGDP_t = \alpha_3 + \Sigma_{j=1}^{k}\beta_{3j}LEMP_{t-\mathrm{j}} + \Sigma_{j=1}^{k}\lambda_3 LREXCH_{t-\mathrm{j}} + \Sigma_{j=1}^{k}\gamma_{3j}LGDP_{t-\mathrm{j}} + u_{3t} \tag{4}$$

Where: α_n denotes the constant, β_n, λ_n and γ_n denotes the coefficients; k is the proxy for the number of lags while the stochastic error or shocks in the VAR model are denoted by $u_{1t}, u_{2t}\ and\ u_{3t}$. Prior to conducting the analysis, the Augmented Dickey-Fuller (ADF) test was used to test the variables for stationarity or unit root. The use of non-stationary data may result in "spurious" results implying that results may be misleading (Mushtaq, 2011). If the observed variables are found to be stationary, then the VAR model in Equations 2 to 4 is estimated. However, if all variables are found to be non-stationary then a co-integration test is estimated to determine whether a linear combination of such non-stationary variables is stationary. This is known as the co-integration test for a long-run relationship (Nielsen, 2005).

Johansen's multivariate co-integration method was used in testing the long-run relationship amongst the variables. The existence of co-integrating relationships between the variables further implies undertaking the Vector Error Correction Model (VECM) (Kakes, 2000). Alternatively, the study may proceed with the VAR model of the first differenced variables in case there are no co-integrating relationships. The VECM equations based on our VAR model are as follows:

$$\Delta LEMP_t = \alpha_1 + \Sigma_{j=1}^{k}\beta_{1j}\Delta LEMP_{t-j} + \Sigma_{j=1}^{k}\lambda_1\Delta LREXCH_{t-\mathrm{j}} + \Sigma_{j=1}^{k}\gamma_{1j}\Delta LGDP_{t-j} + \varphi_1 u_{1t-1} + e_1 \quad (5)$$

$$\Delta LREXCH_t = \alpha_2 + \Sigma_{j=1}^{k}\beta_{2j}\Delta LEMP_{t-j} + \Sigma_{j=1}^{k}\lambda_{2j}\Delta LREXCH_{t-\mathrm{j}} + \Sigma_{j=1}^{k}\gamma_2\Delta LGDP_{t-j} + \varphi_2 u_{2t-1} + e_2 \quad (6)$$

$$\Delta LGDP_t = \alpha_3 + \Sigma_{j=1}^{k}\beta_{3j}\Delta LEMP_{t-j} + \Sigma_{j=1}^{k}\lambda_{3j}\Delta LREXCH_{t-\mathrm{j}} + \Sigma_{j=1}^{k}\gamma_3\Delta LGDP_{t-j} + \varphi_3 u_{3t-1} + e_3 \quad (7)$$

Where: Δ denotes the first difference operator. Error correction terms are further denoted by $u_{1t-1}\ldots. u_{3t-1}$. Adjustments for short-run dynamics towards the long-run equilibrium are captured by error correction coefficients denoted by $\varphi_1 \ldots \varphi_3$; while short-run variations of the model are captured by the coefficients β_n, λ_n and γ_n. Preceding the interpretation of the VCM output, diagnostic tests are conducted to ensure that the model meets stochastic properties. Further analysis including variance decomposition and impulse response was conducted to assess the proportion of movements in the dependent variable caused by endogenous and exogenous shocks and to assess the responsiveness of the dependent variable to shocks in the error term, respectively (Brooks, 2014).

4. Empirical Results

4.1 Correlation analysis and unit root tests

Table 1 indicates the relationship between the variables in the correlation analysis. The analysis suggests a strong positive relationship between the log of employment and the log of the real exchange rate, significant at the 0.01 significance level. Log of employment and log of GDP suggest a positive moderate relationship between the series, which is significant at 0.01 significance level.

Table 1: Pairwise Correlations

	LEMP	LEXCH	LGDP
LEMP	1.000000	0.540372	0.943460
	-----	[0.0000]	[0.0000]

Note: *P-values in [ ].*

Table 2 reports unit root test results of the Augmented Dicky-Fuller test. At level, all variables are non-stationary as the p-values are greater than 0.05, implying that the null hypothesis is rejected at 0.05 significance level. This means that the series exhibits a unit root, with and without trend. At first differences, all variables are stationary as the p-values are less than 0.01. The null hypothesis is therefore rejected at 0.01 significance level. Therefore, all variables reached the same order of integration at I(1) or first difference. The proceeding step is a test for co-integrating vectors or long run relationship using the Johansen co-integration approach.

Table 2: Augmented Dickey-Fuller Unity Root Test

Variables	Level I(0)		First Difference I(1)		Result
	t-stat	P-value	t-stat	P-value	
LEMP	-2.208194	0.4786	-9.014124	0.0000**	I(1)
LEXCH	-1.719281	0.7340	-7.935363	0.0000**	I(1)
LGDP	-1.179592	0.9078	-4.526323	0.0004**	I(1)

Note: *** denotes stationary series with unit root at 1% level of significance*

4.2 Lag-length selection criteria

Prior to conducting the Johansen co-integration test, a lag order selection process was used to select and determine the number of lags to be used in this test, including the vector error correction model (VECM). The optimal lag selection was based on five selection criteria, namely; LR, FPE, AIC, SC and HQ, where all criteria reached the same conclusion of 2 lags. Therefore, 2 lags were used with intercept and no trend in the Johansen co-integration test and VECM.

4.3 Co-integration test results

Table 3 reports results for the Trace test and Max-Eigenvalue statistics in the Johansen co-integration test with intercept and no trend. The trace statistic shows one co-integrating equation ($r \leq 1$) at 0.05 level of significance. However, the null hypothesis of no co-integrating equation ($r=0$) is accepted for the Max-Eigenvalue as it failed to support Trace test results. The results obtained in the Max-Eigenvalue, of no co-integration compared to the Trace statistic, remain in favour of the study. The Trace test statistic has proven to be superior and outperforms the Max-Eigenvalue when working with large data samples (Saikkonen & Luetkepohl, 2000). Thus, the null hypothesis of no co-integrating equation is therefore rejected. This suggests that variables are co-integrated or that a long-run relationship exists within the series.

Table 3: Johansen co-integration test results

H0: No. of CE(s)	Trace Test			Maximum Eigenvalue		
	Trace Statistic	T-critical value	P-values*	Max-Eigen Statistic	T-critical value	P-values*
None*	37.17346	35.19275	0.0302*	18.87637	22.29962	0.1406
At most 1	18.29708	20.26184	0.0911	13.05709	15.89210	0.1326
At most 2	5.239993	9.164546	0.2581	5.239993	9.164546	0.2581

** denotes rejection of H_0 at 0.5 significance level*

4.4 Long-run relationship

The existence of a co-integrating relationship between LEMP, LREXCH and LGDP suggests that the selected variables explain the long-run equilibrium in LEMP. The long-run relationship is expressed in Equation (8) as follows:

$$LEMP = -18.0107 - 0.5059(LREXCH) + 0.8710\ (LGDP) \quad (8)$$

In the long-run (Equation 8), there is a negative relationship between the real exchange rate and employment: meaning that a depreciation in the ZAR leads to a decrease in employment. As such, a one percent depreciation in the ZAR against the USD dollar induces a 0.51 percent decrease in employment. Nevertheless, Equation 8 indicates a positive relationship between GDP and employment, suggesting that an increase in GDP induces an increase in employment. Therefore, a one percent increase in GDP induces an increase in employment by 0.87 percent.

4.5 Short-run relationships

All variables being co-integrated, VECM can be estimated to explain short-run adjustments towards the long-run equilibrium (Magee, 2013; Noumbissie & Mongale, 2014). Therefore, it follows that a negative adjustment coefficient (error correction term) and a significant t-value are conditions in explaining short-run adjustments towards the long-run equilibrium (Mukhtar & Rasheed, 2010). The VECM output (Table 4) indicates that CointEq1 constitutes two significant equations which explain the existence of short-run adjustment towards the long-run equilibrium in LREXCH and LGDP. These results provide a robust set of items of evidence of error correction in the first co-integrating equation. LREXCH and LGDP have negative coefficients; -0.207265 and -0.016806 and t-values of -2.58155 and -3.08642, respectively. Both variables are significant at 0.05 significance level. The log of the real exchange rate and the log of GDP exhibit evidence of error correction in the first co-integrating equation. This suggests that equilibrium is restored in the real exchange rate and GDP equations. Therefore, about 20.7 percent of the disequilibrium in LREXCH is corrected/ adjusted in each quarter and it takes approximately 5 quarters to reach full equilibrium; whilst 1.6 percent of the disequilibrium in LGDP is corrected in each quarter and takes approximately 60 quarters to reach full equilibrium.

Table 4: Vector Error Correction Model results

Error Correction:	D(LEMP)	D(LREXCH)	D(LGDP)
CointEq1	0.039189	-0.207265	-0.016806
	[0.87868]	[-2.58155] **	[-3.08642]
D(LEMP(-1))	-0.084972	-0.296781	0.014020
	[-0.67049]	[-1.30090]	[0.90611]
D(LEMP(-2))	-0.109822	-0.078032	0.026680
	[-0.91360]	[-0.36061]	[1.81787] *
D(LREXCH(-1))	-0.109134	0.120523	-0.006007
	[-1.79560] *	[1.10156]	[-0.80956]
D(LREXCH(-2))	-0.001360	-0.148519	-0.002857
	[-0.02214]	[-1.34266]	[-0.38084]
D(LGDP(-1))	1.349974	-1.916694	0.523291
	[1.40329]	[-1.10679]	[4.45530] **
D(LGDP(-2))	0.860603	0.840217	0.051673
	[0.87495]	[0.47453]	[0.43028]

** denotes significance at 10%. ** denotes significance at 5%*

Results of the employment equation (Table 5) indicate that the t-value of LREXCH(-1) is above 1.645 critical t-value, which is statistically significant at the 10 percent level of significance. This implies that there is a significant negative short-run relationship between the log of employment and the real exchange rate; meaning that past changes in the real exchange rate have a significant negative effect on the current change in employment. A depreciation of the ZAR in the previous quarter induces a decrease in current employment growth. Moreover, the second lag of the log of employment and the first lag of the log of GDP in the GDP equation are positive and statistically significant at the 0.05 significance level. This implies that past changes in employment affect current changes in GDP, while previous shocks in GDP result in its current changes. To confirm these results, Granger causality, variance decomposition and impulse response tests were conducted.

4.6 Granger-causality test

Similar to ECT results, further analysis, recorded in Table 5, indicates a one-way causal relationship from LGDP to LEMP and LEXCH to LEMP, meaning that short-run changes in economic growth and the real exchange rate cause changes in employment levels: exhibiting a one-way causality from GDP to employment and real exchange rate to employment. These results are reinforced by the variance decomposition results in Table 6.

Table 5: Pairwise Granger Causality results

Null Hypothesis	F-statistic	P-value
LEXCH does not Granger Cause LEMP	3.93172	**0.0237 ***
LEMP does not Granger Cause LEXCH	1.81362	0.1700
LGDP does not Granger Cause LEMP	5.69116	**0.0050 ***
LEMP does not Granger Cause LGDP	0.16239	0.8504
LGDP does not Granger Cause LEXCH	0.85738	0.4283
LEXCH does not Granger Cause LGDP	1.23503	0.2965

** reject null hypothesis of no Granger causality at 0.05 significant level*

4.7 Variance Decomposition

Results of Granger causality are supported by results in the variance decomposition (Table 6). Employment is affected by its own shocks, and employment shocks are also caused by shocks in economic growth and the real exchange rate. The effect of these shocks increases successively from the 2nd to the 10th quarter or period. In the second quarter, 97.1 percent of shocks in employment rate is due to its own shocks, while the remaining 2.9 percent is caused by shocks in the real exchange rate and real GDP. A point to note is that exchange contributes more (1.64%) to these shocks than the GDP (1.26%). Confirming the short-run effect of real exchange rate on employment rate, established by the VECM results. In the fourth quarter, 89.2 percent of shocks in the employment rate are caused by its own shocks, whereas shocks in economic growth and the real exchange rate explain about 11.2 percent of variations in employment during the fourth period. As of the 10th period, 19.6 percent and 5.2 percent of variations in employment are explained by economic growth (LGDP) and the real exchange rate, respectively, while 75.2 percent of shocks in employment are explained by its own variations. Granger causality, variance decomposition and impulse response results confirm results provided in the VAR analysis.

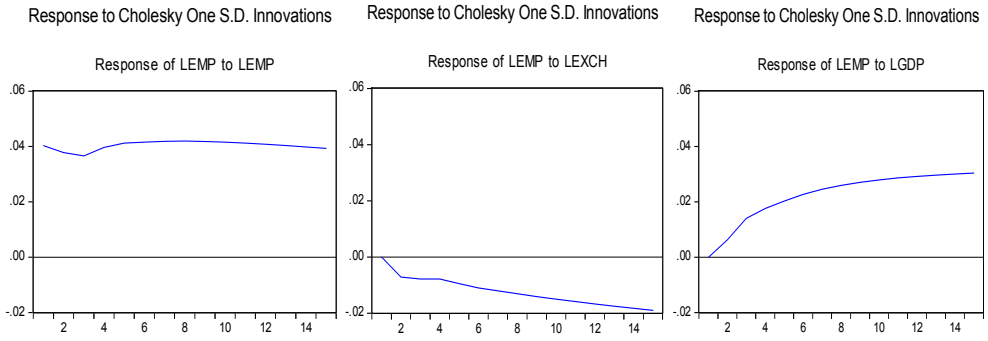
Table 6: Variance decomposition results of LEMP

Period	S.E.	LEMP	LREXCH	LGDP
1	0.040293	100.0000	0.000000	0.000000
2	0.056061	97.10599	1.635231	1.258775
3	0.068860	92.61041	2.390748	4.998842
4	0.081768	89.19624	2.609287	8.194477
5	0.094260	86.22520	2.979641	10.79516
6	0.106063	83.44778	3.436910	13.11531
7	0.117264	81.00502	3.873071	15.12191
8	0.127893	78.86670	4.302673	16.83063
9	0.137972	76.95420	4.740392	18.30541
10	0.147542	75.22577	5.183164	19.59107

4.8 Impulse Responses

In assessing the responsiveness of variables to shocks resulting from exogenous and endogenous variations, these reactions are measured through impulse responses as depicted in Figure 1. Considering the responsiveness of employment to shocks in the real exchange rate, such shocks tend to result in a significant negative effect on South Africa's employment. Such effects do not tend to decrease across the 15th quarter period as they seamlessly induce a decrease in employment moving forward. This confirms the VECM results of negative relationship between the real exchange and the empolyment. On the other hand, shocks in GDP cause a positive significant impact on employment. As such, employment tends to increase from the mid first-second quarter across the few quarters. Such an effect becomes positively consistent up to the 7th quarter. However, the positive impact is seemingly maintained as at it approaches the 8th to 15th quarter. Once, again this confirms the long-run results of a positve long-run relationship between real GDP and the real echange.

Fig. 1: Impulse response test results



4.9 Diagnostic testing

The underlying model passed diagnostic tests of no heteroscedasticity and no serial correlation, with results shown in Table 7. Nevertheless, the model failed the Jacque-Bera normality test at 0.05 level of significance. However, it is natural to reject the null hypothesis of normality testing in large data samples as they do not possess an "α-stable" distribution (Frain, 2007). This implies that some regressions are not constant over time (Ruxanda & Botezatu, 2008) and that normality testing is sensitive to increased sample sizes (Kundu *et al.*, 2011). Thus the null hypothesis in the test for normality may be rejected "more often than it should" (Chen & Kuan, 2003). Stability testing is mandatory in the case of a failed Jarque-Bera test (Zanini *et al.*, 2000). AR root test estimates can further be estimated (Razali & Wah, 2011; Hain, 2010). Results of the AR root test confirm the stability of the model as all AR roots lie within the unit circle, making it appropriate to proceed with causality, impulse and variance decomposition testing. The results of the stability test also confirms that the relationship between the employment, the real exchange rate and the real GDP was consistent throughout the sample period. Thus, changes in economic stability, such as the 2008 financial crisis, did not affect the relationship between these variables.

Table 7: Diagnostic tests results

Test	*H0*	*Probability*	*Decision*
LM Test	No serial correlation	0.0937	With a P-value above 5%, do not reject the H0. Therefore, there is no serial correlation in the model.
White (CT)	No heteroscedasticity	0.8800	With a P-value above 5%, do not reject the H0. Therefore, there is no heteroscedasticity in the model.
Jarque-Bera	Residuals are normally distributed	0.000	With a P-value less than 5%, reject H0. Therefore, the results show that the data is not normally distributed.
Inverse Roots of AR Characteristic Polynomial shows that the VEM is stable			

5. Discussion of results

The positive and significant long and short-run relationships between employment and GDP, together with causality results, are supported by Leshoro (2013). However, contrary to the results recorded by Biyase and Bonga-Bonga (2015) during the years 1970 to 2008, of a weak and non-responsive reaction of employment to GDP growth suggesting jobless growth, the results of this study show that economic growth does have a positive impact on job creation, but the impact is low. In addition, the Granger causality results indicated that economic growth does cause employment growth. This result is similar to the results established by Leshoro (2013) and Hanabakize and Muzindutsi (2105) for South Africa and Funlayo (2013) for Nigeria.

Further results in the variance decompositions results suggest that the growth in employment corresponds with increased GDP growth. The descriptive analysis of this study shows that employment growth has been significantly increasing along with economic growth since 1994. However, findings within the impulse response test of the current study demonstrate that the growth in employment has not been significant from the 8th quarter to the 15th quarter although it has remained constant. This can be explained by the country's low economic growth post the 2008-2009 global financial crisis, which has recorded moments of negative economic growth at certain times during the period. However, variance decomposition in this study suggests that shocks in GDP explain 24% of shocks in the country's employment during the 15th quarter. Seeing that the results revealed that GDP has a significant impact on employment growth, as suggested by Okun's law and assumptions by Keynes (1937), it is therefore best to find effective ways of boosting the growth of the country's economy in order to stimulate job creation.

Furthermore, contrary to the results by Ngandu (2009), the study established a significant negative short-run and long-run relationship between employment and the real exchange rate. These results confirm results by Mpofu (2013) and Bhorat *et al.* (2014) of a significant negative relationship between the two variables where an depreciation in the rand decreases employment growth, while an appreciation in the

rand promotes job creation. Significant employment effects of changes in the real exchange rate correspond with results by Alexandre (2011) in low technology sectors, whereas these findings where however offset by a non-compliance of employment towards exchange rate movements in high technology sectors. Simply indicating the negative effects of capital intensive other than employment intensive production on employment growth. Therefore, the country's high unemployment rate of 26.6 percent could be explained by the country's volatile and unstable currency and low economic growth as supported by variance decomposition and impulse response results.

6. Conclusion and recommendations

The creation of jobs is at the centre of economic growth and development. Globally, economies are under pressure with the phenomenon of jobless growth becoming a growing problem due to technology and innovation. The creation of sustainable jobs assists in maintaining economic and social stability. Persistent structural unemployment has major negative long run impacts on developing countries specifically on individuals and firms. It leads to decline in aggregate demand by consumers, which affects business development and success negatively. Considering that job creation is beneficial to both firms and individuals, the study focused on creating a job-enabling platform that sustains South Africa's businesses and its people. As such, the study examined the factors resulting in job dynamics by assessing the short and long run relationships between South Africa's aggregate employment growth and the country's real exchange rate and GDP growth. The extent and degree of employment responsiveness to the aforementioned factors were further investigated.

Despite having a significant but yet low employment elasticity to economic growth for both variables, the results revealed that, in the long-run, employment growth is more responsive to changes in economic growth than those in the real exchange rate. A greater percentage change in employment is explained by GDP growth. However, both factors have a significant impact on the country's employment. Effects of the real exchange rate may be such that the real exchange rate affects the country's employment through its economic growth. The research confirmed that the stability of the local currency is vital for economic growth and employment creation. The exchange rate volatility however has different impacts on job creation in different sectors as well as on imports and exports. Further studies may be conducted investigating the impact and percentage changes in economic growth explained by real exchange rate fluctuations when different sectors are considered.

Results of low employment responsiveness to economic growth correspond with results by Herman (2011) of low employment elasticity to economic growth based on the economic growth process. Both results highlight the importance of sound labour market institutions and labour flexibility in intensifying employment responsiveness to economic growth as well as employment befitting exchange rate movements. Labour flexibility takes on aspects such as the ease of wage negotiations. The creation and sustenance of extensive growth processes remains vital for intensifying employment elasticity to growth for South Africa and other various developing countries. Similarly, these developments may contribute towards intensifying the pace and reallocation process of jobs within economic sectors upon facing fluctuating movements in the exchange rate.

Since the study investigated the relationship of the changes in aggregate employment levels to exchange rate fluctuations, further studies should be conducted to investigate sectoral changes in employment in terms of changes in such fluctuations in order to determine the sectors that are most sensitive to currency fluctuations and those that maintain the growth in the country's employment. In this regard the findings of current sectoral literature are in conflict. On the other hand, more studies can be conducted to examine the extent of South Africa's sensitivity in creating jobs as a result of its level of openness to trade or trade liberalization. As suggested in the literature, further employment growth may be achieved with fewer labour regulations for increased productivity and growth, considering that South Africa's unemployment rate may be explained by the existence of structural unemployment (Malakwane, 2012). This indicates a mismatch between jobs. Training people with skills suitable for the right jobs may occupy more jobs. Maintaining stability in the country's currency exchange rate to prevent unexpected shocks may prove beneficial for job creation. Moreover, amidst South Africa's trade exposure, promoting skills training and more labour intensive export industries could be beneficial for job creation rather than the existing capital-intensive export industries mentioned by Altman (2003).

The study proposes new findings of a more comparative assessment of employment effects of economic growth and the real exchange rate dynamics. Then again, the results suggest that both variables, "economic growth and the real exchange rate", albeit not significantly impressive, comparatively establish an environment inductive for employment generation. South Africa's highly protective labour laws convey the implied rationale for low employment gains of economic growth and real effective exchange rate as aforementioned by Sőgner and Stiassny (2000) in the study. Likewise, other inhibiting include rigid labour market structures as aforementioned. A further relaxation of the country's labour laws may oversee enhanced responsiveness of employment gains to economic growth as well as the intended employment benefits of exchange rate induced job reallocation dynamics. Moreover, our findings reinforce the "jobless growth" agenda revealed by previous studies, further stressing the need to proliferate state policies and actions focused on raising employment effects of economic growth. Future research could include a comparative analysis of labour laws and policy in developing countries.

In conclusion, recommendations to assist policy formulation in ensuring a job-enabling environment in a developing country include; necessitating the need for substantial economic growth to spur employment growth; and making provision of a stable currency with exchange rate required boosting economic growth and employment growth. In addition, labour regulations need to be job creation friendly; the mismatch in skills need to be rectified by means of appropriate skills training; the promotion of small business development and entrepreneurship; labour intensive programmes by the private and public sector should be encouraged. Lastly, export promotion programmes should be implemented.

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STUDIA UNIVERSITATIS BABEŞ-BOLYAI OECONOMICA
VOLUME 62, ISSUE 2, 2017, pp. 42-54
DOI: 10.1515/subboec-2017-0008

THE OUTCOMES OF THE ROMANIAN EDUCATIONAL SYSTEM AND ECONOMIC INDICATORS

Alexandru JIVAN
West University of Timisoara, Romania

Ciprian Alexandru ȘIPOȘ[*]
West University of Timisoara, Romania

Janeta WEISZ
Christian University "Dimitrie Cantemir"

Abstract: The paper highlights some important correlations between the outcomes of the Romanian educational system and certain key indicators concerning the Romanian economy. The indicators are selected on the basis of the logic correlations and considering the limits of available data. The time-lag models were used because the macroeconomic effects of the factorial indicators considered as determinants on dependent variables cannot be usually detected in the same year. The results allowed interesting discussions concerning the Romanian education system and its funding-related evolutions in the last decade.

JEL classification: I21, I28, O15

Keywords: outcomes of education, material and human efforts for education, macroeconomic effects

1. Introduction

Education and its correlations with the economic indicators can always reveal interesting aspects, on diverse time horizons. The paper proposes an analysis of the correlations between outcomes of education and some economic indicators, concerning, on the one hand, the economic effort for carrying out the educational process, and, on the other hand, the state of economy as a whole. The research is made inside the frame of the topic concerning the productivity of education,

[*]Corresponding authors. Address: West University of Timisoara, Faculty of Economics and Business Administration, J.H. Pestalozzi, no. 16,300115, Timisoara, 0040.744.834.835, Email: ciprian.sipos@e-uvt.ro

dedicated to the case of Romania. The main purpose of the paper is to reveal possible connections that can be relevant in a widened horizon concerning the productivity of education linked to the key economic indicators (see Jivan, 2014).

Usually the productivity of education is analysed in a business approach – at the level of educational units, with stress on the didactic curricula, methods, management of the specialized institutions etc. Previous studies (Denison and Chung, 1976, Damme, 2004, Tavenas, 2004, Li and Prescott, 2009, Lehmann and Koelling, 2010, and Jivan et al., 2016) focus on such topics. The paper of Jimenez (2006) is also most important, for the focus on the education topic and for the presentation of the background analysis. Further, we highlight the important work of Djellal and Gallouj (2008), because they see productivity in educational services on the bases of a widened horizon. See also Jivan (2014) and Jivan et al. (2016), for some short references to the important work of Djellal and Gallouj (2008).

In the view of our research, productivity is differently approached, in a not common conception, as the global productivity of the national educational system. Namely, indicators concerning the outcomes of education as high school graduation rate and number of graduates were used, in correlation with some key economic indicators (GNP, GNP/capita, GDP, GDP/capita, GDP/person employed).

The study presented is made on certain groups of factors established according to the criteria described in the paper by using diverse directions of the presumed causal influences. The data sets were selected from the available data, in the purpose of allowing certain time lags of the correlations, as shown in the second section. The econometric analysis was made following Jula (2003 and 2011) and Şipoş and Preda (2006).

Certain specific correlations between the outcomes of education and certain economic indicators in Romania are revealed, as detailed by the three main hypotheses developed in the second section. The econometric analysis of the hypotheses is made in the fourth section, taking into account a period of time that include the economic crisis after 2007. The empirical research is significant from the point of view of the widened approach on the analysed correlations that comes from our different conception about global productivity, based on the mediated and long term effects of education on the economy (see also Jivan, 2014). The econometric results confirm the hypotheses formulated, as shown in the fourth section, emphasizing the maximal relevance of the correlations for a maximum time lag of 2-4 years. They allow interesting interpretations concerning the Romanian education system and its funding-related evolutions in the last decade.

2. The conceptual model. Methodology issues

The conceptual model regarding the influences of the education system at the macroeconomic level presented in Table 1 consists in the system of correlations considering the research hypotheses H1 and H2. The datasets were properly used to manifest the causal elements of complex indicators of educational outcomes in the relationship with the economy. Thus, the indicators have been chosen considering the professional results of education either as an influence factor or, respectively, as an effect of the selected economic indicators. The selection of indicators was done limited to the available data, using databases from the World Bank and National Institute of Statistics of Romania.

The analysis is made at global level, not at the individual entity level, as economic enterprise or educational institution, nor at the level of individuals as teachers, pupils, students. This conceptual choice can be considered both as added value and limit of the research, assumed from the beginning of conception of the work.

Based on these considerents, the conceptual model regarding the relationships between educational system in Romania and some key economic indicators is presented in the Table 1:

Table 1. The conceptual model regarding the influence of the education system at the macroeconomic level

Hypotheses		Results presumed
H1: $I_{prof} \rightarrow I_{ec}$	Educational Services Productivity	The professional outcomes of the education system (I_{prof}) have an important influence on general economic indicators (I_{ec}), proving to be responsible for many problems in the real economy and social life.
H2: $I_{ec} \rightarrow I_{prof}$		On the other hand, the general economic situation of the country (I_{ec}), has an important effect on the evolution of the indicators describing the professional outcomes of the education system (I_{prof}).
H3: $I_{efort} \rightarrow I_{prof}$		Indicators of human and material efforts for education (I_{efort}) are influencing the strictly professional outcomes of education (I_{prof})

Constrained by the availability of the indicators and the way they – and correlations that might exist between them – may be logically suitable to the goals of our research, the analysis has resulted in the structure below (Weisz, Jivan, 2014, Jivan et al., 2016):

- *Strictly professional outcomes in education* (I_{prof}) is the group of indicators for which we were able to choose, within the limits of available data on sufficient long periods: total number of graduates, the number of researchers in R&D and the high school graduation rate. Thus, among this group there are some direct outcome indicators (total number of graduates and high school graduation rate) and are also included the long-term outcome indicator capturing the level of professionalism at national level (number of researchers working in R&D).

- *Indicators of material and human effort for education* (I_{efort}) include public expenses assumed to ensure the educational system: (number of) schools, school laboratories, classrooms and school offices, teaching staff (number), gross average earning per employee in education (the recent meaning of expenditure for staff working in education).

- *Economic Indicators* (I_{ec}) include the key indicators of the Romanian economy: Gross Domestic Product (GDP), Gross National Product GNP), GDP/capita, GNP/capita, GDP/employed person).

The length of datasets is limited by the availability of statistical data. We have chosen only the indicators for which we can verify correlations for sufficiently extended periods, to ensure relevance and to allow a rigorous study. The selection was also limited by the need for time lag calculations because in the education system the effects are not expected in the same year, they appearing ussualy over minimum three or four years, given by the length of a school cycle. In our calculations, we went to a lag of up to six years.

Of course, there are other indicators, involved in logical correlations: the causal mechanisms are more complex, but actual choice of indicators used for this analysis was done as shown above. In a few cases, we have allowed to complete data series (where figures were missing for a year, or even two, joined or dispersed) by approximate extrapolations, based on average data, particularly weighted, with the amounts years adjacent to the missing. Also, we consider that very few approximations did not affect significantly, perhaps not noticeable, overall correlations to those sets of data.

We mention that, as can be seen in detailing above, the groups considered can sometimes contain repetition or duplication of influences, especially in the case of economic indicators; for example, we included in the same group indicators: GDP/capita and GNP/capita.

Such double determination may influence the analysis in research aimed to establish the quantitative values to variables and parameters of empirical analysis. Our study is, however, focused on the principles of influences concerning educational productivity and not on the exact magnitude of these influences; therefore, in our opinion, the repetition does not affect the conceptual and qualitative principles.

The econometric analysis is based on different time lags of the indicators: namely with the gap of one year in some cases going up to a time lag of six years. We noted that some possible influences are logically rather more than two or three years, others more than five years, or other possible variants.

3. Overview of key data as the base of research. Evolutions in the analysed period

The first hypothesis, which means the correlation between *strictly professional outcomes in education* (I_{prof}) as influence factor and *economic indicators* (I_{ec}) as dependent variable, is based on the facts that in the period 2000-2012 *the high school graduation rate* and *the total number of graduates*, have developed oscillations that might be considered minor until around 2008-2009. Thus, the long-term trend was relatively constant in the analysed period. Also *the number of researchers in R&D* has remained relatively constant; its decline, although slightly, is noticed since 2006, being more pronounced since 2010.

The decrease *in the number of graduates* began in 2007, and from 2008 the decline is very visible for the entire Romanian educational system; *the high school graduation rate* is decreasing, the year 2011 registering very low levels.

Thus, there is a downward trend for all these indicators, although there were taken some beneficial measures to the education system, such as computerized distribution of teachers participating in the tenure competition, the increased investment from structural funds, which should have positive effects on the graduation indicators. It explains the fact that the *high school graduation rate* has increased from 2011 to 2012, which is however too little.

Among the possible explanations, certain legislative changes may be mentioned, that were imposed without sufficient justification, in our opinion, including how it has developed and introduced the National Education Law no. 1/2011 without a proper preliminary debate. It is important to remember in these circumstances, the basis on that were applied certain measures, namely the global economic crisis and its overall impact. Thus, a number of important factors have intervened in the context, including the decreasing of the expenses related to education and, and above all, the reducing of salaries for teachers, as can be seen on the second hypothesis examined in this paper.

In order to analyse the relationship between outcomes of education and the economic context, we present the key economic indicators used. Thus, the indicator *Public spending on education* registered a relatively constant variation (between 3-4%) while the *GNP* registered a significant increasing trend of 173% in the period 2000-2012. They can be considered as having a contribution to the changes in the Romanian educational system in the considered period (as influence factors) but also are influenced by educational outcomes, as determined variables. We mention that GNP per capita and GDP per person employed were also considered in our analysis.

As we have presented above, the *Indicators of material and human effort for education* (I_{efort}) include public expenses assumed to ensure the functioning of the educational system. Here, two main aspects are highlighted: firstly, most of the indicators for education effort (number of school laboratories, workshops and schools, classrooms and school classrooms, nominal average monthly gross earning in education) recorded a relatively constant evolution without significant changes; only in the case of average monthly gross earning in education there was a slight change in 2004-2005, which is the period since the passing of the old currency (LEU) to the new parity of the national currency (RON). Secondly, the teaching staff has significantly decreased between 2000 and 2012, from 294.938 persons to 245.174 persons, which is one of the factors that contributed to the decline in graduation rates, as direct outcomes of educational system.

4. The empirical analysis

In our study we used the linear regression model with time-lags; estimators determined by least squares method correspond to the objective pursued if the expected value of each estimator is equal to the actual value of the parameter and the variance of each estimator is as low as possible in relation to the number of samples.

One methodological approach concerns that the order of magnitude of data and units are very different from one indicator to another, even in the same logical category; namely, there are variables expressed in different monetary units (RON, EUR) or physical units (number of people, number of schools, physical units related material endowment, and so on). As a result, to analyse the correlation between the influence factors and dependent variables, the standardization of data was necessary (see Table 2); that is the reason for that we conducted the analysis based on standardized (normalized) data.

Table 2. Standardized data of I_{prof} , I_{efort} and I_{ec}

Years	I_{prof}	I_{efort}	I_{ec}
2000	0.19348	0.54328	-1.26374
2001	0.03186	0.81019	-1.14616
2002	0.41324	0.75875	-0.97487
2003	0.27326	0.61432	-0.81257
2004	0.74810	0.58826	-0.58061
2005	1.03874	-0.10078	-0.34593
2006	-0.05390	-0.22639	0.40616
2007	0.54037	-0.26180	0.44068
2008	0.34156	-0.11771	1.36697
2009	0.20526	-0.31434	0.63586
2010	-0.10802	-0.63157	0.69324
2011	-2.16468	-0.86283	0.77036
2012	-1.45932	-0.79941	0.81060

Correlation analysis for variables is performed using Pearson correlation coefficient, the R Square and the partial correlation coefficients and determination. We also used the linear regression model for lagged variables, and Fisher and Student tests for empirical analysis. Starting with the first hypothesis (*H1*) which assumes that the professional outcomes of the education system (I_{prof}) have an important influence on general economic indicators (I_{ec}), the econometric analysis did not reveal very strong correlations, but highlighted that exists both positive and negative influences.

The positive influences are low or moderate for diverse time-lags. The moderate positive correlations and the main results of linear regression are shown in the Table 3 and the Charts 1, 2, 3 and 4.

Table 3. The positive correlations between I_{ec} and I_{prof}

No.	Variable of influence	Pearson correlation	R Square	t stat for β	F	β
1.	I_{prof} (lag of 3 years)	0.640	0.410	2.97	6.264	0.972
2.	I_{prof} (lag of 4 years)	0.746	0.557	3.17	10.068	1.072
3.	I_{prof} (lag of 5 years)	0.664	0.441	2.35	5.524	0.944
4.	I_{prof} (lag of 6 years)	0.726	0.528	2.59	6.715	1.093

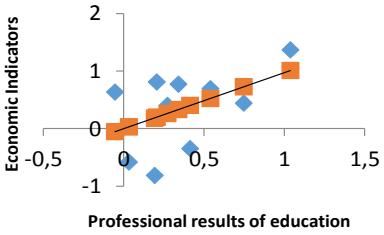

Fig. 1. Moderate positive correlations at a lag of 3 years

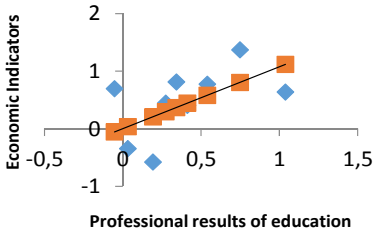

Fig. 2. Moderate positive correlations at a lag of 4 years

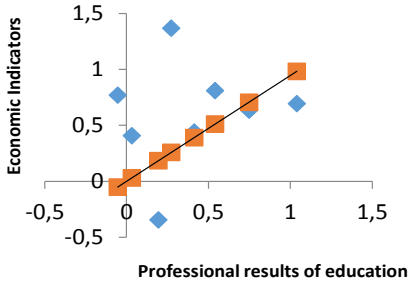

Fig. 3. Moderate positive correlations at a lag of 5 years

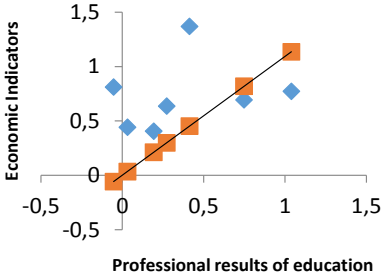

Fig. 4. Moderate positive correlations at a lag of 6 years

We can observe that, for a time lag of 3-6 years, the correlations between factorial variable I_{prof} and the dependent variable I_{ec} are moderate positive.

The most significant correlation is related to a time lag of four years, which corresponds logically to the duration after which I_{prof} can be found in the economy, and can be explained by the average duration of a study cycle.

Further, we synthetically present the correlations regarding the influence of I_{ec} on I_{prof}, according to second research hypothesis (*H2*), which assumes that the general economic situation of the country (I_{ec}) has an important effect on the indicators describing the professional outcomes of the education system (I_{prof}). In this case, the correlations are negative, and the relevant ones are presented in the Table 4, and Charts 5 and 6):

Table 4. The moderate negative correlations concerning I_{prof}

No.	Variable of influence	Pearson correlation	R Square	t stat for β	F	β
1.	I_{ec} (lag of 3 years)	-0,780	0,608	3,74	13,999	-0,848
2.	I_{ec} (lag of 4 years)	-0,721	0,520	2,94	8,687	-0,802

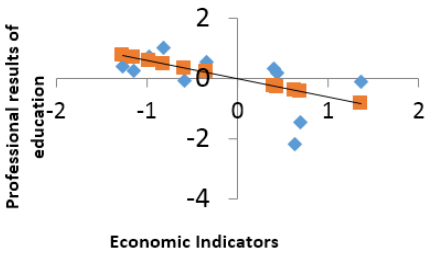

Fig. 5. Moderate negative correlations at a lag of 3 years

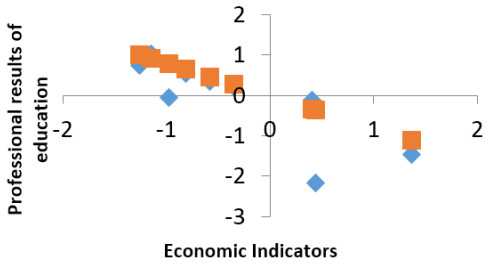

Fig. 6. Moderate negative correlations at a lag of 4 years

From analysis on the correlation between factorial variable I_{ec} and dependent variable I_{prof}, it follows that, for a time lag for 3 and 4 years, they are negative, but moderate. The Pearson correlation coefficient indicates a moderate negative relation between the variables studied, and the coefficient of determination (R Square) shows that over 60%, respectively 52%, of the variation of I_{prof} can be explained by the influence of I_{ec} for a time lag of 3 and 4 years.

Further, the Fisher test confirms that coefficient β is negative, and the relationship between I_{ec} as factorial variable and I_{prof} as result variable is inverse: when I_{ec} increases, I_{prof} take a downward trend, and vice versa. For the case of a time lag of 2 and, respectively, 5 years, econometric correlations between the dependent variable I_{prof} and variable factor I_{ec}, are weak and still negative (see Table 5, and Charts 7 and 8).

Table 5. The weak negative correlations concerning I_{prof}

No.	Variable of influence	Pearson correlation	R Square	t stat for β	F	β
1.	I_{ec} (lag of 2 years)	-0,565	0,319	2,16	4,705	-0,602
2.	I_{ec} (lag of 5 years)	-0,547	0,300	1,73	3,001	-0,685

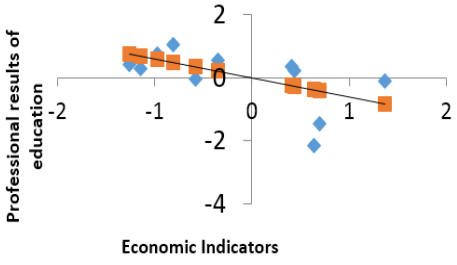

Fig. 7. Weak negative correlations at a lag of 2 years

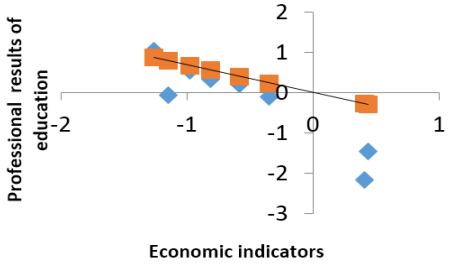

Fig. 8. Weak negative correlations at a lag of 5 years

Also in the case of the second hypothesis, considering I_{prof} as dependent variable and I_{efort} as influence factor, we found one positive econometric correlation and moderate, *i.e.,* for the time-lag corresponding to one year. The gap is logical from the point of view of causality: a change in spending for education is succeeded by an improving of I_{prof} after approximately a year (at least one year).

The Pearson correlation coefficient shows that the influence of I_{efort} on I_{prof} is moderate, meaning that the facilities and the material and human effort from a year determines an increased high school graduation rate in the next year, even if the coefficient of determination indicates that the intensity of relationship between the variables is only moderate.

After the correlation corresponding to one year time-lag between the data sets, the following intensity of correlation is for two years time-lag; for longer intervals, the relationship remains positive, although it is lower intensity (see Table 6):

Table 6. The positive weak correlations concerning I_{prof}

No.	Variable of influence	Pearson correlation	R Square	t stat for β	F	β
1.	I_{efort} (2 years)	0,592	0,350	2,32	5,402	1,054
2.	I_{efort} (3 years)	0,525	0,276	1,85	3,432	0,998
3.	I_{efort} (4 years)	0,537	0,288	1,80	3,243	1,036

The last hypothesis tested (*H3*) assumes that *Indicators of human and material efforts for education* (I_{efort}) are influencing the strictly professional outcomes of education (I_{prof}). Thus, the *number of schools and labs* as material effort indicators and, respectively, the *number of teachers* as a human effort indicator has a significant correlation with the *high school graduation rate* and the *number of graduates* during 2000-2012. A strong direct influence can be considered in the short-term (time-lag of one year), but the influence is weaker as the considered time-lag increases.

On this hypothesis, regarding the influencing on I_{prof} by facilities provided to education (and, generally, by I_{efort}), it appears that the number of units and school laboratories as indicators of material effort and teaching staff as an indicator of human effort, present a significant correlation with high school graduation rate and the number of graduates during 2000-2012. It can be considered a strong influence in the direct sense, on short-term (time-lag of one year); for example in 2001 against 2000, teaching staff percents grew from 29.5% to 30.01%, which influenced the increased graduation rate from 86.3% in 2001 to 86.7% in 2002; but the intensity of this positive influence is increasingly irrelevant as the considered time-lags grows, as demonstrated by econometric research (see Charts 9, 10, 11, and 12):

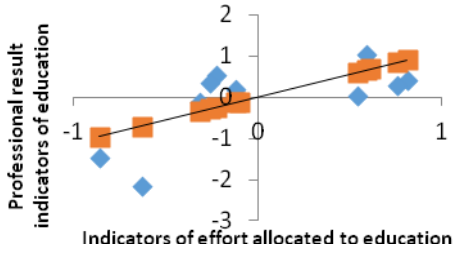

Fig. 9. Moderate positive correlations at a lag of 1 year

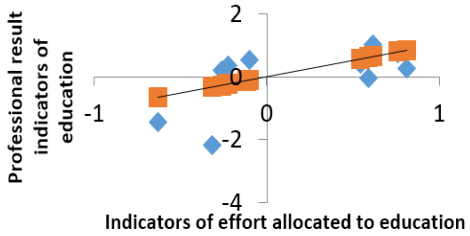

Fig. 10. Moderate positive correlations at a lag of 2 years

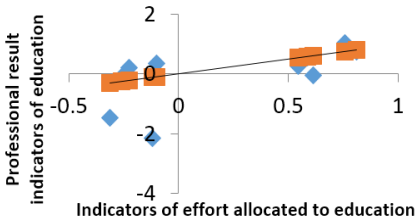

Fig. 11. Weak positive correlations at a lag of 3 years

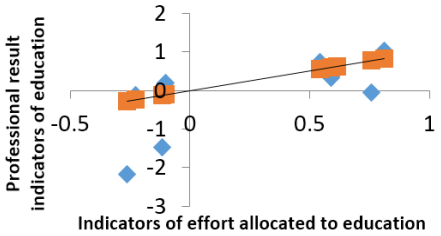

Fig. 12. Weak positive correlations at a lag of 4 years

In our research we have not tested also the reverse version of this hypothesis (a possible hypothesis *H4*), because we consider that the influence which I_{prof} can have on I_{efort} makes no sense; it might be speculated that if the peoples are trained in a higher education quality and the professional education system outcomes are better, the more likely there will be taken more adequate decisions. These better decisions can result in the amplification of the societies' efforts to ensuring the nation's future through education, as there are many examples of nations that have lack of other resources, but relying on education, and has a great development.

Such influences may occur only after long intervals of time in which the present graduates will be the next nation's decision makers, so on very long term. But the large number of factors involved, especially for the medium developed economies, like in the case of Romania, makes such correlations to be not really significant; moreover, on long-term (in our case a time-lag of maximum 6 years), possible econometric correlations show a very low intensity.

Making a succinct centralizing of the results of correlations for lagged variables, we have considered relevant to highlight (in Table 7) the strongest relationships and, respectively, the weakest ones, as can be seen below:

Table 7. Centralizing the results of correlations for lagged variables

Moderate correlations (positive)	**Weak correlations (positive)**	**Moderate correlations (negative)**	**Weak correlations (negative)**
$I_{prof} \rightarrow I_{ec}$ (lags of 3-6 years) $I_{efort} \rightarrow I_{prof}$ (lag of 1 year)	$I_{efort} \rightarrow I_{prof}$ (lags of 2-4 years)	$I_{ec} \rightarrow I_{prof}$ (lags of 3 and 4 years)	$I_{ec} \rightarrow I_{prof}$ (lags of 2 years and 5 years)

5. Conclusions

The research was designed based on the literature review and the analysis of empirical data, according to their availability and other limitations, regarding the correlation between main outcomes of the Romanian educational system and certain

key indicators concerning the Romanian economy. The correlations were analysed on a period of 13 years with various time-lags by using usual econometric methods as Pearson correlation coefficient, linear regression model for lagged variables, the Fisher test and the Student test for significance of regression coefficients.

The results let us to conclude the existence of interesting correlative determinations between the groups of indicators studied, on the periods and time-lags considered, which logically correspond to the educational cycles, as shown above in the paper.

Given those conceptual premises, we made the first hypothesis assuming that the key economic indicators considered as a dependent variable are significantly influenced by professional outcomes of educational system. That hypothesis was econometrically confirmed in a moderate level in the case of Romania. The length of dataset used allowed a pertinent analysis to a maximum time-lag of 6 years (correlations were positive), with diverse intensity of effects, depending on the quality of education, expressed by total number of graduates, the number of researchers in R&D and the high school graduation rate.

In some cases, the invalidation by the empirical analysis of relationships presumed for certain temporal dimensions forced us to revise the number of years for which we considered the time-lag between the influence factors and dependent variables. Therefore, the resulted significant time lags was for one year up to 6 years. Over six years, the correlations are not showing relevant econometric results to justify further analysis.

The second hypothesis, takes into account the economic indicators, considered as an independent variable, influencing the professional outcomes of educational system. Paradoxically, the calculations do not validate that assumption, showing negative correlations (against the relation that can be presumed in the normal logic). Seeing these results, we restricted the research period: compared to 1990-2012, as initially tried, we remade the calculations for the period 2000-2012 only. But there were no better results.

We can think that, regardless of economic evolutions, Romanian governments practically have given to education about the same interest that would be granted in the case of inverse general developments in the economy. Although Romania's overall trend of development over the analyzed period was positive, most of the educational system's output indicators have fallen. We can say that this reality is validated by the personal experience of most Romanians who had students or pupils in their family.

The last hypothesis analysed, reflects the influence of indicators of material and human effort for education on professional outcomes of educational system. In this case, the research confirmed that the results obtained in education are influenced by the human and material effort for education. The correlations are positive, which shows that an increase in the number of schools, labs, number of teachers, and theachers' wages, have a positive influence on the graduates from high school and graduation rate, with direct positive impact on the labour market.

The strongest correlation is for a time-lag of one year; increasing the time-lag resulted in weaker correlations, meaning that ensuring these conditions for the teaching process (the young people have a place where to learn and enjoy good schools, and the educational staff is encouraged by wages), is reflected in the results of graduates only on short-term.

The main ideas that we have drawn during research can be considered as representing a small contribution to the study of education, but relevant: the empirical research presented is significant at least in terms of broad-comprehensive optics on correlations considered, which lies in a complex vision productivity; as developed in (Jivan, 2014), namely, the specific manner of serving the economy, opening to mediated and long-term effects. They can be correlated with other studies of the authors, as (Jivan et al., 2016).

The question of quantitative measurement of productivity in education remains open, and also, in particular, the problem of quantifying the qualitative aspects (estimating specific immaterial issues) which was not addressed in this research. Some guidelines to follow for future research can also aim to extend both the geographical analysed area (in the educational system of other countries too, possibly from Eastern Europe), and the temporal area investigated, and to improve research concerning the opportunities of productivity growth in education.

Acknowledgment

This work was supported by the project "Excellence academic routes in doctoral and postdoctoral research – READ" co-funded from the European Social Fund through the Development of Human Resources Operational Programme 2007-2013, POSDRU/159/1.5/S/137926.

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STUDIA UNIVERSITATIS BABEŞ-BOLYAI OECONOMICA
VOLUME 62, ISSUE 2, 2017, pp. 55-76
DOI: 10.1515/subboec-2017-0009

COMPETITIVE CONDITION OF SUB-SAHARAN AFRICA COMMERCIAL BANKS

Joseph Olorunfemi AKANDE[*]
University of KwaZulu-Natal, South Africa

Farai KWENDA
University of KwaZulu-Natal, South Africa

Abstract. This study assesses the competitive environment and the determinants of the Sub-Saharan Africa commercial banking sectors. We used the Lerner index that is generally acknowledged as the best at estimating the bank level competition and the Generalised Method of Moments (GMM) to study 440 commercial banks for the period 2006 to 2015. We found a monopolistic competitive banking market. We also observed that competition is driven by the level of bank capital including some bank specific variables. Hence, we concluded that the banking market of the SSA region is contestable and competitive. As such, we recommend, among other things, that policy makers should device measures to ensure an ongoing competitive banking environment while stimulating other economic variables to complement this feat.

JEL classification: G21, L10

Keywords: competitive condition, Sub-Saharan Africa, commercial banks, Lerner index, Generalised Method of Moments.

1. Introduction

Competition has attracted attention in banking and finance literature for decades. An extensive body of theoretical and empirical studies has reported the significant role of bank competition in ensuring access to finance (Clarke et al., 2006; Lin et al., 2010; Love and Per´ıa, 2014; Mudd, 2013; Rice and Strahan, 2010; Tan, 2013), efficiency (Mlambo and Ncube, 2011; Ningaye et al., 2014; Pasiouras et al., 2009; Pruteanu-Podpiera et al., 2008) and stability (Beck et al., 2013; Fu et al., 2014; Schaeck and

[*] Corresponding author. Address: School of Accounting, Economics and Finance, University of KwaZulu-Natal, Durban, South Africa, Email - akandeo.joseph@gmail.com

Cih´ak, 2014; Ariss, 2010) in any economy. According to Casu et al. (2015), competition is good for many reasons; it is an essential force in any economy, it encourages firms to be more efficient and provide better allocation of resources. In banking, efficiency should entail lower costs, which should be passed to bank customers in the form of lower charges, higher deposit rates and reduced lending costs (Casu et al., 2015). Essentially, competition in banking improves access to finance, increases overall competitiveness in other sectors of an economy, fosters innovation and increases quality, widens consumer choice and promotes economic growth (Leon, 2015b). As it is the trend across the globe, Sub-Saharan Africa countries have witnessed quite a number of reforms of their financial sector that is predominantly banking in nature in the last two and a half decades. The thrust of these reforms has been the opening up of the financial system for competition to engender a robust banking system that is capable of harnessing the potentials of the region for economic growth. The main reforms which are homogeneous across the region include recapitalisation, liberalisation, privatisation, deregulation, removal of credit controls, establishment of new refinancing policies and relaxing of indigenisation policies. The region has made some good progress from these reforms, but whether they have translated to the much-anticipated competitive banking environment still leaves much to be desired. According to Mlachila et al. (2013) the banking system is highly concentrated and generally inefficient at financial intermediation. Basic indices of a competitive banking system like cost of banking, service charge, interest rate spread, interest costs are very high in this region compared with other regions of the world. The African Progress Panel (Panel, 2014b) in 2014 rose from its meeting to assert that stimulation of competition in the banking sectors will help to bridge interest rate spread that stifles savings and investments and consequently drive the needed economic growth in the region. How informed is this assertion? Is the SSA banking sector truly uncompetitive?

The essence of this study is then to investigate the competitiveness of the Sub-Saharan Africa commercial banks[1]. This becomes imperative because, the starting point of devising a good policy is for policy makers and regulators alike to know how the banking environment have reacted to existing regulations and policies that have been put in place in order to forge the possible way forward. This study contributes to extant literature in developmental finance. To the best of our knowledge, it is the first to comprehensively investigate the competitive condition of the banking sector of the region and using the Lerner index that is capable of analysing bank level competition. Available literature has only focused on a few individual countries in the region and in doing so focused on just the market and without analysing bank level competition. This is particularly necessary in the face of the increased tendencies towards regional integration. Our study revealed that, while considerable market power resides in the individual banks in the region, the market as a whole is highly contestable.

The other parts of this article are structured as follows. Section 2 reviews previous empirical literature and theories in light of how they affect the banking system. The study's methodology is considered in Section 3, then the results and analysis of results in Section 4 and finally Section 5 contains the summary and conclusion of the paper.

[1] Commercial banks account for more than 70% of the region's banking sector (Allen et al., 2011). According to Allen, Otchere, and Senbet (2011), SSA is underdeveloped and faces critical infrastructural challenges. Moreover, countries in this region share similar features in terms of the nature of their economies.

2. Literature review

The efficiency, stability of a banking system and access to finance relate to the level of competitiveness of that banking sector (Love and Per´ıa, 2014; Mudd, 2013; Ningaye et al., 2014; Fu et al., 2014; Schaeck and Cih´ak, 2014). Hence the need for a competitive banking system. But quite a number of reasons account for the imperfection in the banking sector and the fact that the conventional application of competition may not be admissible. These reasons range from regulatory requirements, charter value and capital requirements, existence of double market where a bank may want to create monopoly, for instance, in loan market and compete in the asset market, among others. The imperfections however do not suggest that the productive efficiency benefits of competition do not apply in the banking sectors. In this section, we review a range of relevant underpinning theories and empirical literature on competition in the banking system.

The concept of competition has a long history in economics and finance in which it is considered as a process of rivalry that in the long run forces price to equal the cost of production. It evolved into two major reviews, namely; competition as a static state and as a process of rivalry. The Cournot oligopoly theory formed the basis of the static state view. The static state view of competition defines the ideal of competition as an equilibrium condition because the price of costs approaches zero as the number of producers increases. According to this standard theory, competition is a static state in which firms cannot charge overprice and then earn abnormal profit. Competition as a process of rivalry was a product of the Austrian school under Schumpeter, Hayek and Von Mises who criticised the static state theory with the argument that the traditional neoclassical economists misused the term competition by applying it to a state instead of a process. They view competition as a complex process of rivalry between firms and related the core of competition to the behaviour of the firms in the market. This school's perspective maintained that a market is competitive when rivals are sufficiently aggressive to give an incumbent incentive to improve (lower price, better quality, etc.), in order to maintain its advantage. Competition thus acts as a selection mechanism through the destructive creative principle in which less efficient incumbents are removed and replaced by more efficient entrants.

The Chicago School Industrial Organisation approach on market structure theory extended these theories and argued that many if not most markets tend to approximate perfect competition in the long run. According to Posner (1979), positive profits in competitive markets are considered transitory since their presence stimulate entry yet result in their demise. Baumol et al. (1982) formalised this idea with the theory of contestability which states that markets behave competitively in the absence of entry and exit barriers. They argued that in a contestable market regulation is unnecessary as the threat of entry will both restrain incumbent market power and satisfy the requirement for static welfare maximisation. Market forces ensure that monopoly power will usually be short-lived such that the intensity of competition is unrelated to market structure but linked to market contestability. By contrast, the Austrian school argues that disequilibrium and monopoly power are the normal functioning of competitive markets. The contestability theory has a major impact on the conduct of competition policies and provides a framework to unify industrial organisation that is applicable in a wide range of industrial markets. Abdelkader and Mansouri (2013) argued an efficient industrial

market pricing environment resulting from the threat of potential competition due to free entry and costless exits. The threat of potential competition guarantees an efficient banking system regardless of the existing players in the market (Dietsch, 1993). The empirical works of Claessens and Laeven (2004) found relevance of contestable market theory with number of banks and the level of market structure in their study of 50 countries market structure. Northcott et al. (2004) however found that the existence of regulation that promotes competition determines the workings of the theory.

Overall, most of these theories assumed a perfect competitive market with free entry and exit. However, the existence of friction in banking markets (for instance, barriers to entry, asymmetry information among others), is mitigating the direct application of the welfare theorem that is associated with perfect market, thus allowing room for the exercise of market power. Meanwhile, a healthy degree of rivalry is considered necessary for the dynamic efficiency of the sector, the principle that is at the basis of the trend towards fostering greater competition in banking markets across the globe.

Various attempts to test the foregoing theories have brought about a number of empirical models. The fact that the neoclassical conception poses some clear testable hypotheses explains the two strands of literature dominating the empirical measurement models in banking competition study, the structural and the non-structural models which are based on the traditional and the new industrial organisation theory that are rooted in the competition as a static state. The structural model includes the structure conduct hypothesis (SHC), relative market power (RMP) and efficiency structure hypothesis (ESH). Structural models, (Shepherd, 1983; Smirlock et al., 1986; Chirwa, 2003), except ESH that found a reverse causality between structure and performance (Demsetz, 1973; Amidu, 2013), argued that structure causes performance. Non-structural models such as Lerner index (Lerner, 1934), Panzar-Rosse H-statistics (Panzar and Rosse, 1987, 1977), conjectural variation (Bresnahan, 1982; Lau, 1982; Iwata, 1974), Boone indicator (Boone, 2008a, b) and persistence of profits (Mueller, 1977, 1986) constitute the new empirical industrial organisation (NEIO), introduced in a number of attempts to collect empirical evidence on the nature of competition by observing conduct directly (a shortcoming of the structural models). Lerner index (Lerner, 1934), which is found to be consistent with the industrial organisation theory is employed in this study. The Lerner index measures market power as the difference between price and marginal cost expressed as a percentage of price. The market power of a bank is identified by the disparity between the bank's price and its marginal cost. The price and marginal cost should be equal in perfect competition, but will be at disequilibrium in an imperfect competitive market environment. A wide disparity between price and marginal cost is an indication of high market power. The Lerner index is hence a measure of the extent to which a bank is able to charge price above its marginal cost.

The theoretical foundation of the Lerner index is rooted in static oligopoly theory (Cournot model). Although the index has been around since in the mid-30s, its application in banking is relatively recent due to the inability to econometrically estimate price and marginal cost. Two approaches have been developed to surmount this, the production and intermediation approaches. The production approach considers banks' sole activities as servicing its account holders. Banks in this case offer a

number of financial services such as savings and credit by mobilising labour and physical capital (Heffernan, 2005). Klein (1971); Monti (1972) and Sealey and Lindley (1977) used the intermediation approach as an alternative with the argument that banks intermediate between depositors and borrowers. Under this approach, it is believed that a bank employs labour and physical capital to attract deposits which are used to fund loans. In this approach, labour, physical capital and deposits are considered as inputs and proxy as costs while bank output is defined as total assets or total loan proxing as the price respectively. Furthermore, prices are not directly observable, researchers use balance sheets and income statements to infer prices. The marginal cost is estimated in two ways. The first is by estimating the average variable costs, defined as the total variable costs divided by the total assets or total income. This method, according to Casu et al. (2015), has the advantage of being straightforward but lacks in accuracy. The second approach requires the estimation of a cost function which is usually a translog cost function with a single output (total assets) and three input prices (deposits, labour and physical capital) based on the intermediation approach, see (Beck et al., 2013; Berger et al., 2009).

Many studies have empirically attempted to measure banking competition by averaging the individual Lerner indices. Weill (2013) analysed the evolution of bank competition measured with the Lerner index for the EU banks between 2002 and 2010 and obtained an index for all 27 EU countries ranging from 12.20% to 20.34%. This represented a highly competitive banking environment, but revealed a less improved competitive EU banking system compared to an earlier period of 1994 to 2004 conducted by Carb´o et al. (2009) with an index ranging from 11% to 22%. De Guevara et al. (2007) observed an average of 20.45% for Spanish banking system between 1986 to 2002, likewise Maudos and Sol´ıs (2011) found that the Mexican banking system within 1993 and 2005 was monopolistically competitive. Agoraki et al. (2011), in a study of 13 CEE countries between 1998-2005; Ariss (2010), 60 developing countries including 14 African countries, 1999-2005; Amidu (2013), 55 developing countries inclusive of 22 African countries, 2000-2007; Beck et al. (2013) did a study of 79 countries between 1994-2009; Fu et al. (2014), 14 Asian countries between 2003 and 2010; Berger et al. (2009), 23 industrialised countries, 1999-2005; while employing competition as a variable in their various studies proxies Lerner index and found varied degree of market imperfection in the banking markets considered. We found just (Hussain and Mustapha, 2010) in literature that have considered the determinants of banking competition using banks specific variables in European Union banking sector including some Latin American countries. Their study covered the period 2000 to 2008 and with a panel OLS regression they found that banking market structure is dependent on the characteristics of the industry. They showed that NIM and ROA are negatively related to competition while ECR shows a positive relationship.

Only few empirical studies have measured competition of the banking sectors in the SSA region following the sweeping era of reforms. Without loss of generality, Kouki and Al-Nasser (2014) conducted a study on the implication of competition in 31 African countries, used Lerner index to compute their competition variable and found index waving between 58% in Sudan and 74% in Mauritania with an overall average of 62.21% between 2005 and 2010. Given that his study capturing Africa as a continent did not take cognisance of the peculiarity of the SSA region, this constitutes the gap that this study proposes to fill by measuring the competitive condition

of 37 SSA countries' commercial banking sectors for the period 2006 to 2015 using the Lerner index that is capable of measuring individual bank level competition in the short run and on year-on-year basis.

3. Methodology

A competitive banking environment drives efficiency, access to finance and stability (Casu et al., 2015). The goal of bank under competition according to the industrial organization theory is to manage its volume of loans and deposits such that its corresponding intermediation margin equals its technology Freixas et al. (2008). In other words, competitive banks induce savings by offering high deposit rate, as well as lower its real interest rate for loan to sell more; moreover, the contestable market theory argues that potential competition is enough to drive an efficient pricing banking system. The case is however different for a monopoly bank that is facing a downward sloping demand for deposits and an upward sloping supply for loan, giving it the power to charge very high price for loans and at same time low price for deposits. These suggest that for SSA to harness its potential for growth, its banks must be competitive to mobilize its savings and investment capabilities. It has been argued that SSA developmental aspiration will be unlocked once issues of competition in SSA banks are addressed (Panel, 2014a). Then the question is, how competitive is SSA commercial banks?

3.1 Model Specification

To answer this question, this study will compute the bank level competition index of the SSA commercial banks using Lerner index[2] This method has been widely used in literature and in some studies of the degree of competitiveness of African banks, (see Aboagye et al. (2008) in Ghana, for one country study of SSA and Kouki and Al-Nasser (2014) for a panel of 31 countries in Africa). This study adopts the Lerner index because among its contemporaries, it is one of the most efficient competition measures following the outcome of the correlation of all indicators by Liu et al. (2013). In addition, the index allows for short term estimation and so can be used to compute competition of the banking market at any point in time, (Agoraki et al., 2011; Amidu, 2013; Ariss, 2010; Berger et al., 2009; Fu et al., 2014; Kouki and Al-Nasser, 2014). Finally, it is theoretically sound because it helps to locate the degree of competition between perfect competition and monopoly (Berger et al., 2009; Rojas, 2011). The Lerner index has been criticised by some scholars. There are divergent views on the estimation of price, for instance, while Casu and Girardone (2006) favoured both the traditional and non-traditional activities for price measurement, Molyneux et al. (1994) and Bikker and Haaf (2002), among others, considered just the traditional loan deposits services, this could result in the variation of Lerner index. In addition, it has been argued that the index ignores risk that formed a major part of the costs of banks and the attendant effect would mean inflated index (Tan, 2013). However, research has supported the use of both the traditional and

[2] For the purpose of hindsight, H statistics (Panzar and Rosse, 1987), Boone indicator (Boone, 2008a) conjectural variation approach (Iwata, 1974), persistence of profit (Mueller, 1977) are other alternative methods that could be used.

non-traditional bank activities in price determination because of the increase in non-interest income overtime in banking (Ajisafe and Akinlo, 2013). Moreover, studies that have adjusted the Lerner index to risk found results that are not fundamentally different from the conventional Lerner index. Liu et al. (2013) conducted a correlation analysis of results of competition models and found that Lerner index is one of the two most valid measure of bank competition. To this extent, Lerner index approach which is modelled going forward is considered plausible for this study.

Given that the optimal output, QTY_i, of bank $i, i = 1, \cdots, N$ at time t, is at the point where marginal cost, MC_i, equals its marginal revenue, MR_i, the ratio of the difference between the price, P_i, and the marginal cost, MC_i, on price is the Lerner index denoted as LI_i and expressed algebraically as shown in $equation\,(1.1)$, (see Flamini et al., 2009).

$$LI_i = \frac{P_i - MC_i}{P_i} \tag{0.1}$$

Where P_i is the estimate of average price of bank production in country *i* which is proxy by the ratio of bank total revenue to total assets (Berg and Kim, 1994; Berger et al., 2009; Carb´o et al., 2009; Fern´andez and Gonz´alez, 2005; Shaffer, 2004). To estimate MC_i, the first derivative of translog cost function[3] with respect to QTY_i is computed. The inability to econometrically estimate marginal cost account for the recent application in literature of Lerner index has been known among economists since the mid-30s. Marginal cost is extracted from the cost function through a translog approach.

The translog cost function, used generally in finance (Berger et al., 2009; Kouki and Al-Nasser, 2014) is an expression of a specific production model which for this study is assumed to be specified as the translog production function[4]. The name translog stands for transcendental logarithmic, in other words, translog cost function is a second-order Taylor series expansion of banks cost in natural logarithm. The general form of Taylor series expansion for a function involving more than one variable is given by the expression below;

$$T(x_1,...,x_d) = \sum_{n_1=0}^{\infty} \cdots \sum_{n_d=0}^{\infty} \frac{(x_1 - a_1)^{n_1} \ldots (x_d - a_d)^{n_d}}{n_1! \ldots n_d!} \left(\frac{\delta^{n_1+\ldots+n_{df}}}{\delta x_1^{n_1} \ldots \delta x_d^{n_d}} \right) (a_1,...,a_d)$$

$$= f(a_1,...,a_d) + \sum_{j=1}^{d} \frac{\delta f(a_1,...,a_d)}{\delta x_j} \left(x_j - a_j \right) + \frac{1}{2!} \sum_{j=1}^{d} \sum_{k=1}^{d} \frac{\delta^2 f(a_1,...,a_d)}{\delta x_j \delta x_k} \tag{0.2}$$

$$\left(x_j - a_j \right) \left(x_k - a_k \right) + \ldots$$

Based on the definition of translog cost function, the generalised translog production function which takes into account of *n* inputs (Coelli and Rao, 1998) is given below;

[3] Another way to estimate cost function is the average variable cost expressed as the ratio of total variable cost to total asset or total income. Although this seems a simpler and straight forward approach, it has been argued to be inaccurate.

[4] Some other common production functional forms include; linear, Cobb-Douglas, quadratic, normalised quadratic, constant elasticity of substitution and generalised Leontief functions.

$$ln(Y) = \beta_0 + \sum_{n=1}^{N} \beta_n ln(X_n) + \frac{1}{2} \sum_{n=1}^{N} \sum_{m=1}^{N} \beta_{nm} ln(X_n) ln(X_m) \quad (0.3)$$

Where Y is output, ln is the natural logarithm, X_n are the inputs, β_0, β_n, and β_{nm} are the model parameters. More precisely, β_n, and β_{nm} are the first and the second partial derivatives.

Relying on the intermediation approach for measuring bank output (Ajisafe and Akinlo, 2013; Sealey and Lindley, 1977) the total cost of banks consists of one output, QTY, and three inputs, W_1, W_2, and W_3, representing price of labour (ratio of personnel expense to total assets), price of physical capital (non-interest expense to fixed assets) and price of fund (interest expense to total deposits) respectively. Hence, the total cost function of banks is given by;

$$C = F\left(QTY, W_1, W_2, W_3\right) \quad (0.4)$$

We substitute $Equation\ (1.4)$ in the generalised translog production function in $Equation\ (1.3)$. This produced the translog cost function as shown in $Equation\ (1.5)$ which was obtained by approximating the logarithm of the total cost function by a function of the logarithm of the output and inputs. For the purpose of this work and for simplicity, we drop subscript *it* and denote W_1, W_2, and W_3 as K, L, and M respectively in subsequent equations unless otherwise stated.

$$\begin{aligned} ln(C) = {} & \beta_0 + \beta_q ln(QTY) + \beta_K ln(K) + \beta_l ln(L) + \beta_m ln(M) + \frac{1}{2}[\beta_{qq} ln(QTY) ln(QTY) \\ & + \beta_{qk} ln(QTY) ln(K) + \beta_{kq} ln(K) ln(QTY) + \beta_{ql} ln(QTY) ln(L) + \beta_{lq} ln(L) ln(QTY) \\ & + \beta_{qm} ln(QTY) ln(M) + \beta_{mq} ln(M) ln(QTY) + \beta_{kk} ln(K) ln(K) + \beta_{kl} ln(K) ln(L) \\ & + \beta_{lk} ln(L) ln(K) + \beta_{km} ln(k) ln(n) + \beta_{mk} ln(M) ln(K) + \beta_{ll} in(L) ln(L) \\ & + \beta_{lm} ln(L) ln(M) + \beta_{ml} ln(M) ln(L) + \beta_{mm} lnMln(M)] + \mu \end{aligned} \quad (0.5)$$

Recall from basic partial derivatives that f_{xy} = f_{yx} for any function with two variables. Hence, the second order cross derivatives of the form, $\beta_{nm} = \beta_{mn}$. Based on this,$Equation\ (1.5)$ is simplified thus:

$$\begin{aligned} ln(C) = {} & \beta_0 + \beta_q ln(QTY) + \beta_K ln(K) + \beta_l ln(L) + \beta_m ln(M) + \frac{1}{2} \beta_{qq} ln(QTY)^2 \\ & + \frac{1}{2}[2\beta_{qk} ln(QTY) ln(K) + 2\beta_{ql} ln(QTY) ln(L) + 2\beta_{qm} ln(QTY) ln(M)] \\ & + \frac{1}{2}[\beta_{kk} ln(K) ln(K) + \beta_{kl} ln(K) ln(L) + \beta_{lk} ln(L) ln(K) + \beta_{km} ln(k) ln(n) \\ & + \beta_{mk} ln(M) ln(K) + \beta_{ll} in(L) ln(L) + \beta_{lm} ln(L) ln(M) + \beta_{ml} ln(M) ln(L) \\ & + \beta_{mm} lnMln(M)] + \mu \end{aligned} \quad (0.6)$$

Rearranging $Equation\ (1.6)$ and simplifying it further by collecting like times, it becomes,

$$ln(C) = \beta_0 + \beta_q ln(QTY) + \frac{1}{2}\beta_{qq} ln(QTY)^2 + \beta_K ln(K) + \beta_l ln(L) + \beta_m ln(M)$$
$$+\beta_{qk} ln(QTY)ln(K) + \beta_{ql} ln(QTY)ln(L) + \beta_{qm} ln(QTY)ln(M) + \frac{1}{2}[\beta_{kk} ln(K)ln(K)$$
$$+\beta_{kl} ln(K)ln(L) + \beta_{lk} ln(L)ln(K) + \beta_{km} ln(k)ln(n) + \beta_{mk} ln(M)ln(K) + \beta_{ll} in(L)ln(L)$$
$$+\beta_{lm} ln(L)ln(M) + \beta_{ml} ln(M)ln(L) + \beta_{mm} lnMln(M)] + \mu \quad (0.7)$$

We chose for simplicity to represent the parameters; $\beta_q = \beta_1$, $\beta_{qq} = \beta_2$, $\beta_{k,l,m} = \theta_{1,2,3}$, $\beta_{qk,ql,qm} = \oint_{1,2,3}$, $\beta_{kk,kl,km} = \emptyset_{11,12,13}$, $\beta_{lk,ll,lm} = \emptyset_{21,22,23}$, $\beta_{mk,ml,mm} = \emptyset_{31,32,33}$, and to transform the variables back to their original form such that $Equation\ (1.7)$ becomes;

$$ln(C) = \beta_0 + \beta_1 ln(QTY) + \frac{1}{2}\beta_2 ln(QTY)^2 + \theta_1 ln(W_1) + \theta_2 ln(W_2) + \theta_3 ln(W_3)$$
$$+\iint_1 ln(QTY)ln(W_1) + \iint_2 ln(QTY)ln(W_2) + \iint_3 ln(QTY)ln(W_3) + \frac{1}{2}[\emptyset_{11} ln(W_1)ln(W_1)$$
$$+\emptyset_{12} ln(W_1)ln(W_2) + \emptyset_{13} ln(W_1)ln(W_3) + \emptyset_{21} ln(W_2)ln(W_1) + \emptyset_{22} ln(W_2)ln(W_2)$$
$$+\emptyset_{23} in(W_2)ln(W_3) + \emptyset_{31} ln(W_3)ln(W_1) + \emptyset_{32} ln(W_3)ln(W_2) + \emptyset_{33} lnW_3 ln(W_3)] + \mu \quad (0.8)$$

The reduced translog cost function ($Equation\ (1.9)$) in panel form by bringing back the subscript i that we dropped for simplicity and in introducing time, t, to the model is shown below.

$$ln(C) = \beta_0 + \beta_1 ln(QTY_{it}) + \frac{1}{2}\beta_2 ln(QTY_{it}^2) + \sum_{k=1}^{3} \theta_k ln(W_{kit}) + \sum_{k=1}^{3} \iint_k ln(QTY_{it})ln(W_{kit})$$
$$+\frac{1}{2}\sum_{k=1}^{3}\sum_{j=1}^{3} \emptyset_{kj} ln(W_{kit})ln(W_{jit}) + \mu_{it} \quad (0.9)$$

Where QTY_{it} is bank output measured as the natural log of total assets of bank i in time t (de Guevara and Maudos, 2011), W_{kit} is the vector of the three input prices and μ_{it} is the error term.

Taking the first derivative of the translog cost function with respect to output give the marginal cost as follows:

$$MC_{it} = \frac{\delta C_{it}}{\delta QTY_{it}} = \frac{1}{QTY_{it}}\left(\beta_1 + \beta_2 ln(QTY_{it}) + \sum_{k=1}^{3} \iint_k ln(W_{kit})\right) \quad (0.10)$$

Substituting $Equation\ (1.10)$ for marginal cost in $Equation\ (1.1)$, the degree of competition will be computed using;

$$LI_{it} = \frac{P_{it} - \frac{1}{QTY_{it}}\left(\beta_1 + \beta_2 ln(QTY_{it}) + \sum_{k=1}^{3} \beta_k ln(W_{kit})\right)}{P_{it}} \quad (0.11)$$

According to Leon (2015a), the Lerner index for market j is obtained as follows;

$$L_j = \sum_{i \epsilon j} \phi_{ij} L_{ij} \quad (0.12)$$

Where L_{ij} is the Lerner index of bank i in market or country j and φ_{ij} the weighting of bank i (often the market share of bank i in market j). An unweighted Lerner index implies that $\phi_i = \frac{1}{N}$, where N is the number of banks in market j. Market share has been proxied in literature using the total assets of banks relative to industry, market or country's total asset (Ahokpossi, 2013).

The model for the estimation of the determinants of the competitive condition of the SSA commercial banks is based on Arellano and Bond (1991) and Arellano and Bover (1995) generalised method of moments (GMM). This permits the capturing of the commercial banks specific variables that drive competition while controlling for a range of macroeconomic variables. The estimable version of the model is expressed below;

$$li_{kit} = \delta_{kit} + \lambda li_{kit-1} + \psi_{kit} \Sigma \chi_{kit} + \varrho_{kit} \Sigma \aleph_{kit} + \upsilon_{kit} \quad (0.13)$$

Where the subscripts k_{it} signifies bank, country and year respectively. Li measures bank level competition with its one period lag value, δ is the intercept while λ, ψ, ϱ are coefficients. $\Sigma\chi$ represents the range of banks' specific variables that drives competition, these are; equity capital ratio (ECR), liquidity ratio (LAR), assets quality (QLTY), return on assets (ROA), return on equity (ROE) and net interest margin (NIM). The macroeconomic variables considered are gross domestic product annual growth (GDPG) and annual inflation rate (INF) denoted by $\Sigma\aleph$ with υ as the error term.

3.2. Data

To compute the degree of competitiveness of SSA commercial banks, this study uses the individual bank level annual data sets of 440 banks financial profiles from 37 African countries for the periods 2006 - 2015. The choice of period is informed by data availability on BankScope database compiled by Fitch/IBCA Bureau van Dijk. We excluded countries[5] with issues on data integrity and those we considered outliers.

[5] For instance, South Africa was considered an outlier because of the sophistication of the banking sector and countries like Congo and Sudan were excluded for paucity and integrity of data, resulting from the fact that their economies have been ravaged by wars.

Data on personnel expenses include wages and salaries, social security contributions, contributions to pension funds and other related labour expenses (Delis et al., 2008). For interest expenses, data collected include interests on current accounts, savings accounts, time deposits, repurchase agreements and alternative funding sources such as retail bonds (Tan, 2013; Wang et al., 2014). Non-interest expenses comprise data on administration expenses which include rents, service charges, security, communication and information systems, other office and insurance expenses, professional charges, publicity and advertising, plus depreciation. Data on total revenue include both interest revenue, other operating income and non-interest income. The increase in non-interest income overtime in banking has prompted the use of total revenue in banking research in the recent time (Ajisafe and Akinlo, 2013; Prasad and Ghosh, 2005; Berger et al., 2009).

For the purpose of the determinants of banking competition in the SSA region, we follow (Hussain and Mustapha, 2010) to select bank specific variables of capital, liquidity, quality of assets and profitability measures of banks as potential determinants of bank competition. They argued that changes in these variables have the effects of changing the overall banking conditions, thus hypothesise a logical link to competition. In addition, we included two macroeconomics variables of annual GDP growth and inflation due to the macroeconomic nature of the banking system.

4. Empirical Results

In Tables 1 and 2 below are the results of the competition indices for the SSA commercial banks for the period 2006-2015. We had in Subsection 3.1 modelled the translog cost fiction for the variant of Lerner index used to capture the core activities of commercial banks in the SSA region based on Sealey and Lindley (1977) as their activities to the present are still predominantly intermediation in nature. Hence, Table 2 below contains the summary statistics of the bank level competition reflective of this model. This summary revealed some interesting features of the competitive nature of the banking environment in the SSA region. We found that competition index/degree of market power for individual banks ranges between 0 in 2013 and 0.9978 in 2012 as depicted by the minimum and maximum values. The implication of this is that while some countries have absolute very low market power, others have very high degree of market power with the ability to control a large chunk of the banking environment. However, we found that despite the high degree of market power, the means of the indices are close to the minimum value. We can deduce two possible implications from this. Firstly, is implied that banks with a high the degree of market power are few and in some cases, they are isolated case. This is consistent with literature; using concentration ratio, we found some degree of concentration in the banking sectors of the SSA region. Secondly, the means being close to the minimum suggest some form of competition within the banking sector as the minimum values are close to zero which meant a monopolistic competitive banking market. The standard deviation which measures the deviation from the mean affirms our suspicion providing credence to the conclusion of a competitive banking system.

Table 1: Bank Level's Competition Index Summary Statistics

Year	Mean	SD	Min	Max
2006	0.2557	0.1656	0.0006	0.8370
2007	0.2694	0.1557	0.0129	0.7842
2008	0.2884	0.1773	0.0109	0.9674
2009	0.2939	0.1884	0.0102	0.9213
2010	0.2959	0.1829	0.0004	0.9790
2011	0.2822	0.1728	0.0030	0.9767
2012	0.3237	0.1945	0.0050	0.9978
2013	0.3350	0.3143	0.0000	0.9881
2014	0.3318	0.1855	0.0003	0.9963
2015	0.3244	0.1964	0.0006	0.9957

Source: Authors' Estimation, 2017

4.1. Competition analysis

Specifically, Table 2 shows the results of competition depicting a varying degree of market power in the commercial banking sectors during the periods considered. The total column shows the average index for the countries in the sample and the row total shows the yearly distribution of the index of market power from 2006 to 2016 for the SSA region. Overall, the SSA region's commercial bank competition index stood at 0.2460 during the period of this study. While most countries have their indices below the mean, we found only about six countries above the mean. Furthermore, the results show that out of the six countries with an index above the mean, Botswana, Malawi and Namibia belong to the Southern Africa region with 0.3454, 0.3804 and 0.3784 respectively. Ghana and Nigeria in West Africa also have 0.4352 and 0.3448 with Uganda in East Africa at 0.4221. This suggests that these regions may have the most concentration of market power compared to other regions such as the SSA.

The graphs in Figure 1 and Figure 2 above provide a cursory look at the foregoing results, depicting the analysis of the trend of competition in the regions within the periods under review. Specifically, the graph in Figure 1 represents the country analysis of competition providing a pictorial view of the descriptions attempted above. It suffices to say that the graph shows clearly the distinction of market power amidst the countries of the region, with Ethiopia having the least at 0.0377 and Ghana with the highest at 0.4352. Figure 2's graph depicts the evolution of commercial bank year-on-year competition/market power in the SSA region from 2006 to 2015. The indices peaked in 2008 at 0.2659 and least in 2015 at 0.2300. We noted from the graph that there is a downward trend in market power over the period as indicated by the trend line. This downward movement was maintained except in 2013 when it rose and dropped thereafter.

Table 2: SSA Region Competition Index

Country	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	Total
Angola	0.065421	0.097832	0.120411	0.124526	0.258332	0.207652	0.31061	0.230903	0.204018	0.213769	0.183347
Benin	0.18813	0.268522	0.074342	0.079369	0.109372	0.179535			0.191783	0.028362	0.139927
Botswana	0.41853	0.495537	0.415291	0.398058	0.352876	0.261277	0.290714	0.280079	0.279677	0.261429	0.345347
Burkina Faso	0.071393	0.135803	0.046363	0.068002	0.103534	0.154452	0.086129	0.095664	0.035652	0.018208	0.08152
Cameroon	0.226445	0.100812	0.12154	0.35474	0.38554	0.391537	0.495393	0.515827	0.372902	0.247272	0.321201
Cape Verde			0.080306	0.08957	0.166683	0.126485	0.097364	0.065904		0.016599	0.091845
CAR	0.466527	0.28377	0.567765	0.092447	0.127969	0.132734	0.077789	0.046362	0.122516		0.213098
Chad	0.837031	0.387705	0.275987	0.261423	0.207221	0.296301	0.092021	0.181206	0.147656	0.146466	0.283302
Djibouti	0.101319	0.092217	0.187151	0.074287		0.274413	0.518477	0.467877	0.380818	0.358804	0.272818
E. Guinea									0.274265	0.188215	0.23124
Ethiopia			0.036623				0.01417	0.021523	0.054223	0.061985	0.037705
Gabon	0.304602	0.339941	0.300123	0.257721	0.235867	0.167995	0.148784	0.282051	0.099412	0.119971	0.225647
Ghana	0.445172	0.351556	0.348728	0.462851	0.457683	0.4031	0.429117	0.455854	0.48128	0.516627	0.435197
Guinea	0.141299	0.312424	0.370526	0.074505	0.109427	0.071267		0.145692		0.175163	0.175038
Ivory Coast	0.134617	0.161376	0.143645	0.064083	0.102507	0.119813	0.097698	0.115092	0.11904	0.126009	0.118388
Kenya	0.245114	0.232857	0.277526	0.287116	0.291172	0.302607	0.409676	0.40179	0.385031	0.39278	0.322567
Lesotho		0.2254	0.358871	0.233187	0.171759	0.134115	0.215399	0.285591	0.213069	0.133109	0.218944
Liberia							0.023647		0.20779		0.115718
Malawi	0.456018	0.353385	0.270827	0.30436	0.311011	0.322545	0.390127	0.436769	0.503659	0.455597	0.38043
Mali	0.017308	0.053635	0.075161	0.110276	0.067184	0.092172	0.117589	0.116763	0.075745	0.018696	0.074453
Mauritania	0.236234	0.093693	0.392847	0.255537	0.117236	0.544336	0.109889		0.190124	0.275192	0.246121
Mauritius	0.222107	0.247908	0.292037	0.261771	0.313006	0.250943	0.235541	0.176467	0.059297	0.590743	0.264982
Mozambique	0.228342	0.351254	0.383867	0.308581	0.297472	0.381043	0.385831	0.285624	0.339606	0.306047	0.326767
Namibia	0.444722	0.428396	0.45753	0.460304	0.415033	0.343708	0.281095	0.304976	0.292295	0.355685	0.378374
Niger	0.053738		0.213415	0.186278	0.312917	0.080205	0.070264	0.119265	0.075966	0.105901	0.135328

Country	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	Total
Nigeria	0.224949	0.308661	0.336525	0.450728	0.336709	0.279205	0.379483	0.392744	0.376448	0.362907	0.344836
Rwanda			0.224498	0.264563	0.303845	0.361105	0.300362	0.269553	0.327953	0.297518	0.293675
Senegal	0.248176	0.282613	0.299681	0.292004	0.21978	0.275542	0.147133	0.251955	0.194679	0.123176	0.233474
Seychelles					0.021818			0.27152	0.166672	0.083041	0.135763
Sierra Leone	0.230387	0.238683	0.239474	0.278006	0.238491	0.270726	0.262031	0.275976	0.331167	0.290639	0.265558
Swaziland	0.187937	0.283316	0.398314	0.247199	0.151684	0.087821	0.083403	0.051569	0.11542	0.114098	0.172076
Tanzania	0.177395	0.25941	0.252369	0.281637	0.225099	0.19494	0.303348	0.288705	0.294501	0.289103	0.256651
The Gambia	0.276819	0.346128	0.418295	0.459172	0.348642	0.258864	0.301389	0.189866	0.199847	0.271667	0.307069
Togo	0.159375	0.170577	0.102373	0.059697	0.065713	0.018235	0.157644	0.188696	0.136832	0.09098	0.115012
Uganda	0.367278	0.359364	0.3989	0.404256	0.442976	0.395169	0.425404	0.48976	0.492994	0.445247	0.422135
Zambia	0.297172	0.188736	0.294294	0.292279	0.346161	0.320364	0.185807	0.534413	0.277874	0.337614	0.307471
Total	0.257709	0.256949	0.265927	0.244954	0.23796	0.240631	0.232604	0.257376	0.235889	0.229959	0.245996

Sources: Authors' Estimation, 2016; based on Leon (2015a)'s market Lerner index

Fig. 1: SSA Competition Index by Country

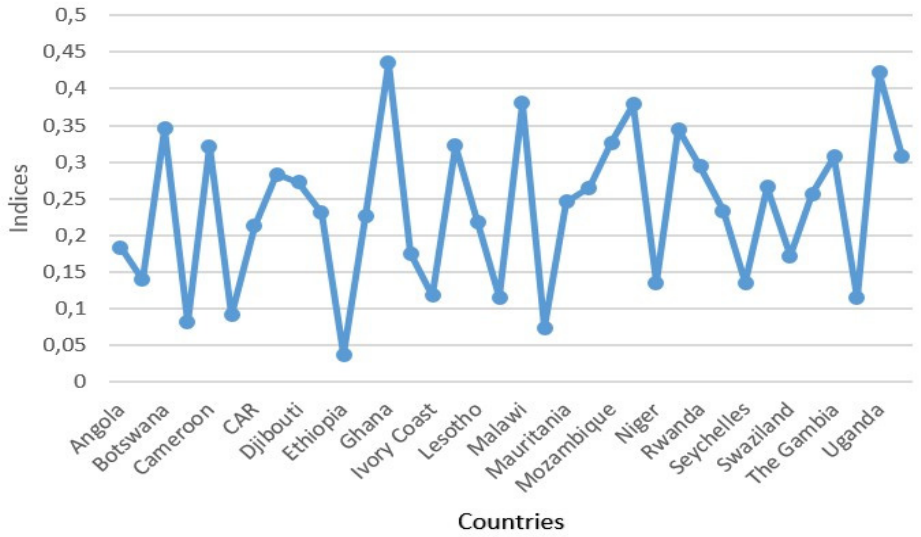
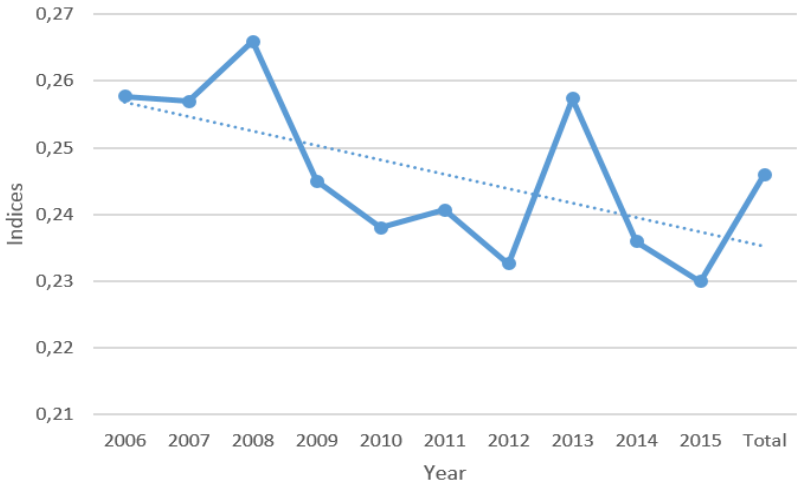


Fig. 2: SSA Competition Index by Year



4.2. Econometric Analysis

The analysis of the determinant of competition in the commercial banking sectors of the SSA region is presented in Table 4 below with the correlation between the endogenous and the exogenous variables reported in Table 3. We found a generally weak, but significant correlation between competition and the determinant variables for most part of the study period. ECR shows negative correlation all through the period while LR exhibits the same association except in 2006 wherein it is positive but rather too weak and insignificant. Although ALQTY shows a positive association, they are not statistically significant. The measures of profitability, ROA, ROE and NIM show positive correlation in most cases, but with mixed significance. This is the same for the macroeconomic variables, GDPG and INF. How much this influences competition will depend on whether the signs are consistent with the results of the econometric analysis in Table 4.

Table 3: Correlation Analysis

	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
li & ecr	-0.143	-0.282	-0.046	-0.145	-0.337	-0.333	-0.306	-0.013	-0.098	-0.023
pvalue	0.048	0.000	0.471	0.016	0.000	0.000	0.000	0.803	0.043	0.635
li & lr	0.005	0.035	-0.020	-0.280	-0.090	-0.144	-0.284	-0.145	-0.163	-0.106
pvalue	0.949	0.611	0.760	0.000	0.127	0.010	0.000	0.004	0.001	0.028
li & aqlty	0.076	0.035	0.011	0.048	0.050	0.026	-0.039	0.043	0.033	0.040
pvalue	0.335	0.636	0.873	0.453	0.425	0.662	0.495	0.429	0.532	0.441
li & nim	0.189	0.163	0.199	0.184	0.266	0.115	0.112	0.220	0.012	0.114
pvalue	0.010	0.018	0.002	0.003	0.000	0.042	0.036	0.000	0.803	0.019

	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
li & roa	0.034	0.265	0.077	0.319	0.039	-0.060	0.121	0.056	0.072	0.006
pvalue	0.643	0.000	0.224	0.000	0.504	0.288	0.022	0.270	0.139	0.897
li & roe	-0.001	0.050	0.079	0.158	0.022	0.010	0.036	0.030	0.007	-0.012
pvalue	0.994	0.472	0.218	0.009	0.703	0.861	0.500	0.552	0.882	0.806
li & GDPG	-0.051	0.009	0.075	0.072	0.067	0.046	0.067	0.042	0.109	0.034
pvalue	0.485	0.892	0.239	0.231	0.253	0.409	0.205	0.412	0.023	0.494
li & inf	0.061	-0.017	0.041	0.093	0.033	0.034	0.062	0.104	0.074	0.134
pvalue	0.404	0.805	0.520	0.126	0.569	0.542	0.240	0.040	0.129	0.008

Source: Authors' Estimation, 2017

Our analysis followed the efficient estimation technique of (Arellano and Bond, 1991) to improve on (Hussain and Mustapha, 2010) and as well account for endogeneity. Hence, we employ the two-step system GMM approach with robust and orthogonal deviation option to analyse the determinant of commercial banks competition in the SSA region. Column 1 of Table 4 shows our main result while column 2 of the table serves as a robustness check on the result to investigate the sensitivity of the result to a further addition of bank specific variables that determines competition in the banking system in literature. The results, at a glance, show that previous year banking competition is a strong determinant of their current competition. This is evidenced by the positive and statistically significant coefficient of the lagged value of competition variable, LI. Contrary to the signs of the correlation result, but in line with our expectations and consistent with the study of Hussain and Mustapha (2010), we found capital, ECR, to be positive and strongly significant to explain competition. A 1% increase in capital is to induce about 4% increase in competitive pressure of the banking system. Both liquid assets, LAR, and asset quality, AQTLY exhibit strong significance, but negative relationship with competition. While this is consistent with the correlation results, we expect positive signs as banks are most likely going to find incentive to compete with more liquidity at their disposal, although issues of how much liquidity could be used up in the ordinary cause of their business is a subject of regulation. Similarly, the better the quality of asset the more competitive we expect the sector to be, however, the result might as well reflect the reality as the quality of asset in the study period is not particularly superb as shown in the descriptive statistics. All the performance measures employed, NIM, ROA and ROE, and are significant and positively related to competition, with the exception of ROE that is negative. The results of ROA and NIM do not follow the study of Hussain and Mustapha (2010) who found them to be negatively related to competition in their studies. We indeed expect a profitable bank to find incentive to compete and this is the case with the SSA commercial banking sector. In closing, GDPG and INF are found to be positive and strongly significant to determine competition in the banking sector of the SSA region. This is in fact in line with a priori, growth period encourages more economic activities while in periods of rising price level banks would strive to keep their firm's value by competing the more.

Table 4: GMM Regression Result

VARIABLES	Model 1 lerneri	Model 2 lerneri
L.lerneri	0.575***	0.575***
	(0.000637)	(0.000703)
size		0.0978***
		(0.0186)
ecr	4.218***	4.493***
	(0.222)	(0245)
lar	-0.781***	-0.647***
	(0.0427)	(0.0429)
aqlty	-1.180***	-0.980***
	(0.264)	(0.29)
nim	0.874***	1.157***
	(0.18)	(0.195)
roa	0.0391***	0.0279***
	(0.0057)	(0.00609)
roe	-0.00402***	-0.00324***
	(0.000786)	(0.000817)
gdpg	0.500***	0.524***
	(0.146)	(0.145)
inf	0.00858***	0.00844***
	(0.00123)	(0.00126)
Constant	-0.387***	(-1.724***
	(0.0333)	(0.248)
Observations	2.306	2.306
Number of id	393	393
Number of instruments	117	117
Wald χ^2 (9)	1.25E+06	1.31E+06
Prob > χ^2	0.000	0.000
AR2 (p-value)	0.285	0.297
Hansen J Stats (p-value)	0.373	0.388

standard error in parentheses; *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.
Source: Authors' Estimation, 2017

For robustness, we introduced bank size as a determinant of competition in the banking system based on the structure-conduct-performance (SCP) hypothesis theory. We found that while size is positive to explain competition in the region; the inclusion does not change the signs and significance of the various determinants that were considered and discussed above.

The variation in the bank level market power index as shown by the margin between the maximum and the minimum values in the competition summary statistics in Table 1 of this study, is an indication of the pockets market concentration that is found to be prevalent in most Sub-Saharan African banking markets (Mlachila et al., 2013) and in our reviews. These call to mind whether the various regulations implemented to ensure a competitive banking system have fully actualised their aims. We have also found results that are consistent with studies in the extant literature as per the behaviour of bank level competition in a number of SSA countries in which similar studies have been carried out. Kouki and Al-Nasser (2014) found an average market power index of within 58% and 74% within the period 2005-2010. Studies by

Aboagye et al. (2008), Amidu (2013) and Ariss (2010) found a varying degree of market power in a number of countries that were studied.

In the case of market competition, it is not surprising, as already stated, to find a competitive market, which in this case is in the form of a monopolistic competitive market. This, no doubt, is informed by the contestable market theory of Baumol et al. (1982) who argued that even in the face of market power and/or market concentration, a market could be contestable, as the threat of entry will impact on the behaviour of the incumbents in the market. How much this competition has impacted on the extent of financial intermediation as the core banking function in the region has left much to be desired. As shown in statistics by the World Bank Development Indicators over our study period, interest rate spread is high, banks credit to the private sector is low, lending cost is high, while deposit rates could not be said to be moderate, and banking coverage is low on aggregate. These indicators are not consistent with a competitive market environment, which should mean the reverse. Unfortunately, banks in the region are being accused of competing for government funds rather than mobilising surplus for deficit financing of the real sector of the economy, which could engender an overall growth in the long term. It is also noteworthy to argue that other factors relating to state policies that favour certain banks over the others, and a range of other exogenous factors other than were discussed here account for why the current competitive nature of the banking system could not help to impact on these development indicators in the region and we recommend further studies to investigate these. This, notwithstanding policy implication, will be to seek macroeconomic policies that gel with relevant statutory pronouncements and will complement the current level of market competition, while continually working to encourage the antitrust authorities to keep market power as low as practicable.

Ultimately, we found all the bank specific variables considered to be significant in determining the level of competition in the region. Capital especially increased the level of competition considerably as well as the level of performance including macroeconomics variable of annual GDP growth and inflation. Both the quality of assets and liquid assets were found to be indirectly related to the level of competition when, in fact, we expected a direct relationship. The fact that these variables can significantly influence competition in the region suggests that they can be tinkered with to moderate as well as increase the level of competition especially for a region that seeks to increase the competition conditions of its banking sectors.

5. Summary and Conclusion

The Lerner index has been used to analyse the bank level and market competitive condition of the SSA commercial banks. We took account of the various criticisms of the Lerner index, notably that it ignores risk which is fundamental in bank cost and price measurement that has no single acceptable measure. As plausible as the arguments may be, empirical evidence has shown that studies that have adjusted for these issues have not achieved much remarkable difference from the results of the conventional Lerner index. Moreover, studies of Liu et al. (2013) revealed the Lerner index to be one of the two must valid ways of measuring competition hence validating our methodology. We also modelled the translog cost function to reflect that the core activities of commercial banking sectors in the SSA region still remain that of intermediation.

The study found a mixed market power at bank level across the 37 SSA countries that have been considered. Meanwhile, at market level lower market power is seen depicting a relatively competitive banking sector. Hence the study concludes that the SSA banking sector is competitive notwithstanding that it is laced with varying degree of market power. This thus give credence to the theory of contestable market that although there may be high market power residing in the banks, the threat of potential entry will make the market contestable. Mlachila et al. (2013); Senbet and Otchere (2006) found that banks in Africa and implied SSA countries jostle for government rather than performing the main financial intermediation role of mobilising surplus unit saving to bridge the gap of deficit units. We recommend that while the antitrust agency still needs to concentrate more efforts at devolving the market powers that reside in the individual banks, it should continuously maintain and improve on the market competition. Furthermore, fiscal and monetary policies must be harnessed to take advantage of the subsisting competitiveness of the region banking sector to cash in on the much-needed economic growth. Attention should also be paid to capital and other bank specific variables that impact on bank competition in the region. We also recommend studies should take into consideration the influence of state on the operations of the banking system in the region to further shed light on the nature of the system for a holistic policy implication.

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STUDIA UNIVERSITATIS BABEŞ-BOLYAI OECONOMICA
VOLUME 62, ISSUE 2, 2017, pp. 77-88
DOI: 10.1515/subboec-2017-0010

THE IMPACT OF THE PROBLEMS FACED BY ONLINE CUSTOMERS ON ECOMMERCE

Simona SABOU[*]
Technical University of Cluj-Napoca, Romania

Bianca AVRAM-POP
Technical University of Cluj-Napoca, Romania

Liliana Adela ZIMA
Technical University of Cluj-Napoca, Romania

Abstract. The purpose of this study is to identify the behavior of customers in the online environment. We analyzed the evolution, characteristics, advantages and disadvantages of this type of commerce, and its implications on the consumers. In order to identify the customers' behavior online, we selected three variables which are characterized by time intervals of the latest online order, and six variables which analyze the main problems faced by consumers of goods/services bought online (a long shipping time, damaged products, non-compliant products, fraud related issues, underperforming complaint system, technical issues, lack of customer and legal aspects). Online commerce is less developed in the Czech Republic, Romania, Poland, Lithuania, Ireland, Bulgaria, Estonia, Slovenia and Norway. But, the advantages of ecommerce weigh more for the consumer than the problems they face, for example: online shoppers will continue to make online purchases even if they have experienced delays in delivering goods/services, damaged products, online fraud, technical problems or difficulties in finding information about the warranty of goods/services.

JEL classification: E20, F10

Keywords: e-commerce, unsatisfied customers, European states.

[*] Corresponding author. Address: Faculty of Sciences, Technical University of Cluj-Napoca, North University Center in Baia Mare, Victoriei, nr. 76, 430122, Baia Mare, România, Tel. 0262-276059, E-mail: simona.sabou@gmail.com

1. Introduction

The Electronic Data Interchange (EDI) first appeared in the 1960's and can be considered the forefather of Electronic Commerce (EC) (Antohi, 2009). Cyberspace has brought about an era during which acquisitions and sales have become more automated and more convenient, businesses have become interconnected and have also connected with their customers in a network, time and distances, which acted as commercial barriers and required high costs in the past, have shortened immeasurably, and vendors continuing to sell the old-fashioned way will disappear from the marketplace (Kotler, 2003). As the use of the internet has increased, e-commerce has become available for a great number of customers (Holdorf and Haasis, 2014), and predictions show the electronics links between companies will intensify (Benjamin and Wigand, 1995). In recent years, the Internet (and its technology) has brought about an increase in international commerce (Totonchi and Manshady, 2012). The volume of international commerce will increase through e-commerce (Terzi, 2011). Since the first online transaction, which was first performed in 1995, to the present day, e-commerce has grown rapidly (Laudon and Traver, 2013).

Consumers are ever more attracted by online shopping due to their attitude as regards saving time, price flexibility and availability of various products and a range of products on one platform (Ferri et al., 2008). Online shopping has been growing in time because more and more consumers have begun trusting online commerce and have moved a significant part of their shopping online (Lixandroiu, 2017).

The consumers in the European countries also join this evolution. But being a relatively new phenomenon, their behavior can be influenced by the various difficulties which appear in the online environment. That's exactly why we have proposed in this paper to analyze how it affects the problems encountered by online customers developing this type of commerce.

2. Literature review

E-commerce is a new way of doing business (Seyal and Rahman, 2003). Several authors have tried to define this notion. E-commerce represents the use of electronic devices in doing business (Choi et al., 1997) or the process of buying and selling products or services which use electronic data transmission by means of the internet (Grandon and Pearson, 2004).

Electronic commerce means using the computer and the internet when proposing businesses, including the selling, buying, and exchange of goods, services, and information (McKay and Marshall, 2004). Another definition of electronic commerce refers to the electronic exchange of information, goods, services, and payments (Harrington and Reed, 1996).

E-commerce is the enterprise of buying and selling by means of remotely sending data, which is specific to the expansive policy of the commercial companies' marketing strategy (Bucur, 2002).

Many studies have noticed the benefits and the impact of e-commerce, these being summarized as follows (Nejadirani et al., 2011):

- it offers unmatched savings as regards transaction costs;
- it reduces advertising and promotion costs;
- it grants fast communication between the buyer and the seller;
- it minimizes transportation obstacles;
- it limits delivery costs;
- it eliminates the physical limitations of time and space.

E-commerce intensifies competition and generates advantages for the consumers, who can get lower prices due to having several options (Malkawi, 2006). Moreover, the development of global markets through the internet makes historical relations less important and suggests that countries with the least previous commercial relations have the most to gain from e-commerce, especially developing countries (Freund and Weinhold, 2004). E-commerce can add more value to enterprises and consumers in developing countries than in developed countries (Annan, 2001). The legal regulations of e-commerce are justified since its dynamics leads to the creation of a significant market, and most laws regarding e-commerce state that transactions carried out over the internet fall under the jurisdiction of the supplier's country (Bătăgan et al., 2010).

Ensuring the consumer's protection in the virtual environment, where the commercial transaction is carried out, requires the existence of new and extremely important aspects regarding the security of the consumer (Surcel and Dinu, 2007). E-commerce comprises a wide range of problems such as security, trust, reputation, legal framework, payment mechanisms, advertising, online catalogues (Haleema and Iyengar, 2016).

The issues regarding security and the legal framework are the most recent problems which prevent companies from joining e-commerce (Savrul et al., 2014). One reason why consumers do not buy online, which is often mentioned, is the lack of trust (Petrovic et al., 2003). Trust has always been the underlying component, with great importance within the uncertain, internet-based environment of e-commerce (Gefen and Straub, 2003).

Within e-commerce the behavior of consumers from various areas could differ because of the geographical and cultural environment, as well as because they live in different countries and social cultures (Dabidian et al., 2016). Thus, the manner of shopping could differ very much from region to region (Zhou and Wang, 2014).

Some advice regarding safe online shopping and payments could be summarized as follows (Bătăgan et al., 2010):

- the need to take a closer look to the type of information generally requested when buying goods and services online;
- the need to be careful to the rights regarding the physical delivery of the products ordered online, the right to return the ordered products if they do not meet the requirements.

Within e-commerce, the behavior of consumers tended to be concerned mainly with functional and utilitarian considerations (Brown et al., 2003). The study of e-consumer behavior is gaining in importance due to the proliferation of online shopping (Dennis et al., 2004). The behavior of online consumers is not yet fully understood, due to the fact that there are a lot of problems that clients encounter. Therefore, in this paper, we are trying to analyze some of them.

3. Research Methodology

The aim of this study is to identify the behavior of customers in the online environment – a hot topic recently. The results of this study should serve both policy makers who need to implement and adapt laws that protect both consumers, as well as companies involved in ecommerce. The latter must adapt their online sales strategies according to customer needs, both loyal and potential clients.

In order to achieve this, we selected 3 variables which are characterized by time intervals during which the latest online order was made (the last 3 months, 3-12 months, more than 1 year), and six variables which analyze the main issues consumers of goods/services bought online are faced with (long shipping time, damaged products, non-compliant products, fraud related issues, underperforming complaint system, technical issues, lack of customer and legal aspects).

All these variables are expressed in percentages (e.g.: the percentage of individuals who placed their latest ordered within the past 3 months of the total number of individuals living in the country or the percentage of individuals for whom the delivery of goods lasted longer of the total number of individuals ordering over the internet) and are related to the population of the 29 European states, the data being collected from the EUROSTAT website and referring to the year 2016.

We used graphics in order to present the three variables for each country included in the study. Moreover, in order to analyze the manner in which problems occurring within online commerce influence the buyer's decision, we want to study the relation between the time interval of the latest online order and the difficulties which occur most often in this situation, and for this we used the statistics software SPSS (Statistical Package for the Social Sciences).

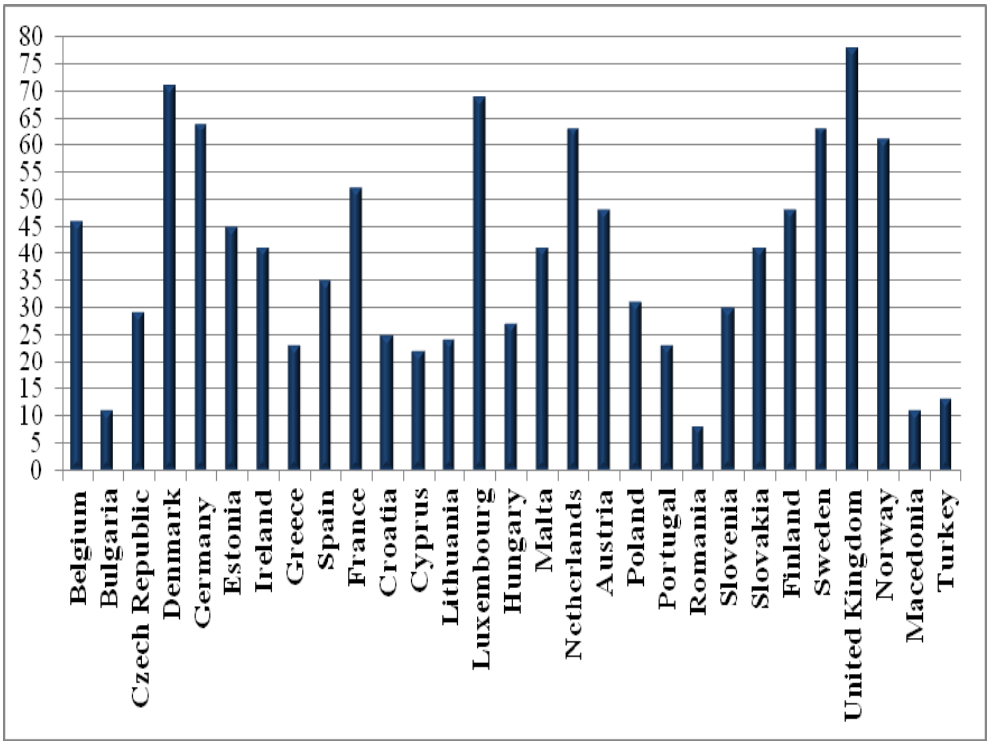
4. Outcomes and Discussions

To begin with, it is important to identify and analyze the differences which appear amongst European states when considering the time interval of the latest online order. Thus, in figure 1 we present the percentages of individuals of the 29 European states included in the analysis who placed at least one online order within the past 3 months of the total number of individuals. One can notice in this figure that Great Britain holds the highest percentage (78%) of individuals who purchased online a good/service within the past 3 months, while at the opposite end of the scale one can find Romania, a country where only 8% of the population made at least one online purchase over the analyzed period of time. Close to Romania, at the end of the classification, one can find countries such as: Bulgaria (11%), Macedonia (11%) and Turkey (13%). As regards this percentage of individuals, we calculated the average of the 29 European states and thus obtained the value of 39%. Thus we can identify the states which are bellow this value. There are 14 countries in total, amongst which: Bulgaria, the Czech Republic, Spain, Croatia, Lithuania, Hungary, Poland, Portugal, Romania, Cyprus and Turkey.

With this analysis we seek to identify the European states where e-commerce is not very well developed because certain interventions and changes need to happen here in order to generate its development. In the above list one can notice

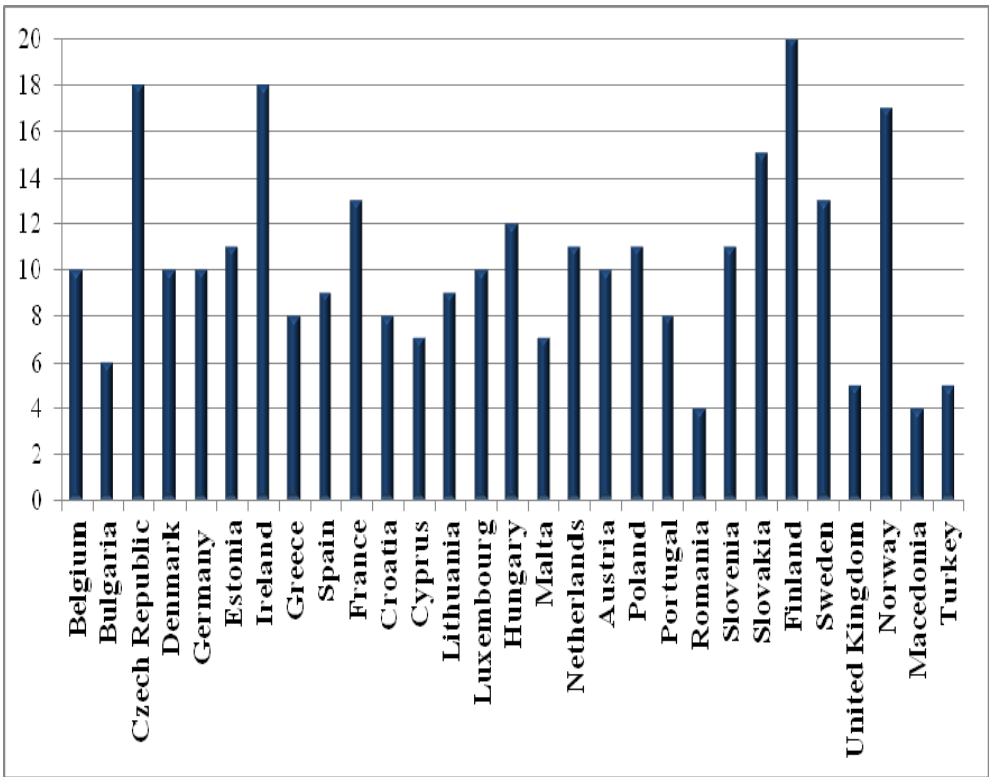
that the economy of most countries included here is developing (e.g.: Romania and Bulgaria), as well as the fact that there are cases where its growth is very slow (e.g.: Greece, who had to enforce some austerity measures during the recent years).

Fig. 1. Representation of the European states depending on the percentages of individuals who placed at least one order within the past 3 months



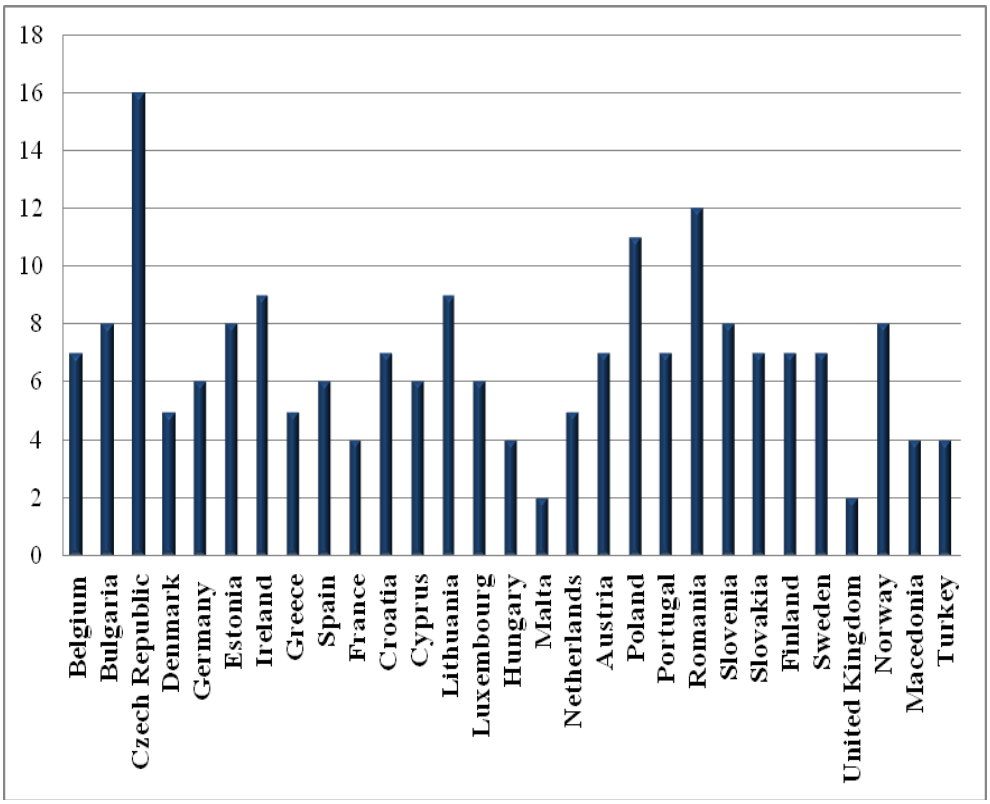
As regards the percentages of individuals who shopped online within the time interval of 3-12 months, seen in figure 2, the classification changes, the top positions being held by Finland (20%), the Czech Republic (18%) and Ireland (18%), while the bottom positions are held by Romania (4%), Macedonia (4%), Turkey (5%) and Great Britain (5%). The small percentages recorded by Great Britain as regards the latest online order placed within the 3-12 month time interval and the one placed more than one year before (2% - figure 3) is due to the fact that over 70% of the individuals often shop online (at least one order within the past 3 months). As regards the other 3 states at the bottom of the hierarchy, the explanation is different and is related to the level of development in these countries. Five of the 29 European states record the average value of the sample (10%) when speaking about the percentage of individuals who ordered a good/service online within the time interval 3-12 months. These countries are characterized by stability and a strong economy: Belgium, Denmark, Germany, Luxemburg and Austria.

Fig. 2. Representation of the European states depending on the percentages of individuals who placed the latest order within the 3-12 months time interval



The last figure included in this paper, figure 3, represents the percentages of individuals who have not ordered anything online for over a year. Thus the states where these values are higher, e-commerce is less developed. Here are some examples of such states: the Czech Republic, Romania, Poland, Lithuania, Ireland, Bulgaria, Estonia, Slovenia and Norway. All of the above states are characterized by percentages of individuals who order online higher than the average value of 7%.

Fig. 3. Representation of the European states depending on the percentages of individuals who placed ordered a good/service online more than one year before



In order to better understand e-commerce in Europe, we calculated the descriptive statistics of the percentages of individuals depending on the time interval of their latest online order. If the minimal and maximal values were highlighted in the above representation of the three variables, in table 1 we calculated the range, which is the difference between the extreme values, offering an image of the scope of the data. The highest range can be found, as expected, in the percentage of individuals who placed at least one online order within the past 3 months (70), being followed at a great distance by the one for online shoppers within the past 3-12 months (16), a range which nevertheless is close to the one recorded in the case of individuals who ordered at least one good/service more than one year before (14).

The fact that the average value and the modal values are equal in all three situations can be explained by the limited size of the analyzed sample (29 European states). Thus the value which divides the observations in two equal parts and the one which can be found most frequently in the series of data is 41 in the case of individuals who ordered online within the past 3 months, 10 when the latest order was placed within the past 3-12 months, and 7 when the period is over on year.

Table no. 1. Descriptive statistics of the values which describe the time interval of the latest online order

	Customers of e-commerce within the past 3 months	Customers of e-commerce within the past 3-12 months	Customers who shopped online more than 12 months before
Range	70	16	14
Mean	39.41	10.3448	6.7931
Median	41	10	7
Mode	41	10	7
Std. Deviation	19.785	4.20269	2.89555
Variance	391.466	17.663	8.384
Skewness	0.243	0.63	1.103
Kurtosis	-0.933	0.009	2.708

In table 1 we also represented the variance and the standard deviation, yet we shall only explain the values of the latter because it represents the square root of the variance, being a more precise parameter. The standard deviation shows the average deviation of the recorded values as compared to the average values. As regards the three variables analyzed descriptively, the standard deviation (19.785 – customers of online shopping within the past 3 months, 4.20269 – customers of online shopping within the past 3-12 months, and 2.89555 – customers of online shopping more than 12 months before) is far below the average value, which means a wide spread of the studied values.

In analyzing the series of data we also used the Skewness and Kurtosis indicators. Skewness indicates the deviation of the empirical distribution in relation to a symmetrical distribution around the average, and the values higher than 0 in all three variables show that the distributions are tilted towards the left, with more extreme values towards the right. The value of the Kurtosis indicator is used in order to indicate the level of flatness of pointedness of a distribution, and is compared with value 3. Thus all 3 variables have flatter distributions than the average and have values dispersed over a wider interval around the average.

The graphical representation of the European states as regards e-commerce serves in creating a classification which points out the top and bottom positions.

In this paper we want to carry out a more complex analysis of e-commerce in Europe, and in order to achieve this we identified in table no. 2 the correlation between the frequency of online orders and the main six problems individuals face when buying online (it takes a long time to deliver the goods/services, the goods/services are damaged are do not correspond with the ordered, fraud related issues, complaints were not solved or there was no satisfactory solution, technical problems and difficulty in finding information regarding guarantees/warranties, and other legal rights).

Table no. 2. Spearman correlation coefficients between the time of the latest online order and the main problems customers face

		Customers of e-commerce within the past 3 months	Customers of e-commerce within the past 3-12 months	Customers who shopped online more than 12 months before
Speed of delivery longer than indicated	Correlation Coefficient	.890*	.543*	-.185
	Sig. (2-tailed)	.000	.002	.336
	N	29	29	29
Wrong or damaged good/services delivered	Correlation Coefficient	.864*	.250	-.284
	Sig. (2-tailed)	.000	.218	.159
	N	26	26	26
Problems with fraud	Correlation Coefficient	.532*	.216	-.431
	Sig. (2-tailed)	.016	.360	.058
	N	20	20	20
Complaints and redress were difficult or no satisfactory response received	Correlation Coefficient	.753**	.175	-.251
	Sig. (2-tailed)	.000	.424	.247
	N	23	23	23
Technical failure	Correlation Coefficient	.879**	.409*	-.083
	Sig. (2-tailed)	.000	.031	.674
	N	28	28	28
Difficulties finding information concerning guarantees	Correlation Coefficient	.749**	.120	-.452*
	Sig. (2-tailed)	.000	.587	.030
	N	23	23	23

Due to the fact that the database is made up of a small number of observations (29 states), for the study of the impact of difficulties customers face when ordering online upon the frequency of the buyer, we chose to use a non-parametrical test. Moreover, the characteristic of the variables used for the analysis (quantitative analysis) allows the calculation of the correlation between the variables with the the Spearman test. The results of this test are presented in table no. 2, where for every association between a problem customers faced and the percentage of those who made a purchase within the past 3 months, 3-12 months or more than 12 months.

We start the analysis of the correlation between the frequency of online shopping and the main problems occurring in this field with individuals who purchased online at least one good/service within the past 3 months by comparing the Sig values of column 3 with the chosen significance threshold (0.05). Subsequent to this operation, we reached the conclusion that there are relations (marked *) between the percentage of individuals who faced all six studied problems and those who ordered online within the past 3 months. Moreover, all these correlations are positive, which means that as the percentage of people who face one of the problems presented above when ordering online grows, so will the percentage of those who ordered online within the past 3 months.

Positive correlations, yet weaker in intensity, are also formed between the individuals who last ordered online within the past 3-12 months and those who waited for a long time for the good/service to be delivered (Sig=0.002<0.05). Moreover, the former category of individuals is significantly influenced by individuals who faced technical difficulties when ordering online (Sig=0.031<0.05). These two correlations lead to the idea that as the percentage of individuals who faced these two types of problems grows, so will the percentage of those who placed an online order within the 3-12 months time interval.

If we take a look at the last column, where the coefficients of the correlation between the six categories of problems occurring in e-commerce and the percentage of individuals who did not place any online orders within the past year are calculated, we can notice only one correlation (between the percentage of individuals who had difficulties in finding information about guarantees/warranties and those who rarely order online), and this is a negative one (the Sig value = 0.030<0.005, and the Spearman coefficient = -0.452). This correlation signifies that as the percentage of individuals who had difficulties in finding information about guarantees/warranties grows, the percentage of those who rarely ordered online will decrease, and vice-versa. In this situation there are two possibilities: either some of the customers who do not order online often stop ordering entirely or order even more rarely, being discouraged by this problem, or they order more often and then the percentage of those who ordered online one year ago will decrease and the percentage of those who purchased something online within the past 3 months and 3-12 months respectively will increase.

5. Conclusions

In an ever-developing market, subjected to globalization, it is important that both businesses and decision-makers make sure that e-commerce is carried out fairly. The expansion of this sector needs careful monitoring and analysis due to the huge potential of development it has, but they also need to ensure the safety of online consumers by clearly stating the rights and obligations of each party, by eliminating fraud or ensuring technical maintenance of the online store.

At European level there are significant differences as regards of e-commerce, which occurred due to the different levels of economic growth and level of education of every people. In order for an individual to order a good/service online they first need access to a computer/phone/laptop and to the internet, as well as knowledge to use these devices. Moreover, e-commerce is also influenced by the difficulties the customers face. What is interesting is the fact that as the number of unsatisfied customers increases, so does the number of people who order online more often. Amongst the possible explanations of this phenomenon one can mention the advantages e-commerce has for shoppers, such as: fast shopping at any time of the day or night, fast product/service search, as well as the possibility of comparing prices and the quality of these products/services, and the multitude of choices.

These are only the most important advantages of e-commerce for the consumer, which make him/her overcome the problems he/she faces when shopping online and continue to purchase goods/service in online shops. Despite these, vendors should not neglect the problems occurring along this process because competition is fierce and customer can easily choose someone else.

The advantages of ecommerce weigh more for the consumer than the problems they face, for example: online shoppers will continue to make online purchases even if they have experienced delays in delivering goods/services, damaged products, online fraud, technical problems, or difficulties in finding information about the warranty of goods/services. Moreover, those who never ordered online are not discouraged by such problems as even as the number of unsatisfied clients grows, the number of those who make frequent online purchases will also grow.

At the opposite end there are the customers who rarely order online and who are not at all influenced by the problems which may occur when ordering online, except difficulties in finding information about guarantees/warrantees and other legal rights, an issue which deters many buyers from purchasing online.

A limitation of this study is the impossibility of conducting these analyzes at the level of each European country as there is insufficient data collected, much of it being accumulated over a period of 10 years, inadequate for formulating relevant conclusions. In few years, this specific shortcoming can transform and it might enable us to creating robust data bases that allow for the study of ecommerce in each European country. This is a proposal for future articles in the field.

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