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Contact
„Alexandru Ioan Cuza" University of Iasi
Faculty of Economics and Business Administration
Bd. Carol I no. 22, Iaşi - 700505, Romania
Tel.: +40232 201433, Fax: +40232 217000
Email: saaic@uaic.ro, Website: http://saaic.feaa.uaic.ro

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NEW CONCEPTS OF INNOVATION IN ECONOMIC SCIENCES – IMPLICATIONS IN THE FIELD OF FOOD ECONOMY

Małgorzata JUCHNIEWICZ*
Barbara GRZYBOWSKA**

Abstract

The development of innovation theory points to the growing importance of innovation in the processes occurring in the economy. The paper characterizes evolutionary changes innovation models - starting with the linear models up to the cooperation network concept. Particular attention was paid to the creation of contemporary models of innovation and the possibility of their implementation in the food industry. It was found that innovation should increasingly be based on the concept of open innovation. It assumes the active participation of many actors in the creation of cross-organizational knowledge and skills improvement. This trend may be the answer to food industry companies to the growing competitive pressure in global markets.

Keywords: innovativeness, innovation model, open innovation, user-driven-innovation, open knowledge

JEL classification: A10, L66, 030, 011

1. INTRODUCTION

In the contemporary economy, focus of structural changes on innovation and innovativeness is consistent with the fundamental cultural and civilizational changes taking place in the global environment. Those changes at the same time modify approach to innovation in the theory of economy. Evident transition from the neoclassic through endogenous to evolutional economic growth theories that result in changes to the innovation models is noticeable. Initially the supply and demand based concept of creating inventions and technological progress developed in the economic theory. Those models referred to the deterministic resource allocation model based on single direction in the information flow (from the buyer to the manufacturer – market pull model or from the manufacturer to the buyer – technology push model). Being sequential in their nature, they did not consider the feedbacks typical for modern economies. The evolutional economic growth theory, highlighting the importance of knowledge and learning processes taking place within the complex relations involving numerous entities of the economic scene caused changes in the

* University of Warmia and Mazury in Olsztyn, Poland; e-mail: *mali@uwm.edu.pl.*
** University of Warmia and Mazury in Olsztyn, Poland; e-mail: *barg@uwm.edu.pl.*

approach to the innovation models. The most important and best visible trends in that area include treatment of innovation activity as a system that requires combined action of numerous entities. As a result, the concepts of interactive innovation models were developed: the model of feedbacks and interactions (so-called chain-linked model) by Kline and Rosenberg (1986), the „feedback" model by Rothwell and Zegveld (1985) as well as the network and systemic innovation process concept. The presented innovation models indicate at the same time, which is correctly noticed by Rogut (2007), the necessity for changing the views concerning the character of advantages determining success in the contemporary world. The author, referring to the works of Porter, (1990, 1998), states that the first of such changes occurred during mid-1970-s. It involves shifting the focus from comparative advantages to competitive advantages. Continuing those considerations she states, after Cooke and Leydesdorff (2006), that the economies in which rapid and effective process of learning and development of friendly environment for exchange of knowledge are the most effective economies functioning in the global environment. Consequently the concept of intended advantages emerges. Such advantages are built on the foundations of knowledge based economy while simultaneously using the instruments applied in parallel in a number of interlinked areas. Another evolutional change in the approach to the innovation models on the grounds of economic sciences was related to the finding that the tacit knowledge was the major source of innovation (Chaminade and Roberts, 2002, p. 11). In the currently described innovation models at micro-, meso- and macro- levels the exchange of knowledge during various processes of group interaction is of the critical importance. In this context, making use of generally available knowledge generated based on public funds and for the general benefit (the so-called knowledge spillover) is also important. Joint use of knowledge resources allows the synergy effect involving simultaneous increase of innovation and value of the knowledge itself. In the economic sciences the following innovation models are currently present: the open innovation, user-driven-innovation and the open knowledge idea.

2. MODERN INNOVATION MODEL CONCEPTS – THEORETICAL PRESENTATION

Increasing the level of innovation and competition of enterprises, regions and countries is seen increasingly frequently from the perspective of the necessity for establishing relations among organisations, clients, suppliers, competitors, public and private research institutions or enterprises, even seemingly unrelated. It is to allow, as a consequence, allow acquiring additional knowledge and skills generating innovation improvement at business and territorial entities (Hauser *et al.*, 2006, p. 688). Hence, intensification of activities aiming at expanding collaboration between entities and sharing the knowledge is the key element. The concept of open innovation by Chesbrough (2003) fits that flow of economic considerations. The paradigm of open innovation model is based on the assumption that business entities may and should search for opportunities for innovation improvement not only within their structures but also in their environment. This equalizes the importance of the internal and external paths of creating innovations and treats them as complementary. Pomykalski (2011, p. 139) claims also that under conditions of open innovation the principle of maximising the values originating from different ideas, emerging within the organisation and outside it is the most important. This means that its formal frameworks represent just a conventional border in the flow of knowledge between organisation and its environment. It is worth mentioning here that this is a very wide concept, it is the subject of interest for

numerous scientific disciplines, not only economies but also, e.g. psychology, sociology and even cultural anthropology (von Krogh and Spaeth, 2007, p. 239).

Within the open innovation concept two its dimensions can be identified: the *outside-in open innovation* and the *inside-out open innovation* (Chesbrough and Garman, 2010, p. 49). The outside-in open innovation is based on the principle of knowledge flowing into the organisation and making use of external cooperation. The inside-out open innovation assumes transfer of a part of the resources or projects outside the organisation. This approach means, on the one hand, extensive and selective use of the knowledge available in the environment and on the other, less closing the knowledge within the business entities. In the first case, the propensity to undertake cooperation by business entities is higher – enterprises (or industry sectors) may generate benefits from access to knowledge, innovation and technology developed and financed earlier by other entities. The situation where organisations transfer their knowledge to the environment finds much lower acceptance in them (Cheng and Huizingh, 2010). Kline (2003, p. 91) claims that the situation results, among others, from the historical considerations and the fear of making own knowledge available to others. This is interrelated mainly to protection of intellectual and industrial property rights.

The open innovation concept assumes searching for innovative solutions in the environment. The idea of *user-driven-innovation* (UDI), which is based on better understanding and knowledge (of both open and tacit) needs and expectations of the consumers is a consequence and a specific variation of that model. It can be defined as the process of using the knowledge of the users for the purpose of developing new products, services and concepts, which are based on true understanding of the user needs, and which involves the users in the enterprise development process in a systematic way (NORDEN, 2008, p. 8). The client has always been and will be the reference point in development of new concepts. This approach, hence, is not an innovative approach. The new element in the UDI though is the systematic and scientific approach in determining the client needs. It assumes not only obtaining information from the consumers (as it took place most often in the past) but also including them to take active part in the innovation activity. Participation of the users in the innovation process allows presentation of own demands that will be satisfied later. This takes place thanks to the increasingly common acceptance of the open innovation model. Not without importance here are also the information technology solutions that facilitate communication among the innovation process participants. Hence, the enterprises, in a systematic way, obtain knowledge and inspiration from outside, get better insight as concerns the increasingly sophisticated remands of the consumers and focus on developing of products and services that satisfy their so far unsatisfied needs or provide new solutions for the existing problems (PARP, 2012, p. 22). In the UDI model, the users are also not perceived as individual consumers but in a wider sense as, e.g. the family, children, disabled, sportsmen, groups of citizens or the public as the whole. On the one hand, they have different requirements concerning the product while on the other they possess different qualifications to offer. Moreover, the term "user" also encompasses enterprises or sectors that may also be the source for innovative ideas. This expands the potential for obtaining valuable information but also the group of active participants in innovation creation significantly.

Within the demand innovation model, two notions can be identified: the voice of the customer and the lead-user innovation (Nordic Council of Ministers, 2006, p. 13). The first is linked to identification of hidden needs and the effect is the modification or improvement

of the existing products or services. The important element of such activities is to diversify between the identified and unidentified (hidden) needs. During the times of fierce competition, reading just the identified needs is insufficient to maintain lasting competitive advantage. It is necessary to design solutions that would be able to satisfy also the new, not yet revealed needs. In the second case (the consumer leadership), the search goes for solutions originating from the clients. Enterprises involve users as active participants in the innovation processes. It should be noticed that the above-mentioned types of consumer participation in the UDI model are complementary. This results from the fact that the dialogue between the enterprise and the clients or other market entities should be the outcome of observations and discovering the needs. This may lead to development of further collaboration that may result in creating innovative solutions. The effectiveness of user involvement in the user driven innovation model is the result of the increasingly common belief that the user has certain added value that he/she can offer. Thanks to that, it creates opportunities for increasing the effectiveness of operation under conditions of complexity in case of contemporary economic transformations (TACTICS and European Commission, 2012, p. 17). This approach supports maintaining long-term competitiveness as the users are treated as the source for projections of the market trends.

The involvement of participants in the innovation activity according to the UDI may assume different forms. Nordic Innovation Centre (NICe) lists user exploration, user participation, user innovation and user tests (NORDEN, 2010, p. 15). User exploration aims at observation and understanding to user actions and customs in the cultural context. The aim of participation is to create new ideas and innovative solutions. Innovative users (in most cases experts or so-called *advanced users*) are involved in the innovation team at some stages of the innovation process. In that way their specific knowledge that is not available within the enterprise is used. User tests are the oldest and the form of collaboration most frequently employed by enterprises. They aim at conducting evaluation of the developed product or service and making required adjustments according to consumers' suggestions. A different classification of users based on the level of their involvement was proposed by Ives and Olson (1984, p. 588). Those authors identify six user involvement categories: *no involvement* – the users do not want or were not invited to collaborate, s*ymbolic involvement* – the situation where the users were invited to collaborate but their ideas are not used, *involvement by advice*, *involvement by weak control* – the situation where the users are required „*to sign off*" at each stage of the development process, (*involvement by doing*) – the users are design team members or have the official collaboration agreement, and finally *involvement by strong control* – the users may pay for development of new solutions and evaluation of activities depends on the development work results. It should be pointed out here that some researchers (Barki and Hartwick, 1989) differentiate between the notion of participation and involvement of the users. The concept of participation encompasses the actions performed during the innovation process while involvement represents the mental condition where the users are more committed to it. Olsson (2004, p. 374) supplements this concept by the statement that the notion of participation is imprecise and the users are frequently treated as the source of information and not as equal partners.

The never-ending need of searching for access to knowledge is the consequence of the open innovation model, including the *user-driven innovation.* This triggers discussions aiming at determination who is the holder of the knowledge and on what conditions the holder can transfer it to those that need it. His became the premise for spreading of the open access movement activities and hence the *open knowledge* model. Hofmokl *et al.* (2009, p.

54) point out that the notion of open knowledge is wider than the notion of open access because it encompasses access to not only the scientific publications but to the entire scientific accomplishment. According to the assumption this applies to the dynamic process of scientific communication (treating the publication as a process and not the output), openness and transparency as well as expanded measures of scientific accomplishments and hence establishment of new "knowledge communities" around the available contents (Otwarta Nauka, 2013). The principles of open science have been formulated within the framework of the Science Commons project (Science Commons, 2013). The first of them – open access to contents – encompasses, according to the *open access* model, access to scientific publications. The next principle is that of open access to the tools meaning the possibility of access to materials that make repeating the given research possible. Implementation of the open science principle also involves the principle of open access to the data, i.e. the possibility of accessing and using raw data obtained from other research processes. Formulation of the widest approach to the open science was possible thanks to the digital technologies. The principle of open cyber-infrastructure assumes creating public infrastructure allowing not only storage and search through the data but also combining various sources. The open science model assuming public access to its resources favours development of the open innovation model and hence improvement of the economy innovation. Despite increasingly wide development of the open science idea the economic, legal and technical barriers to popularisation of it are still pointed at.

3. MODERN INNOVATION MODELS IMPLEMENTATION POSSIBILITIES IN THE FOOD ECONOMY

The considerations presented indicate that simultaneously with significant benefits of modern innovation models' concepts the potential problems related to implementation of them emerge. This offers premises for formulating the conclusion that despite the visible process of transition (in many sectors and industries) from the closed and traditional innovation model to the open innovation system, not all the entities may apply the open innovation principle to the same extent. So far, it has been applied more frequently in the sectors of advanced technologies such as computer industry and information technology industry, pharmaceutical and biotechnology industry, financial services and in large enterprises and multinational corporations. This is caused by their dynamic development and relatively short life cycle of the technology and short product life cycle. In some industries, e.g. nuclear or aviation engines' industries that base their operations on strong internal technology and low labour mobility, the closed innovation idea dominates (Gassmann, 2006, p. 224). Other studies confirm that depending on the sector and industry differences exist as concerns the acceptance intensity for the open innovation model (Lichtenthaler and Ernst, 2009, p. 48; van de Vrande *et al.*, 2009, p. 424).

High technology enterprises are by their nature more innovative than the traditional ones and they decide the level of innovation of the given economy. This, however, does not mean that the solutions applied in that sector may not be applied in traditional sectors among which the widely understood agribusiness is classified. Skilful adaptation of the solutions implemented by high technology enterprises may be a factor in improving competitiveness and innovation of food economy. This is of key importance in the regions where the agricultural food sector represents the natural direction for development. This induces formulating questions concerning the potential for and scope of applying open innovation

models in the food economy. Empirical studies concerning that issue in the global subject literature are relatively few (Huston and Sakkab, 2006; Sarkar and Costa, 2008; Vanhaverbeke and M., 2006; Enzing *et al.*, 2011). Dahlander and Gann (2010) project low level of openness in low technology industries. Sarkar and Costa (2008, p. 575) claim that this may apply in particular to small and medium enterprises operating in the food economy sector. According to Huston and Sakkab (2006), however, there is no clear evidence that the open innovation model may not be applied in traditional and mature sectors.

Premises inducing application of modern innovation models in the food economy sector can be presented from a number of perspectives. First, there are many different entities involved in widely understood food production. Satisfying all heterogeneous (and frequently even contradictory) requirements of the indirect clients, end users and public institutions requires coordination of their activities. This is the circumstance that supports conducting innovation processes along the value chain and not within individual organisations (Costa and Jongen, 2006). Hence, the larger the dependence between the entities (agriculture, food industry and trade) is involved in creating, development and commercialisation of new solution, the larger is their propensity to implement the principles of the open innovation model. In the light of this, stimulation and development of open innovation in the Polish agricultural food sector may be stimulated by establishment and development of clusters. Figiel *et al.* (2011, p. 130) claim that the process is supported, first of all, by the supply factors resulting from the manufacturing capacity of that sector (particularly the processing industry). The authors add that this allows achievement of a higher specialisation level and development of exports of innovative products with high added value. Similar to the entire economy, lack of links between the sectors of enterprises and science as well as low level of social capital are the major problems in operation of cluster type structures. The currently applied structural and institutional solutions have not eliminated those weaknesses. Hence, the ability of spreading the knowledge in the cluster and the potential for creating improving as well as radical (novelty) innovations is limited. Knowledge exchange within the cluster may have the character of commercial or non-commercial (based on mutual trust) transactions. The open knowledge idea stimulates non-commercial exchange among the cluster participants and joint creation of innovative knowledge by scientific entities. It seems that the development of cluster structures in food economy supports the open approach to innovation by all the participants. It should still be taken into account that supporting bottom-up cluster initiatives or top-down organisation of clusters may not take place without appropriate analyses determining their actual economic potential. Undoubtedly this is one of the activities that can be used for improving food economy sector innovation and competitiveness.

The specific character of innovation in food economy sector represents another perspective influencing the degree of innovation process openness. Innovation processes in food sector are burdened with relatively higher uncertainty than in the other sectors. Pascucci *et al.* (2011, p. 169) list the characteristics of food sector that influence increased uncertainty of innovation activities. They point out the key importance of agricultural products, which are characterised by short shelf life and influence of unpredictable weather conditions on their volume and quality in food manufacturing. Second, food industry obtains raw materials from many, frequently diversified and small farmers, which is also not without influence on the quality and volume of supplies. The specificity of innovations in the food economy sector is also a consequence of their type. On the one hand, they are tightly related to the so-called „*technology-pushed*" – the use of modern technologies

developed by high technology sector for the purpose of creating new products. For that reason the conclusion by Avermaete *et al.* (2004, p. 480) that in determining the index of the capacity of food economy sector to innovate one should not focus on the internal closed innovation processes (i.e. the effort in the research and development domain) only seems right. However, the strong R&D department and the possibility of using well-educated employees and experts represents the condition necessary for assuming a more open innovation system. In this context, the observation made by Gooroochurn and Hanley (2007, p. 1492) that according to transaction costs economy enterprises incurring high R&D activity costs will protect those investments to decrease the risk of revealing and prevent or delay imitation by competitors (particularly in concentrated markets) seems interesting. As a result, larger food economy sector enterprises will show lower propensity to implement open innovation. In that situation it is important to differentiate the areas that should be protected as critical for survival of enterprises from those in which partnership may accelerate technology and market development. On the other hand, innovations in food economy are "pulled by the market". Hence, they are rather of the increase and not radical type. Consumers are afraid of entirely new products and changes in consumption habits. This is confirmed by surveys of innovation preferences for products and services conducted among the citizens of the EU countries (Baruk, 2010, p. 70). More than a half of the buyers purchase known products and they are not interested in novelties. In Poland that percentage 62%) is the highest among the surveyed countries. This has been reflected by food manufacturers. Surveys conducted by TNS Pentor (2011) indicate that as many as 75% of manufacturers plan improving the existing products and many fewer (65%) development of entirely new products. In this context the commercialisation effectiveness in case of newly implemented products involves favourable interactions with partners from the end of the value chain, i.e. the wholesalers and retailers. Consequently, collaboration with them within the open innovation model framework may decrease the market risk involved in new solutions. This is of even larger importance as new food products usually have low success index (Enzing *et al.*, 2011).

Within the framework of the global food system within which the innovation activities of producers is linked to the changing patterns of consumption and the necessity of assuring food safety and sustainable development, agricultural food sector entities should undertake actions that can allow meeting those challenges. Increasingly frequently the consumers prefer so-called health food, light type products, etc. The increased professional activity of many people and hence limited time for preparation of meals is a common phenomenon. In the European market the interest in the *fair trade* i.e. foods originating from fair trade has increased (Wyborcza.biz, 2013). For that reason convenience food, organic food, functional food and minimally processed food are the dominating directions for product innovations in food industry. It can be assumed that the prospects for applying the *user-driven innovation* will create opportunities to individual segments of food economy for more rapid reacting and getting ahead of the expectations presented by the consumers. Participation of food products' clients in the innovation development process may assume the earlier mentioned forms. The current experiences at the same time indicate that the enterprises in most cases cooperate with the clients. It seems, nevertheless, that the cooperation takes the form of surveying their opinions and to a lesser extent including them in the innovation activities and designing the new products. It should be noticed that the potential for active cooperation will expand continually and supplying clients with exactly the things they expect will be the outcome. In the food economy sector this will not apply to all the products. This approach

results in better matching of production and services provided to the expectations of the end buyer and hence reduction of the costs involved in the innovation development.

Meeting the increasing food products consumers' expectations causes higher than in the other sectors demand of food economy sector entities for using the external knowledge resources. According to Enzing *et al.* (2011), this is another area for considerations concerning correlation between the food economy sector specificity and the open innovation. Development of such scientific disciplines as, e.g. biotechnology and nanotechnology shows high potential for increasing the added value of products satisfying the demands of modern consumers. This has led at the same time to the development and floating to the market the food products that were more sophisticated (e.g. functional food and nutraceutics). A significant proportion of innovative solutions that can potentially find application in food economy are present outside that sector. This causes the necessity of undertaking more or less formal agreements with other innovation sector entities and hence supports open innovation.

4. CONCLUSION

The approach to innovation evolved during the last few decades starting with the linear models up to the cooperation network concept. The development of theory provides evidence for the increasing importance of innovation and innovativeness in the processes taking place in the economy. Contemporary innovation models are holistic and they stress different links between entities implementing them. This results from the new innovation creating perception according to which it is a process requiring interactive collaboration of many entities (from different areas of activities). Perception of innovation in the open process categories represents a relatively new model that because of its high effectiveness coupled with relatively low costs is gaining increasing popularity. Progressing globalisation processes and technology development exert at the same time direct influence on the consumer role perception. The consumer is no longer just the passive buyer of products but he is becoming also the partner in creating them. This means that innovation activities in food industry may be based to the increasing extent on the open innovation models considering active participation of many entities in creating inter-organisational knowledge and improving skills. This trend may represent the response of the food economy enterprises to the increasing competition pressure in the global markets. The effectiveness of those models in the agricultural food sector still is the subject of relatively limited studies by the scientific community. This indicates the need for continuation of research activities concerning the theoretical components of open models, such as learning (acquisition of knowledge) and ability of adjusting to the changing socioeconomic and institutional conditions (adaptation potential). This leads at the same time to the conclusion that the concepts of open innovation models should not be implemented in separation from other opportunities for innovative development of food economy entities but should represent a valuable complement to them.

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MODELING THE FREQUENCY OF AUTO INSURANCE CLAIMS BY MEANS OF POISSON AND NEGATIVE BINOMIAL MODELS

Mihaela DAVID*
Dănuţ-Vasile JEMNA**

Abstract

Within non-life insurance pricing, an accurate evaluation of claim frequency, also known in theory as count data, represents an essential part in determining an insurance premium according to the policyholder's degree of risk. Count regression analysis allows the identification of the risk factors and the prediction of the expected frequency of claims given the characteristics of policyholders. The aim of this paper is to verify several hypothesis related to the methodology of count data models and also to the risk factors used to explain the frequency of claims. In addition to the standard Poisson regression, Negative Binomial models are applied to a French auto insurance portfolio. The best model was chosen by means of the log-likelihood ratio and the information criteria. Based on this model, the profile of the policyholders with the highest degree of risk is determined.

Keywords: claim frequency, count data models, Poisson model, overdispersion, mixed Poisson models, negative binomial models, risk factors

JEL classification: G22

1. INTRODUCTION

We are living in a society that needs to manage risks of various types and with a significant economic impact. In the context of a risk based civilization, the need of protection has become more pronounced, having as a consequence the request of financial security against possible losses. Therefore, the emergence and development of the insurance business are related to the urgent need to protect the individuals and their assets against a possible loss caused by a particular event. The entire process of insurance consists in offering an equitable method of transferring the risk of a contingent or uncertain loss in exchange for payment.

* Faculty of Economics and Business Administration, Alexandru Ioan Cuza University of Iaşi, Romania; e-mail: *mihaela_david88@yahoo.com.*

** Faculty of Economics and Business Administration, Alexandru Ioan Cuza University of Iaşi, Romania; e-mail: *danut.jemna@uaic.ro.*

Non-life insurance business, especially auto insurance branch, holds an increased interest because it is required to manage a large number of situations (both the number of insured vehicles and of accidents) with a wide variety of risks.

A fundamental goal of insurance companies is to calculate an appropriate insurance price or premium corresponding to an insured in order to cover a certain risk. A well-known method to calculate the premium is to multiply the conditional expectation of the claim frequency with the expected cost of claims. Therefore, modelling frequency of claims, also known in theory as count data, represents an essential step of non-life insurance pricing. As sustained in Boucher and Guillen (2009), count regression analysis permits the identification of the risk factors and the prediction of the expected frequency of claims given the risk characteristics.

In the past years there has been considerable interest in count data models, particularly in the actuarial literature. As mentioned in Cameron and Trivedi (1998), an important milestone in the development of models for count data is reached by the emergence of Generalized Linear Models (GLMs). The Poisson regression is a special case of GLMs that was first developed by Nelder and Wedderburn (1972) and detailed later in the papers of Gourieroux *et al.* (1984a, 1984b) and in the work on longitudinal or panel count data models of Hausman *et al.* (1984). Within non-life insurance context, McCullagh and Nelder (1989) demonstrate that the usage of the GLMs techniques, in order to estimate the frequency of claims, has an a priori Poisson structure. Antonio *et al.* (2012) present the Poisson distribution as the modelling archetype of claim frequency.

Although it offers a favourable statistical support, Gourieroux and Jasiak (2001) emphasizes that the Poisson distribution presents significant constraints that limit its use. The Poisson distribution implies equality of variance and mean, a property called equidispersion that, as sustained in Cameron and Trivedi (1999), is a particular form of unobserved heterogeneity. One of the well-known consequences of unobserved heterogeneity in count data analysis is overdispersion which means that the variance exceeds the mean. Other explanation is provided by Jong and Heller (2013) who termed the overdispersion as extra-Poisson variation because this type of data displays far greater variance than that predicted by the Poisson model.

Vasechko *et al.* (2009) state that the problem of overdispersion, inherent to the Poisson model, implies the underestimation of standard errors of the estimated parameters, which leads to the rejection of the null hypothesis, according to which the regression coefficients are not statistically relevant. Consequently, the restrictive nature of Poisson model has sustained the development of numerous techniques proposed for both testing and handling overdispersed data. An exhaustive analysis of these tests is provided in Hausman *et al.* (1984), Cameron and Trivedi (1990), 1998), Gurmu (1991), Jorgensen (1997) or in more recent studies such as Charpentier and Denuit (2005), Jong and Heller (2013), Hilbe (2014).

The alternative distributions used most frequently in order to correct the overdispersion are known as compound or mixed distributions. According to the literature, a particular example of this class is the negative binomial distribution which consists of simple and efficient techniques that oversee the limits of the Poisson distribution and offer results qualitatively similar. In the statistical literature there are presented many ways to construct the negative binomial distribution, however the most used are the NB1 and NB2 forms, introduced by Cameron and Trivedi (1998). Among the recent studies, Denuit *et al.* (2007) give a comprehensive image concerning the mixed Poisson models and they highlight that negative binomial distribution is a satisfactory alternative to Poisson distribution in order to

estimate the claim frequency for an auto insurance portfolio. Working with cross-sectional insurance data, Boucher *et al.* (2007) sustain that the comparison of the log-likelihoods for the two distributions reveals that the extra parameter of the negative binomial distribution improves the fit of data in comparison with the Poisson distribution. For longitudinal or panel data, an excellent account of claim frequency distributions can be consulted in Boucher *et al.* (2008), Boucher and Guillen (2009) and Antonio and Valdez (2010), in which the authors analyse and emphasize the practical use of negative binomial models for auto insurance data.

In the literature of non-life insurance pricing a current research topic is how to identify the variable and the types of variables that allow estimating the frequency of a certain insured risk. A standard classification would include: age and gender-marital status of insured, usage purpose of the insured vehicle, geography (location of garage) and other factors such as whether the vehicle is a sport car or not (Antonio and Valdez, 2010). A more systematic classification is provided by Kouki (2007) who identifies three categories of risk factors: the driver (age, sex, age of driving license, bonus-malus coefficient), the vehicle (power, age) and the insurance contract. In this context, the empirical studies are valuable because they permit the evaluation of a theoretical hypothesis while projecting these factors on an insurance portfolio (Charpentier and Denuit, 2005; Yip and Yau, 2005; Denuit *et al.*, 2007; Allain and Brenac, 2012; Boucher *et al.*, 2013). The results of these studies are considered by the insurance companies while assessing their calculation tools and proposing new solutions according to changes in the behaviour and characteristics of clients.

The present study lines up with the current focus of the auto insurance literature. The aim of this study can be highlighted at two levels. The first is theoretical and methodological and aims to present synthetically the econometric modelling methodology of auto claim frequency. The second objective is related to the empirical part of this research. Working with a French auto insurance portfolio, we estimate an econometric model for claim frequency. On this level, the main contribution of the study is represented by a specific set of explanatory variables that take into account a number of updates concerning the data registered by insurance companies. For example, in this study, we introduce as risk factors the variables occupation of insured, GPS and value of vehicle. Also, in comparison with similar studies, we use a different classification of the insured based on age intervals on the assumption that more homogenous groups will be obtained and the calculation of premiums will better correspond to the reality of studied phenomenon. Although the results cover a portfolio of a French insurance company, the methodology of data count models can be applied to other insurance portfolios of companies from other European countries such as Romania.

The paper is structured as follows. Section 2 deals with a brief presentation of the used data and aspects related to methodology of count data models. Section 3 includes our empirical study. Concluding remarks are summarized in Section 4.

2. DATA AND METHODOLOGY

In this paper, we worked with an auto insurance portfolio of a company operating in France. The analysed phenomenon concerns the third party liability for the damages of the vehicles, for which the insurance is covering the losses within the limits of the insured amount.

2.1. Sample

The sample contains 150021 policies observed during the period 2007-2009. We use 9 exogenous variables for every policy, as well as the total frequency of claims at fault that were reported within the yearly period. Therefore, except the explained variable, the *frequency of claims*, the other ones are considered risk factors that are known a priori by the insurer. In comparison with similar empirical studies, we group the risk factors into three categories that reflect the policyholder characteristics: *age*, *occupation*; the vehicle features: *value*, *type*, *category*, *use*, *GPS*; the insurance policy characteristics: *insurance policy duration*, *bonus-malus coefficient*. Table 1 summarizes the information available about each policyholder.

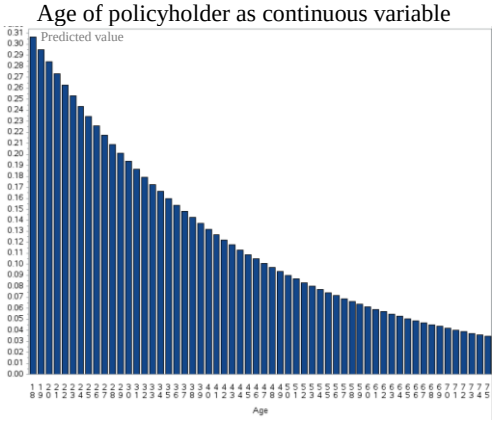
Table no. 1 – List of variables

Variable	Description	Values
Count	Frequency of claims	From 0 to 5 claims declared
Age	Age of policyholder	From 18 to 75 years
Occup	Occupation of policyholder	Employed, Housewife, Retired, Self-employed, Unemployed
Type	Type of vehicle	A, B, C, D, E, F
Categ	Category of vehicle	Large, Medium, Small
Use	Purpose of vehicle usage	Private, Professional, Other
Value	Value of vehicle	From 1000 to 50000 Euros
GPS	GPS device	Yes, No
Bonus	Bonus-malus coefficient	From -50 to 150
Duration	Duration of insurance policy	From 0 to 15 years

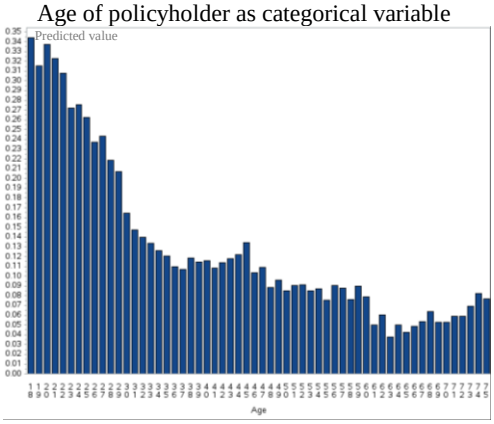
Among these variables, *bonus-malus coefficient* presents a particular interest for auto insurance pricing, having a specific meaning according to the insurance system of each country. Within the French bonus-malus system, this coefficient indicates an increase or a decrease of the insurance premium depending on the number of claims declared by a policyholder. Therefore, if the policyholder does not cause any responsible accident, he receives a bonus, meaning that the insurance premium will be reduced. Contrary, if the policyholder is responsible for the accident, he is penalized by applying a malus, which will have the consequence of a premium increase. These increases and decreases are based on a standard tariff defined by the insurer, depending on which the premium is multiplied by a coefficient. The basic coefficient is 1 and it corresponds to the reference premium of the insurance company. If the *bonus-malus coefficient* is lower than this value, a bonus is applied, and if it is higher, a malus is considered. More specifically, the French bonus-malus system involves a malus of 25% for a claim declared and a bonus of 5% for the non-declaration of any claims in the reference period, usually a year. In this way, the system aims the encouragement of prudent insured drivers and the discouragement of those who, for various reasons, register severe losses. In the studied portfolio, the calculations corresponding to the *bonus-malus coefficient* are already generated, registering negative and positive values, which indicate a decrease or an increase of the insurance premium, respectively.

To assess how best to enter policyholder's age variable into the count model, we examined the difference between the fitted frequency of claims, considering age as a single risk factor, once being introduced as continuous variable and once as categorical variable. Figure 1 illustrates simultaneously the distribution of the expected frequency of claims explained by the policyhoder's age both as continuous and categorical variable (with 58 categories of age).

Age of policyholder as continuous variable



Age of policyholder as categorical variable



Source: Data processed within SAS 9.3

Figure no. 1 – The fitted frequency of claim depending on the age of policyholder

In the first case, a decrease of the claim frequency can be observed along with an increase in the *age of policyholders*. In the case with the age categorical, is also noted the concave shape of the fitted frequency of claims, obtaining high values for the category of young drivers, an obvious decrease over the years, but a slightly increase in elderly drivers category. Taking into account that among certain age groups the estimated frequencies of claims do not differ significantly, this variable could be grouped into fewer categories considering the breakpoints that can be easily observed on the right side of the graph. Therefore, based on this graphic representation, the policyholder's age could be grouped on year intervals as follows:

$$AgeGroup = \begin{cases} Beginner \ (18\text{-}22 \text{ years}); \\ Young \ (23\text{-}29 \text{ years}); \\ Experienced \ (30\text{-}60 \text{ years}); \\ Senior \ (61\text{-}67 \text{ years}); \\ Elderly\ driver \ (68\text{-}75 \text{ years}). \end{cases}$$

Further, the age of the policyholder will be considered in analysis as a risk factor (with the five categories established) in order to obtain homogeneous groups of policyholders, and thereby an accurate assessment of their risk level.

2.2. Econometric models

Within non-life insurance, when actuaries are interested in estimating the frequency of claims, the Poisson model is often considered. Although the literature sustains that it offers a favourable statistical support for count data, the Poisson model implies the equidispersion assumption that is a drawback in practical use when data is overdispersed. The literature presents several reasons why data can be overdispersed and also many models to address the variety of overdispersion found in data. In general, if the cause of overdispersion in Poisson model is not diagnosed, the negative binomial models are commonly recommended. There are a wide number of negative binomial models used, but for insurance data the more intuitive ones are considered the NB1 and NB2 forms of the negative binomial distribution.

The following part of this paper deals with aspects related to insurance count data and applied methodology, presenting at length the properties, the empirical evidence and the comparison of the three applied count data models.

Poisson model

An excellent definition of the law of rare events is given in Cameron and Trivedi (1998). The authors state that the total number of events will follow, approximately, the Poisson distribution if an event may occur in any of a large of trials but the probability of occurrence in any given trial is small. In the context of actuarial literature, comprehensive references on Poisson distribution, used as the main tool in estimating the claim frequency, are Dionne and Vanasse (1989), 1992), Denuit and Lang (2004), Gourieroux and Jasiak (2004), Yip and Yau (2005) and many others.

If the discrete random variable Y_i (claim frequency or observed number of claims), conditioned by the vector of explanatory variables X_i (the insured's characteristics), is assumed to be Poisson distributed, the probability density function of Y_i is:

$$f(y_i|x_i) = \frac{e^{-\lambda_i}\lambda_i^{y_i}}{y_i!} \tag{1}$$

Therefore, the relation (1) represents the probability that the random variable Y_i takes the value y_i ($y_i \in \mathbb{N}$), considering the characteristics of policyholders.

Although the Poisson distribution is considered to be the benchmark model in non-life insurance data, McCullagh and Nelder (1989) sustain that it implies a particular form of heteroskedasticity, leading to the equidispersion hypothesis. This assumption is emphasized by Gourieroux and Jasiak (2001) as a severe drawback that limits the model use because it implies that the conditioned mean and variance of claim frequency are equal. Therefore, the Poisson distribution parameter represents at the same time the mean and the variance of distribution:

$$E(y_i|x_i) = V(y_i|x_i) = \lambda_i \tag{2}$$

Within GLMs framework, the mean of the dependent variable is related to the linear predictor through the so called link function. It is well known fact from the literature that a logarithmic function is the natural link function for the Poisson distribution:

$$ln(\lambda_i) = \beta_0 + \sum_{j=1}^{p} \beta_j x_{ij} \Rightarrow \lambda_i = e^{x_i^t \beta} \tag{3}$$

Estimations of the parameters are done by maximum likelihood. In order to find the maximum likelihood of (1), the likelihood function is defined as follows:

$$L(\beta) = \prod_{i=1}^{n} \frac{e^{-\lambda_i}\lambda_i^{y_i}}{y_i!} = \prod_{i=1}^{n} \frac{e^{-e^{x_i^t\beta}}(e^{x_i^t\beta})^{y_i}}{y_i!}$$

Using a logarithm in both sides of the previous equation, the log-likelihood function is obtained:

$$LL(\beta) = \sum_{i=1}^{n} [y_i ln\lambda_i - \lambda_i - lny_i!] = \sum_{i=1}^{n} [y_i x_i^t \beta - e^{x_i^t \beta} - lny_i!] \quad (5)$$

The maximum likelihood estimators $\hat{\beta}_j$ are the solutions of the equations obtained by differentiating the log-likelihood in terms of regression coefficients and solving them to zero. The equations forming the system are not generating explicit solutions and therefore they need to be solved numerically by using an iterative algorithm. Charpentier and Denuit (2005) consider that the most common iterative methods are either Newton-Raphson or Fisher information.

Although Poisson distribution is often used to estimate the frequency of claims, the empirical evidences from literature show that it is usually too restrictive for this type of data. The fundamental problem of the Poisson distribution is that for count data the variance usually exceeds the mean, a feature known as overdispersion.

Overdispersion can result from many reasons. Hilbe (2007) provides an excellent discussion of this issue, differentiating between apparent and real overdispersion. Apparent overdispersion can occur as a result of outliers, the exclusion of relevant risk factors or interaction terms. In this respect, Denuit *et al.* (2007) highlight that overdispersion arises because differences in driving behaviour among individuals cannot be observed by the insurer, such as swiftness of reflexes, aggressiveness behind the wheel, consumption of drugs, etc. When the resolution of these issues does not have a conclusive response, the overdispersion is assumed to be real and it may be due to unobserved heterogeneity related to the equidispersion hypothesis.

The literature presents numerous techniques developed in order to test the assumption of overdispersion. In this regard, Cameron and Trivedi (1990) propose a test for overdispersion by estimating the Poisson model, constructing fitted values $\hat{\lambda}_i = exp(x_i^i \hat{\beta})$, and performing the auxiliary OLS regression without intercept:

$$\frac{(y_i - \hat{\lambda}_i)^2 - y_i}{\hat{\lambda}_i} = \alpha \frac{g(\hat{\lambda}_i)}{\hat{\lambda}_i} + u_i \quad (6)$$

where u_i is the error term and $g(\hat{\lambda}_i)$ is a known function, most commonly $g(\hat{\lambda}_i) = \hat{\lambda}_i^{\,2}$ or $g(\hat{\lambda}_i) = \hat{\lambda}_i^{\,2}$. The first function corresponds to the NB2 form of negative binomial distribution, and the second is related to the NB1 form of negative binomial distribution, both forms being discussed at length in the following part of methodology. The null hypothesis of no overdispersion ($H_0: \alpha = 0$) can be tested against the alternative hypothesis of overdispersion ($H_1: \alpha > 0$) using the t statistic for α.

Another practical and reliable test for overdispersion is introduced by Greene (2002) and is based on the Lagrange Multiplier test (LM). This statistics follow the χ^2 distribution with one degree of freedom and it is given by:

$$LM = \frac{(\sum_{i=1}^{n} \lambda_i^{\,2} - n\bar{y}_i)^2}{2\sum_{i=1}^{n} \lambda_i^{\,2}} \quad (7)$$

If after comparing the statistics calculated value with the theoretical one the test appears to be significant, then the hypothesis of no overdispersion is rejected. Therefore, the approach of the various alternatives of Poisson model is preferred.

Negative Binomial models

The alternative to the Poisson distribution used most frequently in order to handle count data when the variance is appreciably greater than the mean is the negative binomial distribution.

The negative binomial distribution is employed as a functional form that relaxes the equidispersion restriction of the Poisson model. The literature presents many ways to construct the negative binomial distribution, but Boucher *et al.* (2008) argue that the more intuitive one is the introduction of a random heterogeneity term θ of mean 1 and variance α in the mean parameter of the Poisson distribution. This general approach is discussed at length by Gourieroux *et al.* (1984a, 1984b), Cameron and Trivedi (1986, 1990, 1998), Winkelmann (2004) and Greene (2008). Regarding the usage on the insurance data, a classic example arises from the theory of accident proneness which was developed by Greenwood and Yule (1920). This theory sustains that the number of accidents is Poisson distributed, but there is gamma-distributed unobserved individual heterogeneity reflecting the fact that the true mean is not perfectly observed. Within the actuarial literature, the problem of mixed models is also illustrated and developed in the studies of McCullagh and Nelder (1989), Lawless (1987), Dionne and Vanasse (1989), Denuit and Lang (2004), Boucher *et al.* (2007), Hilbe (2014).

The traditional negative binomial is derived from a Poisson-gamma mixture distribution. Therefore, if the variable θ is considered to be gamma distributed, with the following density distribution:

$$f(\theta) = \frac{(1/\alpha)^{1/\alpha}}{\Gamma(1/\alpha)} \theta^{1/\alpha - 1} \exp(-\theta/\alpha) \tag{8}$$

it is well known that the negative binomial is the resultant overall distribution of claim frequency.

McCullagh and Nelder (1989) sustain that a random variable Y_i is called a negative binomial distributed count with parametersλ_i and α (> 0) if the probability mass function is given by:

$$f(y_i, \lambda_i, \alpha) = \frac{\Gamma(y_i + \alpha^{-1})}{\Gamma(y_i + 1)\Gamma(\alpha^{-1})} \left(\frac{\alpha^{-1}}{\alpha^{-1} + \lambda_i}\right)^{\alpha^{-1}} \left(\frac{\lambda_i}{\alpha^{-1} + \lambda_i}\right)^{y_i} \tag{9}$$

In (9) the term α plays the role of a dispersion factor and it is a constant. When α goes to 0, it is obvious that the NB distribution reduces to the standard Poisson distribution with parameter λ_i.

Cameron and Trivedi (1986) consider a more general class of negative binomial distribution (NBp) having the same mean λ_i, but a variance of the form $\lambda_i + \alpha\lambda_i^p$. Cameron and Trivedi (1998) there are presented the two most commonly known and utilized variants of the negative binomial distribution. When p is set to 1, it leads to the NB1 distribution and a model with $p = 2$, is called the NB2 distribution, also referred to as a quadratic negative binomial distribution.

The probability mass function of the NB1 model is:

$$f(y_i, \lambda_i, \alpha) = \frac{\Gamma(y_i + \alpha^{-1}\lambda_i)}{\Gamma(y_i + 1)\Gamma(\alpha^{-1}\lambda_i)}(1+\alpha)^{-\lambda_i/\alpha}(1+\alpha^{-1})^{-y_i}) \quad (10)$$

The first two moments of the NB1 are the following:

$$E[y_i] = \lambda_i \quad (11)$$

$$V[y_i] = \lambda_i + \alpha\lambda_i = \phi\lambda_i \quad (12)$$

For the NB1 model, the log-likelihood function (LL) is presented below:

$$LL(\alpha, \beta) = \sum_{i=1}^{n}\left\{\left(\sum_{k=0}^{y-1}(k + \alpha^{-1}\lambda_i)\right) - lny_i! - (y_i + \alpha^{-1}\lambda_i)\, ln(1+\alpha) + y_i ln\alpha\right\} \quad (13)$$

Estimation based on the first two moments of the NB1 density, as suggested in Cameron and Trivedi (1998), yields the Poisson GLMs estimator, which is also called the NB1 GLMs estimator.

For the NB2, the probability mass function coincides with the general negative binomial density function as in (9). The two first moments of the NB2 distribution are:

$$E[y_i] = \lambda_i = e^{x_i^t\beta} \quad (14)$$

$$V[y_i] = \lambda_i(1 + \alpha\lambda_i) \quad (15)$$

The log-likelihood function corresponding to the NB2 model is given as follows:

$$LL(\alpha, \beta) = \sum_{k=1}^{n}\left\{-log(y_i) + \sum_{k=1}^{y_i} log(\alpha y_i - k\alpha + 1) - (y_i + \alpha^{-1})log(1 + \alpha\lambda_i) + y_i log(y_i)\right\} \quad (16)$$

Cameron and Trivedi (1998) argue that the differences of estimating α have received little attention in the literature, mostly because the interest lies in estimation of β_j, with α as a nuisance parameter. The same authors highlight that even then they are important, as the standard error estimates of $\hat{\beta}_j$ depend considerably on $\hat{\alpha}$.

Boucher and Guillen (2009) state that the process of parameters' estimation is approximately the same for all three models. However it is highlighted that this situation is expected when a satisfactory number of conditions for consistency are satisfied. For the NB models, Vasechko *et al.* (2009) and Allain and Brenac (2012) state that the estimated parameters $\hat{\beta}_j$ and estimated values $\hat{\lambda}_i$ differ slightly while compared with the results achieved after applying Poisson model, but the standard errors values of the estimators $\hat{\beta}_j$ increase significantly after applying the model's alternatives. Boucher and Guillen (2009), analysing the auto claim frequency through the NB models, observe that although the regression coefficients do not change significantly, they allow a better assessment of the standard errors of the estimates that may be underestimated by Poisson model. A similar

point of view belongs to Hilbe (2014) who sustains that the NB distribution presents similar properties as Poisson distribution, knowing that the mean is understood in the same manner as the Poisson mean, but the variance has a much wider scope than is allowed by the Poisson distribution.

Criteria for assessing goodness of fit

The literature presents many statistics that can be used to select and to assess the performance of count data models.

As discussed in Denuit and Lang (2004), the standard measure of goodness of fit that can be used to assess the adequacy of various models is the likelihood ratio (LR) that follows a $\chi^2_{\alpha,p}$ distribution for a level of significance α of 0.05 and with p degrees of freedom, where p represents the number of explicative variables included in the regression model. This statistics test is obtained from the difference between the deviance of the regression model without covariates (D_0) and the deviance of the model including the independent variables (D_p):

$$LR = D_0 - D_p \tag{17}$$

Charpentier and Denuit (2005) define the deviance as twice the difference between the maximum log-likelihood achievable ($y_i = \lambda_i$) and the log-likelihood of the fitted model:

$$D = 2(LL(y_i|y_i) - LL(\lambda_i|y_i) \tag{18}$$

A value of the likelihood ratio higher than the statistics theoretical value ($LR > \chi^2_{\alpha,p}$) suggests that the regression model explains well the analysed data.

In order to compare the models, there are used some tests based on the log-likelihood function. In this regard, a standard method of comparison between the Poisson and NB models is to use the likelihood ratio, given by the expression: $LR = -2(LL_P - LL_{NB})$, where LL_P and LL_{NB} are the values of the log-likelihood under the Poisson and negative binomial models, respectively. This statistics follows the χ^2 distribution with one degree of freedom. A calculated value of the test higher than the theoretical value ($LR > \chi^2_{2\alpha;1}$) underlines that the NB models are chosen to the detriment of Poisson regression.

A convenient method used to discriminate between the two NB models is the comparison of the log-likelihood function values. Another standard method to distinguish the discussed models refers to information criteria, which is also based on the fitted log-likelihood function. Boucher *et al.* (2007) sustain that the criteria used to compare the models must penalize the one with a large number of parameters, considering the fact that the likelihood increases with the addition of parameters. The standard criteria refers to Akaike Information Criteria ($AIC = -2LL + 2p$) and the Bayesian Information Criteria ($BIC = -2LL + pln(n)$), where p represents the number of parameters introduced in the regression model, n indicates the sample volum, and LL is the model log-likelihood function. The literature proposes many others information criteria that employ a penalty term associated with the number of parameters (p) and the sample size (n), but AIC and BIC criteria are the most often used in practice. An overview of penalized criteria is presented at duration by Kuha (2004).

According to the literature, mixed results were obtained concerning the models employed to estimate the claim frequency. In the application of Cameron and Trivedi

(1998), the NB2 model is preferred to NB1 as it has higher log-likelihood, with the same number of parameters. In contrary, the results of a more recent study of Boucher *et al.* (2007) confirm that the NB1 was one of the best models to fit the auto insurance data with which they worked. Analysing different type of insurance data, including auto portfolios, Hilbe (2014) argues that NB1 and NB2 are valuable models both to diagnose and to adjust overdispersion in data. Hence, there is no empirical evidence in the literature to support a certain count model, given the fact that the overdispersion appears for several reasons as discussed previous in this section.

3. EMPIRICAL RESULTS

3.1. Descriptive statistics

Analysing the insurance portfolio structure, it can be noticed that the maximum frequency of declared accidents or claims by a policyholderis 5. More specifically, throughout the analysed period, 131838 (87.88%) of policyholders did not declare any accident, 15395 (10.26%) of policyholders declared one claim, 2202 (1.47%) of them informed the insurance company of the occurrence of two accidents, 442 (0.29%) of policyholders had three claims declared, 100 (0.07%) policyholders with four claims and only 44 (0.03%) of them declared to the company five claims. The distribution of the claim frequency suggests that the portfolio is heterogeneous, an aspect that can be easily deduced from the results shown in Table 2.

Table no. 2 – Variables Analysis

Variable	Mean	Median	Std Dev	Min	Max
Count	0.1449	0	0.4299	0	5
Bonus	-6.8603	-30	48.7486	-50	150
Duration	5.4975	4	4.6031	0	15

Source: Data processed within SAS 9.3

Thus, with a mean of 0.1449 and a variance of 0.1848, the variance of claim frequency exceeds its mean. In addition, the distribution of the independent variable, *bonus-malus coefficient*, shows that more than 50% of policyholders benefit from a bonus because they did not have any accidents declared. On one hand, it indicates a lack of homogeneity in the data, but on the other hand, it shows that the policyholders present a low risk for the insurance company. These results admit the assumption of heterogeneity and justify the a priori differentiation of policyholders.

3.2. Econometric models

Within SAS, the GENMOD procedure is used to fit the Poisson and NB2 regression models in the framework of GLMs. The Type 3 analysis, generated by using this procedure, permits a test of the relevance of one variable taking all the others into account. For the fit of NB1 model, the used procedure in SAS is COUNTREG.

Poisson model

The results obtained from the Poisson regression for the insurance portfolio presented in Section 2 are shown in Table 3 (LR statistics for analysed variables) and Table 5 (regression coefficients' estimations). In Table 3, in column *Chi-square* is calculated, for each variable, two times the difference between the log-likelihood of the model which includes all the independent variables and the log-likelihood of the model obtained by deleting one of a specified variable. This test follows the asymptotic $\chi^2_{\alpha,p}$ distribution for a level of significance α of 0.05 and with p degrees of freedom that represent the number of parameters associated to the analyzed variable.

Table no. 3 – LR Statistics for Type 3 Analysis

Source	Poisson Regression(*)		Poisson Regression(**)	
	Chi-Square	**Pr > ChiSq**	**Chi-Square**	**Pr > ChiSq**
AgeGroup	3822.01	<.0001	3977.74	<.0001
Occup	1126.40	<.0001	1129.56	<.0001
Type	375.13	<.0001	375.27	<.0001
Categ	1.25	0.5358	-	-
Use	1690.01	<.0001	1794.57	<.0001
GPS	608.82	<.0001	608.92	<.0001
Value	3.79	0.0516	-	-
Bonus	7450.25	<.0001	7454.48	<.0001
Duration	325.67	<.0001	325.92	<.0001

(*) Poisson regression including all the explanatory variables
(**) Poisson regression including only the significant explanatory variables

Source: Data processed within SAS 9.3

It can be observed that the variable denoting the *category of vehicle* is not statistically significant as it yields a *p-value* of 0.5358 greater than the level of significance α of 0.05. In consequence, this variable is excluded from the model and the analysis will continue in the same manner until it is obtained the optimal combination of factors (*p-values* < 0.05) which can explain the variation of claim frequency. After excluding from the model the non-significant factors (*category* and *value of vehicle*), it is noticed that all the other predictors appear to significantly contribute to the process of understanding and predicting the frequency of claims made on vehicle insurance policies. Nevertheless, if the equidispersion assumption of Poisson distribution is not fulfilled, we are dealing with overdispersed data, and thereby the *p-values* tell us nothing about the relationship of the predictor and response. Therefore, it is imperative to test the equidispersion assumption, meaning the equality between the conditioned mean and variance of claim frequency, when constructing and interpreting a Poisson model. In this context, the method of Cameron and Trivedi and the test of Greene are used. Table 4 shows the results obtained after estimating and testing the parameter α for both forms of the known function $g(\hat{\lambda}_i)$ developed by Cameron and Trivedi.

Table no. 4 – Parameter Estimates

Form of function $g(\hat{\lambda}_i)$	Parameter (α)	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|
$g(\hat{\lambda}_i) = \hat{\lambda}_i$	α_0	1	0.01412	0.00553	2.55	<.0107
$g(\hat{\lambda}_i) = \hat{\lambda}_i{}^2$	α_1	1	0.22806	0.04904	4.65	<.0001

Source: Data processed within SAS 9.3

At a level of significance of 0.05, the values of t statistic obtained for both α_0 and α_1 parameters leads to the rejection of the null hypothesis of equidispersion, indicating that there is overdispersion in the data and that the use of both NB1 and NB2 forms of negative binomial distribution is justified. With a *p-value* under 0.05, the Lagrange Multiplier test (LM = 1896.19) appears to be significant, and thereby the hypothesis of no overdispersion is again rejected. Both test statistics indicate very strong evidence against the fit of the Poisson model to the data and thus to correct the overdispersion, the alternative mixed models presented in Section 2 are used.

Negative binomial models

Both NB1 and NB2 regressions are based on the same explanatory variables of the claim frequency, leading to similar results as the ones from the Poisson regression. For all parameters, the *p-value* is under 0.05. Analyzing the results from Table 5, it can be observed that the parameters and the estimated values are very close to those obtained in the previous model. The standard errors of parameter estimates are slightly higher than those obtained for the Poisson model, but this does not impact the statistical significance of the regression coefficients. The two adjusted models do not provide further details in comparison with the Poisson regression in terms of risk factors that explain the variation of claim frequency, but managing these enhanced models could make a difference in terms of adjusting the Poisson overdispersion in the data.

Table no. 5 – Analysis of Parameter Estimates

Parameter	Poisson Regression		NB1 Regression		NB2 Regression	
	Estimate	Standard Error	Estimate	Standard Error	Estimate	Standard Error
Intercept	-0.1644	0.0339	-0.1775	0.0351	-0.1714	0.0362
AgeGroup (Elderly)	-0.8917	0.0504	-0.8796	0.0517	-0.8849	0.0521
AgeGroup(Experienced)	-1.1281	0.0184	-1.1167	0.0191	-1.1230	0.0195
AgeGroup (Senior)	-1.1332	0.0541	-1.1139	0.0551	-1.1255	0.0555
AgeGroup (Young)	-0.4328	0.0203	-0.4285	0.0211	-0.4296	0.0217
Occup (Employed)	-0.2417	0.0183	-0.2404	0.0189	-0.2403	0.0194
Occup (Retired)	-1.1899	0.0445	-1.1870	0.0455	-1.1907	0.0454
Occup (Self-employed)	-0.3772	0.0216	-0.3761	0.0223	-0.3762	0.0227
Occup (Unemployed)	-0.0749	0.0207	-0.0738	0.0214	-0.0763	0.0220
Type (A)	-0.4009	0.0292	-0.3992	0.0301	-0.4025	0.0310
Type (B)	-0.3072	0.0296	-0.3040	0.0306	-0.3103	0.0315
Type (C)	-0.2443	0.0314	-0.2405	0.0325	-0.2449	0.0334
Type (D)	-0.1308	0.0295	-0.1318	0.0305	-0.1317	0.0314
Type (E)	-0.0693	0.0317	-0.0734	0.0328	-0.0732	0.0338
Use (Other)	-0.9163	0.0280	-0.9048	0.0288	-0.9156	0.0290
Use (Private)	-0.4624	0.0141	-0.4582	0.0145	-0.4619	0.0149
GPS (Yes)	-0.3568	0.0148	-0.3531	0.0152	-0.3480	0.0155
Bonus	0.0106	0.0001	0.0105	0.0001	0.0106	0.0001
Duration	-0.0272	0.0015	-0.0267	0.0016	-0.0271	0.0016
Scale	1.0000	0.0000	0.2824	0.0148	0.3952	0.0239

Source*: Data processed within SAS 9.3*

Reviewing the coefficient signs from Table 5, a decrease of the claim frequency can be observed along with an increase in the *duration of the insurance contracts*. When the *bonus-malus coefficient* increases, the frequency of claims increases as well. The interpretation of Poisson and negative binomial models is the same. Based on the regressions coefficients, the profile of policyholders with the higher risk for the company can be established. This profile corresponds to policyholders from the beginner's age group, housewife, having insured a vehicle of type F, using it in professional purposes, not having a GPS device, with a malus of 150 applied to their premiums and being the client of the insurance company for one year.

The estimated frequency of claims represents one of the components of the insurance premium for those new clients of the insurance company who present the same characteristics that correspond to one of the policyholders' groups. In order to obtain the estimated value of claim frequency for these groups, we have to take into consideration that the link function for Poisson or negative binomial distribution is the logarithm function as presented in the methodology section of this paper. Considering the regression coefficients for NB2 model, the estimated value of claim frequency for the most risky policyholders' group is obtained by the following calculation:

$$\lambda_{riskiest\ class} = e^{-0.1644+0.0106*150-0.0272*1} = 4.0487$$

which represents the expected value of claim frequency for the clients who present the same characteristics as those with the riskiest profile for the insurance company.

In this paper, the used factors that differ from other similar studies, has a significant impact on the frequency of claims, with the exception of the vehicle's value. Taking into account the occupation of the insured, it can be noticed that there are significant differences between all 5 categories of occupation and the policyholders corresponding to the *housewife* group present the highest risk for the insurer. As consequence, the insurance company could exclude from the insurance portfolio the new clients that fall into this category. Another important factor is represented by the age of insured grouped into 5 categories as presented in Section 2.1. The results obtained show that the drivers from the *beginner* group present the highest level of risk for the company, as has been shown in other studies. Nevertheless, working with more years' intervals, in comparison with other empirical results, allows a more accurate differentiation of policyholders and more homogeneous groups of clients, so that the introduction of this variable in pricing analysis will not be considered a discouraging factor while choosing insurance services. In addition, the introduction of GPS as risk factor is significant for the determination and implementation of some protection measures that could be taken by the policyholders in order to prevent the accidents or could be included in the pricing policy of the insurance company. Concerning the value of vehicle, although it does not have a significant impact on the frequency of claims, the insurance company could take it into consideration while assessing the second component of insurance premium, the cost of claims.

Based on the 95% confidence intervals for the dispersion parameters of NB1 regression ($\alpha\epsilon(0.2534;\ 0.3114)$) and NB2 regression ($\alpha\epsilon(0.3484;\ 0.4420)$, it can be sustained that dispersion is significantly different from 0 and the application of the negative-binomial models is justified. Moreover, the NB2 model indicates a higher level of dispersion in comparison with the NB1 model, meaning that the first one could be considered more effective in correcting the overdispersion.

Models' goodness-of-fit

An essential step in the econometrical analysis represents the validation of models by comparing the calculated values with the observed ones. Examine the relationship between the expected and observed values, respectively (Table 6), the negative binomial models appear to be a substantial improvement over the Poisson model and this confirms the conclusion of the last paragraph that NB2 model provides the best fit to our insurance data.

Table no. 6 – Observed Claim Frequency versus Predicted

Claim Frequency	Observed	Model		
		Poisson	NB1	NB2
0	131838	134147.67	134225.58	134717.33
1	15395	14134.97	14010.41	13235.19
2	2202	1506.78	1532.11	1678.07
3	442	195.76	210.09	296.68
4	100	29.74	34.63	67.17
5	44	5	6.49	18.08

Source: Data processed within SAS 9.3

To conclude the comparisons between the analyzed count data models, Table 7 summarizes the results obtained for the goodness-of-fit tests.

Table no. 7 – Criteria for Assessing Goodness of Fit

Criterion	Model		
	Poisson	NB1	NB2
Log Likelihood	-55144.7684	-55050.4282	-54942.9562
AIC (smaller is better)	116020.9824	110138.8563	115619.3581
BIC (smaller is better)	116209.4344	110327.3084	115817.7287

Source: Data processed within SAS 9.3

The obtained values of the likelihood ratio test ($LL_{NB2-P} = 403.62$ and $LL_{NB1-P} = 188.68$) are greater than the theoretical one ($\chi^2_{2\alpha;1} = 2.706$) for both NB1 and NB2 models in comparison with Poisson regression.The resultsunderline that NB1 and NB2 models give a better fit of the data as opposed to Poisson regression. The remaining comparison between the negative binomial models indicates that NB2 model is preferred here to NB1 as it has higher log-likelihood ($LL_{NB2} = -54942.9562 > LL_{NB1} = -55050.4282$). The validity of these statements can also be confirmed by the information criteria. The lowest values of AIC and BIC comparative-fit tests are obtained for the NB2 model which underlinesthat this one is chosen to the detriment of both NB1 and Poisson models.

Eventually, to determine whether the data is better modeled using NB2, we considered the likelihood ratio test discussed in Section 2. The log likelihood for the full model is $LL_{NB2(7)} = -54942.9562$ and for the null model is $LL_{NB2(0)} = -62236.1707$. The likelihood ratio value obtained is $LR = 2(-54942.9562 + 62236.1707) = 14586.429$ and since the full model includes seven predictor variables, the statistics theoretical value is $\chi^2_{0.05,7} = 14.067$. This yields a *p-value* < 0.0001, highlighting once more that the NB2 is the best model to adjust the basic Poisson algorithm in order to estimate our insurance data.

4. CONCLUSIONS

An accurate insurance pricing system allows insurance companies to cover expected losses, expenses and make adequate the provision for contingencies. The first step in auto insurance pricing is the modeling of claim frequency, which represents an essential part for obtaining a reasonable and equitable insurance premium.

In this paper, it was considered an analysis of the classical and mixed count data models employed to estimate the frequency of claims made on vehicle insurance policies, focusing on the factors used to explain the insured risk. After a distinct analysis of insured's age variable, we obtained five categories of age depending on different years intervals in comparison with similar studies. This classification is used in the econometric modeling of insurance premiums.

After testing the equidispersion assumptions of Poisson distribution, both statistics presented in this paper reach the same conclusion, meaning the existence of overdispersion within the studied insurance portfolio. Results of these tests showed that NB models correct the overdispersion, providing a better fit to the data in comparison to the Poisson model. Furthermore, the comparison of NB1 and NB2 models indicated that the last one is preferred. By using the likelihood ratio in order to test the fit of the NB2 model, the results suggest that this model is the most appropriate to deal with the problem of overdispersion and to predict the claim frequency for the analyzed auto insurance portfolio.

While using Poisson and negative binomial models in the framework of GLMs, the risk factors that appeared to explain significantly the frequency of claims was the age-group and occupation of policyholders, the type, use and GPS device of vehicle, the bonus-malus coefficient and duration of the insurance policy. Based on the obtained results, we observed a decrease of claim frequency along with an increase of the insurance contracts duration, and also an increase of the frequency of claims along with the increase of bonus-malus coefficient. For these variables, there were obtained results which are similar with other actuarial studies and also consistent with the reality of the studied phenomenon.

The results obtained for the three variables introduced as risk factors indicates that the insured's occupation and GPS device appears to be significant, while the value of vehicle does not explain the frequency of claims. The modeling results could be considered as interesting sugestions for the insurance companies while implementing their pricing policy. Thus, the company could work with more age groups in order to evaluate the risk level of each insured and implicitly to calculate the insurance premium. The insured's occupation represents another valid factor that could be considered by the company in order to group the insurance portfolio in homogenous classes. Based on the GPS variable, the company could implement some precautionary measures, suggesting the new insured to use a GPS device. All this aspects aim at obtaining reasonable premium that corresponds to the risk level of each insured, and therby respecting the principle of equity in insurance.

Our empirical study could be useful to the policy-makers by allowing a better control on the insured risks and an accurate assessment of the insurance company liabilities leading to solvency and profitability.

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EQUITY MARKET REACTION TO SHARP PRICE CHANGES: EVIDENCE FROM POLAND

Rasoul REZVANIAN[*], Zbigniew KRYSIAK[**], Ewelina KLACZYNSKA[***]

Abstract

We examine investors' reaction to sharp price changes using two equity market indices in Poland: WIG and WIG20. Using daily market returns for the two indices from April 1991 and April 1994 to November 2012, we identify the event days as the days where market indices exhibited positive or negative daily price changes of 3 percent or more as well as two and three standard deviations from the mean of the market returns. By following the market behaviour through price trend for 30 days after the event days, two conclusions can be reached: (a) The arrival of unexpected news that cause sharp price changes impacts volatility of market indices, and (b) the subsequent price adjustments after the initial sharp price changes take an upward corrective pattern only after the initial negative price changes, but not after positive price changes.

Keywords: Poland's equity markets; overreaction and under-reaction; market efficiency

JEL classification: G14; G15

1. INTRODUCTION

The sustained economic development of the emerging economies requires a gradual development of financial markets and regulations overseen the financial markets. Since early 1990s, the countries in Central and Eastern Europe (CEE) have seen a rapid economic growth compared with other developed countries in the region. Along with this economic growth, the financial markets and the banking system of these countries have been instrumental in providing funds and liquidity to the economy and have also experienced a significant growth. As financial markets in the CEE countries are less developed compared with other advanced economies, the banking system has been playing a major role in supplying funds and liquidity into the economy[1]. However, the sustained long-term economic growth of these countries will depend on further improvement of their financial markets. Developed financial markets of the emerging countries would also provide non-domestic investors an opportunity to diversify their portfolio through international diversification.

[*] Northeastern Illinois University, United States of America; e-mail: *r-rezvanian@neiu.edu.*

[**] Warsaw School of Economics, Poland; e-mail: *zbigniew.krysiak@sgh.waw.pl.*

[***] Northeastern Illinois University, United States of America; e-mail: *e-klaczynska@neiu.edu.*

Among the CEE countries, since 1991 transition to market economy, the economic growth of Poland has been impressive. Poland has been one of the fastest growing economies in Europe in the past two decades. One of the major contributors to this economic growth has been the numerous regulatory measures taken by policy makers to improve efficiency of financial system[2]. Like other CEE countries, the primary and secondary financial markets (both for debt and equity markets) in Poland are small and are not well developed, and the banking system is still the major provider of funds to the economy. However, capital markets can be a major source of capital for economic development in future.

The equity market in Poland started in April 1991 and has been growing since then both in terms of volume and market capitalization[3]. The growth of equity markets accelerated since 1994, after the introduction of mass privatization of public institutions and with the passage of accounting regulations that required Polish companies listed in equity markets to comply with uniform accounting principles based on the international standards. In this study we contribute to the existing research on development of equity markets in emerging markets by examining the reaction of equity market participants to market shocks that resulted in sharp price changes in equity indices. The remainder of this paper is organized as follows: In the next section we provide a brief summary of existing research on the reaction of investors to sharp price changes in equity markets in different countries. Section 3 briefly presents new developments in financial markets in Poland. Section 4 describes the methodology and data. Section 5 provides the results and Section 6 concludes the paper.

2. LITERATURE REVIEW

The research on investors' overreaction to sharp price changes started after publication of the seminal paper by DeBondt and Thaler (1985, 1987) who argued that investors initially overreact to market news by setting equity prices higher (lower) than their fundamental values after the announcement of good (bad) news which leads to subsequent price reversal. There have been numerous studies examining the investors' reaction to sharp price changes using equity indices from developed countries of Europe and USA[4]. Equity markets of emerging economies in Europe and Asia have also been subject of numerous studies[5]. The results from the above studies are not conclusive, but generally indicate that there is a price reversal in equity markets after sharp price changes which in turn supports contrarian hypothesis that recommends purchasing a losing stock and selling a winning stock in order to earn an abnormal profit.

The results obtained and the conclusions reached from the studies on US and advanced European markets as well as the studies from other emerging economies may not be appropriate for the case of Polish equity market because of the differences in degree of market development and the unique characteristics of each equity market and its participants. Although there are some studies which examine different characteristics of equity markets in Poland, we are aware of only one published study on the reaction of equity market participants to sharp price changes in equity indices in five CEE countries including Poland, namely Stoica *et al.* (2013). Nivet (1997) studies the efficiency of Poland equity market using daily return of WIG index for the period of 1991-94. He shows that the stock market returns do not follow a random walk, and concludes that Polish equity market is not efficient in its weak form[6]. The same conclusion is also made by Gilmore and McManus (2003), who used daily returns of Polish equity indices for the period of July 1999 through September 2000 and applied both univariate and multivariate tests. Rockinger and Urga (2000) evaluated the market efficiency

of several Central European equity indexes, including Poland, over the period of April 1994 through June 1999. Using daily returns, they reported that Hungarian equity markets satisfy the weak-form efficiency, while the Czech and Polish equity markets are not efficient although moving towards efficiency. Worthington and Higgs (2004) test the random walk hypothesis for both developed and emerging countries (Czech Republic, Hungary, Poland, and Russia). Using unit root test, univariate and multivariate variance ratio tests, they report that among emerging markets, only the Hungarian market shows evidence of a random walk and hence is a weak-form efficient. More recently, Stoica *et al.* (2013) study the investors' reaction to the arrival of unexpected information in five CEE countries (Bulgaria, Czech Republic, Hungary, Poland, and Romania) pre and post 2008 financial crisis. They conclude that except for Czech Republic, investors in other CEE markets overreact to positive sharp price changes and under-react to negative sharp price changes. They suggest the contrarian strategy of taking a short position following a positive sharp price change and a long position following negative sharp price changes. To contribute to better understanding of reaction of investors to sharp price changes, in this paper we examine the reaction of equity market participants to sharp price changes in the two major equity indices in Poland, WIG, and WIG20.

3. RECENT DEVELOPMENT IN FINANCIAL MARKETS IN POLAND

One of the challenges faced by transition economies is developing their financial system conducive to a sustainable growth of their economies. In the wake of the Soviet Union breakdown in 1989, the post-socialist Poland was challenged with inevitability of creating new political and financial systems. Since 1992, after tackling a post-transition recession and hyperinflation, Poland has managed a positive yearly GDP growth rate of ranging from 1% to 7%[7]. Over the last five years, Polish GDP growth rate has been one of the top five among 27 European Union countries. Moreover, while the global economic crisis in 2008 and 2009 has slowed down the economic activity in Europe and pushed many European economies in recession, Poland was the only European Union country that generated a positive 1.6% growth rate in 2009 and thus avoided recession. Currently, Polish economy with a GDP of $488 billion in 2012, is tenth largest in Europe and twenty-fourth largest in the world, and has the S&P rating of A.

Transition to market economy in Poland started with privatization of government owned institutions accompanied with Foreign Direct Investment (FDI), which granted foreign investors the right to invest in joint ventures and purchase shares of Polish state owned enterprises[8]. Establishment of an independent central bank, the National Bank of Poland (NBP) in 1989, and Warsaw Stock Exchange (WSE) in 1991 had a profound impact on initiating and developing a new financial system to promote competitive market economy. The NBP has played a major role in assuring the stability of banking system and thereby ensuring domestic financial stability. At the same time, reviving the Warsaw Stock Exchange (WSE) in 1991 not only facilitated privatization process of government owned enterprises by providing liquidity to the shares of newly listed companies, but it also contributed to the efficient flow of FDI, as well as ensured faster integration of Polish markets with its international counterparts[9]. Along with transition reforms, Polish government initiated a process of integrating its economy and domestic financial markets with that of its European and international counterparts, through accession to different international economic organizations such as: European Community (EC) in 1989[10], World Trade Organization (WTO) in 1995, the Organization for Economic Cooperation and Development (OECD) in 1996, and the European

Union (EU) in 2004. The commitment to openness and the enforcement of the reforms as a condition for joining these international organizations elevated Polish regulatory and market environment to be in line with those of advanced European countries. As a result, Poland has been considered a pioneer among the CEE countries in stabilizing economy, attracting foreign investment and leading in the development of financial system.

As in other emerging economies experiencing economic growth, the role of financial system in overall growth of economy becomes more important as evidenced by the increasing ratio of financial assets to GDP[11]. However, in Poland, where the banking system has the largest share of the market (69.5% in 2012), financial institutions are still the major providers of funds to the economy[12].

The Polish financial market has its origins in the 19th century, when bills, bonds and shares were traded at the Warsaw Mercantile Exchange until the start of the World War II in 1939. The exchange remained closed for over fifty years during which the communist party imposed the centralized command economy. The current financial market in Poland consists of equity, bond, money, foreign exchange, and derivatives markets. However, except for the equity market, the other financial markets are at their early stage of development. Following the implementation of necessary regulations and institutional reforms, a modern WSE was established on April 12, 1991. On the first trading session of WSE on April 16, 1991, trading started on the Main List with five listed companies and market turnover value of $ 2,000. Since then, Polish stock exchange has grown into the largest in the CEE region with four different markets and twenty six indices[13]. The WSE Main List remains a primary market with $ 237.6 billion capitalization and 438 listed companies traded either on main or parallel market in 2012, where companies with a free float less than 10% and €1 million are listed on parallel market. The average value of equities trading on the Main List was $ 263.7 million with 46,388 transactions per session and with an average value of $ 5,684 per transaction. WIG and WIG20 are the major indices in terms of volume and value of transactions. All companies listed on the main market – 354 in 2012 – are covered by the total return index WIG while twenty largest blue-chip stocks constitute the price index WIG20[14]. The trading value of WIG20 companies represent 80% of total value of the Main List, which makes WIG20 a good proxy for the performance of the whole equity market.

The market value of top ten constituents in WIG and WIG20 accounted for 59 and 84 percent of portfolio respectively in 2012. Furthermore, the market value of companies in WIG and WIG20 was 96 and 47 percent of the WSE Main List total capitalization. The largest domestic company in both indices had a market value of $14.9 billion, while the smallest one had a value of $ 2.9 million in WIG and $425.8 million in WIG20. Although foreign companies constituted 11% of WIG index and 5% of WIG20 index, their cumulative market value accounted for 29% of WSE Main List capitalization. The market cap of the largest foreign company was $ 29.4 billion and the smallest – $ 10.6 million.

4. DATA AND RESEARCH METHOD

4.1. Data

In this study, we focus our attention on investors' reaction to sharp price movements in market indices rather than on individual stocks[15]. We use daily closing values of the two major stock market indices in Poland: WIG and WIG20. Our sample consists of daily closing values of the two indices from the date of inception – April 1991 for WIG and April

1994 for WIG – to November 2012. Figure 1 shows the trend of the two indices and Figure 2 illustrates their returns.

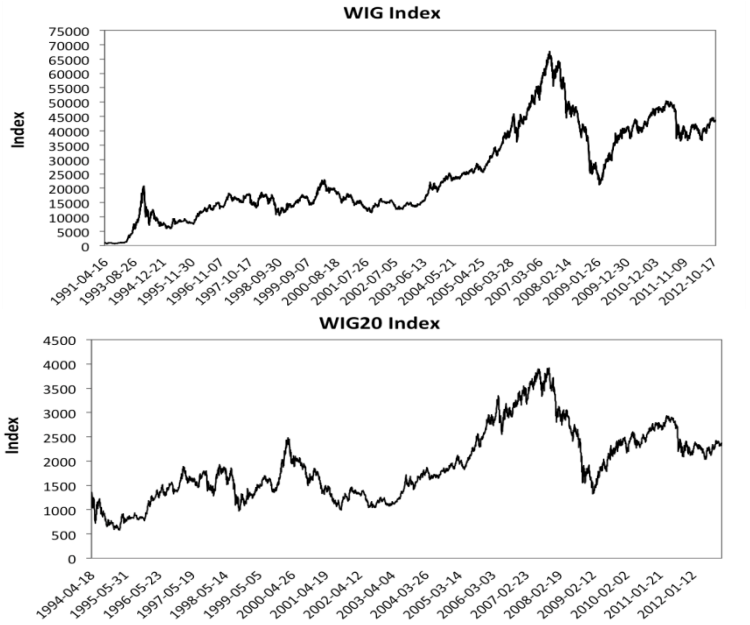

Figure no. 1 – Warsaw Stock Exchange indices

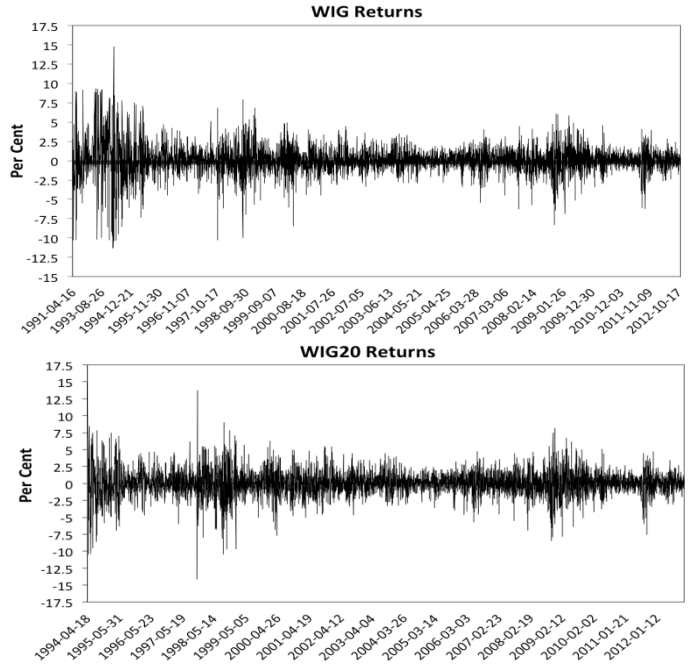

Figure no. 2 – Warsaw Stock Exchange returns

As it is evident from Figure 1, after a long relatively stagnant period from the date of inception until the end of 2002, the value of both indices sharply increased and reached their peaks in the second half of year 2008. Due to global financial crises, the equity indexes in Poland, like other equity markets in the world, took a sharp downturn until the first half of 2009. However, the decline in equity indices of Poland was not as severe as equity indices in developed and other emerging economies. Starting the second half of 2009, the indices then resumed an upward trend but so far have not reached their pre financial crises levels. The distinctive feature of variability of return of the WIG and WIG 20 can be seen from Figure 2. There is a high volatility of returns for both indices before the middle of 1999. Following this, the variability of returns subdued until the last global financial crises of 2008, when the volatility again increased and this high volatility persisted until 2010. Similar pattern of variability of returns can be seen from Figure 1 for both indices. Table 1 presents the summary statistics for two major indices in Poland compared with indices in other CCE countries. The average daily returns of WIG are the highest among its peers followed by BET Romanian. However, BUX Hungary and PX Czech Republic have the highest range of daily returns. In terms of variability measured by standard deviation of return, WIG has the highest standard deviation of return followed by WIG20 index. The striking observation is when we compare the average daily return and risk of the two indices in Poland. The average daily return of WIG is four times that of WIG20 (0.08% versus 0.02%). At the same time volatility of returns measured by standard deviation is almost the same, but the range of return of the WIG20 is slightly higher than the range of returns offered by WIG (29.00% versus 26.12%). This preliminary observation indicates that, on average, the WIG20 index provides a better investment opportunity than WIG since investors can earn higher returns by investing in WIG20 as compared to WIG for the same amount of risk.

Table no. 1 – Summary statistics for market indices of the Central and Eastern Europe (CEE) countries

Index	Days	Mean Return (in %)	STD (in %)	Max (in %)	Min (in %)
WIG Poland	4,954	0.08	1.97	14.78	-11.34
WIG 20 Poland	4,622	0.02	1.95	14.84	-14.16
PX Czech Republic	4,656	0.02	1.53	15.39	-16.19
BUX Hungary	3,909	0.03	1.86	13.62	-18.03
BET Romania	3,794	0.04	1.83	10.56	-13.12
SAX Slovakia	4,243	0.00	1.30	11.88	-14.81

4.2. Research Method

We calculate the daily returns of the WIG and WIG20 equity market indices using equation (1) as follows:

$$R_{it} = ln\ (\ I_{it} / I_{it-1})\ \text{x}\ 100 \qquad (1)$$

where R_{it} is the daily return of stock index *i* on day *t*, I_{it} and I_{it-1} are the closing values of stock index *i* on days *t* and *t-1* respectively, *i* represents the WIG and WIG20 indices used in this study, and *ln* is a natural logarithm[16].

The next step in our analysis is to identify event days. We select a set of event days that are represented by large price changes in the WIG and WIG20 indices. Researchers have used different ranges of prices changes to identify the event days for large price shocks[17]. In this study, we apply three measures of large price changes: positive and negative daily price changes of 3 percent or more; two standard deviations from the mean of market returns; and three standard deviations from the mean of market returns. Therefore, overall there are six measures of sharp price change in this study: three positive and three negative[18]. If the percentage changes in the value of the indices are equal to or more than the predefined sharp price change ranges, then that day is labelled as an event day. The event days are labelled "positive (negative)" if the news was favourable (unfavourable) and percentage change in indices values were greater (less) than or equal to each of the above defined three thresholds. As time passes and investors thoroughly analyse the importance and magnitude of the news, their initial reaction to the news may be revised upward or downward depending on their realization of the news. There are two contrary opinions explaining the secondary reaction of investors to sharp price changes initiated by news. Based on DeBondt and Thaler (1985), investors initially overreact to the announcement of both positive and negative news on the event days, and later on as they correct their overreaction, market would take a reversal trend. Contrary to the above, Brown, Harlow and Tinic (1988 and 1993), argue that the dissemination of news (both good and bad) increases market volatility and induces investors to set equity prices below their fundamental values. As more information about the event day news becomes available, investors would correct their initial reactions and the subsequent price trend is expected to be upward for both positive and negative news event days. The overreaction of investors relates to the negative changes only while the under-reaction to the positive changes.

Subsequent to the identification of the event days, is the selection of the event windows. The event window is a period of time in days during which changes in price are to be analysed. We use thirty-day window to track the daily price movement of indices after each of the positive and negative event days[19]. We believe that a longer window is more appropriate in the study of emerging markets because of slower pace of information flow in these markets, such that the investors require a longer time to correct their initial overreaction. After identifying the event days and selecting thirty-day trading window, we eliminated those event days that were followed by another event day within the defined trading window of the previous event day. Of course, this step reduced the number of observations to be used in the remaining part of the study. More importantly, however, it eliminated a distorting effect of the overlapping trading windows and minimized a bias with respect to the initial price shock[20]. Table 2 provides the number of event days for the WIG and WIG20 for the three defined price change thresholds used in this study. We also provide the remaining event days after dropping the event days that fell within the thirty-day trading window after an initial price shock.

Table no. 2 – Number of event days for the three measures of sharp price changes

	Measures of Price Changes		+/-3%	Mean +/-2 STD	Mean +/-3 STD	Total
Warsaw Stock Exchange WIG	Number of event days	Positive	240	136	56	432
		Negative	218	120	50	388
		Total	**458**	**256**	**106**	**820**
	Remaining event days	Positive	20	17	6	43
		Negative	11	9	10	30
		Total	**31**	**26**	**16**	**73**
Warsaw Stock Exchange WIG20	Number of event days	Positive	249	128	26	403
		Negative	239	129	41	409
		Total	**488**	**257**	**67**	**812**
	Remaining event days	Positive	18	22	7	47
		Negative	12	12	12	36
		Total	**30**	**34**	**19**	**83**

As is evident from Table 2, the total number of event days identified for the two equity indices and three measures of price changes is 1,632 days; 820 event days for WIG (of which 432 event day are positive event days, and 388 days are negative event days), and 812 event days for WIG20 (of which 403 days are positive event days and 409 event days are negative event days). Therefore the total number of positive event days is 835 (432 event days for WIG and 403 event days for WIG20), and total number of negative event days is 797 (388 negative event days for WIG and 409 negative event days for WIG20). Table 2 provides a detailed distribution of positive and negative event days for each of the equity indices for the three measures of price changes. As explained above, to avoid any double counting effects, for each index, we drop the event days that occur within thirty days of the previous price shock. Table 2 also provides information on the remaining event days for each index and the three measures of price changes after eliminating the subsequent price changes within the overlapping thirty-day trading window. For the WIG index (WIG20 index), there are 73 (83) remaining event days, of which 43 (47) represent positive event days and the remaining 30 (36) represent negative event days. The list of the remaining event days used in this study for further analysis with the corresponding price changes is provided in Panels A and B of Table 3.

Table no. 3 – Event days and corresponding price changes (in %)

Panel A: Warsaw Stock Exchange WIG						
Date	**Positive corresponding price changes**			**Negative corresponding price changes**		
	+ 3%	**Mean + 2 STD**	**Mean + 3 STD**	**- 3%**	**Mean - 2 STD**	**Mean - 3 STD**
1991-12-17	---	---	---	---	---	-7.6622
1992-01-07	---	5.8940	---	---	---	---
1992-07-07	---	---	8.3831	---	---	---
1992-12-03	4.4675	4.4675	---	---	---	---
1994-09-13	---	---	---	---	---	-7.5298
1994-12-12	---	---	5.9975	---	---	---
1995-02-24	---	---	7.2627	---	---	---
1995-05-30	---	---	---	---	---	-6.2617
1995-06-05	---	4.9274	---	---	---	---

Panel A: Warsaw Stock Exchange WIG						
Date	**Positive corresponding price changes**			**Negative corresponding price changes**		
	+ 3%	**Mean + 2 STD**	**Mean + 3 STD**	**- 3%**	**Mean - 2 STD**	**Mean - 3 STD**
1995-07-17	3.2815	---	---	---	---	---
1995-11-20	---	---	---	---	-3.8751	---
1996-03-11	---	---	---	-4.4740	-4.4740	---
1996-05-07	---	4.2382	---	---	---	---
1996-08-05	3.8716	---	---	---	---	---
1996-11-06	3.0626	---	---	---	---	---
1997-03-14	---	---	---	---	-4.2684	---
1997-04-02	---	---	---	-3.1978	---	---
1997-08-08	---	5.0748	---	---	---	---
1997-08-11	3.2174	---	---	---	---	---
1997-10-29	---	---	6.8323	---	---	---
1998-01-12	---	---	---	---	---	-6.1407
1998-02-09	---	4.1279	---	---	---	---
1998-03-10	3.5410	---	---	---	---	---
1998-10-01	---	---	---	---	---	-6.9817
1999-01-18	---	---	6.8039	---	---	---
1999-01-29	4.2787	---	---	---	---	---
1999-01-29	---	4.2787	---	---	---	---
1999-03-24	---	---	---	-5.1692	-5.1692	---
1999-09-15	---	---	---	-3.5810	---	---
2000-02-28	---	---	---	---	-6.0259	-6.0259
2000-04-17	---	---	---	---	---	-8.4678
2000-05-24	---	---	---	---	-4.1148	---
2000-05-30	3.3630	---	---	---	---	---
2000-10-16	---	4.0400	---	---	---	---
2000-11-13	---	---	---	-3.2829	---	---
2001-03-12	---	---	---	---	-4.5160	---
2001-04-18	3.3651	---	---	---	---	---
2001-11-13	3.0927	---	---	---	---	---
2002-01-03	---	4.4220	---	---	---	---
2002-01-09	3.9973	---	---	---	---	---
2002-05-16	3.1627	---	---	---	---	---
2002-09-03	---	---	---	-3.3562	---	---
2003-10-06	3.5059	---	---	---	---	---
2004-01-05	3.3174	---	---	---	---	---
2005-10-13	---	---	---	-3.3990	---	---
2006-02-28	---	---	---	-3.0893	---	---
2006-06-27	---	4.0553	---	---	---	---
2006-07-27	3.0134	---	---	---	---	---
2007-02-27	---	---	---	---	-4.4968	---
2007-03-08	3.1480	---	---	---	---	---
2007-08-16	---	---	---	---	---	-6.3059
2007-08-22	---	4.4638	---	---	---	---
2007-09-19	3.2378	---	---	---	---	---
2007-11-15	---	---	---	-3.1578	---	---
2008-01-24	---	4.0961	---	---	---	---

Panel A: Warsaw Stock Exchange WIG						
Date	**Positive corresponding price changes**			**Negative corresponding price changes**		
	+ 3%	**Mean + 2 STD**	**Mean + 3 STD**	**- 3%**	**Mean - 2 STD**	**Mean - 3 STD**
2008-03-18	3.0659	---	---	---	---	---
2008-11-24	---	6.0204	6.0204	---	---	---
2009-02-17	---	---	---	---	---	-6.8813
2009-04-08	---	4.4577	---	---	---	---
2009-07-14	---	4.1246	---	---	---	---
2009-09-22	---	4.1082	---	---	---	---
2009-10-02	---	---	---	-3.0434	---	---
2010-02-05	---	---	---	-3.3469	---	---
2010-05-10	---	4.5794	---	---	---	---
2010-05-26	3.6182	---	---	---	---	---
2011-09-22	---	---	---	---	-6.2436	-6.2436
2011-11-30	3.9903	---	---	---	---	---
Total Observations	**20**	**17**	**6**	**11**	**9**	**10**

Panel B: Warsaw Stock Exchange WIG20						
Date	**Positive corresponding price changes**			**Negative corresponding price changes**		
	+ 3%	**Mean + 2 STD**	**Mean + 3 STD**	**- 3%**	**Mean - 2 STD**	**Mean - 3 STD**
1994-09-13	---	---	---	---	---	-7.6535
1994-12-08	---	---	---	---	---	-5.8462
1995-02-24	---	---	7.5072	---	---	---
1995-05-30	---	---	---	---	---	-6.3261
1995-06-05	---	5.0536	---	---	---	---
1995-07-18	3.0159	---	---	---	---	---
1995-11-20	---	---	---	---	-3.9917	---
1996-03-11	---	---	---	-4.6706	-4.6706	---
1996-05-07	---	4.6565	---	---	---	---
1996-08-05	4.0993	4.0993	---	---	---	---
1996-11-06	3.0445	---	---	---	---	---
1997-02-13	---	4.2028	---	---	---	---
1997-04-01	---	---	---	-6.0018	-6.0018	-6.0018
1997-08-07	---	---	6.2006	---	---	---
1997-08-08	---	4.1283	---	---	---	---
1997-09-03	3.0361	---	---	---	---	---
1997-11-12	---	---	---	---	---	-6.2441
1998-01-12	---	---	---	---	---	-8.0061
1998-03-09	---	5.0722	---	---	---	---
1998-06-15	---	---	---	---	---	-6.8408
1998-11-02	---	---	7.8194	---	---	---
1999-01-18	---	6.2809	6.2809	---	---	---
1999-01-22	---	---	---	-3.2277	---	---
1999-04-19	---	5.7201	---	---	---	---
1999-04-20	---	---	---	-3.1738	---	---
1999-06-11	4.3260	4.3260	---	---	---	---
1999-09-24	---	---	---	---	-5.0074	---

Panel B: Warsaw Stock Exchange WIG20						
Date	**Positive corresponding price changes**			**Negative corresponding price changes**		
	+ 3%	**Mean + 2 STD**	**Mean + 3 STD**	**- 3%**	**Mean - 2 STD**	**Mean - 3 STD**
2000-02-03	---	---	6.2461	---	---	---
2000-04-17	---	---	---	---	---	-7.7057
2000-05-16	---	4.1567	---	---	---	---
2000-06-06	---	---	---	-3.2443	---	---
2000-11-06	---	4.0870	---	---	---	---
2001-04-18	---	4.8273	---	---	---	---
2001-07-20	---	---	---	---	-4.4691	---
2001-11-14	---	3.9369	---	---	---	---
2002-01-09	---	4.6224	---	---	---	---
2002-01-22	3.4643	---	---	---	---	---
2002-05-16	4.3472	4.3472	---	---	---	---
2002-09-03	---	---	---	-4.6759	-4.6759	---
2003-01-03	3.5060	---	---	---	---	---
2003-03-10	3.4569	---	---	---	---	---
2003-07-07	3.5953	---	---	---	---	---
2003-10-06	---	4.0752	---	---	---	---
2004-01-05	---	3.9791	---	---	---	---
2004-03-01	3.0191	---	---	---	---	---
2004-04-22	---	---	---	-3.1057	---	---
2005-03-02	---	---	---	-3.5901	---	---
2005-10-13	---	---	---	---	-4.0185	---
2005-11-02	3.2183	---	---	---	---	---
2006-02-28	---	---	---	-4.1175	-4.1175	---
2006-07-13	---	---	---	---	-4.5286	---
2006-09-04	3.8357	---	---	---	---	---
2007-02-27	---	---	---	---	-4.5714	---
2007-03-08	3.5607	---	---	---	---	---
2007-08-22	---	4.4570	---	---	---	---
2007-09-19	3.8458	---	---	---	---	---
2008-01-21	---	---	---	---	---	-6.9672
2008-03-25	---	3.9956	---	---	---	---
2008-04-11	---	---	---	-3.2679	---	---
2008-11-24	---	---	8.1548	---	---	---
2009-02-17	---	---	---	---	---	-7.8215
2009-04-02	---	---	6.7226	---	---	---
2009-06-22	---	---	---	---	---	-6.4076
2009-10-02	---	---	---	---	-5.0718	---
2009-11-16	3.0433	---	---	---	---	---
2010-02-05	---	---	---	-4.0299	-4.0299	---
2010-05-26	4.3597	4.3597	---	---	---	---
2011-09-22	---	---	---	---	---	-7.5431
2011-09-27	---	4.0802	---	---	---	---
2011-11-30	4.7224	4.7224	---	---	---	---
2012-07-12	---	---	---	-3.0745	---	---
Total Observations	**18**	**22**	**7**	**12**	**12**	**12**

Before analysing the abnormal returns and cumulative abnormal return of market indices over the thirty-day post event window, we examine the volatility of stock indices. For each of the market indices and for each of three measures of large price changes, we sub-categorize the sample into: non-event days (NED)[21], all post-event days (PED), and its subsamples of post-favourable (PFED) and post-unfavourable (PUED) event days. Using standard deviation of each of the above four subcategories, and using F-test, we test the following four null hypotheses for equality of the variance of returns as follows: NED = PED; NED = PFED; NED = PUED; PFED = PUED. In all cases, we expect the null hypotheses to be rejected. The rejection of the null hypothesis provides evidence to indicate that there is a statistically significant difference between the level of risk during non-event periods and the level of risk in the post-event periods. Table 4 provides the results of F-test for pairs of sub-categories. The equality of variance of sample pairs is rejected in all cases except for the PFED and PUED pair. Table 5 provides detailed information on the number of days, average variance of each of the above categories along with the results of F-test repeated from Table 4. It is striking to see that the variance of returns of PED (and its subcategories, PFED and PUED) is higher than the variance of NED[22].

Table no. 4 – Comparative variance of returns and F-test for event days (positive and negative) for three measures of sharp price changes for the two indices

Warsaw SE	Method	F-Test			
		NED & PED	NED & PFED	NED & PUED	PFED & PUED
WIG	+ / -3%	***	***	***	
	Mean + / - 2 STD	***	***	***	
	Mean + / - 3 STD				
WIG 20	+ / -3%	***	***	***	
	Mean + / - 2 STD	***	***	***	
	Mean + / - 3 STD	***	***	***	

****, **, * indicate significance at 0.01, 0.05, and 0.1 levels, respectively.*
NED – Non-Event Days
PED – Post-Event Days
PFED – Post-Favourable Event Days
PUED – Post-Unfavourable Event Days

Table no. 5 – Comparative variance of returns and F-test for event days (positive and negative) for three measures of sharp price changes for the two indices

Panel A: F-test results for +/- 3%						
Sample		No. of days	Variance (in %)	F-test Samples	F-test	
WIG	Non-Event Days (NED)	3992	4.4052	NED & PED	3.32	***
	Post-Event Days (PED)	930	1.3263	NED & PFED	3.54	***
	Post-Favourable Event Days (PFED)	600	1.2458	NED & PUED	3.03	***
	Post-Unfavourable Event Days (PUED)	330	1.4531	PFED & PUED	1.17	
WIG 20	Non-Event Days (NED)	3691	4.3121	NED & PED	3.06	***
	Post-Event Days (PED)	900	1.4073	NED & PFED	3.21	***
	Post-Favourable Event Days (PFED)	540	1.3446	NED & PUED	2.87	***
	Post-Unfavourable Event Days (PUED)	360	1.5041	PFED & PUED	1.12	

****, **, * indicate significance at 0.01, 0.05, and 0.1 levels, respectively.*

Panel B: F-test results for Mean +/- 2 STD						
Sample		**No. of days**	**Variance (in %)**	**F-test Samples**	**F-test**	
WIG	Non-Event Days (NED)	4147	4.0814	NED & PED	1.89	***
	Post-Event Days (PED)	780	2.1892	NED & PFED	1.77	***
	Post-Favourable Event Days (PFED)	510	2.3093	NED & PUED	2.08	***
	Post-Unfavourable Event Days (PUED)	270	1.9659	PFED & PUED	1.17	
WIG 20	Non-Event Days (NED)	3567	4.1407	NED & PED	1.98	***
	Post-Event Days (PED)	1020	2.0898	NED & PFED	1.93	***
	Post-Favourable Event Days (PFED)	660	2.1420	NED & PUED	2.09	***
	Post-Unfavourable Event Days (PUED)	360	1.9784	PFED & PUED	1.08	

****, **, * indicate significance at 0.01, 0.05, and 0.1 levels, respectively.*

Panel C: F-test results for Mean +/- 3 STD						
Sample		**No. of days**	**Variance (in %)**	**F-test Samples**	**F-test**	
WIG	Non-Event Days (NED)	4457	3.7257	NED & PED	1.02	
	Post-Event Days (PED)	480	3.8170	NED & PFED	1.08	
	Post-Favourable Event Days (PFED)	180	4.0277	NED & PUED	1.01	
	Post-Unfavourable Event Days (PUED)	300	3.6875	PFED & PUED	1.09	
WIG 20	Non-Event Days (NED)	4032	3.5027	NED & PED	1.27	***
	Post-Event Days (PED)	570	4.4643	NED & PFED	1.32	***
	Post-Favourable Event Days (PFED)	210	4.6307	NED & PUED	1.25	***
	Post-Unfavourable Event Days (PUED)	360	4.3740	PFED & PUED	1.06	

****, **, * indicate significance at 0.01, 0.05, and 0.1 levels, respectively.*

To calculate the Cumulative Abnormal Returns (CARs) for windows (both positive and negative) for each of the three defined thresholds of price changes, we first calculate abnormal returns as the deviation of each return from the mean return of the non-event days for each index *i* on day *t* (t = +1…. +30) following an unexpected event *d*. Formally,

$$AR_{itd} = R_{itd} - \overline{R_i} \tag{2}$$

where

AR_{itd} = Abnormal return for stock index *i* on day *t*, given event *d*

d = 1.....n, where *n* represents each of the positive and negative price shocks.

R_{itd} = Return of index *i* on day *t* for event *d*

$\overline{R_i}$ = Mean return of index *i* for non-event days.

Thus, the abnormal return AR_{itd} measures the difference between stock returns on each of the days within each window following a price shock and the mean stock return for all non-event days.

Having calculated the abnormal return (AR_{itd}) as above, we then calculate, as a second step, the mean of abnormal returns ($\overline{AR_{it}}$) for index *i* on day *t* as:

$$\overline{AR_{it}} = (1/n)\left(\sum_{d=1}^{n} AR_{itd}\right), t = +1..... + 30 \tag{3}$$

Finally, the CARs are generated by using the following equation:

$$CAR_{i1} = +\overline{AR}_{i1} \tag{4}$$
$$CAR_{it} = CAR_{i(t-1)} + \overline{AR}_{it}, t = 2...30$$

We perform a standard t-test to test whether the calculated CARs are statistically different from zero. The t-statistic is obtained as:

$$t = \frac{CAR_{it}}{\left[Var\left(CAR_{it}\right)\right]^{1/2}} \tag{5}$$

If the values of CARs following positive and negative price shocks are statistically significantly positive (or at least non-negative), this may indicate that the investors have under-reacted to good news and overreacted to bad news. Alternatively, if the CARs exhibit a statistically significant corrective price reversal pattern [statistically negative (positive) CARs following positive (negative) price shocks], then investors have overreacted to both good and bad news.

5. EMPIRICAL RESULTS

The results from the F-test, as presented in Table 4, are used to compare the volatility of returns of post-event days and its components (positive and negative post-event days) with the variance of non-event days for the two indices and the three measures of price changes. As it is evident from Table 4, for both indices and the three measures of price changes, the null hypotheses of equality of average variance of non-event days and post-event days (and its components, post-favourable event and post-unfavourable event days) are rejected at 1% level of significance. However, the null hypothesis of equality of average variance of post-favourable event days and post-unfavourable event days cannot be rejected. This indicates that the arrival of news (good and bad) changes market volatility, and the change is similar for both positive and negative news. Table 5 presents the comparative variance of returns and corresponding F-test results for NED and PED (and its components, PEFD and PEUD) for the two indices and three measures of price changes. As is evident from Table 5, except for the very sharp price changes (Mean +/- 3 STD), the variance of return of post-event days (and its components, PFED and PUED) is lower than the variance of non-event days. These results contradict the results reported by Rezvanian *et al.* (2011) and 2012) and Mehdian *et al.* (2004) for the equity markets in China, India, and Turkey, respectively.

To examine the subsequent reaction of investors after the initial price shocks, we used equation 4 to calculate CAR values for the subsequent 30 days for both indices. Panel A of Table 6 and the corresponding graphs in Panel A of Figure 3 present the CARs' trend for positive and negative price changes for the three measures of price changes for WIG market index. Similar information is provided in Panel B of Table 5 and corresponding graphs in Panel B of Figure 3 for WIG20 market index. As apparent from Table 5 and Figure 3, the price trend after a negative shock for the three price change measures follows a clear pattern of price reversal for both indices, evident from positive and increasing CAR values after the initial negative price shock. Further examination of price reversal after negative price shock reveals that, for both indices, the price reversal is stronger after a larger negative price shock. For

example, in the case of WIG20 and for the largest negative price shock of Mean - 3 STD, the CAR value increases from 0.51% in the day after price shock and reaches its maximum level of 8.075% 24 days later. Similar upward trend price reversal patterns, with different strength, can be seen for all three price measures in both indices. It seems that the price reversal pattern after a negative price shock for both indices reaches it maximum levels sometime between 24 to 30 days after the initial price shock. The above trend may signify that the investors in Poland overreact to negative news by pushing the equity price below its fundamental value, and thereby creating an environment conducive for subsequent price reversal and a possible opportunity for larger return. This overreaction is more pronounced for the larger negative price shocks. Similar results have been reported by Rezvanian *et al.* (2012) using National Stock Exchange and Bombay Stock Exchange indices in India, and Rezvanian *et al.* (2011) using the four major equity market indices from People's Republic of China, namely, Shanghai Stock Exchange Class "A" and Class "B", and Shenzhen Stock Exchange Class "A" and Class "B".

In contrast to the clear price reversal pattern after a sharp negative price change, the CAR values after the initial positive price shock do not provide a consistent pattern. For example, the CAR values for WIG index after the positive price shock (measured as +3% and Mean + 3STD) are negative and increasing, indicating investors' overreaction to positive price shock with subsequent price reversal. However, we could not detect similar pattern for the same price shock measures in the WIG20 index, although, similar pattern is detected for only the positive price shock measure of Mean + 3 STD. Therefore, it is difficult to draw any consistent price trend from investors' behaviour after the initial positive price shock from either of the equity indices of Poland.

Table no. 6 – Post-event Cumulative Abnormal Returns (in %)

Panel A: WIG						
Days	**CARs Favourable (in %)**			**CARs Unfavourable (in %)**		
	+ 3%	**Mean + 2 STD**	**Mean + 3 STD**	**- 3%**	**Mean - 2 STD**	**Mean - 3 STD**
1	0.493	0.991	-0.898	0.113	-0.017	-0.117
2	0.097	0.760	-2.115	0.994	0.500	0.976
3	0.015	0.758	-0.993	0.990	0.905	0.206
4	-0.531	1.078	-1.617	0.780	0.707	0.611
5	-0.942	0.224	-1.256	1.268	1.707	0.716
6	-1.009	-0.049	-0.728	1.542	1.943	0.635
7	-0.912	0.483	-1.403	0.907	1.941	1.051
8	-1.189	0.350	-2.480	0.674	2.023	-0.243
9	-0.835	0.275	-2.922	0.958	2.301	0.029
10	-0.952	1.078	-2.337	0.836	1.790	0.372
11	-1.051	0.654	-2.455	0.729	1.407	0.859
12	-1.001	0.639	-2.581	1.049	1.709	1.372
13	-1.342	**1.490**	-2.817	1.209	1.431	2.022
14	-1.439	**1.743**	-2.999	1.593	2.102	2.963
15	-1.578	**2.108**	-2.426	1.841	2.295	3.259
16	-1.210	**2.165**	-2.525	**2.419**	**2.585**	3.686
17	-1.691	**1.983**	-4.762	**2.495**	**2.709**	3.362
18	-1.697	**1.558**	-4.826	**2.181**	**2.919**	**4.018**
19	-1.871	**1.398**	-5.247	**2.342**	**3.006**	**4.406**
20	-1.912	**1.743**	-5.062	**2.086**	**3.191**	**4.347**

Panel A: WIG						
Days	**CARs Favourable (in %)**			**CARs Unfavourable (in %)**		
	+ 3%	**Mean + 2 STD**	**Mean + 3 STD**	**- 3%**	**Mean - 2 STD**	**Mean - 3 STD**
21	-2.097	**2.291**	-4.315	**2.131**	**3.605**	**4.965**
22	-2.189	**2.660**	-3.834	**2.023**	**3.695**	**5.237**
23	-2.559	**2.434**	-3.588	**2.056**	**3.439**	**5.294**
24	-2.520	**2.161**	-3.049	**1.945**	**2.712**	**4.941**
25	-2.090	**2.021**	-1.653	**2.413**	**4.254**	**4.928**
26	-2.005	**1.738**	-1.785	**3.102**	**4.440**	**4.452**
27	-2.048	1.375	-2.906	**3.198**	**3.861**	**4.193**
28	-2.069	1.423	-4.463	**3.439**	**3.761**	3.043
29	-1.887	**1.971**	-4.944	**3.497**	**4.239**	2.462
30	-1.755	**1.742**	-4.103	**3.998**	**4.208**	2.128

*Numbers in **bold** indicate significance of CARs at 10% confidence level based on t-test results.*

Panel B: WIG 20						
	CARs Favourable (in %)			**CARs Unfavourable (in %)**		
Days	**+ 3%**	**Mean + 2 STD**	**Mean + 3 STD**	**- 3%**	**Mean - 2 STD**	**Mean - 3 STD**
1	-0.152	-0.210	-0.473	0.480	-0.164	0.510
2	-0.421	0.137	0.133	0.980	-0.021	1.302
3	-0.663	-0.068	0.829	1.282	0.376	2.222
4	-1.092	-0.949	0.494	1.355	0.420	2.230
5	-0.749	-1.234	0.564	**1.920**	1.461	2.083
6	-0.886	-1.160	-0.072	**1.889**	2.000	2.419
7	-0.540	-1.133	-0.273	0.982	1.884	3.247
8	-0.976	-1.489	0.880	0.428	2.210	1.570
9	-0.758	-0.665	1.102	0.069	1.714	1.716
10	-0.636	-0.917	0.975	-0.194	1.780	1.847
11	-0.347	-0.995	0.830	0.018	2.223	2.546
12	-0.703	-1.427	0.435	-0.195	2.213	3.149
13	-0.894	-1.683	1.372	0.072	**2.392**	4.423
14	-0.471	-1.377	1.130	0.223	**2.336**	**5.529**
15	-0.758	-1.532	1.081	0.627	2.289	**6.455**
16	-0.663	-1.286	-0.147	1.124	**2.465**	**7.829**
17	-0.800	-1.521	-0.688	1.053	**2.725**	**6.826**
18	-0.323	-1.446	-0.081	1.112	**2.461**	**7.368**
19	-0.649	-1.298	0.434	**1.570**	2.159	**6.537**
20	-0.365	-1.154	-0.714	**1.533**	1.974	**7.268**
21	-0.342	-1.485	0.439	**1.646**	1.728	**7.236**
22	-0.616	-0.960	0.352	**1.707**	1.979	**7.821**
23	-0.945	-0.798	0.931	**1.996**	**2.387**	**7.657**
24	-0.485	-0.743	1.222	1.302	**2.747**	**8.075**
25	-0.018	-0.683	**2.665**	1.363	**2.870**	**8.016**
26	0.051	-1.068	**3.006**	1.138	**2.920**	**7.794**
27	-0.054	-1.322	**2.178**	1.425	**3.705**	**7.231**
28	0.341	-1.196	**2.383**	**1.818**	**4.203**	**7.726**
29	**1.040**	-0.562	**2.106**	**2.072**	**4.397**	**7.240**
30	0.861	-0.519	**2.759**	**2.262**	**4.928**	**6.518**

*Numbers in **bold** indicate significance of CARs at 10% confidence level based on t-test results.*

Figure no. 3 – Graphs of CARs for the WIG and WIG20 indices under the three measures of sharp price changes

6. SUMMARY AND CONCLUSIONS

This study examines the price patterns of the two major equity market indices in Poland after sharp price changes. Using daily stock returns from WIG and WIG20 equity markets, we examine the CARs trend after initial negative and positive large price changes. We apply three measures of large price changes: positive and negative daily price changes of 3 percent or more; two standard deviations from the mean of market returns; and three standard deviations from the mean of market returns. Therefore, overall we investigate the trend of the twelve possible CAR values 30 days after the initial large price changes; six positive and six negative sharp price event days for each of the equity indices.

The empirical results suggest that there is a consistent and statistically significant evidence of positive CAR values after a large negative price change in both indices.

However, a similar pattern cannot be detected after large positive price changes. We conclude that equity markets in Poland overreact to large negative unexpected macro news on the event days by pushing the value of index to less than its fundamental value. As markets gradually analyse the true value of information, they overcome their overreaction by taking corrective action by pushing the value of index upward toward to its true value. Contrary to the above, we could not find a similar consistent price reversal after a large positive price changes. It seems that investors in equity markets in Poland overreact only to large negative (rather than both negative and positive news) price changes. Overall conclusion from this study is that the announcement of negative macro news initially would increase volatility of equity indices and causes equity investors to overreact to negative macro news. Afterwards, as more information about the bad news (causing a large decline in equity induces) is widely available, and as equity investors more accurately analyse the news, they become more rational and take corrective action. This creates an environment that is conducive for subsequent price reversal and may create an opportunity for larger return. Our study also indicates that the price reversal is a gradual process and completes itself between 24 to 30 days after the initial large price decline. It is during this reversal period that we believe there is an opportunity for larger return. This above investment opportunity may also be more beneficial to international portfolio investors who are in the search of international diversification. The fact that historically, the market returns of equity indices in Poland are not highly correlated with the equity markets in Europe and US, and the fact the recent financial crises of from 2008-2011 did not have a severe adverse impact on the equity markets in Poland, provide another reason for investing in equity markets of Poland to benefit from international diversification.

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Notes

[1]. Didier and Schmukler (2013) argue that contrary to the perception in the literature that equity markets in the most advanced emerging economies such as China and India are relatively well developed, the capital markets in these two countries have not been a significant sources of financing across firms and their activities has been more subdued than what the aggregate numbers suggest.

[2]. For review of the recent regulatory measures taken by policy makers, please visit the Polish Financial Supervision Authority website: http://www.knf.gov.pl/en/Capital_market/Law/index.html.

[3]. Polish Stock Exchange organization called Giełda Papierow Wartościowych (GPW) is located in Warsaw, the capital of Poland.

[4]. For example, Brown, Harlow and Tinic (1988 and 1993), DeBondt and Thaler (1985), 1987), Kadiyala and Rau (2002), Atkins and Dyl (1990), Park (1995), Ajayi and Mehdian (1994a), Nam *et al.* (2001) and Ciobanu *et al.* (2008).

[5]. For example, Ajayi and Mehdian (1994b) study Hong Kong and Korea stock markets; Chan (1996) examines the Hong Kong equity market; Wang *et al.* (2000, 2004), Yeh and Lee (2000) and Rezvanian *et al.* (2011) investigate the Chinese equity markets, Da Costa (1994) study Brazil; Brailsford (1992), Allen and Prince (1995), and Gaunt (2000) study Australia; Diacogiannis *et al.* (2005) study Greece; Bowman and Iverson (1998) study New Zealand; Alonzo and Gonzalo (1990) study Spain; Mehdian *et al.* (2004) study Turkey. To address comparative investors' overreaction in different countries, a few other studies, such as Lasfer *et al.* (2003), investigate investors' reaction to sharp price changes in both advanced and emerging markets. Others, such as Mazouz *et al.* (2009), examine ten different Asian market indices. For an excellent review of short term predictability of stock prices conditional on large prior price change, refer to Amini *et al.* (2013).

[6]. This study was conducted at early stage of capital market development in Poland, when the number of listed companies and volume of trade were small. The Polish economy and capital markets in Poland have advanced since the mid 1990, and therefore the result of this study should be considered cautiously.

[7]. The GDP performance in Poland can be divided into the following stages: "Shock therapy" 1990-1993, "strategy for Poland" 1994-1997, "overcooling" 1998-1st half of 2002, "public finance reform program" 2nd half of 2002-2005, and "EU membership" since 2006. For more detailed discussion of GDP cycle in Poland please refer to Kolodko (2009).

[8]. There were more than 8,500 government owned enterprises registered for privatization in 1990, of which 86.4 percent completed privatization process by 2012.
[9]. There have been numerous reforms that facilitated Polish economy in transition period. These reforms resulted in dismantling of the old economic system, macroeconomic stabilization, domestic price liberalization, trade liberalization, privatization and restructuring of the inherited state-owned enterprises, social safety net, labor market reforms, and the advancement in business regulations for domestic firms, including procedures on registering property, implementation of new taxes procedure, enforcing contracts and resoling insolvency.
[10]. On September 19th 1989, Poland signed a five-year trade cooperation agreement with EC. The major objective of the agreement was to improve the conditions of access to Polish market for EC firms and therefore encourage direct investment.
[11]. The ratio of financial assets held by banks to total financial assets in the economy was 62.19 percent in year 2000. This ratio has been declining, and it was 35.24 percent in 2012.
[12]. This ratio was 1.26 in year 2000 and at the end of 2012 it jumped to 2.10.
[13]. These markets are: the Main List, NewConnect, Catalyst and WSE Energy. The indices include 24 indices of the Main List and 2 indices of NewConnect.
[14]. On September 23, 2013, the WSE introduced WIG30 which consists of 30 largest blue-chip stocks. The WIG20 index will be published until the end of December 2015.
[15]. With the exception of Richards (1996, 1997); Nam *et al.* (2001); Lasfer, Melnik, and Thomas (2003); and Ajayi and Mehdian (1994a, 1994b), other studies employ individual stock price data (rather than market index data) to examine investors' reaction to unexpected extreme price movements.
[16]. We performed Dickey-Fuller unit root test on each data series to test for stationarity of the series. The results, not reported, provide evidence to indicate that all return series used are stationary in their first differences.
[17]. For example, Bremer and Sweeney (1991) classify price changes of at least 10 percent as large; Lasfer *et al.* (2003) define large price shocks as those recorded when returns exceed by two standard deviations of the average market daily return, and Rezvanian *et al.* (2011) used different ranges of price changes – ±8, ±7 and ±5 percent – for the four different equity market indices in China.
[18]. The assumption is that as macroeconomic news (both good and bad) are announced, the investors will react to the news by bidding equity indices higher or lower depending on the strength and nature of the announced news.
[19]. Researchers have used different definition of windows in studies of investors' reaction to sharp price changes using the event study. For example, Howe (1986) Brown, Harlow and Tinic (1988), and Ketcher and Jordan (1994), take a short window of a day or two, but Chan (1988), Ball and Kothari (1989), Chen and Sauer (1997), and Rezvanian *et al.* (2011) take a long-term view and examine the subsequent price movement of the market index up to forty days after the initial sharp price changes.
[20]. Specifically, if the previous and successive event days are both at the same direction, then the successive event day may cause an over-estimation of the effect of the previous event day. However, if the previous and successive event days are in different direction (that is one negative and the other positive, for example, previous event day is positive followed by a negative event day, and vice a versa), then the market trend presented in thirty-day window is biased.
[21]. Non-event days are calculated by subtracting the event days and thirty trading days following the event days. We also subtracted the event days and the days following the event days where successive price changes fell within the thirty-day trading window after the initial price shock.
[22]. This result are in contrast with the results obtained by Stoica *et al.* (2013) who reported that in Poland the volatility of returns on non-event days is smaller than that on post-event (and its sub-categories of favorable and non-favorable) days.

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CONTRIBUTION TO THE RESEARCH OF SUSTAINABLE TOURISM DEVELOPMENT CONCEPT IN THE EXAMPLE OF ISTRIA (CROATIA)

Pavlo RUŽIĆ*
Damir DEMONJA**

Abstract

Tourism is a phenomenon which affects the entire economic and social life, and the implications of its development can be observed in different spheres (economic, psychological, behavioral, and others). Taking into account the simplistic interpretation of the economic development of tourism on the one hand, and social development of tourism on the other hand, it is justified to highlight the problem of so-called "social costs of tourism" as the need for more precise determination of the character of the consequences of its development. In the field of "social costs of tourism" there is a need to the overall tourist development closer approaches and with increased responsibility. This tendency is particularly noticeable in the last decades of the 20th and the early 21st century, when tourism has entered a phase of maturity, which basically requires a change in its interpretation and treatment. The aim of this paper is to identify, evaluate and predict factors that support the sustainable development of tourism in Istria (Croatia). The research used comparative and SWOT analysis, and the results of the research will confirm the application elements of the concept of sustainable development in tourism of Istria, which is introduced with different intensity activities of all stakeholders in the surroundings.

Keywords: Croatia, Istria, tourism, sustainable development, characteristics, problems, priorities

JEL classification: O1

1. INTRODUCTION

Tourism is the driver of economic development of the region, but at the same time makes a lot of pressure on natural resources and the environment. Sustainable tourism development (Welford and Ytterhus, 2004; Groth, 2000) can be classified into three categories: *economic sustainability*, which provides an objective and effective economic development and the training of future generations for development; *socio-cultural sustainability*, which is consistent with the culture, values and identity of the region; and *environmental sustainability*, which ensures the development in accordance with the sustainability of basic processes, biodiversity and resources. Improvement of sustainable

* Institute of Agriculture and Tourism, IPTPO, Poreč, Croatia; e-mail: *pavlo@iptpo.hr*.
** Institute for Development and International Relations, IRMO, Zagreb, Croatia; e-mail: *ddemonja@irmo.hr*.

tourism is of vital importance, especially in Mediterranean countries where it is evident the largest percentage of global warming with all the consequences associated with a reduction in reserves of drinking water and loss of biodiversity (ARLEM, 2013, pp. 1-12). Thus, water resource management, resolving the issue of pollution and waste is illustrated by the fact that natural resources are used faster than it can regenerate. As for the Istria, it recorded a large growth of the domestic and foreign tourists' arrivals and overnight stays which certainly results in a greater impact on the environment.

Tourism with all the related services and investments gives the vital importance of the economy of the region in terms of employment and its contribution to foreign trade balance (Hall and Richards, 2003). In the last thirty years, tourism, both in a positive and negative sense, become an important factor in the context of sustainable development. According to the World Tourism Organization (WTO) tourism in the European Union is an important factor in the economy with 9% of employees and 9% share in consumption. Tourism is one of the five export categories in 83% of all countries of the world and a major source of foreign exchange earnings in almost 38% of countries. Thus has a major role in the economy of many countries as a source of employment and a way to fight poverty. According to forecasts by the World Tourism Organization (WTO), the number of tourist arrivals in Europe will be doubled by 2020 and will amount to 720 million visitors. This expected development implies a serious risk to the environment and welfare of the population, but also for tourism.

With the increase of leisure time, earnings and trends, 180 million Europeans are traveling for holidays every year. Adventure spirit is more evident in modern tourists as well as greater demand for holidays that are full of outdoor activities, cultural and recreational contents. It was noted that most of the tourists avoiding destinations with impaired environment.

Istria is a leading tourist destination in Croatia. Tourism in Istria recorded steady growth and development as demonstrated by the data in Table 1.

Table no. 1 – Indicators of Istria tourism

Type of indicators	Year 2010	Year 2014	Index 2014/2010	% share in 2014 in the Republic of Croatia
Capacities (beds and places in campsites)	233.122	249.861	107	27,0
Arrivals (visitors) in 000	2.627	3.272	124	27,5
Overnight stays in 000	17.731	22.274	126	36,2
Average stay in days	6,7	6,8	98	5,1

Source: Istria Tourist Board (2011, 2015b)

According to available information, in Istria in the 2014, to tourists was available total accommodation capacity of 249.861 units (beds and places in campsites). Of this number of accommodation units, 50% are places in campsites. With a total capacity, Istria County participates with 27% in the overall capacities of the Republic of Croatia. According to available data, in four years (2010-2014), capacities in Istria County were increased by 7%. Tourist traffic in Istria County recorded a larger increase than the increase in capacities. Thus, according to the latest public data, in 2014 it was more than 3.2 million arrivals, which is 27.5% in total arrivals in Croatia, and more than 22.2 million overnight stays, or 36.2% of realized in Croatia. The average stay of tourists in Istria in 2014 was 6.8 days and is higher than the Croatian average of 5.1 days.

2. THEORETICAL BASIS

2.1. The origins and definition of sustainable tourism development

During the 60s, especially the 70s and largely in the 80s of the last century drawing attention of many countries and companies holders of tourist services was solely on economic aspects of tourism development, i.e. to its direct, indirect and multiplying effects, which on the economy has a consumption of domestic and foreign tourists. This caused exceptional criticism and directing on issues of tourism development influences on society and the tourists themselves. Arguments are drawn from a number examples of the negative sign in the development of tourism, such as for example the destruction of space (its "devouring" for the purposes of tourism construction), derogation of the natural environment and natural attractiveness, commercialization of cultural, historical and other heritage, the neglect of anthropological specificity and distinctiveness, etc. (Dobre, 2005). This caused changes in many destinations that are adapting to the needs of tourism development, lost its originality and uniqueness which discourage tourist travel.

After 90s of the last century it has developed the whole movement of "humane tourism", "responsible tourism", "healthy tourism", "tourism with of consideration and future", "eco-tourism" (McMinn, 1997; Wall, 1997; Buckley, 2000; Dobre, 2005; Spenceley, 2008; Jiaying and Sanjay, 2009). In recent years, all of these terms include the concept of "sustainable tourism". It can be stated that concept of sustainable tourism, as a form, basically, also means aspirations of the local community (or communities of wider scope) in relation to tourism development, which should be responsible for the type, nature and pace of the selected tourism development. In other words, sustainable tourism planning should recognize the rights and needs of residents (hosts), to respect their resources (physical environment), lifestyle and culture, as well as the right that they independently influence the fate of local resources (tourism and other).

Sustainable tourism could be defined as tourism that *"takes into account the current and future impact on the environment, economy and society taking into account visitors, industry, the environment and the local community"* (Blue & Green Tomorrow, 2014) or as a positive approach that seeks to reduce tensions and fictions that arise from complex interactions between the tourism industry, visitors, environment and society as a host (Dobre, 2005). It is an approach that includes work for a longer-lasting quality of natural and human resources. Also, sustainable tourism is defined as ability to meet the needs of present generations (tourists and hosts) without arrogant interpretation of future generation's ability (tourists and hosts) to satisfy their needs.

2.2. Differentiating sustainable and unsustainable development of tourism

Sustainable tourism development meets the tourists' and the local population needs while preserving resources for future development. This development implies the management of resources by meeting basic economic, social and aesthetic requirements while preserving the cultural integrity, essential ecological processes and biological diversity (McMinn, 1997). It is characterized by economic prosperity as a long-term competitive and cost-effective way of doing business and a quality source of employment. Furthermore, sustainable tourism development is characterized by social balance and unity, i.e. tourism which improves the quality of life of the local community and its involvement in

tourism planning and management. It is particularly aimed at protecting the environment and cultural heritage, reducing pollution and environmental degradation on a global and local level, it is tourism that enriches the uniqueness and diversity of cultural heritage. The main differences between sustainable and unsustainable development of tourism are shown in Table 2.

Table no. 2 – The differences between sustainable and unsustainable development of tourism

Sustainable development of tourism	Unsustainable development of tourism
Slow development	Rapid development
Controlled development	Uncontrolled development
Long-term perspective	Short-term profit
Qualitative development	Quantitative development
Local control/participation	Control without the local community
The plan is preceded by the development	Development without a plan
The developed concepts	Small projects
Local development	External development
Local employees	Imported labor force
Authentic architecture	Non-autochthonous architecture

Source: Roland Berger Strategy Consultants (2008, p. 8)

Consequently, sustainable tourism development is based on the principles that marks: a holistic approach, long-term planning, taking into account the limits, addressing global and local impacts, promoting sustainable consumption, balancing sustainability and quality, the insistence on the involvement of all stakeholders, allocation of costs to polluters, minimizing risks and continuous monitoring of key indicators. Sustainable tourism development is achieved by long-term, targeted-oriented planning and respecting the identity of the region. It is possible only with good cooperation between all stakeholders, from local communities to the tourists themselves (Byrd, 2007). Important stakeholders are: relevant ministries, local community, all segments of the tourism industry, transportation providers, non-profit environmental organizations, bodies for cultural preservation, works councils, tourists. The main areas of sustainable tourism development are: the environment and all forms of pollution, resources use, travel agencies business practices, sustainable production and consumption, the public sector and regulatory guidelines for protection.

2.3. Indicators of sustainable development in tourism

The main instruments for the implementation of sustainable tourism development are: the measurement tools (indicators of sustainability, identified limit values), economic instruments (taxes and duties, financial incentives), voluntary instruments (guidelines, testing and reporting, voluntary certification, voluntary contributions), and the management and controls (legislation, regulations, control of construction and spatial plans).

Indicators of sustainable tourism development were developed by the European Commission in 2013 as a result of the Study on the feasibility of the European system of indicators for sustainable management at the destination level (European Union, 2013). The study shows 70 indicators that are calculated and tracked in the Mediterranean countries of the European Union. The indicators are divided into four groups of nine indicators for managing sustainable tourism development destination, which, in the end, provide answers to the questions whether there is a plan and policy for the development of tourism in the

destination. Ideally, the plan should be multi-year and should include environmental, social, quality, health and safety areas. Such a plan should have a clear, time-bound goals which develops cooperation with all stakeholders in tourism, and it should be adjusted, focus on sustainability and open to the public and the surrounding.

The second group is indicators of sustainable tourism development economic values which is eighteen. They should monitor the contribution of tourism in sustainable economic destination, and among these indicators are those of tourist spending/consumption per day, according to which a tourist destination is more effective in creating value from tourism.

A third set are the indicators of social and cultural influence in the sustainable development of tourism. Travel movements are caused by the need getting to know cultural-historical heritage of certain destination and they are its anthropogenic factor. These attractive values of an area gain importance because they often involve uniqueness, rarity and unrepeatability. Convert function of tourism indicates the possibility of evaluating these non-economic goods and their transformation into an economic goods, but also means their partially defilement, destruction or, in extreme cases (e.g. due to careless construction), total destruction. Because of that their protection is needed, which should be carried out within the framework of sustainable tourism development. This group includes fourteen indicators.

A fourth group of indicators are indicators of effects on the environment in the sustainable development of tourism with a total of twenty six. They start from the fact that the environment has a great force in tourism. It must be long term "exploit", rather than short-term "consume". Tourism must be treated as an activity that environment should be valorized with a positive way for hosts and guests. The relationship between tourism and the environment must be managed so that the environment is a long-term exploited. To achieve this should establish a harmonious connection between the needs of visitors, the place itself and the local community. Changes in the "fast-growing world" must be observed, but not at the cost of forgetting the aforementioned principles. Tourism, the local community and various agencies (related to the environment) must respect the above and work together on their practical realization. Finally, indicators of the effects on the environment are focused on those elements that are critical to the sustainability of the natural environment destinations.

3. RESEARCH METHODOLOGY

3.1. Sources and research methods

The research in this paper is based on primary and secondary sources, and the approach and methods based on the views of domestic and foreign researchers. The key elements of sustainable tourism development will be studied using comparative analysis and SWOT analysis. Also in this research are used data from the statistics on realized arrivals and overnight stays in municipalities and cities in the whole territory of Istria, i.e. County of Istria.

3.2. Research objectives and hypothesis

The main objectives of this paper are the detection of the key elements of sustainable tourism development of Istria. In this regard, the proposed hypothesis claims that the development of tourism in Istria takes elements of sustainable development that are evident

with different intensity activities of all stakeholders in the surrounding. Proving the proposed hypotheses will be carried out on the example of the tourist destination of Istria.

3.3. Time and area of research

The research covered period from 1966 to 2014 and for the entire period were analyzed the developmental aspects and established the beginnings of the introduction of sustainable development elements in tourism of Istria.

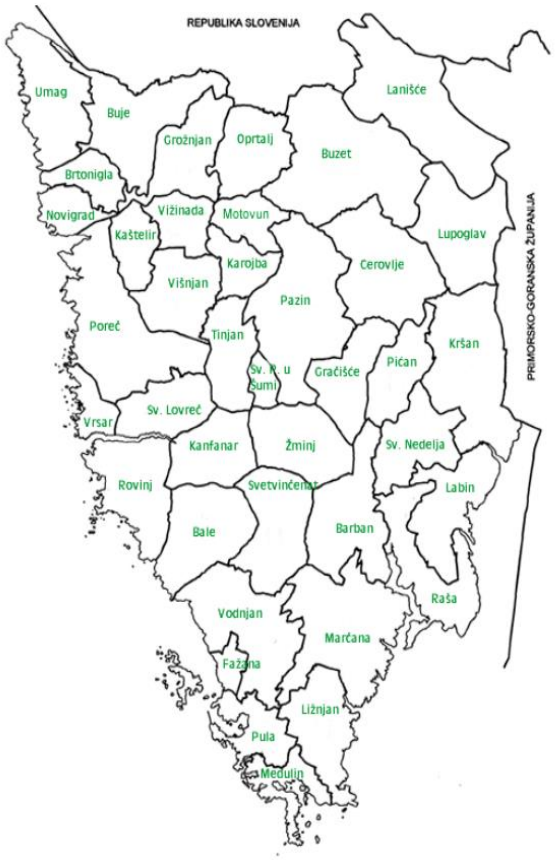
The spatial volume of research concerns the rural and maritime area of Istria, which is located on the north-eastern part of the Adriatic Sea on the westernmost and largest Croatian peninsula. Northern boundary to the continent is a line between Bay of Milje (Muggia) in the immediate vicinity of Trieste and the Bay of Preluka near Rijeka. Istria is the westernmost county of the Republic of Croatia and the largest Croatian peninsula, which is situated along a major thoroughfare between the Alps and the Dinaric Mountains, making a unique European area which Central Europe comes to the warm Adriatic Sea. Istria is the closest Mediterranean destination for central European countries.

Picture no. 1 – Map of Istria
Source: Wikipedia (2015)

Surface area of the Istria peninsula is 3,476 square kilometres and three countries "share" it: Croatia, Slovenia and Italy. A very small part of Istria, north side of the peninsula with the Gulf of Muggia, belongs to the Republic of Italy. Slovenian coastline, with Koper Bay and part of the Piran Bay to the mouth of the river Dragonja, is part of the Republic of Slovenia. Most of the Croatian part of the peninsula is located in the County of Istria with 2,822 square kilometres which makes 4.98% of the surface area of the Republic of Croatia. Length of the coast of Istria is 539 kilometres including the islands. The western coast of Istria is indented, and long, together with the islands, 327 kilometres. East coast, together

with islets, is 212 kilometres long. The rest of the Istria peninsula administrative-territorial belonging to Primorsko-Goranska County Istria (The Istria Region, 2015a).

The Istria County consists of local self-government units, 10 towns and 31 municipalities (Picture 2). Towns are: Pula, Pazin, Poreč, Buje, Buzet, Labin, Novigrad, Rovinj, Umag and Vodnjan. Municipalities are: Bale, Barban, Brtonigla, Cerovlje, Fažana, Funtana, Gračišće, Grožnjan, Kanfanar, Karojba, Kaštelir-Labinci, Kršan, Lanišće, Ližnjan, Lupoglav, Marčana, Medulin, Motovun, Oprtalj, Pićan, Raša, Sveta Nedelja, Sveti Lovreč, Sveti Petar u Šumi, Svetvinčenat, Tar-Vabriga, Tinjan, Višnjan, Vižinada, Vrsar and Žminj (The Istria Region, 2015c).



Picture no. 2 – Town and municipalities of Istria County
Source: The Istria Region (2015b)

Of these structural units, towns and municipalities, 19 of them have access to the sea while others are in the heartland of the Istria peninsula. Organizational units with access to the sea are towns: Pula, Poreč, Labin, Novigrad, Rovinj, Umag and Vodnjan, and the municipalities: Bale, Barban, Brtonigla, Fažana, Funtana, Kršan, Ližnjan, Marčana, Medulin, Raša, Tar-Vabriga and Vrsar. In municipalities with an access to the sea is realized 97% of tourist traffic of all the tourist traffic/activity in the tourist destination of Istria.

Conducted research determined the developmental periods of tourism in Istria and their basic characteristics. Within the research of development it is particularly explored whether in certain periods of development were no indications of involvement the concept of sustainable development elements. Finally, based on the SWOT analysis, i.e. the analysis of strengths, weaknesses, opportunities and threats will be checked what has been done, what now must to do and what should be taken in the future in order to develop tourism of Istria on the principles of sustainability.

4. DISCUSSION

4.1. Developmental periods of Istria tourism

Tourism in Istria after World War II was in very poor condition. The full range of tourist accommodation facilities, hotels and restaurants, were mostly damaged by war. Until 1960, the war damages were repaired and began the development of tourism in Istria, which can be researched through three periods:

1. first period from 1960 to 1980,
2. second period from 1980 to 1990, and
3. third period from 1990 until today.

The first period of tourism development in Istria, from 1960 to 1980, marks the intensive development of the tourists' capacity for accommodation, nutrition and entertainment.

Table no. 3 – Indicators of tourism development of Istria from 1966 to 1980

Year	Total accommodation capacities	Places in campsites	Marine berths	Rural tourism – beds	Maritime tourism		Rural tourism		Total	
					Visits in 000	Overnight stays in 000	Visits in 000	Overnight stays in 000	Visits in 000	Overnight stays in 000
1966	38.600	19.428	-	-	397	3.497	-	-	397	3.497
1970	111.400	46.120	-	-	744	6.556	-	-	744	6.556
1980	198.300	102.332	-	-	1.708	16.237	-	-	1.708	16.237

Source: Statistical Office of the Rijeka Municipalities Association (1986, pp. 82-87)

This period of tourism development in Istria characterized by intensive facilities and capacities construction/building with the primary aim/objective of ensuring conditions for the reception the largest possible number of tourists. The fundamental characteristic of this period is the construction/building of large accommodation facilities with a capacity of 400-1500 beds with elementary technical and technological equipment. During this period, the sustainable development of tourism is not even considered, but efforts have aimed at creating the conditions for the reception the largest possible number of tourists.

The second period of tourism development in Istria, from 1980 to 1990, characterized slightly slower intensity of new facilities and capacities construction/building. During this period, development was focused on improving the offers with new contents to meet the increasing tourists' demands and needs.

Table no. 4 – Indicators of tourism development of Istria from 1980 to 1990

Year	Total accommodation capacities	Places in campsites	Marine berths	Rural tourism – beds	Maritime tourism		Rural tourism		Total	
					Visits in 000	Overnight stays in 000	Visits in 000	Overnight stays in 000	Visits in 000	Overnight stays in 000
1980	198.300	102.332	-	-	1.708	16.237	-	-	1.708	16.237
1990	245.815	126.420	4.030	-	2.094	17.467	-	-	2.094	17.467

Source: Statistical Office of the Rijeka Municipalities Association (1986, pp. 82-87), Ivošević (1995, p. 75)

In this period of development, more attention is paid to the tourists, their needs for entertainment, sport and recreation, and furnishing hotels with additional amenities. Also in this period were built the first marina for nautical tourism, and in campsites is conducted subdivision and build additional facilities for tourists' entertainment, sports and recreation.

In the third period, from 1990, which continues to this day, all efforts are focused on raising the quality of accommodation and service of food and beverages. Also improves the business efficiency and management by introducing modern information systems to monitor and control processes in accommodation units and the destination. In this period hotels are being renovated merging two rooms into one with full equipment (air conditioning, TV, video, etc.). Also in the hotels are being built swimming pools, spa, and more in order to satisfy every tourists wish and needs.

Table no. 5 – Indicators of tourism development of Istria from 1990 to 2014

Year	Total accommodation capacities	Places in campsites	Marine berths	Rural tourism – beds	Maritime tourism		Rural tourism		Total	
					Visits in 000	Overnight stays in 000	Visits in 000	Overnight stays in 000	Visits in 000	Overnight stays in 000
1990	245.815	126.420	4.030	-	2.094	17.467	-	-	2.094	17.467
2000	217.924	106.067	11.000	2.920	2.080	14.284	-	-	2.080	14.284
2010	230.122	113.525	16.606	27.510	2.514	17.363	223	1.678	2.737	19.041
2014	249.861	124.930	16.610	27.600	2.944	19.518	327	2.756	3.272	22.274

Source: Statistical Office of the Rijeka Municipalities Association (1986, pp. 82-87), Administrative Department of Tourism of Istria County (2012), Istria Tourist Board (2011, 2015b)

Also, in campsites except allotment/parcelling are introduced new forms of accommodation – mobile homes, campsites are equipped with swimming pools and other contents/facilities/attractions for a maximum satisfaction of the tourists' needs and desires. Tourism is developing not only by the sea but also in rural areas. Small accommodation facilities are becoming increasingly popular and they are noticed in the structure of accommodation capacities. In this period of development begins to think about sustainable development, and the development of tourism in Istria are beginning to apply and monitor indicators of sustainability.

4.2. Problems of tourism development in Istria

The development of tourism in Istria from 1960 to the present day is followed by successes and undesirable consequences. The successes and the consequences of the rapid development of tourism in Istria are evident in all its periods. In the first period, which insisted on the rapid growth of the capacities of tourist accommodation (hotels, campsites) capacity growth was not accompanied by adequate growth of supporting infrastructure (water supply, electricity, telephones, building utilities and other facilities for drainage and waste water treatment, transport infrastructure construction, etc.). The above discrepancy in peak season caused nasty water and electricity shortages, traffic jams, shortage of goods in the shops, shortages of gasoline at gas stations, and more.

One of the major problems in the development of tourism in Istria, in almost all periods, was the lack of personnel. Intensive development of tourism demanded a large number of professional and educated personnel. In the 60s of the last century highly trained personnel were too few in the entire territory of Istria. This can also apply to the qualified and medium educated personnel. Also, the personnel with lower education and those without qualifications for cleaning rooms and other facilities at the hotel, support personnel in the kitchen, and more were missed. The personnel were not possible to provide in the neighbourhood, in the area of Istria, and during the season the personnel had to bring in from other parts of the Croatia and the former Yugoslavia. With such personnel it was difficult to keep track of intensive development and achieve good business results, because the personnel had a special cultural, customary habits, it had to be hastily prepared and trained for jobs in tourism.

Furthermore, due to the great pressure of guests who wanted to spend a vacation in Istria, due to the regular delays with the construction/building and putting into function new facilities, each year occurred the excessive sale of accommodation, so there have been major problems in accommodating all newly arrived tourists. Many tourists come on vacation in Istria without staying at the hotel who booked because it was not put in function in time.

The appearance and equipment of hotels was also a particular problem. Basically were built large hotels with small rooms, equipped only with necessary equipment (bed, wardrobe). Also, the development of other forms of tourist offer is neglected: restaurants for non-pension offer of food and beverages and entertainment, sport and recreation facilities. Listed facilities for non-pension offer were small compared to the number of tourists stationed in Istria, so tourists are often forced to wait to get rid of a table or chair in the restaurant, then were rows of getting sports equipment or to use sports fields.

With all of the above has been neglected the development of tourism in rural areas of Istria. Until 90s of the last century tourism offer in rural areas in Istria has been very modest, and the only facilities of tourism in rural areas at that time were in Krculi near Žminj and in Motovun.

4.3. Characteristics of tourism in Istria once and today

The motives of tourists' arrival in Istria were once the sun, sea and gastronomy. Today these motifs, as compared to the past, extended to entertainment, sports, recreation, adventure, and more. Primarily insists on the quality of offer while ago the quantity was important.

Table no. 6 – Realized arrivals and overnight stays in Istria in 2014, the average tourists stay and average capacity utilization

Month	Arrivals	Overnight stays	Average length of stay in days	Average capacity utilization in days	Average capacity utilization in %
January	13.021	56.383	4,3	0,2	0,6
February	20.426	66.675	3,3	0,3	0,1
March	44.802	155.689	3.5	0,7	2,8
April	174.617	606.080	3,5	2,6	6,6
May	261.331	1.131.860	4,3	4,8	20,3
June	522.339	3.195.497	6,1	13,7	37,7
July	792.892	6.057.455	7,6	25,9	87,1
August	940.842	7.517.368	8,0	32,2	100,0
September	352.790	2.905.710	8,2	12,4	40,0
October	98.824	410.460	4,2	1,8	5,5
November	24.645	87.201	3,5	0,4	1,3
December	25.751	84.163	3,2	0,4	0,9
Total	**3.272.280**	**22.274.541**	**6,8**	**95,4**	**26,5**

Source: Istria Tourist Board (2015b)

From the data in Table 6 it can be seen that the problem of seasonality is present even today, as it was once, i.e. that more than 50% of tourist traffic (visitors and overnight stays) on yearly basis achieves in July and August. According to data from 1984 (Statistical Office of the Rijeka Municipalities Association, 1986, pp. 412-415), in Istria that year, thus 30 years ago, achieved a total of 2.071.523 visits and 18.793.018 overnight stays, the average stay of tourists was 9 days, average utilization of capacity in days was 83,7, less than 2014 when amounts of 95,4, and 1984 was less the average use of capacity in percentage, 23,2%, compared to 2014 when the utilization capacity is 26,5%.

According to the data in Table 7, in the tourists structure once dominated the Germans, Austrians, Italians and Dutch, while tourists from then Eastern Bloc countries (Czech Republic, Slovakia, Hungary and Russia) were very poorly represented. Nowadays there are more tourists from East European countries, which are represented in the structure more than once before.

Table no. 7 – Tourist arrivals and overnight stays in Istria by country of origin in 2014 and the structure of tourists in Istria by countries of arrival in 2014 and 1984

Country	Arrivals*	Overnight stays*	The structure of tourists in % in 2014*	The structure of tourists in % in 1984**
Austria	469.710	2.593.730	11,6	13,5
Czech Republic	111.693	726.064	3,3	-
Denmark	34.305	289.343	1,3	1,8
France	53.465	251.493	1,1	1,7
Italy	388.396	1.970.089	8,8	12,2
Hungary	76.228	408.092	1,8	1,8
Netherlands	147.149	1.476.267	6,6	5,9
Germany	777.906	6.786.065	30,5	44,4

Country	Arrivals*	Overnight stays*	The structure of tourists in% in 2014*	The structure of tourists in % in 1984**
Poland	78.649	545.030	2,4	0,4
Russia	47.798	485.119	2,2	0,3
Slovakia	41.896	258.570	1,2	-
Slovenia	460.379	3.103.822	13,9	-
Switzerland	44.124	271.725	1,2	1,5
United Kingdom	72.507	490.963	2,2	8,7
Croatia	183.442	945.392	4,2	-
Other countries	284.633	1.663.777	7,7	7,8
Total	**3.272.280**	**22.274.541**	**100,0**	**100,0**

Source: * *Istria Tourist Board (2015a);* ** The structure of tourists for 1984 been calculated according to data from the *Statistical Office of the Rijeka Municipalities Association (1986, pp. 412-415)*

The main objective of the tourism policy used to be the realization of a large number of arrivals and overnight stays. Today insist on greater consumption per tourist per day and at the same time in the offer include numerous activities that were once unknown. Tourist offer used to be very modest and amounted to the services of accommodation, catering and entertainment. Today's offer is significantly expanded, diverse, and constantly taking care to increase its quality and strives to satisfy every tourist's wishes and needs. Tourist demand used to be less demanding, and today is very demanding, especially in terms of services quality and price level.

The situation with the personnel, compared to the past, today is excellent. In the employment/hiring of trained personnel today conducts selection and testing. Employment/hiring of trained personnel before were carried out without testing and immediately they ensure large benefits (salary, housing, status, position, etc.). Supporting infrastructure (water, drainage, electricity, telecommunications, roads) today is satisfactory than before. Infrastructure is coordinated and monitors the development of tourism. Former shortages today are unimaginable.

The development of tourism until 1990 was focused exclusively on the sea, on the 19 cities and municipalities that have access to the sea. Today, tourism in Istria is developing in municipalities and cities in its rural areas, which recorded good results.

Table no. 8 – Tourist arrivals and overnight stays by Tourist Boards of Istria County in 1984 and 2014

Tourist Board	Arrivals 1984	% 1984	Overnight stays 1984	% 1984	Arrivals 2014	% 2014	Overnight stays 2014	% 2014
Bale	-	-	-	-	34.225	1,05	208.695	0,94
Barban	-	-	-	-	6.949	0,21	61.210	0,27
Brtonigla	-	-	-	-	54.470	1,66	480.572	2,16
Buje	-	-	-	-	31.987	0,98	155.015	0,70
Buzet	10.033	0,5	120.911	0,6	9.088	0,28	33.004	0,15
Fažana	8.545	0,4	90.711	0,5	111.372	3,40	900.1622	4,04
Funtana	90.428	4,4	939.919	5,0	173.164	5,29	1.390.270	6,24
Grožnja	-	-	-	-	2.370	0,07	15.298	0,07
Kanfanar	-	-	-	-	4.644	0,14	39.752	0,18

Tourist Board	Arrivals 1984	% 1984	Overnight stays 1984	% 1984	Arrivals 2014	% 2014	Overnight stays 2014	% 2014
Kaštelir-Labinci	-	-	-	-	4.131	0,13	50.719	0,23
Kršan	-	-	-	-	5.178	0,16	40.588	0,18
Labin	119.764	5,8	1.037.071	5,5	199.909	6,11	1.286.126	5,77
Ližnjan	-	-	-	-	18.253	0,56	175.714	0,79
Marčana	-	-	-	-	28.388	0,87	240.332	1,08
Medulin	126.181	6,1	987.198	5,3	318.810	9,74	2.313.353	10,39
Motovun	-	-	-	-	13.097	0,40	32.682	0,15
Novigrad	97.829	4,7	850.036	4,5	193.306	5,91	1.175.317	5,28
Oprtalj	-	-	-	-	15.838	0,48	70.491	0,32
Pazin	5.263	0,2	11.218	0,1	19.353	0,59	149.273	0,67
Poreč	561.567	27,2	5.040.986	26,8	437.182	13,36	2.839.064	12,75
Pula	262.320	12,7	1.770.700	9,5	271.033	8,28	1.450.945	6,51
Raša	-	-	-	-	29.185	0,89	252.351	1,13
Rovinj	301.389	14,5	2.732.881	14,5	478.810	14.63	3.137.615	14,09
Svetvinčenat	-	-	-	-	8.620	0,26	83.773	0,38
Tar-Vabriga	-	-	-	-	193.202	5,90	1.548.069	6,95
Umag	341.292	16,5	3.678.345	19,6	365.979	11,18	2.033.534	9,13
Višnjan	-	-	-	-	2.002	0,06	19.421	0,09
Vižinada	-	-	-	-	2.342	0,07	22.462	0,10
Vodnjan	-	-	-	-	32.766	1,00	510.470	2,29
Vrsar	110.912	5,3	1.255.042	6,6	181.297	5,54	1.370.560	6,15
Žminj	-	-	-	-	4.511	0,14	42.446	0,19
Nautics	36.000	1,7	278.000	1,5	20.819	0,64	145.258	0,65
Total	**2.071.523**	**100,0**	**18.793.018**	**100,0**	**3.272.280**	**100,0**	**22.274.541**	**100,0**

Source: Istria Tourist Board (2015b)

Once the tourism development was accompanied by great optimism and enthusiasm of employees and to the guests are expressed hospitality and respect. In tourism was worked with pride, lot of sacrifice and great will, and today there are less those working qualities.

4.4. Analysis of tourism in Istria from the aspect of sustainable development

Analysis of Istria tourism in the context of sustainable development is viewed within the four factors that make the analysis of the situation, i.e. SWOT analysis. Through four factors of SWOT analysis: strengths, weaknesses, opportunities and threats, determine the current position of Istria tourism in sustainable development.

Table no. 9 – SWOT analysis of sustainable development of tourism in Istria

STRENGHTS	WEAKNESSES
• natural tourist values • diversity and preservation of the landscape • advantageous geographical position • anthropogenic tourist values • hospitality • tradition in tourism • ability to produce healthy food	• depopulation and inadequate age structure of the rural population of Istria • migration of the rural population of Istria • relatively small number of accommodation units in the rural areas and a large number of accommodation units in the maritime area • insufficient capacity utilization

• wealth of wild fruits and herbs • number of events • the ability to link the mountain with maritime part of Istria (nearness the Učka massif and the sea) • existing accommodation capacities • engagement of tourist boards in promotion of tourism • satisfying the needs of tourists and the local population • conservation of resources for future development • management of resources with the aim of meeting the economic, social and aesthetic requirements • preservation of cultural integrity, ecological processes and biodiversity • quality source of employment in tourism • improving the quality of life in the local community • community involvement (stakeholders) in tourism planning and management • reducing pollution and environmental degradation • long-term planning • respecting the limits • promoting sustainable consumption • reallocation of costs to polluters • minimizing risks of doing business in tourism • continuous monitoring of key indicators	• insufficient quality standards resistance • environmental pollution in rural part of Istria (Plomin) • minor problems of water supply and drainage in settlements • lack of training in tourism • insufficiently diversified tourist offer • insufficient involvement of all stakeholders in tourism development planning • seasonality • insufficient project control in tourism
OPPORTUNITIES	**THREATS**
• development of rural tourism as a Istria chance and the trend on the global level • agricultural development • connecting with other subjects with the aim to integrate offers • the availability of European funds • regional joining • initiatives to create souvenirs, activation of traditional crafts and local handicrafts • implementation of strategic solutions such as master plan and project of tourism sustainability	• migration of the rural population • nearness to environmental pollutants (Plomin) • lack of financial resources • economic crisis • partly unsatisfactory legislation in the field of tourism • insufficient interest of local and foreign investors for investment in tourism development • rapid development • uncontrolled development • short-term profits • quantitative development • control without local community • development without a plan • imported workforce • non-autochthonous architecture

Source: authors' of the manuscript research results

This SWOT analysis shows that there are strengths, weaknesses, opportunities and threats in the development of sustainable tourism in Istria. Opportunities in tourism in Istria have changed over time. While the current strengths and weaknesses based on past, present and future opportunities and threats are based on past and present.

In Istria is awakened awareness of the need to develop tourism on the concept of sustainable development. It happened at the beginning of the 90s of the last century when tourism has entered a phase of deep maturity and had to take measures to turn the concept of mass tourism in sustainable tourism. The measures are evident: the insistence on the development of tourism in the entire region of Istria, rural and maritime, insistence on offer quality and on new contents, insistence on improving business efficiency, preservation of the area from pollution, preservation of cultural and natural heritage, long-term planning, involvement all stakeholders in the planning, etc. Based on this, there are two main priorities:

1. reduce the impact that tourism has on the environment through awareness raising and more effective resources and infrastructure management, and
2. develop alternative forms of tourism.

It is important that through sustainable tourism provide the maintenance of traditions without disrupting the wealth of diversity in the region. Regional and local authorities must play a key role in regulating the development of tourism and ensure its sustainability.

5. CONCLUSION

In Istria, the development of tourism went through three developmental periods, for which the following was established. The first period is characterized by intensive development with only one goal – to create accommodation conditions for the reception of the largest possible number of tourists. On the concept of sustainable development was neither conscious nor unconscious insistence. In the second period, new contents offer is introduced in order to meet increasing and more complex tourists' demands and needs. In this period can be seen the beginnings of the concept of sustainable development in tourism in Istria with elements of slow development, development focused on the tourists needs and wishes, improving the quality of offer and professionalism in the tourism industry. These elements emerged out of necessity in order to mass tourism extend life, not from entrants (awakened) awareness that sustainable development is the best alternative for the future. In the third period the sustainable development of tourism is gaining in importance. The actors in tourism development in Istria are becoming aware that it is the right alternative for the future of tourism which is the key factors of successful development:

- multidisciplinary approach (economic, ecological and socio-cultural analysis),
- constant consultation with stakeholders, private and public enterprises, households rooms renters, tourist organizations, associations for the protection of nature, cultural heritage, and residents and tourists,
- openness for development (organization of public debates, media engagement, communication between holders of strategic development and the local community), and
- development which becomes a long-term and flexible project, open to amendments depending on changes in the environment.

The development of tourism in Istria is not only incentive to the economy, but also the preservation of customs and traditions. Today the development of tourism in Istria is not intense and focused on creating conditions for the accommodation of a greater number of tourists, but on the offer quality and creation more satisfied and happy tourists and all actors involved in tourism. Tourism development is controlled and long-term perspective. The plan is preceded by the development that involves local communities, and holders of development are local stakeholders.

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THE INFLUENCE OF THE BANKING SECTOR FUNCTIONS ON ECONOMIC ACTIVITY IN MACEDONIA

Elena NAUMOVSKA[*], Kiril JOVANOVSKI[**], Gorgji GOCKOV[***]

Abstract

The subject of this paper is the way in which the banking sector in Macedonia contributes to the economic growth by performing five basic functions: savings mobilization, risk diversification, resource allocation, corporate control and easing exchange. The basic purpose of this paper is, through assessment of the relative importance of each of the functions of the banking sector and analysis of the relationship existing between the banking sector intermediation and economic growth (as measured by GDP) to investigate the impact of the banking sector on the real sector performance in the Macedonia. According to the obtained results the paper provides conclusions for opportunities and directions for increasing the efficiency of the banking sector in the Republic of Macedonia.

Keywords: banking sector, bank credit, bank deposits, economic growth, savings mobilization, risk diversification, resource allocation, corporate control, easing exchange

JEL classification: E51, G21

1. INTRODUCTION

According to Levine (1997), if we analyse the impact of the banks on economic growth, the focus of interest would be two channels. The first channel refers to activities for attracting more savings, thus efficiently and effectively working to create favourable sources of financing of the credit activity. The second direction, however, concerns the operations of the assets directed to the appropriate diversification of risk in the loan portfolio and the selection of contributive and secure investment projects for lending. Having completed the five functions of the financial sector, through these channels, the banks act in order to encourage economic growth.

[*] Financial Management, Faculty of Economics, University ss. Cyril and Methodius, Skopje, R. Macedonia; e-mail: *elenan@eccf.ukim.edu.mk*.

[**] Financial Management, Faculty of Economics, University ss. Cyril and Methodius, Skopje, R. Macedonia; e-mail: *kirilj@eccf.ukim.edu.mk*.

[***] Financial Management, Faculty of Economics, University ss. Cyril and Methodius, Skopje, R. Macedonia; e-mail: *gockovg@eccf.ukim.edu.mk*.

This paper consists of four sections. The review of the literature that explores the impact of finance on growth is provided in the first section. Furthermore, the second section is a discussion of the potential impacts of the functions of the banking sector on economic activity. Description of the banking sector in Macedonia, in order to be easier to understand its role and impact on economic activity is provided in the third section. In the end, the fourth section of the paper represents a modelling of the relationship between the functions of the banking sector and economic growth.

In this section, based on the five basic functions of the financial sector (mobilization of savings, risk diversification, resource allocation, corporate control, and easing exchange) we have developed an empirical model that investigates the impact of each of these functions on the economic growth in the example of Macedonia. Our basic goal is through determination of the influence of each separate function to discover the directions for future activities in order to achieve greater efficiency of the banking sector.

2. LITERATURE REVIEW

There is considerable debate dating back to the XIX century concerning whether the type of the financial system and the level of financial development affect economic growth. Economists sharply disagree about the role of the financial sector in economic growth. Some analysts confirm the positive relationship, while others believe that finance is a relatively unimportant factor for economic growth.

Robinson (1952) argued that financial development primarily follows growth in the real economy as a result of increased demand for financial services. Moreover, some economists just do not believe that the finance-growth relationship is important. Robert Lucas (1988) stressed that economists "badly over-stress" the role of financial factors in economic growth.

On the other hand, Schumpeter (1934), Gurley and Shaw (1955), Goldsmith (1969), and McKinnon (1973) have discovered a strong positive correlation between the level of development of the financial system and the rate of economic growth. Their findings have clarified the understanding of the role of finance in economic growth. In addition, Joseph Schumpeter (1934) contends that well-functioning banks spur technological innovation by identifying and funding those entrepreneurs with the best chances of successfully implementing innovative products and production processes. King and Levine (1993) presented evidence to support this view. In order to investigate whether Shumpeter was right, King and Levine (1993) introduced various indicators of the level of development of financial intermediaries. They showed that initial levels of financial development play a substantial role in explaining subsequent growth and concluded that "finance does not only follow growth, finance seems importantly to lead economic growth". Besides the previous focus on banking, expanding theoretical literature has analysed the relationship between the stock market and economic growth. Levine and Zervos (1998) have a significant contribution to the progress made in this direction. Including various measures for the development of the stock market, their work (Ibid.) is an extension of the study of King and Levine (1993) which refers only to the previous focus on banking.

Further analyses have examined the relationship between finance and growth using different approaches: from the level of individual industries (Rajan and Zingales, 1998); from the level of firms (Kunt and Maksimovic, 1998; Love, 2003; Beck *et al.*, 2005); in terms of the orientation of the financial sector – bank-oriented or market-oriented (Kunt and

Levine, 1999; Beck *et al.*, 2001); in terms of the different components of the development of financial intermediaries (Levine *et al.*, 2000); from an institutional perspective (Demetriades and Law, 2006); from the time perspective (Loayza and Ranciere, 2006; Rousseau and Waachtel, 2011) etc.

Assessing the role of financial development in fostering economic growth in low and middle –income countries classified by geographic regions, Hassan *et al.* (2011) have found that well-functioning financial system is a necessary but not sufficient condition to reach steady economic growth in developing countries. Other variables from the real sector such as trade and government expenditure play an important role in explaining economic growth.

Tenant *et al.* (2010) analytical model provide inferences about the importance of financial sector functions and cointegration and error correction methods are used to distinguish between the long and short-run impacts of financial sector intermediation on economic growth in Jamaica. According to their results, the functions of the financial sector have statistically significant long-run impacts on GDP. Additionally, they suggest that greater focus has to be placed on mechanisms through which savings mobilization can be maximized, and the allocation of resources can be facilitated.

Petkovski and Kjosevski (2014) have examined the question whether in 16 transition economies from Central and South Eastern Europe the banking sector influences economic growth. The research results show that credit to the private sector and interest margin are negatively related to the economic growth, while ratio of quasi money is positively related to economic growth.

3. DISCUSSION OF THE POSSIBLE IMPACTS OF THE FUNCTIONS OF THE BANKING SECTOR ON ECONOMIC ACTIVITY

The basic role of the banking sector is intermediation between deficient and sufficient economic units. Mediating between savers and borrowers, the banking sector is trying to reduce transaction and information costs that arise as a result of the financial markets' imperfections. As a crucial part of the financial sector, the banking sector facilitates the allocation of resources across time and space in the uncertain environment. The primary function of the financial sector defined by Merton (1995) is a starting point for Levine (1997) to perform its breakdown of the five basic financial functions: savings mobilization, risk diversification, resource allocation, corporate control and easing exchange. This paper will focus on these five financial functions but from the point of view of the banking sector.

Saving mobilizations

The banking sector mobilizes savings by offering a wide range of instruments for denominated savings of different amounts. According to Levine (2005), mobilizing savings involves overcoming the transaction costs associated with collecting savings from different individuals and overcoming the informational asymmetries associated with making savers feel comfortable in relinquishing control of their savings. The banking sector that is more effective in savings mobilization may affect economic development by increasing savings, thus exploiting economies of scale and overcoming investment indivisibilities. Furthermore, more effective mobilization of savings has a direct effect on the accumulation of capital. Indirectly, it improves the allocation of resources and strengthens technological innovation. Through the effective mobilization of resources to finance investment projects, the banking sector allows the adoption of improved technological lines in the manufacturing process,

hence causing an increase in economic growth. Mobilization usually involves the creation of small denomination instruments that provide opportunities for holding diversified portfolios (Sirri and Tufano, 1995). Acemoglu and Zilibotti (1997) show that in large indivisible projects, financial arrangements that mobilize savings from many diverse individuals and invest in a diversified portfolio of risky projects, facilitate a reallocation of investment toward higher return activities with positive effects on economic growth.

Risk diversification

According to Bencivenga *et al.* (1995), the banking sector plays a key role in facilitating the diversification of the various types of risk. Traditionally, financial theory focuses on cross-sectional diversification of risk (Levine, 2005). The banking sector may mitigate the risk associated with individual projects, companies, industries, regions, and countries. Through the ability to provide risk-diversified services, this sector has the opportunity to alter resource allocation and saving rates with an influence on the long-term economic growth. While savers generally do not like risk, high-return projects tend to be riskier than low-return projects. Additionally, financial markets that make it easier for people to diversify risk tend to induce a portfolio shift toward projects with higher expected returns (Gurley and Shaw, 1955). The reduction of liquidity risk is also an opportunity offered by the banking sector in the realization of the function of risk diversification in general. The banking sector manages liquidity risk by offering highly liquid financial instruments that may be easily converted into cash. Simultaneously, banks transform these liquid financial instruments into long-term capital investments. Consequently, more investment is likely to occur in the high-return projects since more companies are enabled to continue their current operations and provide additional funding to support investment projects. All this has a positive impact on overall economic performance and maintenance of liquidity of the system as a whole.

Easing exchange

The role of the banking sector in easing exchange is represented by a particular set of financial activities: accepting deposits, financing companies' and individuals' investments, offering a wide assortment of payment cards, enabling fast and efficient payments electronically, etc. The role of the banking sector in maintaining a stable means of exchange is related to the mobilization of bank savings. If they are in need of funds to finance the purchase of real goods and services, savers can withdraw their savings before or within their maturity. The banking sector allows exchanging savings for cash that will continue to be subject to the exchange for real goods and services, while deficit economic units can assume the role of borrowers who obtained loans to finance their investments. On the basis of mobilized savings from sufficient economic units, the banking sector finances deficit economic units and allows them to access needed funds.

Resource allocation

By generating the necessary information for making investment decisions, financial intermediaries have their own share of the increase in economic growth. Mobilizing savings by intermediaries that will be only technically channelled to the borrowers is not enough. From the perspective of the role of the banking sector in increasing the efficiency of resource allocation, a critical point leads to an improvement of the preliminary assessment of investment opportunities with positive effects on the allocation of resources. Assuming

that there are many entrepreneurs who need capital, whose offer is insufficient and limited, financial intermediaries that have better information about the companies will recognize better market investors enabling a more efficient allocation of capital and channeling capital to the places of their most productive use (Greenwood and Jovanovic, 1990). King and Levine (1993) have argued that banks can even enhance the rate of technological innovation by identifying those entrepreneurs who have the best opportunity to successfully introduce new products in the production process.

Monitoring managers and exerting corporate governance

The effectiveness of corporate governance mechanisms directly impacts firm performance with potentially large effects on national growth rates. According to Diamond (1984), banks are effective in implementing this financial function as being able to reduce the cost of monitoring through economies of scale. Furthermore, they can create financial arrangements forcing managers to operate in a certain way. Banks lend to companies from the mobilized savings, and then on behalf of the savers control the use of the funds of the borrowers. Through this delegated monitoring, banks reduce the cost of channelling funds and influence greater profitability of funded projects. Levine and Zervos (1998) have argued that Establishing long-term mutual cooperation between banks and companies and offering borrowers the opportunity to gain confidence creates greater certainty for funding high-return and innovative capital projects. An efficient mechanism of corporate governance directly affects the performance of companies with potentially positive effects on national growth rates. The efficiency in the allocation of resources will be improved if shareholders and creditors adequately monitor companies and encourage managers to maximize the value of companies. Otherwise, the absence of financial arrangements that encourage corporate governance can impede the mobilization of savings and the movement of capital to more profitable projects.

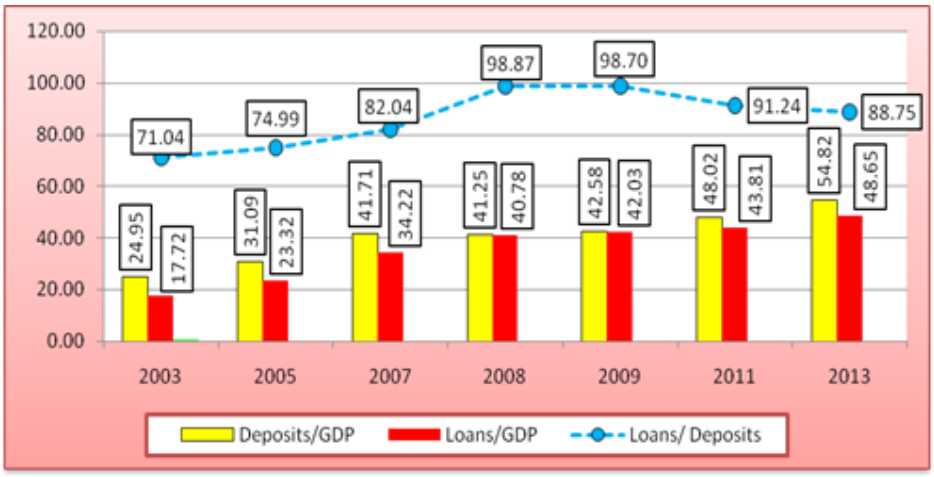
4. THE MACEDONIAN BANKING SECTOR

The Macedonian banking sector is bank-oriented with a structural share of the total assets of around 90% in the whole financial sector and 70% in GDP. In addition, Macedonian banking sector is represented by 15 banks, functioning under the supervision of the National Bank of the Republic of Macedonia, i.e. 14 commercial banks, and 1 development and export bank, whose strategic goal as a state-owned bank is to provide support and to incite development of the Macedonian economy through providing finance to small and medium-sized enterprises and export-oriented companies. As almost 70% of the total bank assets are derived from the three largest banks, the Macedonian banking sector has a high degree of concentration.

The Macedonian banking sector dominantly (75.3%) consists of foreign shareholders equity. Additionally, the subsidiaries of eurozone banks have the largest share in the total assets, by 51.1%. This is indicative for higher sensitivity of the Macedonian banking system to external shocks, especially from the Eurosystem.

In general, the Macedonian banking sector is characterized by a relatively high rate of capital adequacy ratio (15.7%, 2014). Contrary to the occurrences in the international framework, Macedonian banking system belongs to the group of banking systems that did not need a state capital intervention to overcome the crisis. Conservativeness and the resilience of the banking sector in Macedonia practically confirmed “the benefits of underdevelopment”.

The credit activity is the most important channel with potential positive influence on the whole economic activity. In the period between 2003 and 2008 the Macedonian banking sector registered rapid credit growth. Furthermore, the Credit/GDP indicator increased by 2.5 times (from 16.45% in 2002 to 40.78% in 2008), and during this period the absolute amount of credit provided to the private sector increased by 4 times, while the average annual growth was about 30%. The driver of this tendency can be seen in the objective of the banks to achieve larger volume of loan portfolio, profits, and higher market share.



Source: National Bank of the Republic of Macedonia

Figure no. 1– Financial intermediation of the Macedonian banking sector in the period 2003-2013 (in %)

As a result of the effects of the global financial crisis and reduced activity of national economy, slower growth of deposits, limited sources for financing the credit activity with foreign credit lines, course of tightened monetary policy, increased precaution in the loans approval process, beginning from 2009 the credit activity in Macedonia. The crises also brought the quality of the loan portfolio down. In the upcoming period, banks had redirected their attention to stability and liquidity, focusing on the quality of the loan portfolio.

The quality of the proposed projects is a significant determinant in the decision-making process for the approval of loans. Banks have also intensified their activities to improve the credit risk management system, increase supervisory and regulatory requirements, as well as apply more conservative strategies, especially as a result of the directions of the foreign mother banks.

The Macedonian banking model is relatively conservative, which means that the credit expansion is mainly funded by deposits, and less from additional sources such as international credit lines and the domestic interbank market. In spite of the persistent upward trend in the level of financial intermediation, it is far below the level of financial intermediation, that can be seen in the banking systems of the EU member states, and even for the average levels of financial intermediation of many countries in the region.

The level of loans/deposit ratio in Macedonia of about 90% indicates: (1) that the deposits are dominant source of funding the credit activity and (2) that there is an excess of liquidity and insufficient utilization of the bank's deposits. Namely, as a result of recent

deteriorating loan portfolio quality, application of conservative strategies in some of the major banking groups in Macedonia, insufficient quality demand of the credit market, shows that the banks have demonstrated great caution in their credit activity.

5. MODELING THE RELATIONSHIP BETWEEN THE BANKING SECTOR FUNCTIONS AND ECONOMIC GROWTH IN MACEDONIA

In this section, based on the five basic functions of the financial sector, according to the model implemented by (Tenant *et al.*, 2010), we have developed an empirical model that investigates the impact of each of the functions on the economic growth in the example of Macedonia. In developing the model being tested, detailed attention is given to careful selection of proxies that would adequately reflect each of the functions. The analysis is based on quarterly bank level data (aggregate data for the banking sector, comprising of all 14 commercial banks) obtained from the National Bank of the Republic of Macedonia for a period of 18 years, from the first quarter of 1997 to the first quarter of 2014.

5.1. Specifying the proxies of the banking sector functions in Macedonia

The proxies selected for each function of the banking sector are explained in the upcoming section.

Savings mobilization (SMOB). A useful proxy for measuring the effectiveness of the banking sector in fulfilling the savings mobilization function is identified as: the total value of funds collected through all the savings instruments offered by the banking sector as a percentage of GDP. Increased effectiveness in savings mobilization will release more funds for investment, thus increasing the possibilities for economic growth. Therefore, we expect a positive relationship between SMOB and economic growth.

Risk diversification (DRISK). Since SMOB has already captured the banking sector effect on liquidity risk, the proxy developed for risk diversification focuses solely on diversification borrowers in different risk categories. This measure of risk diversification is calculated as a percentage of loans in the C, D and E risk category within the total credit exposure. It is reasonable to expect that the lower share of loans in the C, D and E risk category within the total credit exposure indicates a greater loans portfolio with positive influence on economic growth. Hence, a negative relationship between **DRISK** and economic growth is expected.

Resource allocation (RESAL). In order to formulate a proxy for effective resource allocation, researchers typically take into consideration what types of projects, firms or managers have the greatest potential to be productive and contribute to economic growth. So as to be focused on the type of projects with the greatest potential to contribute to economic growth through productive investment, our proxy for resource allocation is RESAL = loans given to the manufacturing companies/total loans. It is expected that RESAL will have a positive relationship with economic growth, as it is argued that when credit to manufacturing companies increases as a proportion of total loans, resources are being allocated to the projects most likely to be productive.

Corporate control (CORPC). Finding a proxy for the ex post monitoring and corporate control by the banking sector is challenging, since it is extremely difficult to conceptualize a quantitative measure of this financial function. We have formulated the indicator CORPC, which represents loans given to corporations as a percentage of GDP, as

an indirect proxy for the corporate control function. It is expected that the larger value of this indicator can have a positive impact on economic growth by increasing the banks' opportunity to influence the performance of corporations (borrowers and investors) through the application of the corporate governance concept.

Easing exchange (ETRAD). This function is represented by the degree of financial intermediation as a measure of the banking sector ability for effective utilization of the funds collected through different savings instruments. We will use a proportion between total loans and total deposits as a proxy for the easing exchange function. As it is obvious that a greater degree of financial intermediation increases the possibilities for economic growth, we expect that ETRAD will have a positive relationship with economic growth.

Control variables. In the model as control variables there is also inclusion of the trade openness indicator (TRADE), which represents the sum of exports and imports in the country in terms of GDP, the ratio of the rate of unemployment (UNIMP), and the ratio of foreign direct investment (FDI).

Openness to trade (TRADE). The trade openness indicator represents the sum of exports and imports in the country as a percentage of GDP. The credit activity of the banks rises with the increase of export and import arrangements in the economy. Hence, the indicator TRADE is proportionally associated with economic growth.

Unemployment rate (UNIMP). This indicator is the ratio between the unemployed and the total working population in a particular economy. It is expected that its value is in inverse relation to the economic growth.

Foreign direct investments (FDI). This indicator shows the amount of foreign direct investment as a percentage of GDP in an economy. FDI are often recognized as the basis for further completion of the investments that would be financed through domestic bank loans. If foreign direct investments represent investments in the infrastructure, they could be the basis for starting new domestic investments that would be financed with domestic bank loans. In addition, foreign direct investments would reduce a rate of unemployment and increase credit-worthy population. Hence, a positive relationship between this variable and the economic growth is expected.

The proxies selected for each function of the banking sector are summarized in the following table.

Table no. 1 - Proxies of the banking sector functions

Financial function	Proxy	Calculation of the proxy
Savings mobilization	SMOB	Deposits/GDP (%)
Risk diversification	DRISK	Loans in C, D and E risk category / Total credit exposure (%)
Resource allocation	RESAL	Loans given to the manufacturing companies / Total loans (%)
Corporate control	CORPC	Loans given to the corporations / GDP (%)
Easing exchange	ETRADE	Total loans / Total deposits
Openness to trade	TRADE	Sum of exports and imports in the country / GDP (%)
Foreign direct investments	FDI	Amount of foreign direct investment/ GDP (%)
Unemployment rate	UNIMP	Unemployed population / Total working population (%)

The time series for the observed period consists of 69 observations. In addition, is presented the descriptive statistics of all the data variable series in Table 2. The sample means are greater than zero for all variables. In terms of standard deviations the volatility is

relatively higher than the other variables in the case of FDI variable, and the smallest volatility is detected in UNIMP variable. This result is completely logical having in mind the nature of UNIMP and FDI variables regarding the observed period. BDP variable has medium volatility level, regarding the general level of volatility of all observed variables. This statement is also confirmed through the minimum and maximum values of the variables BDP, FDI and UNIMP.

Table no. 2 – Descriptive statistics of the data series

Variable	Mean	Std. Dev.	Maximum	Minimum
GDP	80787.54	25727.01	127455	44037
CORPC	63717.76	37390.09	126310	18959.22
DRISK	17.91222	12.72973	42.1	5.5
ETRAD	0.972491	0.245997	1.614101	0.613713
FDI	1.054458	1.457542	10.54112	0.007486
RESAL	12.11719	4.188085	18.35131	5.934116
SMOB	30.97979	14.74108	55.46825	8.330782
TRADE	24.02379	3.439478	30.91201	18.19653
UNIMP	33.31074	2.590498	38.67769	28.39

5.2. Creating an empirical model

This paper represents an attempt to examine the existence of a long-term relationship between the five financial functions of the banking sector on the one hand, and GDP on the other hand. Regarding this hypothesis most relevant choice for the empirical aspect of this paper is the choice of the VEC (Vector Error Correction) model, as the most relevant model for long term relationship and function equilibrium determination.

The long-term relationship between GDP and the proxies for banking sector functions are presented by the following form of a logarithmic function based on the VEC (Vector Error Correction) model:

$$\log (GDPt) = \alpha_0 + \sum_{m=1}^{M} \left(\alpha_m X_{m,t} \right) + \varepsilon_t \quad (1)$$

where GDP is the quarterly value of GDP for time t, α_0 denotes a constant, α_m for m = 1,..,M denote M coefficients, $X_{m,t}$ represents variables with potential influence on growth, and ε_t represents the residuals of the equation.

Using variables with potential influence on growth (proxies for each banking sector function as well as the instrumental variables already specified), the econometric model to be estimated is expressed as follows:

$$\begin{aligned} InGDP_t = {} & \alpha_0 + \alpha_1 * InSMOB_t + \alpha_2 * InDRISK_t + \alpha_3 * InRESAL_t + \alpha_4 * InCORPC_t \\ & + \alpha_5 * lnETRAD_t + \alpha_6 * InTRADE_t + \alpha_7 * InUNIMP_t + \alpha_8 * InFDI_t + \varepsilon_t \end{aligned} \quad (2)$$

We have used quarterly data for the above eight variables in the period between the first quarter of 1997 and the first quarter of 2014 in the Republic of Macedonia.

5.3. Presentation of the results

To avoid obtaining any spurious relationships, we examined the data series for stationarity by performing the augmented Dickey-Fuller test on each proxy. The following table is a representation of the Augmented Dickey Fuller test for stationarity:

Table no. 3 – Results of the unit root test (level of significance of 1%)

Variable	Augmented Dickey Fuller
ln (BDP)	I(1)
ln (SMOB)	I(1)
ln (DRISK)	I(1)
ln (RESAL)	I(1)
ln (CORPC)	I(0)
ln (ETRADE)	I(1)
ln (TRADE)	I(1)
ln (UNIMP)	I(1)
ln (FDI)	I(0)

Source: Authors calculations

The estimation continues with the evaluation of the VECM model in accordance with the previously presented equation. Table 4 represents the long-term relations and their significance between GDP and the variables with potential influence on growth.

Table no. 4 – Estimation of the model cointegration equation

Variable	Coefficient	T-statistic
ln (SMOB)	-0.072934	[-7.24033]*
ln (DRISK)	-0.007187	[-3.66697]*
ln (RESAL)	0.083300	[9.78246]*
ln (CORPC)	-0.007105	[-1.28623]
ln (ETRADE)	-0.060272	[-6.53541]*
ln (TRADE)	0.043607	[16.9994]*
ln (UNIMP)	0.024550	[2.02998]**
ln (FDI)	0.000674	[2.07075]**

*Note: * means level of significance of 1%*
*** means level of significance of 5%*
**** means level of significance of 10%*
Source: Authors calculations

According to the presented results in Table 4, the **SMOB** variable is highly significantly correlated with the GDP indicator with negative sign, which shows that if the SMOB grew by 1 percent, the value of GDP would be reduced on average for 0.072934%, assuming all other factors remain unchanged. It indicates that increased deposits cause slowing of the economic growth rate, which is not in accordance with the initial expectations. However, this is compatible with the real economic conditions in the Republic of Macedonia – the low level of financial intermediation, sufficient bank liquidity as well as no effectiveness of the banking sector in canalizing the mobilized savings to the area of their most productive utilization with potential positive influence on economic growth.

The **DRISK** variable is greatly significantly correlated with the GDP indicator with negative sign, which shows that if the DRISK grew by 1 percent, the value of GDP would

be reduced on average for 0.07187%, assuming all other factors remain unchanged. Considering that this measure of risk diversification is calculated as a percentage of loans in the C, D and E risk category within the total credit exposure, it is reasonable to expect that the lower share of loans in the C, D and E risk category within the total credit exposure indicates a greater loans portfolio with positive influence on economic growth. Hence, the obtained result is in accordance with our initial expectations.

The **RESAL** parameter is positive and highly significant showing that if the REASAL increases by 1 percent, then GDP on average will increase by 0.0833%, assuming all other factors remain unchanged. This suggests that the increase in credits to manufacturing companies causes a positive reaction in regards to economic growth. Considering that when credit to manufacturing companies as a proportion of total loans increases, resources are being allocated to the projects most likely to be productive, then it is expected that RESAL will have a positive relationship to the economic growth.

For corporate control (**CORPC**), there has been obtained a negative and insignificant long-term relation, assuming all other factors remain unchanged. It is highly recommendable for the banks to strengthen the mutual cooperation with the corporate sector, influencing the performances of their strategic clients through the application of the corporate governance concept.

The long-term parameter of the **ETRADE** is negative and highly significant, showing that if the indicator for financial intermediation increases by 1 percent, then the economic growth will decrease on average for 0.060272%, assuming all other factors remain unchanged. The obtained result for negative influence of the increased Credit/Deposit ratio on economic growth indicates no effectiveness on the banking sector in canalizing the mobilized savings to the area of their most productive utilization.

The **TRADE** parameter is positive and significant, showing that if the TRADE increases by 1 percent, then GDP on average will increase by 0.043607%, assuming that all other factors remain unchanged. This suggests that the increase in openness to trade causes a positive reaction regarding economic activity, which is in accordance with our previous expectations.

The **UNIMP** parameter is positive and with a lower significance at the level of 5%, showing that if the UNIMP decreases by 1 percent, then GDP on average will decrease by 0.024550%, assuming that all other factors remain unchanged. This is theoretically unsupported, but is an objective reflection of the real economic conditions in the Republic of Macedonia experienced in the previous period – a reduced rate of unemployment simultaneous with the slowing economic activity.

The **FDI** parameter is positive and with a lower significance at the level of 5%, showing that if the amount of foreign direct investment as a percentage of GDP increases by 1 percent, then GDP on average will increase by 0.000674 %, assuming that all other factors remain unchanged. The obtained result is also in accordance with our previous expectations for a positive relationship between this variable and the economic growth.

6. CONCLUSIONS

This paper represents an attempt to examine the existence of a long-term relationship between the five financial functions of the banking sector on the one hand, and GDP on the other hand. Based on the five basic functions of the financial sector (mobilization of savings, risk diversification, resource allocation, corporate control, and easing exchange) we have developed an empirical model that investigates the impact of each of these functions

on the economic growth in the example of Macedonia. In developing the model being tested, detailed attention is given to careful selection of proxies that would adequately reflect each of the functions. The long-term relationship between GDP and the proxies for banking sector functions are presented by the specific form of a logarithmic function based on the VEC (Vector Error Correction) model. The basic purpose of this model was, in accordance with the obtained results, to provide findings for opportunities and directions for increasing the efficiency of the banking sector in the Republic of Macedonia.

The presented results suggest that there is a long-run relationship among the variables as five out of eight variables are highly significantly correlated with the economic growth (SMOB, DRISK, RESAL, ETRADE and TRADE), two variables (UNIMP and FDI) are at the level of significance of 5% and only one variable (the proxy for a corporative control function - CORPC) represents an insignificant relationship with economic growth. Importantly, all the significantly correlated variables expected for SMOB, ETRADE and UNIMP show signs that confirm the theoretical expectations.

The negative coefficients for SMOB as a proxy for savings mobilization function and ETRADE as a proxy for the easing exchange function indicate the reality of Macedonian banks - the low level of financial intermediation, sufficient bank liquidity as well as no effectiveness of the banking sector in canalizing the mobilized savings to the area of their most productive utilization with potential positive influence on economic growth. Since there has been obtained a negative and insignificant long-term relation between the CORPC variable (as a proxy for corporate control) and economic growth, it is highly recommendable for the Macedonian banks to strengthen the mutual cooperation with the corporate sector consisting of borrowers and potential investors, influencing the performances of their strategic clients through the application of the corporate governance concept.

Our results only partially support Tenant *et al.* (2010) suggestion that a greater focus has to be placed on mechanisms through which savings mobilization can be maximized, and the allocation of resources can be facilitated. In addition, the effects of promoting the growth of the banking sector arise not only from the increase in savings and investment, but also from the increase in the marginal rate of return on investment as a result of more efficient allocation of savings between potential investors. Moreover, the effects of economic growth resulting from the improved allocation of resources may be of greater importance for economic growth than just increasing savings and investments.

In order to incite development of the Macedonian economy, it is highly recommendable for Macedonian banks to participate in the improvement of the investment climate and to act in a proactive manner through supporting the creation of new values based on knowledge, entrepreneurial initiative, and natural resources. Additionally, the credit activity of the banks should be re-oriented from refinancing loans to investment financing. Consequently, banks should also train their employees for providing consultant services to existing and potential borrowers in order to encourage the development projects. They should also follow the effects of the financed projects concerning unemployment reduction - creation of new jobs, expansion and modernization of the production capacities, development of the rural areas, rational utilization of the national resources, support of agriculture, infrastructure, as well as energy efficient projects, improvement of the balance of payments in the country, instigation of exports, and substitution of imports. However, this should also be accompanied with the appropriate legal and institutional basis, which allows for simplification of the administrative and bureaucratic procedures, and better functioning of the rule of law.

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BOND YIELD SPREADS IN THE EUROZONE

Denisa PROKSOVÁ*
Mária BOHDALOVÁ**

Abstract

Euro Area sovereign bond yield spreads fell significantly after the creation of the monetary union and moved in unison until the recession of 2008, when investors' risk pricing changed considerably. Rising bond yield spreads caught the attention of economists who tried to find the factors influencing their size. Evolution of bond spreads was mostly related to various macroeconomic factors as well as the soundness of the countries' banking sectors and a general level of risk aversion in the financial markets. Analysis presented in this paper compares bond yield spreads of Euro Area member countries and relates them to their debt levels as well as the liquidity of the securities and a general level of risk aversion. Apart from the usual variables, we also analysed differences in purchasing power to assess the impact of the common monetary policy in the pre-crisis period. After adjusting the model to better explain movements of linear regression residuals, we could not prove a systematic assessment of the above-mentioned factors except for time periods of high market volatility. We explain sudden changes in the importance of idiosyncratic factors as consequences of policies of the European Central Bank and other European Union institutions following such time periods, which, as our analysis suggests, distorted pricing of risk in the markets.

Keywords: bond spread, bond yield, Euro Area, monetary union, EMU

JEL classification: E42, G15

1. INTRODUCTION

Increased bond yields of certain Euro Area countries after the start of the mortgage and financial crisis caused serious problems for many governments and even gave rise to questions about several members exiting the common currency block. The financial and economic situation in the region prompted several governments to resign to various bailout schemes organized by the EU and the IMF. Yield spreads among government bonds, which had been minimal since the start of the monetary union, were once again relatively large, reflecting different risk premium. Investors' risk pricing changed after the onset of the mortgage and financial crisis when spreads of individual Euro Area countries widened. Economists focused

* Faculty of Management, Comenius University, Bratislava, Slovakia; e-mail: *denisa.proksova@fm.uniba.sk*.
** Faculty of Management, Comenius University, Bratislava, Slovakia; e-mail: *maria.bohdalova@fm.uniba.sk*.

on identifying the factors that caused this rise in yield spreads, testing the importance of factors theoretically relevant in determining bond yield spreads and assessing the exact size of their impact on spreads. In times of global financial uncertainty, investors seek securities with lower credit risk and higher liquidity, driving spreads of lower-quality bonds up. This was also the case in the Euro Area, whose common monetary policy and low inflation risk decreased differentials in sovereign bond yields of its member countries to a minimum, but deterioration in their public finances raised their risk premiums back to previous levels; however, this time monetary policy remained outside of their control.

Euro Area sovereign bond yields used to move in unison but started to be influenced by different factors from 2008 on. Economists tried to find the factors influencing the developments in Euro Area bond markets and the price for risk assigned to them by the markets. Most empirical studies stress the importance of credit risk, illiquidity, and global risk aversion as drivers of sovereign bond spreads but also include variables which capture other relevant factors, such as the situation in the banking sector of individual Euro Area members. Their findings point out to distinct differences between risk pricing before the financial crisis and afterwards. Risk pricing after the start of the financial crisis seems to be more in line with the theory but also appears to price in various risks that are not justified by theoretical assumptions. These studies test the relevance of credit risk, liquidity, and international risk aversion as the main drivers of increasing bond yields. These variables enter as endogenous variables in linear regression while the dependent variable is bond spreads to Germany. The resulting coefficients differ significantly depending on the time period; macroeconomic variables often showing little relevance before 2007/2008.

The aim of this paper is to analyse and show the importance of several factors most commonly listed by literature as determining bond yield spreads throughout a longer time period and compare the results with the results of other authors. The paper is organized into four chapters. The second chapter reviews related literature. It lists a few other papers with common analyses and briefly comments on their findings. The third chapter describes our data and methodology which includes variables commonly used in other authors' regressions as well as a few other variables. The fourth chapter describes our findings and the last chapter then comments on our findings as well as the findings of other authors. It tries to compare them, find similarities, and explain the differences.

2. LITERATURE REVIEW

In this section we aim to review some literature related to the issue of Euro Area Bond Yield Spreads. We describe methods and results of other authors and compare them. Most of these authors use similar methodology but analyse slightly different time periods and factors influencing bond spreads. We will focus our attention on three papers: Barrios *et al.* (2009); Barbosa and Costa (2010) and Afonso *et al.* (2012). We will describe the results of these authors more in depth but we will also briefly describe some new findings of other authors. We begin this chapter with a description of the methodology used by other authors, which can then be compared to our methodology.

All the above-mentioned authors used linear regression analysis in order to assess the influence of several variables on bond spreads of Euro Area countries. The most important variables in these regressions are credit risk, liquidity, and risk aversion. While the two former variables can be assessed relatively easily, the last one is sometimes hard to estimate. These authors therefore use principal component analysis to find common patterns in

financial markets which could be attributed to different levels of risk aversion in international financial markets. Apart from this, many authors also analyse common patterns in the movement of European bond spreads. This analysis was applied by Barrios *et al.* (2009) and Afonso *et al.* (2012).

Barrios *et al.* (2009), compared the first components of 2 principal component analyses: the first principal component of Euro Area sovereign bond yield spreads and the first principal component of 4 various risk indicators: corporate bond spreads in AAA- and BBB- bonds, euro-yen exchange rate volatility and stock price volatility. The latter was used as a measure of global risk aversion in international markets. The two resulting first principal components proved a close relation between risk aversion and bond spreads from June 2005 to September 2008. However, when comparing the two components, there was a sudden divergence of the two first components at the start of the financial crisis. Until the start of the financial crisis, both of the components moved in unison, reacting similarly to external shocks, but this changed after the start of the financial crisis when there was a relative increase in the price of risk for European sovereign bonds without a corresponding increase in risk aversion.

Afonso *et al.* (2012) also used PCA to identify common patterns in Euro Area bond yield spreads. The first component included similar loadings for all the included countries but the second component showed positive values only for the core countries and negative values for countries hit by the debt crisis. The second component was therefore identified as measuring transmission effects of the debt crisis to the so-called core countries. It explained around 15% of the variance, whereas the rest of the components did not seem to affect the evolution of bond spreads strongly. The second principal component, which was calculated by Barrios *et al.* (2009) for a slightly shorter time period (Jan 2005 – Jul 2009), resulted in negative weight for all the countries except for Ireland, Greece, and Austria whose banking systems were already influenced by the crisis at the time of writing; suggesting a similar finding.

Barrios *et al.* (2009), found general risk perception to be the most important but not the only factor in determining the size of sovereign spreads in the Euro Area. The data seems to suggest that while relevance of domestic fiscal indicators is higher in times of heightened risk aversion, it is especially their interaction with higher risk aversion that raised bond spreads. They studied weekly changes in bond spreads to Germany and, like many other authors they also used linear regression to find the price for risk assigned to various risk factors, both idiosyncratic and other. Independent variables entering the regression analysis were expressed in relation to Germany and included changes in CDS spreads as a measure of credit risk and changes in bid-ask spreads as an estimate of liquidity. The first principal component of risk indicators was also included as an estimate of general risk perception. Finally, they included a crisis variable equal to one from September 2009 onwards and zero otherwise.

Credit risk was significant in case of Austria, Italy, Portugal, Spain, and Greece, whereas liquidity was important in determining yield spreads of France, Greece, and Italy. Risk aversion, on the other hand, was relevant mainly for Belgium, France, Italy, and Portugal. The above-mentioned crisis-effect variable was significant for all countries except Spain and Italy. Calculating coefficients for separate time periods, before and after the start of the financial crisis, showed a limited effect of idiosyncratic factors on bond spreads before the start of the financial crisis and significantly lower explanatory power. However, risk aversion indicator was significant for all countries except for Austria.

Another study of this kind is Barbosa and Costa (2010) which analyzed bond yield spreads between January 2007 and May 2010. The countries included in their analysis were

the initial Euro Area members except for Luxembourg. They used securities with residual maturity of around 5 and 10 years; using CDS premiums and a weighted average of forecasts of macroeconomic variables related to public finances and countries' external position as measures of credit risk. The authors concluded that forecasts of international institutions explain changes in credit risk premiums better than observed data. Barbosa and Costa's measures of liquidity are expressed in relation to Germany and include a wide range of variables; such as transactions costs, trading volumes, and outstanding amounts. International risk appetite was measured using the first principal component of several measures of risk aversion: corporate bond spreads, CDS premiums, market volatility, etc.

Their findings suggest a significant increase in the importance of idiosyncratic factors after the collapse of Lehman Brothers. Their importance was smaller during the time period leading up to the start of the financial crisis when the main determinant of sovereign bond yield spreads was global risk aversion. The importance of credit risk and liquidity increased after September 2008. Liquidity conditions proved to be relevant especially in case of securities with shorter residual maturity; securities with longer residual maturity, on the other hand, displayed higher contribution of credit risk. Macroeconomic variables were relevant in determining bond yield spreads both in case of variables describing recent trends as well as their baseline position. Credit risk was relevant especially in case of Greece, but also Italy and Portugal. Liquidity did not seem to affect big economies, such as Italy and France.

Afonso *et al.* (2012) also used linear regression to test the relevance of macroeconomic variables and international risk aversion but also included other variables, which were not included in the former analyses: lagged spread, real exchange rate, growth of industrial production, and a crisis' transmission indicator, which is the second principal component of sovereign bond spreads to Germany. The purpose of their analysis was to find common coefficients for all the included countries, which included the so-called core countries as well as South European countries. Their regression analysis proved only lagged spread, risk perception, liquidity indicator, and growth of industrial production significant at 1% level. The rest of the variables, including crisis' transmission indicator and macroeconomic indicators capturing the level of indebtedness, were insignificant. Inclusion of a multiplicative term which multiplied past spread level and bid-ask spread (their liquidity indicator) proved significance of the interaction of spreads and liquidity at 1% level. Including this variable made the liquidity indicator insignificant and close to zero while significance of the government budget balance changed from 1% to 5%.

The former regressions were repeated using the same variables and their multiplications with dummy variables equal to one from August 2007 and March 2009 on and zero otherwise in order to find any changes in market's perception of risk over time. Including these dummy variables slightly improved the explanatory power of the regression analysis. The results showed that risk perception was only relevant to determining spreads from August 2007 onwards, but not from March 2009 onwards. The variable itself without a multiplicative term was insignificant which contradicts the findings of the former authors Barrios *et al.* (2009) and Barbosa and Costa (2010) who assumed risk perception to be the main driver of bond spreads before the financial crisis but who also used a slightly different approach. All of the authors used market volatility as measures of risk perception but the former authors also included data from bond spreads in their risk aversion indicators. This difference in data and methodology might have been the reason of different findings.

Coefficient of the crisis' transmission to the core countries, which was insignificant in the first analysis, was significant when multiplied by the March 2009 dummy variable.

While multiplication by the August 2007 dummy variable resulted in a coefficient with higher significance, the coefficient was negative. There seems to be a compensation for this after March 2009 when the coefficient is positive and higher, which makes also the sum of both of the coefficients positive. Significance of macroeconomic fundamentals rose; budget balance was significant and debt-to-GDP was significant after March 2009. Liquidity, which was insignificant in the former analyses, was significant when multiplied by the March 2009 dummy variable. The share of long-term government debt in the overall stock of debt was also insignificant when added to the former analysis but exhibited quite a high significance after being multiplied by both of the dummy variables. The coefficient for March 2009 is negative, and the sum of the 2 coefficients is also negative, which the authors interpreted as the ability to successfully place long-term debt priced with lower spreads by the markets. Spread multiplied by the bid-ask spread was only significant after inclusion of the March 2009 dummy variable; however, negative.

Overall, the above-mentioned authors found that the markets did not price in macro- and fiscal fundamentals in sovereign spreads until the start of the mortgage crisis; the role of liquidity also seems to be limited during this time period. Many cited authors assume international risk aversion to be the main driver of bond spreads in this time period, Barrios *et al.* (2009) and Barbosa and Costa (2010) among them. Credit risk seems to be relevant; with certain sovereigns exhibiting permanently higher spreads irrespective of their fiscal position. However, credit risk premium did not seem to be affected by market volatility and market uncertainty that much. Slightly higher risk premiums seemed to reflect differentials in bond yields from before the start of the monetary union. These differentials (before 1999) arose mostly because of higher inflation rates of certain countries. These countries managed to fulfil the Maastricht criteria and decrease the level of inflation but kept higher levels of inflation because of increasing productivity rates even after the start of the monetary union. High inflation rates in an environment with equal nominal interest rates made the real interest rates of these countries relatively low, which had adverse effects on their banking systems. Mody and Sandri (2011) in their paper stress the importance of the soundness of the banking system for economic growth. Their analysis proves its importance in determining the level of spread and shows that it became a significant risk factor after the start of the mortgage crisis in 2007. The authors compared the ratio of a financial sector equity index and an overall stock market index of Euro Area members to 10-year sovereign spreads. Then they used this data in regression analyses to prove and calculate the exact size of its influence on bond spreads. The influence of the soundness of the banking sector on bond spreads was obvious. Since we assumed that the banking sector was affected by equality of interest rates across the whole region, we decided to include variables that could capture some implications of this equality: country-specific inflation rates, real exchange rates, and loss of purchasing power. These variables were not included in the former analyses, which mostly focused on different kinds of variables instead.

The next chapter deals with the data and methodology used in our own analysis to determine the influence of several factors on the size of bond yield spreads to Germany. At first we list the variables included in our model and justify their inclusion. In the second part of the chapter we describe our data and the details of our model as well as an adjusted model which does not give autocorrelated residuals. Adjusting the model led to low explanatory power, which is why we decided to take on a different approach and analyse various time periods to find any changes in the patterns of risk pricing. Our approach showed that some variables were only significant during certain time periods, which supports the idea that risk

pricing of sovereign bonds changed at a certain point in time under the impact of the financial and economic crisis.

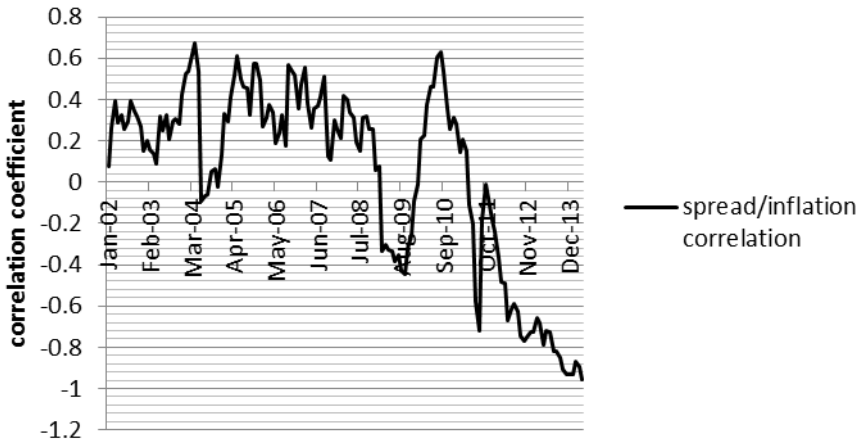
3. DATA AND METHODOLOGY

We used a very similar methodology to the methodologies of the above-mentioned papers. We analysed the influence of credit risk, liquidity and risk aversion during the whole time period of 2002 to 2013 using regression analysis and repeated this analysis for different time periods. Countries included in the analysis were Euro Area members with the exception of smaller countries and new member states: Belgium, Ireland, Greece, Spain, France, Italy, the Netherlands, Austria, Portugal, and Finland. Sovereign yield on German bonds was used as the risk-free rate for the Euro Area. Each of the countries was analysed separately, based on monthly data. Spread between the respective country's yield on its 10-year sovereign bonds over German bond yields (European Central Bank, 2014) was used as the dependent variable. The whole time period of the analysis is January 2002 to December 2013, which accounts for 144 observations. We decided to analyse time periods with different risk pricing separately to be able to observe any changes in investors' risk perception. The overall time period was therefore divided into 2 shorter time periods: time period before the financial crisis that started in September 2008 (80 observations) and time period after the start of the financial crisis (64 observations).

The influence of credit risk, liquidity and risk aversion was analysed for two distinct time periods: January 2002 to August 2008 and September 2008 to December 2013. The analysis of the time period before the financial crisis was then compared with a similar analysis including inflation and real interest rates, which is in line with the assumption that high inflation levels damaged the European banking sector, which later proved to play a significant role in determining the size of the spread after the start of the financial crisis – Mody and Sandri (2011). High inflation rates made real interest rates too low for certain countries, which increased their growth and made borrowing cheaper for both the government and the banking sector. As a result, countries that had had high rates of inflation and paid relatively high interest rates before joining the monetary union could finance their debt more easily after joining the monetary union due to lower interest rates. They managed to meet the Maastricht criteria but their economies required slightly higher interest rates than interest rates imposed by the European Central Bank after the joining the monetary union. Inflation also influences balance of trade through price adjustment, which leads to different levels of both public and private debt. We assumed that real interest rates might have already been priced in bond spreads and repeated the analysis using both inflation and real interest rates. Then we substituted these variables with the loss in purchasing power relative to Germany since the start of the currency union and irrevocable fixing of interest rates. We included inflation rates in our 2002 to 2008 regression but did not do so for the rest of the regressions because spreads seem to react to slow economic growth, high debt, and budget cuts which are associated with low inflation and deflation. The resulting regression would therefore reflect influence of economic growth on spreads rather than support our hypothesis.

European countries experienced quite different inflation rates during the 2002 to 2008 time period; the difference sometimes being even 2% between 2 Euro Area regions. Their productivity and purchasing power changed over time and differed more but their nominal interest rates and nominal exchange rates were equal for all the regions. This had implications for their growth rates as well as their ability to service debt. While this might have improved

growth rates in many cases, it made their growth unequal over time. We assumed that low real interest rates would increase indebtedness of all of the sectors (as opposed to just the public sector expressed in the debt/GDP variable) and thus might capture tendency to create more debt. Moreover, high inflation induces to dissave and when it suddenly decreases, the country's ability to service its debt is threatened. Country-specific inflation rates and individual country spreads are positively correlated at certain time periods (usually when growth rates are also relatively high) and negatively correlated at other time periods (mostly in times of slower growth). They are hardly ever close to zero – see Figure no. 1.



Source: ECB Statistical Data Warehouse (2014a, 2014b, 2014c, 2014d), Stoxx (2014), own calculations

Figure no. 1 – Spread/Inflation Correlation

Similarly to the above-mentioned analyses, we supposed that credit risk, liquidity, and risk aversion would be the main drivers of bond spreads, and included these variables in our regressions[1]. Credit risk was measured as government debt to GDP (European Central Bank, 2014), which captures a large part of the government's ability to meets its liabilities. Unfortunately, this data is not available on a monthly basis. Therefore we used quarterly data published by the ECB.

Second independent variable in our regression was liquidity. Literature lists multiple measures of liquidity conditions in the markets. These measures usually depend on the value of transactions, outstanding amounts, and transaction costs. We used the value of outstanding amounts published by the ECB (European Central Bank, 2014) on a regular basis. These included the value of long-term government debt, which was compared to the value of outstanding amounts of long-term government debt of Germany. We created a ratio of values of Germany to the values of each country in order to capture the different liquidity conditions in comparison with the benchmark bonds. This approach is different from the one used in credit risk. Credit risk was not compared to Germany, although heightened credit risk in comparison with the benchmark should raise spread. Even though many studies express credit risk in relation to Germany, we did not do so, as there does not seem to be a strong relation between spread and relative credit risk. Markets seem to price credit risk based on actual data instead.

Risk aversion was measured based on volatility in the stock market as well as in the money markets. Stock market data was retrieved from the STOXX Global 3000 index (Stoxx, 2014), which included stock prices from all over the world, and thus better captures risk perception reflected in price movements in international stock markets. Data from the money markets was retrieved from the ECB (European Central Bank, 2014), which publishes daily data on the EUR/USD exchange rate. We calculated monthly variation coefficients based on daily data of both of these data sets, out of which we created a moving average at the length of 7 months. This data was then used in principal component analysis – Bohdalová and Greguš (2012) in calculation of the first principal component, which should reflect common patterns in variance in both of the markets. Heightened variance in stock and foreign exchange markets is usually due to higher international risk perception. We assumed therefore that the first principal component out of this data would capture global risk aversion. The first principal component explains 95.6% of the variance of the data.

The results of the 2002-2008 analysis were then compared to the results of the same analysis that included also other variables: inflation[2], real interest rate[3], and an overall change in purchasing power[4] since the start of the monetary union. Inflation rates were taken from the European Central Bank (European Central Bank, 2014) and used in the next regression model, which included real interest rates, calculated based on ECB main refinancing rates (ECB Statistical Data Warehouse, 2014b) and interest rates. Since these regressions resulted in autocorrelated residuals, we adjusted the model further using differences and natural logarithms of our variables[5]. Our independent variables were almost all insignificant for the chosen time periods. Therefore we decided to take on a different approach and use this model with data of various time lengths. All of the used time periods started in January 2002 and went further into the future until the last analysis which ended in December 2013. We decided to analyse time periods with different risk pricing separately to be able to observe any changes in investors' risk perception. The purpose of these analyses was to find when changes in risk pricing occurred as the markets evolved under the changing economic environment, debt crisis, persisting banking sector issues, extremely low interest rates, and an altering balance of trade. In line with the hypothesis that the markets started to price in idiosyncratic factors only after the start of the financial crisis of 2008 or later on, we repeated the analysis with an increasing number of observations to find when this change in risk pricing occurred. Our data starts in January 2002 and ends in December 2013. The shortest time period of our analysis contains 50 observations, which corresponds with the time period between January 2002 and February 2006. The following analyses include more observations. The longest time period accounts for 144 observations.

The next chapter describes our results and comments on our findings. It also tries to compare our results with the results of other authors. Even though our methodology, data, time period of analysis, etc. were slightly different, we did find both similarities as well as differences in the results. Our analysis confirmed that country-specific factors were important mostly after the start of the financial crisis, and they did not influence bond spreads of European government debt to a great extent before the crisis. We found that risk aversion affected bond spreads throughout the whole time period of our analysis, and it also seems that changes in purchasing power and their differences across the whole region might have played a role in determining the cost of government debt before the crisis. The results of the adjusted models suggest that markets perceived different factors as determining to sovereign bond yields, and that the importance of these factors evolved over time differently for each country.

4. RESULTS

The results of the regression analysis (1) are shown in *Table no. 1*. Significance of the analysis is quite high, with the exception of Austria and Finland, where the explanatory power is limited. These countries did not face high public debt nor high sovereign bond yields. On average, the linear regression did not explain the size of the spread of countries with low borrowing costs to such a great extent as it was in the case of countries with high borrowing costs, whose bond yields were affected by the level of their debt and the overall situation in the region's economy.

Table no. 1 – Bond Yield Spreads from 2002 until 2013

Spread 2002-2013	**Belgium**	**Ireland**	**Greece**	**Spain**	**France**	**Italy**	**Netherlands**	**Austria**	**Portugal**	**Finland**
multiple R	0.86	0.80	0.77	0.86	0.87	0.92	0.86	0.57	0.85	0.66
constant	**-12.83**	**1.64**	**-21.95**	**-7.71**	**-6.41**	**-23.54**	**-2.05**	**-6.77**	**-11.29**	**-1.52**
p value	*0.00*	*0.21*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*
t-stat	-17.81	1.26	-9.85	-3.09	-7.44	-21.61	-13.52	-6.76	-4.79	-8.98
lower interval (95%)	*-14.26*	*-0.94*	*-26.35*	*-12.64*	*-8.11*	*-25.69*	*-2.35*	*-8.75*	*-15.96*	*-1.85*
upper interval (95%)	-11.41	4.23	-17.54	-2.78	-4.71	-21.38	-1.75	-4.79	-6.63	-1.18
credit risk	**6.43**	**3.30**	**21.58**	**10.35**	**3.76**	**10.32**	**1.97**	**5.04**	**12.77**	**1.62**
p value	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*
t-stat	14.09	4.09	11.63	6.76	16.53	18.04	18.69	7.83	16.03	7.65
lower interval (95%)	*5.53*	*1.70*	*17.91*	*7.32*	*3.31*	*9.19*	*1.76*	*3.77*	*11.20*	*1.20*
upper interval (95%)	7.33	4.89	25.24	13.38	4.22	11.45	2.18	6.31	14.35	2.03
liquidity	**1.53**	**-0.08**	**-0.06**	**1.08**	**3.22**	**13.24**	**0.20**	**0.43**	**0.19**	**0.04**
p value	*0.00*	*0.02*	*0.57*	*0.05*	*0.00*	*0.00*	*0.00*	*0.00*	*0.17*	*0.00*
t-stat	17.77	-2.44	-0.57	2.00	5.36	11.99	8.78	5.06	1.38	9.43
lower interval (95%)	*1.36*	*-0.15*	*-0.28*	*0.01*	*2.03*	*11.06*	*0.16*	*0.26*	*-0.08*	*0.03*
upper interval (95%)	1.70	-0.02	0.15	2.14	4.41	15.42	0.25	0.60	0.46	0.05
risk aversion	**5.67**	**9.87**	**9.48**	**-4.78**	**2.17**	**15.23**	**1.72**	**3.28**	**18.93**	**2.82**
p value	*0.00*	*0.06*	*0.54*	*0.07*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*
t-stat	4.64	1.92	0.62	-1.80	3.33	6.60	4.88	2.96	2.97	5.27
lower interval (95%)	*3.25*	*-0.32*	*-20.91*	*-10.01*	*0.88*	*10.67*	*1.02*	*1.09*	*6.34*	*1.76*
upper interval (95%)	8.09	20.06	39.86	0.46	3.46	19.79	2.41	5.46	31.52	3.87

Note: Coefficients are significantly different from zero at 95% level if their p-values are equal to 0.05 or lower (Wonnacot and Wonnacot, 1990, p. 125)

Source: ECB Statistical Data Warehouse (2014a, 2014b, 2014c, 2014d), Stoxx (2014), own calculations

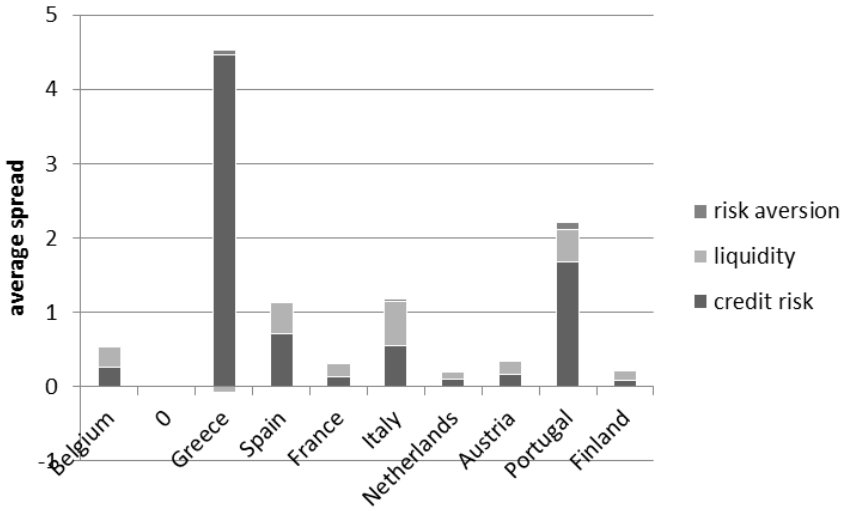
Except for a few coefficients, all the variables have the expected sign. Negative sign was found in the coefficient of liquidity for Ireland and Greece; however, liquidity was insignificant for Greece. It seems that credit risk was so important in determining the size of the spread for Greece that it made the rest of the variables insignificant and almost unimportant. The negative sign might have resulted from the fact that we measured liquidity using the value of outstanding amounts, which rises with higher debt. This might have slightly affected also other calculated coefficients. The coefficient of risk aversion of Spain is also negative, but its significance is quite weak.

Risk aversion variable did not differ across countries and the size of the coefficients can be easily compared. Its significance is satisfactory except for Ireland, Greece, and Spain. Its importance can be ruled out for Greece, whereas its significance in case of Ireland and Spain can still be taken into account. The size of the significant coefficients ranges from the minimum value of 1.72 in the Netherlands to 18.93 in Portugal (see Table no. 1).

International risk aversion seems to have a small impact on the size of the spread of France, the Netherlands, Austria, and Finland, while it affects highly-indebted countries, such as Italy and Portugal but also Ireland. The results seem to suggest that risk aversion affected mostly countries with higher debt.

Liquidity was significant for all the countries except for Portugal and Greece. The significance of Ireland's coefficient is lower but still satisfactory; however the coefficient is negative, which might suggest that liquidity did not affect its spread. Liquidity coefficient is exceptionally large for Italy, and is relatively high for France, Belgium, and Spain. Overall, liquidity seems to have affected mostly larger economies.

All of the credit risk coefficients were significant, and their size seems to depend not only on the indebtedness of the countries but also on the situation in the banking sector. The most affected country seems to be Greece, followed by Portugal, Spain, and Italy. The coefficients for Belgium and Austria are also relatively high. The size of the coefficients seems to point to an interaction of credit risk and risk aversion, except for Greece and Spain where risk aversion is insignificant. Countries with generally less sound banking sectors, such as Ireland, Spain, and Austria featured higher coefficients than would have normally been expected judging by their level of public debt.



Source: ECB Statistical Data Warehouse (2014a, 2014b, 2014c, 2014d), Stoxx (2014), own calculations

Figure no. 2 – Contribution to Spread (2002-2013)

Credit risk and liquidity data is different for each of the countries and can be compared more easily when shown graphically: see Figure no. 2 and Figure no. 3. Ireland was excluded from Figure no. 2 because it would dwarf the data of other countries. The chart shows the contribution of the average size of each of the data sets based on the calculated coefficients. The resulting size of the columns is the average size of the spread during the time period of the analysis. The chart suggests that credit risk is the most important factor, followed by liquidity conditions, while the importance of risk aversion seems to be limited. Credit risk clearly contributes to the spread of highly-indebted countries more than countries with low debt. Moreover, the size of the calculated coefficients also shows that the yields of

these countries are more sensitive to changes in the level of their public debt. In general, they also face higher yields in times of worse liquidity conditions.

The results of the January 2002 to August 2008 analysis are a lot lower in significance (Table no. 2). Credit risk coefficients are either insignificant or negative. The only exception is Ireland whose credit risk coefficient is positive and significant at the same time. The results for liquidity are similar. The only positive and significant coefficient was Italy's liquidity coefficient. Risk aversion, on the other hand, was significant for most of the countries. Insignificant were only the Netherlands, Austria, and Portugal. These countries also exhibited relatively low coefficients. These coefficients are very similar in size, especially when compared to the previous analysis for 2002 to 2013 (Table no. 1). A slightly higher coefficient was assigned to Greece, while the rest of the countries' coefficients were between 1 and 2. Low significance of the credit risk and liquidity variables and importance of global risk perception are in line with the previous analysis of Barrios *et al.* (2009) and Barbosa and Costa (2010) but slightly contradicts the findings of Afonso *et al.* (2012). The former authors assumed risk aversion to be the most important determinant of bond yield spreads before the financial crisis, and our results support these findings. Low significance of idiosyncratic factors in this analysis might suggest that there were other factors affecting sovereign spreads, since they continued to differ slightly even after the creation of the monetary union.

Table no. 2 – Bond Yield Spreads from 2002 until 2008

Spread 2002-2008	**Belgium**	**Ireland**	**Greece**	**Spain**	**France**	**Italy**	**Netherlands**	**Austria**	**Portugal**	**Finland**
multiple R	0.56	0.65	0.76	0.60	0.45	0.48	0.52	0.62	0.69	0.67
constant	**2.00**	**-0.20**	**0.75**	**0.13**	**0.17**	**-0.43**	**0.71**	**2.02**	**1.52**	**0.54**
p value	*0.01*	*0.45*	*0.12*	*0.88*	*0.74*	*0.60*	*0.09*	*0.00*	*0.00*	*0.02*
t-stat	2.80	-0.76	1.59	0.15	0.34	-0.52	1.72	4.31	3.17	2.46
lower interval (95%)	*0.57*	*-0.73*	*-0.19*	*-1.59*	*-0.83*	*-2.06*	*-0.11*	*1.09*	*0.56*	*0.10*
upper interval (95%)	3.42	0.33	1.70	1.86	1.17	1.21	1.54	2.96	2.47	0.98
credit risk	**-1.20**	**1.20**	**0.27**	**-0.45**	**0.81**	**-0.45**	**-1.11**	**-1.48**	**-0.13**	**-1.06**
p value	*0.00*	*0.00*	*0.42*	*0.52*	*0.02*	*0.45*	*0.03*	*0.00*	*0.71*	*0.00*
t-stat	-2.99	2.96	0.81	-0.65	2.31	-0.76	-2.27	-4.80	-0.37	-2.98
lower interval (95%)	*-2.01*	*0.39*	*-0.39*	*-1.81*	*0.11*	*-1.62*	*-2.08*	*-2.09*	*-0.84*	*-1.76*
upper interval (95%)	-0.40	2.01	0.93	0.92	1.51	0.72	-0.14	-0.87	0.58	-0.35
liquidity	**-0.18**	**0.00**	**-0.14**	**0.03**	**-0.53**	**1.20**	**-0.02**	**-0.12**	**-0.09**	**0.00**
p value	*0.03*	*0.51*	*0.00*	*0.87*	*0.07*	*0.00*	*0.54*	*0.00*	*0.00*	*0.27*
t-stat	-2.28	-0.66	-5.19	0.17	-1.87	3.77	-0.61	-3.28	-4.88	-1.12
lower interval (95%)	*-0.33*	*-0.02*	*-0.19*	*-0.31*	*-1.09*	*0.56*	*-0.09*	*-0.19*	*-0.12*	*-0.01*
upper interval (95%)	-0.02	0.01	-0.08	0.36	0.03	1.83	0.05	-0.05	-0.05	0.00
risk aversion	**1.37**	**1.98**	**2.28**	**1.79**	**1.04**	**1.77**	**0.41**	**0.45**	**0.55**	**1.50**
p value	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.06*	*0.17*	*0.27*	*0.00*
t-stat	4.16	3.54	7.19	6.54	3.79	3.64	1.92	1.39	1.11	5.85
lower interval (95%)	*0.71*	*0.86*	*1.65*	*1.24*	*0.49*	*0.80*	*-0.02*	*-0.19*	*-0.43*	*0.99*
upper interval (95%)	2.02	3.09	2.92	2.33	1.59	2.74	0.84	1.09	1.53	2.01

Note: Coefficients are significantly different from zero at 95% level if their p-values are equal to 0.05 or lower (Wonnacot and Wonnacot, 1990, p. 125)

Source: ECB Statistical Data Warehouse (2014a, 2014b, 2014c, 2014d), Stoxx (2014), own calculations

Regression analysis of the 2008 to 2013 time period (Table no. 3) had a relatively high significance for several countries, where its explanatory power was comparable to or even higher than in the previous analysis including data from 2002 to 2013. However, the significance of the analysis was a lot lower for several other countries, namely Greece, Ireland, and the Netherlands.

Table no. 3 – Determinants of Bond Spreads from 2008 until 2013

Spread 2008-2013	Belgium	Ireland	Greece	Spain	France	Italy	Netherlands	Austria	Portugal	Finland
multiple R	0.80	0.51	0.49	0.79	0.71	0.92	0.56	0.64	0.74	0.56
constant	**-17.38**	**-4.97**	**-27.62**	**-12.39**	**-9.26**	**-26.32**	**-1.03**	**-5.47**	**-17.99**	**0.23**
p value	*0.00*	*0.10*	*0.04*	*0.00*	*0.00*	*0.00*	*0.22*	*0.00*	*0.00*	*0.81*
t-stat	-8.78	-1.66	-2.13	-3.10	-5.93	-11.15	-1.23	-4.59	-3.61	0.24
lower interval (95%)	*-21.34*	*-10.96*	*-53.52*	*-20.38*	*-12.38*	*-31.05*	*-2.69*	*-7.86*	*-27.96*	*-1.63*
upper interval (95%)	-13.42	1.02	-1.73	-4.39	-6.13	-21.60	0.64	-3.08	-8.02	2.08
credit risk	**5.79**	**6.67**	**23.73**	**12.33**	**5.26**	**5.71**	**1.84**	**5.09**	**18.97**	**-0.08**
p value	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.92*
t-stat	4.42	3.94	3.22	5.42	7.55	3.47	3.19	4.26	6.89	-0.10
lower interval (95%)	*3.17*	*3.28*	*9.01*	*7.78*	*3.86*	*2.42*	*0.69*	*2.70*	*13.46*	*-1.59*
upper interval (95%)	8.41	10.06	38.45	16.88	6.65	8.99	3.00	7.49	24.47	1.43
liquidity	**2.57**	**-0.02**	**-0.01**	**2.23**	**4.38**	**21.96**	**-0.01**	**0.24**	**-0.05**	**0.00**
p value	*0.00*	*0.86*	*0.98*	*0.02*	*0.00*	*0.00*	*0.94*	*0.02*	*0.91*	*0.97*
t-stat	9.51	-0.17	-0.03	2.31	4.27	13.78	-0.07	2.46	-0.12	0.04
lower interval (95%)	*2.03*	*-0.19*	*-0.42*	*0.30*	*2.33*	*18.77*	*-0.20*	*0.05*	*-0.84*	*-0.05*
upper interval (95%)	3.12	0.16	0.41	4.16	6.43	25.15	0.18	0.44	0.74	0.05
risk aversion	**16.11**	**110.21**	**101.48**	**19.25**	**11.70**	**15.32**	**10.09**	**19.80**	**163.79**	**7.15**
p value	*0.00*	*0.00*	*0.44*	*0.29*	*0.01*	*0.14*	*0.00*	*0.00*	*0.00*	*0.00*
t-stat	3.20	3.06	0.77	1.07	2.76	1.51	5.05	5.45	3.64	3.00
lower interval (95%)	*6.04*	*38.19*	*-160.46*	*-16.68*	*3.20*	*-4.97*	*6.10*	*12.53*	*73.71*	*2.38*
upper interval (95%)	26.18	182.23	363.42	55.18	20.19	35.60	14.09	27.07	253.86	11.91

Note: Coefficients are significantly different from zero at 95% level if their p-values are equal to 0.05 or lower (Wonnacot and Wonnacot, 1990, p. 125)

Source: ECB Statistical Data Warehouse (2014a, 2014b, 2014c, 2014d), Stoxx (2014), own calculations

Credit risk's significance was very high with the exception of Finland. Liquidity was significant for Belgium, Spain, France, Italy, and Austria, and did not seem to affect the rest of the countries at all. Again, liquidity coefficients are higher for bigger countries, namely Italy, but also France. Similarly to the 2002 to 2013 analysis, the highest credit risk coefficients are found in Greece, Portugal, and Spain. On the other hand, Belgium, Ireland, France, Italy, and Austria show slightly lower coefficients, whereas the dependency of sovereign spreads on debt to GDP did not seem that strong for the Netherlands. An exceptionally high risk aversion coefficient was found in Portugal and Ireland. The rest of the countries share quite similar coefficients. Risk aversion was insignificant for Greece, Spain, and Italy, so we could not confirm interaction of risk aversion and credit risk any more. The results show differences in comparison to the previous analysis. Liquidity in general is not as important to determining the size of the spread as for the whole 2002-2013 period. Debt crisis made spreads more sensitive to credit risk than to liquidity risk. The size of the risk aversion coefficients also suggests that spreads were affected by international risk aversion to a much greater extent than during the 2002-2008 period.

Table no. 4 − Determinants of Bond Spreads from 2002 until 2008 including inflation

Spread 2002-2008	Belgium	Ireland	Greece	Spain	France	Italy	Netherlands	Austria	Portugal	Finland
multiple R	0.79	0.70	0.86	0.67	0.76	0.80	0.64	0.79	0.69	0.74
constant	**0.15**	**0.31**	**-0.06**	**0.81**	**0.39**	**-2.41**	**0.22**	**1.73**	**1.64**	**-0.37**
p value	*0.80*	*0.31*	*0.88*	*0.34*	*0.29*	*0.00*	*0.58*	*0.00*	*0.00*	*0.23*
t-stat	0.26	1.02	-0.15	0.97	1.06	-3.96	0.56	4.60	3.19	-1.21
lower interval (95%)	*-1.02*	*-0.30*	*-0.86*	*-0.85*	*-0.35*	*-3.62*	*-0.56*	*0.98*	*0.61*	*-0.99*
upper interval (95%)	1.32	0.93	0.74	2.46	1.13	-1.20	1.01	2.48	2.66	0.24
credit risk	**-0.05**	**0.32**	**0.50**	**-0.93**	**0.34**	**0.85**	**-0.66**	**-0.95**	**-0.19**	**0.57**

Spread 2002-2008	Belgium	Ireland	Greece	Spain	France	Italy	Netherlands	Austria	Portugal	Finland
p value	*0.89*	*0.51*	*0.06*	*0.16*	*0.20*	*0.05*	*0.15*	*0.00*	*0.60*	*0.28*
t-stat	-0.14	0.66	1.87	-1.41	1.29	1.96	-1.45	-3.71	-0.52	1.09
lower interval (95%)	*-0.72*	*-0.65*	*-0.03*	*-2.24*	*-0.19*	*-0.01*	*-1.56*	*-1.46*	*-0.93*	*-0.48*
upper interval (95%)	0.62	1.30	1.03	0.38	0.87	1.71	0.25	-0.44	0.54	1.61
liquidity	**-0.04**	**-0.02**	**-0.09**	**-0.14**	**-0.54**	**1.48**	**0.02**	**-0.14**	**-0.09**	**0.01**
p value	*0.56*	*0.02*	*0.00*	*0.38*	*0.01*	*0.00*	*0.52*	*0.00*	*0.00*	*0.22*
t-stat	-0.59	-2.35	-3.88	-0.88	-2.59	6.68	0.65	-4.91	-4.85	1.24
lower interval (95%)	*-0.16*	*-0.03*	*-0.13*	*-0.47*	*-0.95*	*1.04*	*-0.04*	*-0.20*	*-0.13*	*0.00*
upper interval (95%)	0.09	0.00	-0.04	0.18	-0.12	1.93	0.08	-0.08	-0.05	0.02
risk aversion	**1.48**	**1.47**	**1.26**	**1.35**	**0.69**	**1.34**	**-0.29**	**0.33**	**0.64**	**1.16**
p value	*0.00*	*0.01*	*0.00*	*0.00*	*0.00*	*0.00*	*0.26*	*0.21*	*0.22*	*0.00*
t-stat	5.97	2.61	4.20	4.73	3.34	3.94	-1.14	1.27	1.25	4.64
lower interval (95%)	*0.98*	*0.35*	*0.66*	*0.78*	*0.28*	*0.66*	*-0.81*	*-0.18*	*-0.38*	*0.66*
upper interval (95%)	1.97	2.59	1.85	1.92	1.10	2.02	0.22	0.83	1.67	1.66
inflation	**0.06**	**0.07**	**0.09**	**0.04**	**0.05**	**0.14**	**0.04**	**0.07**	**-0.01**	**0.05**
p value	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.51*	*0.00*
t-stat	7.73	2.92	6.54	3.46	8.03	9.14	4.21	6.75	-0.66	3.95
lower interval (95%)	*0.04*	*0.02*	*0.06*	*0.02*	*0.04*	*0.11*	*0.02*	*0.05*	*-0.05*	*0.02*
upper interval (95%)	0.07	0.11	0.12	0.06	0.06	0.17	0.06	0.08	0.02	0.07

Note: Coefficients are significantly different from zero at 95% level if their p-values are equal to 0.05 or lower (Wonnacot and Wonnacot, 1990, p. 125)

Source: ECB Statistical Data Warehouse (2014a, 2014b, 2014c, 2014d), Stoxx (2014), own calculations

Table no. 5 − Determinants of Bond Spreads from 2002 until 2008 including real interest rate

Spread 2002-2008	Belgium	Ireland	Greece	Spain	France	Italy	Netherlands	Austria	Portugal	Finland
multiple R	0.67	0.76	0.76	0.61	0.45	0.49	0.57	0.65	0.74	0.70
constant	**0.89**	**-0.96**	**0.67**	**-0.12**	**0.18**	**-0.07**	**0.35**	**2.25**	**1.71**	**0.05**
p value	*0.20*	*0.00*	*0.18*	*0.89*	*0.72*	*0.94*	*0.42*	*0.00*	*0.00*	*0.87*
t-stat	1.30	-3.51	1.36	-0.13	0.36	-0.07	0.81	4.76	3.75	0.16
lower interval (95%)	*-0.48*	*-1.50*	*-0.31*	*-1.90*	*-0.82*	*-1.95*	*-0.51*	*1.31*	*0.80*	*-0.53*
upper interval (95%)	2.26	-0.41	1.65	1.66	1.19	1.81	1.21	3.19	2.62	0.63
credit risk	**-0.64**	**2.46**	**0.33**	**-0.19**	**0.82**	**-0.56**	**-0.97**	**-1.67**	**-0.39**	**-0.46**
p value	*0.10*	*0.00*	*0.34*	*0.79*	*0.02*	*0.36*	*0.04*	*0.00*	*0.26*	*0.27*
t-stat	-1.67	5.75	0.96	-0.26	2.33	-0.93	-2.05	-5.29	-1.13	-1.11
lower interval (95%)	*-1.40*	*1.61*	*-0.36*	*-1.63*	*0.12*	*-1.78*	*-1.92*	*-2.29*	*-1.08*	*-1.29*
upper interval (95%)	0.12	3.32	1.02	1.25	1.53	0.65	-0.03	-1.04	0.30	0.37
liquidity	**-0.07**	**0.01**	**-0.14**	**0.08**	**-0.56**	**1.01**	**0.02**	**-0.14**	**-0.08**	**0.00**
p value	*0.31*	*0.06*	*0.00*	*0.65*	*0.06*	*0.01*	*0.51*	*0.00*	*0.00*	*0.71*
t-stat	-1.03	1.90	-5.19	0.45	-1.95	2.51	0.67	-3.82	-4.82	0.38
lower interval (95%)	*-0.22*	*0.00*	*-0.19*	*-0.27*	*-1.13*	*0.21*	*-0.05*	*-0.21*	*-0.12*	*-0.01*
upper interval (95%)	0.07	0.02	-0.08	0.42	0.01	1.81	0.10	-0.07	-0.05	0.01
risk aversion	**1.92**	**1.66**	**2.34**	**1.66**	**1.11**	**1.47**	**0.21**	**0.54**	**0.45**	**1.58**
p value	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.02*	*0.35*	*0.09*	*0.34*	*0.00*
t-stat	6.00	3.39	7.04	5.67	3.77	2.34	0.95	1.71	0.96	6.31
lower interval (95%)	*1.28*	*0.68*	*1.68*	*1.08*	*0.52*	*0.22*	*-0.24*	*-0.09*	*-0.48*	*1.08*
upper interval (95%)	2.55	2.63	3.01	2.25	1.69	2.72	0.66	1.18	1.37	2.08
real interest rate	**0.003**	**-0.003**	**0.000**	**-0.001**	**0.001**	**-0.002**	**0.002**	**0.003**	**-0.003**	**0.005**
p value	*0.00*	*0.00*	*0.53*	*0.26*	*0.52*	*0.44*	*0.02*	*0.04*	*0.00*	*0.01*
t-stat	4.43	-5.14	0.63	-1.14	0.64	-0.78	2.39	2.07	-3.24	2.52
lower interval (95%)	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*-0.01*	*0.00*	*0.00*	*0.00*	*0.00*
upper interval (95%)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.01

Note: Coefficients are significantly different from zero at 95% level if their p-values are equal to 0.05 or lower (Wonnacot and Wonnacot, 1990, p. 125)

Source: ECB Statistical Data Warehouse (2014a, 2014b, 2014c, 2014d), Stoxx (2014), own calculations

Since none of the variables from the 2002-2008 regression analysis could explain the size of the sovereign spreads sufficiently, we decided to include other variables. The next analysis (2) includes inflation, which features the highest significance of all the variables and increased the significance of the regression analysis. The only insignificant inflation coefficient of this regression analysis was the one calculated for Portugal. Including inflation in the analysis made the significance of the rest of the idiosyncratic variables a lot lower, while the risk aversion coefficients retained their significance. All of the risk aversion coefficients were significant, except for the Netherlands, Austria, and Portugal. Despite the results it was most probably not inflation risk that investors were pricing in. Especially in monetary unions, where exchange rates are fixed and nominal exchange rates are equal, countries with higher economic growth usually face higher inflation rates. Eurozone members with the highest inflation rates prior to the financial crisis were Greece, Spain, Ireland, but also Portugal, and Italy. These countries exhibited high inflation rates even before joining the monetary union, and their economic growth was faster than the economic growth of the rest of the countries after they joined the monetary union until the financial crisis of 2008. The interest rates imposed by the European Central Bank were too low for them, which resulted in higher inflation rates. However, their economic growth did not translate into a better ability to service debt as perceived by the investors in the financial markets. This level of interest rates was damaging to their economies and made their growth more uneven, which showed after the start of the financial crisis when the economic growth of these countries was lower than that of most of the other members of the currency union. It is possible that the effect of the "too-low" interest rates had already been priced in even before the economic crisis hit the region. The banking sectors of these countries were affected by the level of interest rates the most and its soundness turned out to be a very important risk factor during the financial and economic crisis. If investors had been pricing in the slowly deteriorating situation in the banking sectors of these countries, that would have made their sovereign yields higher. So the results of the regression analysis should not be interpreted as compensation for inflation risk but might be interpreted as a compensation for the risks implied by being a part of the monetary union and its consequences for cyclical development of the economy.

It could also be argued that the higher yields before the financial crisis were sort of a "continuation" of the higher yields before the currency union (despite the fact that they no longer carried a higher inflation risk than the sovereign bonds of the rest of the member countries). In the case of a break-up of the monetary union or in case one of its members left the monetary union, its central bank would determine the level of interest rates in their economy again, and there is a high probability that its policy would be similar to the one conducted before joining the currency union. That would not only influence the level of interest rates but also nominal exchange rates.

Apart from the reasons mentioned above, higher spreads for high-inflation countries could also be the result of a compensation for inflation risk by local investors, since many investors still did not seek foreign investments at the time. There has been an increase in the holdings of foreign bonds in Eurozone but there is still a certain preference for domestic bonds which, as a result, back then reflected domestic inflation rates and the need for a compensation for inflation risk.

The rest of the regression analysis includes other variables related to cost of borrowing and loss of purchasing power. We did not repeat this analysis with the 2008-2013 time periods, since low inflation as a result of low economic growth decreased government

revenues and their ability to meet their debt obligations. Including inflation in this regression analysis may thus lead to the wrong conclusion.

Real interest rates provide a better estimate of the cost of borrowing given the purchasing power. The lower the real interest rates, the higher the incentive to borrow. The results of the regression analysis (3) taking into account real interest rates were not as significant as as the results of the regression which took inflation into account. Greece, Spain, France, and Italy were insignificant. The coefficients for Portugal and Ireland, whose economies required slightly higher interest rates than imposed by the European Central Bank, were negative, suggesting that higher real interest rates raised their spreads, as opposed to Belgium, the Netherlands, Austria, and Finland. Higher real interest rates were probably the result of lower inflation during phases of slower economic growth, which might have raised the spreads of Portugal and Ireland, whereas slower economic in the Euro Area might have enticed investors to invest into the "safer" countries, such as Belgium, the Netherlands, Austria, and Finland.

Our last analysis (4) takes into account the loss of purchasing power (Table no. 6). The data is expressed relative to Germany. This is an expression of how much the economy has changed since the nominal interest rates were fixed. This gives us a certain idea about the real exchange rate adjustment since the nominal exchange rates were fixed. This real exchange rate adjustment affected countries' trade balance which in turn affected the overall level of debt (including private debt).

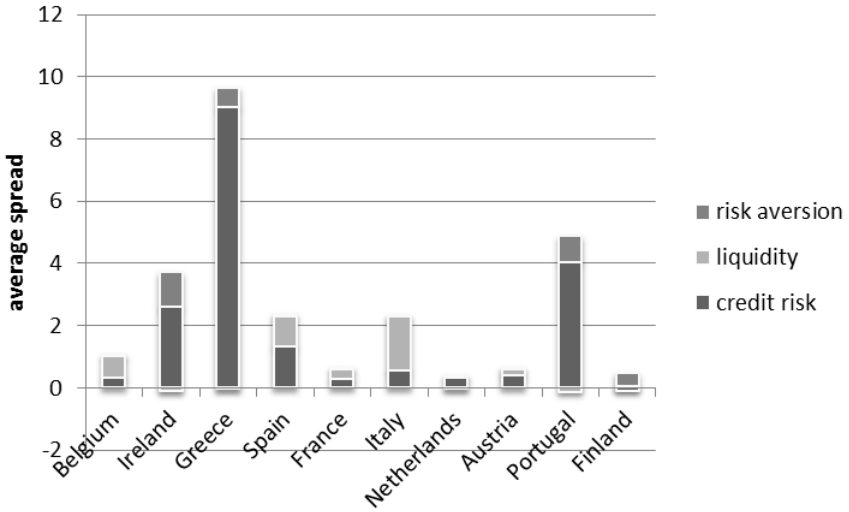
Table no. 6 – Determinants of Bond Spreads from 2002 until 2008 including overall change in inflation relative to Germany

Spread 2002-2008	**Belgium**	**Ireland**	**Greece**	**Spain**	**France**	**Italy**	**Netherlands**	**Austria**	**Portugal**	**Finland**
multiple R	0.60	0.89	0.77	0.68	0.65	0.59	0.61	0.63	0.70	0.71
constant	**1.51**	**-2.14**	**1.23**	**-4.42**	**-0.58**	**0.74**	**0.37**	**1.83**	**1.63**	**0.39**
p value	*0.04*	*0.00*	*0.02*	*0.00*	*0.20*	*0.37*	*0.36*	*0.00*	*0.00*	*0.08*
t-stat	2.08	-8.96	2.33	-3.06	-1.28	0.90	0.92	3.54	3.40	1.78
lower interval (95%)	*0.06*	*-2.62*	*0.18*	*-7.29*	*-1.48*	*-0.91*	*-0.43*	*0.80*	*0.68*	*-0.05*
upper interval (95%)	2.97	-1.67	2.28	-1.54	0.32	2.39	1.16	2.87	2.59	0.83
credit risk	**-1.01**	**3.36**	**0.54**	**5.19**	**2.84**	**-0.29**	**-0.15**	**-1.51**	**-0.76**	**-1.66**
p value	*0.01*	*0.00*	*0.13*	*0.00*	*0.00*	*0.60*	*0.78*	*0.00*	*0.17*	*0.00*
t-stat	-2.51	10.63	1.52	3.20	5.86	-0.53	-0.28	-4.86	-1.40	-4.14
lower interval (95%)	*-1.81*	*2.73*	*-0.17*	*1.96*	*1.87*	*-1.38*	*-1.20*	*-2.13*	*-1.84*	*-2.46*
upper interval (95%)	-0.21	3.99	1.24	8.41	3.80	0.80	0.90	-0.89	0.32	-0.86
liquidity	**-0.27**	**0.02**	**-0.22**	**0.41**	**-0.31**	**-1.56**	**0.01**	**-0.14**	**-0.08**	**0.00**
p value	*0.00*	*0.00*	*0.00*	*0.03*	*0.21*	*0.06*	*0.69*	*0.00*	*0.00*	*0.72*
t-stat	-3.15	4.16	-4.26	2.21	-1.25	-1.91	0.40	-3.21	-4.62	0.35
lower interval (95%)	*-0.45*	*0.01*	*-0.33*	*0.04*	*-0.80*	*-3.18*	*-0.05*	*-0.22*	*-0.12*	*-0.01*
upper interval (95%)	-0.10	0.03	-0.12	0.77	0.18	0.06	0.08	-0.05	-0.05	0.01
risk aversion	**1.32**	**2.54**	**2.12**	**1.69**	**0.64**	**2.27**	**0.05**	**0.63**	**0.83**	**1.16**
p value	*0.00*	*0.00*	*0.00*	*0.00*	*0.01*	*0.00*	*0.81*	*0.10*	*0.12*	*0.00*
t-stat	4.12	7.27	6.56	6.69	2.59	4.81	0.24	1.65	1.59	4.25
lower interval (95%)	*0.68*	*1.84*	*1.48*	*1.19*	*0.15*	*1.33*	*-0.39*	*-0.13*	*-0.21*	*0.62*
upper interval (95%)	1.96	3.23	2.76	2.20	1.13	3.21	0.50	1.38	1.87	1.71
overall inflation	**0.48**	**0.10**	**-0.05**	**0.21**	**-0.64**	**0.60**	**-0.11**	**0.31**	**0.06**	**0.22**
p value	*0.03*	*0.00*	*0.06*	*0.00*	*0.00*	*0.00*	*0.00*	*0.38*	*0.13*	*0.01*
t-stat	2.25	11.17	-1.93	3.78	-5.34	3.63	-3.56	0.89	1.52	2.81
lower interval (95%)	*0.05*	*0.08*	*-0.10*	*0.10*	*-0.88*	*0.27*	*-0.18*	*-0.39*	*-0.02*	*0.06*
upper interval (95%)	0.90	0.12	0.00	0.32	-0.40	0.92	-0.05	1.02	0.14	0.37

Note: Coefficients are significantly different from zero at 95% level if their p-values are equal to 0.05 or lower (Wonnacot and Wonnacot, 1990, p. 125)

Source: ECB Statistical Data Warehouse (2014a, 2014b, 2014c, 2014d), Stoxx (2014), own calculations

According to the regression results, there does not seem to be a strong dependency of this variable on bond yields. Inflation data for the respective time period gave us better results. Portugal, Greece, and Austria were insignificant. The rest of the countries were significant but France and the Netherlands showed negative coefficients. Coefficients were significant and positive for 5 out of 10 countries: Belgium, Ireland, Spain, Italy, and Finland.



Source: ECB Statistical Data Warehouse (2014a, 2014b, 2014c, 2014d), Stoxx (2014), own calculations

Figure no. 3 – Contribution to Spread (2008-2013)

The adjusted model (5) could not prove a clear pattern in risk pricing of sovereign bonds. Very short time periods, especially with less than 100 observations, did not show significant results. The only exception was the liquidity coefficient of the Netherlands. We also did not find any significant coefficients for time periods leading up to the financial crisis of 2008, with the exception of liquidity for certain countries. Most of the coefficients that we found were insignificant with a few exceptions, mostly when using data ending during the financial crisis and during 2011.

Credit risk was significant for shorter time periods before the financial crisis for the Netherlands, Portugal, and France. The significance of the credit risk coefficient of France and Greece fell but remained very high for Portugal and rose substantially for Greek sovereign bonds. Greece and Portugal were among the first ones with major sovereign debt issues in the Euro Area. Their ability to service their public debt started to be questioned along with Ireland and Spain. However, regressions of Spain and Ireland, whose debt issues were of a slightly different character, did not yield any significant results, and our analysis could not conclude what factors were determining to the size of their spread. Liquidity influenced the size of the spread of Italy, the Netherlands and Belgium even before the start of the financial crisis, while risk aversion seemed to have a considerable effect on the yields of France and Greece. Our analysis also proved influence of risk aversion on the yield of Austrian and Spanish sovereign bonds but its coefficients were negative. Since the analysis resulted in negative coefficients for these countries and a positive coefficient for France, we cannot assume that negative risk aversion coefficients were the result of a so-called "flight-

to-safety" by the markets. Using longer time periods proved liquidity to be significant for Belgium and credit risk for France. Liquidity, debt, and risk aversion were all significant for Italian and Portuguese sovereign bonds. Past spread was significant mostly only in those analyses which did not find any other significant variables.

Changes in risk pricing occurred mostly during the second half of 2008 and the first half of 2009 when the volatility in the markets was relatively high. Another time period that stands out in our analysis is year 2011. This might have been the result of higher levels of bond purchases by the European Central Bank which started mainly in 2012 or establishment of the European Stability Mechanism in 2012.

5. CONCLUSIONS

Based on our findings, we can conclude that credit risk and liquidity did not affect Euro Area bond spreads before the financial crisis, although they had a significant impact on them afterwards. It is apparent that risk pricing has changed since the start of the financial crisis. While international risk aversion seems to have played an important role in determining bond spreads before the financial crisis, its influence on bond spreads has been limited since then. The influence of macroeconomic fundamentals has risen since the start of the financial crisis, especially for highly indebted countries and countries with banking sectors affected by the mortgage and debt crisis. Bond spreads of sovereigns with relatively worse macroeconomic position and banking sectors affected by the crisis were influenced by heightened risk aversion more strongly than other sovereigns. Illiquidity of sovereign bonds of certain countries did not seem to be affected by international risk aversion this way. It is interesting to note that liquidity seemed to affect mostly larger economies, especially Italy. This is in line with the findings of Barrios *et al.* (2009) but contradicts the findings of Barbosa and Costa (2010). However, it is important to note that the time period of their analysis and also their approach was slightly different from ours. Differences in real interest rates and purchasing power did show a certain level of significance that should be taken into account but it is questionable what the interpretation of the results should be. Including inflation in the 2002-2008 analysis improved the significance of the analysis, which could be a sign of a compensation for the risks associated with being a member of a common currency block.

Taking into account the results of the adjusted analyses, we can conclude that different sovereign spreads reacted to changes in economic and market environment differently and at different times. Deteriorating situation concerning public finances was mostly perceived in Greece and Portugal around the time when they requested a bailout. Spreads were probably also influenced by the market environment and interventions of the central bank and other institutions. A clear and systematic influence of any of our variables could not be proven but it seems that pricing of risk evolves over time, and markets do take into account all of these factors. Their importance rises especially during times of higher market volatility and higher uncertainty but is probably also influenced by the policies of the central bank. Interventions of the central bank in the bond markets change the price of risk that markets evaluate and finding a relation between spreads and idiosyncratic factors becomes more problematic.

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Notes

[1]. $$spread_t = \beta_0 + \beta_c C_t + \beta_l L_t + \beta_r R_t + \varepsilon_t \quad (1)$$

where β_c is a credit risk coefficient, β_l is a liquidity coefficient, β_r is a risk aversion coefficient, C_t is credit risk, L_t is liquidity, R_t is risk aversion, ε_t is an error term.

[2]. The regression model (1) was changed to:

$$spread_t = \beta_0 + \beta_c C_t + \beta_l L_t + \beta_r R_t + \beta_i I_t + \varepsilon_t \quad (2)$$

where β_0 is constant, β_c is a credit risk coefficient, β_l is a liquidity coefficient, β_R is a risk aversion coefficient, C_t is credit risk, L_t is liquidity, R_t is risk aversion, ε_t is an error term.

[3]. $$spread_t = \beta_0 + \beta_C C_t + \beta_l L_t + \beta_R R_t + \beta_r r_t + \varepsilon_t \quad (3)$$

where β_r is real interest rate coefficient and r_t is real interest rate. We assumed that lower real interest rates would imply higher spreads, which is justified in the previous chapter, and we adjusted the formula to take this into account. We wanted to avoid negative values entering our regression model, so we added 3% to all of the values. The data was adjusted the following way:

$$r_t = \frac{1}{\frac{\left(1+\frac{n_t}{100}\right)}{\left(1+\frac{i_t}{100}\right)}+0.03}$$

where n_t is nominal interest rate (ECB main refinancing rate).

[4]. The last model consists of our usual variables as well as new variables which roughly describes the loss of purchasing power relative to Germany. The regression model (1) was changed to:

$$spread_t = \beta_0 + \beta_C C_t + \beta_l L_t + \beta_R R_t + \beta_p P_t + \varepsilon_t \quad (4)$$

where β_p is a coefficient of the overall change in purchasing power relative to Germany and P_t is an overall change in purchasing power relative to Germany. The overall change in purchasing power relative to Germany P was calculated as the ratio of the respective country value of accumulated loss in purchasing power to the same value calculated for Germany. The first value was calculated first for January 1999, which is the start of the monetary union and equal interest rates:

$$P_1 = \frac{\left(1+\frac{i_1}{100}\right)}{\left(1+\frac{i_{DE}}{100}\right)}$$

and the rest of the values were calculated based on the previous month's value:

$$P_t = \frac{P_{t-1}\left(1+\frac{i_t}{100}\right)}{P_{DE,t-1}\left(1+\frac{i_{DE,t}}{100}\right)}$$

[5]. $$\Delta spread_t = \beta_0 + \beta_1 \Delta spread_{t-1} + \beta_C \ln C_t + \beta_l \ln L_t + \beta_r R_t + \varepsilon_t \quad (5)$$

where β_c is a credit risk coefficient, β_l is a liquidity coefficient, β_r is a risk aversion coefficient, C_t is credit risk, L_t is liquidity, R_t is risk aversion, ε_t is an error term. *Ln* is the natural logarithm of a variable and Δ denotes difference in comparison to the previous value.

and

$$\Delta spread_t = \beta_0 + \beta_1 \Delta spread_{t-1} + \beta_C \ln C_t + \beta_l \ln L_t + \beta_r R_t + \beta_i I_t + \varepsilon_t \quad (6)$$

where $ß_i$ is an inflation rate coefficient, I_t is inflation rate, and ε_t is an error term.

The Durbin-Watson test proved that none of the analyses (5) and (6) had autocorrelated errors.

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EFFECTS OF TOURISM SEASONALITY AT LOCAL LEVEL

Biljana PETREVSKA*

Abstract

The paper underlines the importance of identifying seasonality effects over tourism development. The study applies a simple test for examining the presence of seasonality in tourism demand in the line of exploring its concentration and strength at local level. The investigation is covered by calculating some commonly applied indicators for measuring tourism seasonality, like Gini coefficient, Seasonality Indicator and Coefficient of Variation. The data set addresses the total tourist arrivals between 2000-2013 and elaborates the case of Ohrid, as the most famous tourist destination in Macedonia. The research results point to high level of tourism seasonality with significant flow distribution to tourism development. Finally, the study may serve as a base for identifying measures and activities necessary for creating comprehensive local and regional tourism policy.

Keywords: seasonality, tourism development, tourism policy

JEL classification: L83, O10

1. INTRODUCTION

Regardless the level of economic development, each country is interested in tourism due to its various positive impacts. Generally, tourism contributes to economic growth and development, promoting international understanding and peace, improving living standard, stimulating local trade and industry development, protection of cultural heritage etc. (Goeldner *et al.*, 2000). In this line, seasonality is noted as one of the most influencing factor for limiting continuous development. So, one may understand it as a phenomena that provokes incomplete and unbalanced usage of means necessary for economic development (BarOn, 1973).

This research attempts to answer the main investigation question for examining any seasonal patterns in tourism at local level, by exploring the case of Ohrid as the most famous tourist destination in Macedonia. The research aim is two-folded:

- Firstly, to gain in-depth knowledge regarding seasonal patterns of tourism in Ohrid; and

* Faculty of Tourism and Business Logistics, "Goce Delcev" University, Stip, R. Macedonia; e-mail: *biljana.petrevska@ugd.edu.mk.*

- Secondly, to empirically test and analyse the strength of seasonality in tourism demand at local level.

In order to meet the research aims, the paper is structured in several parts. After the introductory part, Section two gives a brief overview on theoretical aspects of the main reasons for seasonality in tourism flows, underlining the most profound negative, as well as positive effects. A snapshot on stylized facts on tourism flows of Ohrid is given in Section three, while the research design encompassing the methodology and research frame are posed in Section four. Section five presents the main research findings and discussion, while the conclusion remarks are noted in last part of the paper.

Generally, the contribution of this paper is the attempt to quantify seasonality patterns of tourism demand at local level, which is a novelty in Macedonia's academic work. Some exceptions are noted, but in addressing seasonality effects at national level of Macedonia (Petrevska 2013a, 2013b and 2013c).

2. LITERATURE REVIEW

Seasonality in tourism has been a subject of interest among researchers and academicians thus provoking continuous debates and argumentations (BarOn, 1993, 1999; Baum, 1999; Chung, 2009; Higham and Hinch, 2002; Jang, 2004; Lundtorp, 2001; Yacoumis, 1980). Yet, they all generally agree that seasonality is occurred due to temporary imbalance in tourism flows caused by three types of factors:

1. Nature (sunny days, snow falls, insolation etc.);
2. Institutional factor (religious and pilgrimage travel, workers' holidays, students' ferries, festival events etc.); and
3. Other factors (social pressure, personal preferences, inertness etc.).

Moreover, it is noted that this type of systematic variations may be present during the year, semester, but also in the frames of a month or a week, even in a single day (Holloway, 1994; Lundberg *et al.*, 1995). Each of them may have positive or negative influence on tourism development.

If having negative consequences over tourism development, the researches pose the fact that seasonality may not be controlled (Allcock, 1989; Edgell, 1990; Laws, 1991; Snepenger *et al.*, 1990; Szivas *et al.*, 2003). In this respect, they all refer to damaging influences in:

- Employment (part-time employment, social instability and insecurity etc.);
- Investments (high risks over low occupancy rate); and
- Environment (pollution, overcrowding, xenophobia, criminal activity etc.).

Thankfully to various methods for detecting seasonality, one may identify and introduce measures and activities in order to cope and overcome negative impacts on tourism. As the most commonly applied methods, the academicians note: extension of the season by introducing new tourist products immune to seasonality; application of positive pricing policy; developing business tourism, etc. (Nadal *et al.*, 2004; Sutcliffe and Sinclair, 1980; Witt *et al.*, 1991).

On the other side, there is a large body of literature that elaborates an approach that seasonality provokes positive effects as well, particularly in terms of sociology and ecology. Namely, after devastating high season, long and quiet period is more than welcomed especially for recovering the sources, and the local population as well (Butler, 1994; Drakatos, 1987; Grant *et al.*, 1997; Hartmann, 1986).

3. TOURISM FLOW DISTRIBUTION OF OHRID

Ohrid is the most famous tourist destination in Macedonia that generally develops summer tourism simultaneously with other forms of alternative tourism (cultural, congress, etc.). Table 1 presents some stylized facts on tourism data for Ohrid for the period 2000-2013.

It is noticeable an upward trend during the sample with the exception of 2001 (war conflict in Macedonia) and stagnation in 2010 (World economic crisis). Up to 2008, domestic tourists are by far dominant over the foreigners by encompassing up to 69% of total tourist arrivals. Yet, due to governmental measures and activities for supporting and enhancing tourism development by introducing subsidies, the proportion changed in favour to foreign tourists. Namely, a rapid decline of domestic tourists may be noted starting from 2009 to 2013, leading to 'only' 48% participation in total tourist arrivals. Consequently, in 2013 foreign tourists overtook the leading role for the first time in tourism development of Ohrid by covering 52% of total number of tourists. However, the average absolute numbers for the sample period illustrate dominancy of domestic tourists with 117,578 arrivals towards 55,632 arrivals of foreign tourists.

Figure 1 presents the number of tourists that visited Ohrid for the period 2000-2013, by quarters. One may visually conclude that Quarter 3 (comprised of summer months: July, August and September) encompasses the largest quantum of tourists and travellers, thus representing the highest peak-point i.e. the high season. Moreover, this quarter covers 61% (or 105,925 total tourists) of total average tourism demand for the sample period. This may be explained with fact that in Quarter 3 tourism demand is the highest due to presence of multiple factors. Namely, in these months, the usage of holidays and ferries is the highest (institutional factor), there is hot and sunny weather (natural factor) and there is a manifestation of personal preferences and attitudes of tourists and travellers (other factors). The fact that Ohrid is a summer tourist destination explains the high average numbers for July (47,856 tourists or 28%) and August (46,222 tourists or 27%). Consequently, at first glance this may seem as a strong seasonality pattern, which is additionally confirmed by an in-depth analysis.

Table no. 1 – Tourist arrivals in Ohrid, 2000-2013

Year	Domestic	Foreign	Total
2000	153,510	56,318	209,828
2001	86,258	11,499	97,757
2002	137,911	25,517	163,428
2003	136,420	39,390	175,810
2004	114,652	37,522	152,174
2005	116,401	49,564	165,965
2006	114,754	52,640	167,394
2007	123,854	57,456	181,310
2008	139,643	62,461	202,104
2009	122,258	67,441	189,699
2010	105,213	59,896	165,109
2011	102,730	75,547	178,277
2012	99,850	83,485	183,335
2013	92,637	100,109	191,504
Average 2000-2013	117,578	55,632	173,121

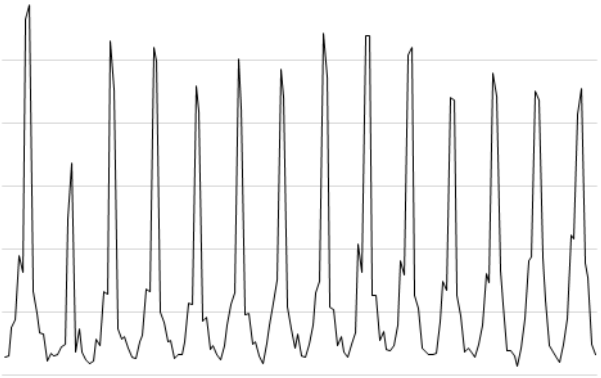

Figure no. 1 – Distribution of tourism flows in Ohrid, 2000-2013

4. METHODOLOGY

The research is mainly covered by quantitative approach in order to meet the set objectives. In this respect, the analysis of seasonal concentration of tourism demand is done by computing the Gini coefficient (G), the Seasonality Indicator (SI) and the Coefficient of Variation (CV). The main variable applied in this research is total number of tourists on monthly basis that visited Ohrid. The data is provided by a secondary source, in this case from the on-line data base of the State Statistical Office of the Republic of Macedonia. Due to public unavailability of the data for previous years, the sample spreads over the period 2000-2013. Calculations for G, SI and CV are based on standard equations (Eq. 1, 2 and 3).

The Gini Coefficient is first developed and introduced in 1912, and since then it is one of the most commonly used coefficients for measuring inequality of revenues caused by temporary disorders. Moreover, the Gini coefficient is often applied as appropriate measure for expressing seasonality in tourism (Arnold, 2008; Bigovic, 2012; Black, 2002; Fernández-Moralez, 2003; Lim and McAleer, 2008; Nadal *et al.*, 2004). In this respect, different approaches are noted for calculating the Gini coefficient (Xu, 2003). Its value spreads between 0 and 1, whereas bigger G represents bigger inequity i.e. seasonality in tourism, and vice versa. In this research, the Gini coefficient on yearly basis is calculated upon standard equation (Eq. 1).

$$G = 2/n\ \Sigma n_i=1\ (x_i - y_i) = 2/n[(x_1 - y_1)+ (x_2 - y_2)+\ldots+((x_n - y_n)] = 2/n[\Sigma n_i=1\ x_i\ - \Sigma n_i=1 y_i] \quad (1)$$

whereas:

n denotes number of months;

x_i denotes rank of the months (1/12, 2/12, ..., 12/12); and

y_i denotes cumulative relative frequency of tourist arrivals in rank by ascending order.

The Seasonal Indicator is additional measure for quantifying empirically observed seasonality patterns in tourism. Most commonly is calculated as an inverse value of the Seasonality Ratio (Wanhill, 1980; Yacoumis, 1980). Its value ranges from 1/12 up to 1, whereas bigger SI represents absence of fluctuation during the year, i.e. seasonality in tourism, and vice versa. In this research, the SI is calculated upon standard equation (Eq. 2).

$$SI = \frac{y_0}{y_n} \quad (2)$$

whereas:

y_0 denotes the average number of tourist arrivals per year; and

y_n denotes the highest number of tourist arrivals in the particular year.

The Coefficient of Variation describes the fluctuation of tourists during the year. Moreover, it measures the spread of each series around its annual mean as a percentage of that mean. This indicator is particularly useful for comparing dispersion in data sets having different standard deviations and different means. It can take values beginning with zero. If the value is small, than the distribution is much homogenous and the average is much representative. Yet, despite the simplification in calculating it, it may be difficult to interpret the results appropriately (Lundtorp, 2001). In this research, the CV is calculated upon standard equation (Eq. 3).

$$CV = \frac{s}{\bar{y}} \quad (3)$$

whereas:

s denotes the standard deviation; and

$\bar{y}$ denotes the mean of the observations in the particular year.

5. ANALYSIS, RESULTS AND DISCUSSION

Since the main aim is to calculate G, SI and CV for tourism demand of Ohrid for the sample period, some previous calculations must be undertaken. In this line, Table 2 presents calculations of the rank of fractiles i.e. months in a year. In addition, due to their consistency, the obtained data are applied in further calculations, particularly in computing the G values.

Table no. 2 – Calculations of fractiles' rank

xi
1/12 = 0.08
2/12 = 0.17
3/12 = 0.25
4/12 = 0.33
5/12 = 0.42
6/12 = 0.50
7/12 = 0.58
8/12 = 0.67
9/12 = 0.75
10/12 = 0.83
11/12 = 0.92
12/12 = 1.00
Total = 6.50

Since the fractiles' rank are computed, the calculations proceed by obtaining further data. So, Table 3 presents cumulative relative frequency of tourist arrivals by ascending order on yearly basis (yi). Additionally, Table 3 presents the difference between number of fractiles and the cumulative relative frequency in rank (Σxi - Σyi).

Table no. 3 – Computing data for G

Year	yi	Σxi - Σ yi
2000	3.525402	2.974598
2001	3.498276	3.001724
2002	3.248556	3.251441
2003	3.424686	3.075314
2004	3.439346	3.060654
2005	3.544259	2.955741
2006	3.491559	3.008441
2007	3.484110	3.015890
2008	3.525452	2.974548
2009	3.501879	2.998121
2010	3.566910	2.933090
2011	3.564795	2.935205
2012	3.595478	2.904522
2013	3.651987	2.848013

The calculated values for G, SI and CV for the sample period are presented in Table 4.

Table no. 4 – Gini coefficient, Seasonality Indicator and Coefficient of Variation

Year	G	SI	CV
2000	0.4958	0.2973	110.9
2001	0.5003	0.2419	124.5
2002	0.5419	0.2557	125.9
2003	0.5126	0.2815	118.3
2004	0.5101	0.2754	117.9
2005	0.4926	0.2748	112.9
2006	0.5014	0.2862	112.5
2007	0.5026	0.2780	114.1
2008	0.4958	0.3115	108.0
2009	0.4997	0.3037	109.9
2010	0.4888	0.3117	106.9
2011	0.4892	0.3094	104.3
2012	0.4841	0.3380	98.3
2013	0.4747	0.3501	93.1
Average 2000-2013	0.4993	0.2939	111.2

With regards to the Gini coefficient, Table 4 poses that the values spreads between 0.4747 and 0.5419. The average value of G for the period 2000-2013 is 0.4993. The data show that seasonality in terms of intra-year monthly variations in tourist arrivals is relatively constant during the 14-year period. Due to fact that research calculations referring Gini coefficient are almost equal to the margin of 0.5, one may conclude a presence of high seasonality in tourism. Namely, the high values of G show that current distribution of tourism demand for the sample period, has substantial meaning to Ohrid. Hence, the concentration in terms of tourist arrivals in Ohrid points to significant unbalance and large inequality. Thus, the high peaks in the third quarter, particularly in July and August have sufficient capacity and strength for serious influence with an in-depth manner.

It can be noted that all calculated values of G are similar, almost identical and approximately constant with small negligible variations. This points to conclusion that during the sample period there was always meaningful and strong seasonal patterns in tourism in Ohrid. So, one may conclude high tourism seasonality in Ohrid with significant characteristics, particularly in summer months.

The graphical representation of the computed G values is visually posted in Figure 2. In this line, the Lorenz curve assists in observing 'the cumulated frequencies in rank with the lowest frequency (winter month) to the left and the month with the highest number of tourists to the right' (Lundtorp, 2001): 30. From Figure 2 it is noticeable that the average Lorenz curve of Ohrid (average for 2000-2013) is positioned relatively away from the Line of equity, which announces presence of seasonal concentration. Furthermore, the area between the average Lorenz curve of Ohrid and the Line of equity is relatively big, thus pointing to unequal seasonal distribution of tourist arrivals and presence of seasonal concentration at local level during the year, being supportive to the constant, similar and high values of G.

Figure no. 2 – Average Lorenz curve of Ohrid, 2000-2013

Concerning the Seasonality Indicator, one may adhere from Table 4 that the calculated values for the sample period range between 0.2419 and 0.3501 noting an average value of 0.2939. Since all computed data are relatively close to zero, one may argue strong fluctuation within a year. Therefore, upon the calculations for SI, one may conclude the presence of resilient tourism seasonality in Ohrid.

Besides the G and the SI, the research encompasses data regarding the Coefficient of Variation. It is used in order numerically to measure stability of tourism demand distribution in the sample period. Table 4 presents data on CV spreading between 93.1% and 125.9%. The average value of CV during the sample period is 111.2% which is far above the limit of 35-40% pointing to non-homogeneous distribution and conclusion that the average is no more representative. Furthermore, the data must be separated in components by groups depending on the variation of another group variables.

The research outcomes point to conclusion for having strong seasonality in tourism in Ohrid, most probably underlining it as the most profound negative effect for further more balanced local tourism development.

6. CONCLUSION

This paper aims to recall the importance of seasonality as one of the major and profound limits for tourism development. In this respect, a brief overview is presented on reasons for the most examined negative effects of tourism seasonality. Additionally, some approaches referring positive impacts due to seasonality have been noted.

In the same time, the research investigated the seasonality effects over local tourism development, by elaborating the case of Ohrid, as the most famous summer tourist spot and a "must-see" destination. In this line, the data registered as the highest peaks in the third quarter in each year, visually pointed to the presence of seasonality. The statistics regarding tourist arrivals which present the largest figures, may be generalized, and interpreted as strong and powerful seasonality in tourism flows. The research posed that in Quarter 3 exists cumulative influence of all factors that provoke extended concentration and increased demand. Such situation includes: acceptable and favourable weather conditions; extensive isolated days; usage of vacations and ferries; personal preferences for summer season etc.

Furthermore, the paper presents the research findings upon the main aim of the empirical investigation. So, in order to investigate seasonality in tourism demand in Ohrid, the basic variable used in the calculation is tourist arrivals on monthly basis. The sample spreads between 2000-2013. The research outcomes gave a scientific clarification for having strong and robust seasonality patterns in tourism in Ohrid. Moreover, the findings point to fact that distribution i.e. concentration of tourism demand in terms of tourist arrivals is substantial and has considerable meaning for further local and regional tourism development. In the first line, the negative effects of seasonality can be observed by extremely low average length of stay of tourists in off-seasons. Namely, the average duration of stay of all tourists is 8 days in July and August towards only 2 days in other months of the year. This additionally results with low level of bed and room occupancy rates of all accommodation facilities in Ohrid.

The strong effects of tourism seasonality can be managed, mitigated and controlled, but cannot be avoided. Despite numerous attempts to overcome seasonality at local level, still plenty needs to be done, such as: lengthening the main season, establishing additional seasons, diversifying markets, using differential pricing and tax incentives on a temporal basis, encouraging the staggering of holidays, boosting domestic tourism in off-seasons, and providing off-season attractions or events. In addition, special events such as festivals and conferences may help to overcome the seasonal effects, if they take place in the shoulder or off-season. It could be pointed out, however, that tourists expect to have attractive programs organized during the main season and out of it. So generally, in order to address the negative effects of seasonality, one may argue introducing different strategies in the line of supporting further local tourism development, like:

- Differential pricing (seasonal/promotional pricing; group booking offers etc.);
- Diversified attraction (changing the product mix);
- Market diversification (determination of optimal segment mix);
- Facilitation by the state and local players (loans or subsidies; tax concession; legislative initiatives; partnerships etc.).

Yet, one must address the positive effects that seasonality provokes as well. Namely, after devastating fifty days of high season in Ohrid, the environment as well as the local population may welcome a long and quiet period free from overcrowding, xenophobia, criminal activity and similar negative effects that tourism development brings. The scarce

resources that Ohrid has in terms of protected natural and historical locations (Lake Ohrid, National park Galicica, over one hundred religious and spiritual locations etc.), need time to rest from tourist activity due to their limit beyond which can suffer from the adverse tourism impacts. Such pressure needs to be processed by integrated planning and management simultaneously maintaining satisfaction of tourist supply and demand, as well as the needs of local residents.

The research was limited by several factors that may be addressed in some future work. Firstly, the sample period (2000-2013) is rather short due to publically unavailable data. In case of having longer time series, the conclusions on seasonality impacts on local tourism development may have more serious meaning since it will reflect much extensive time-frame. Secondly, the investigation uses relatively simple technique which all-the-way can be helpful in some contexts. Yet, the outcomes may be enhanced by employing more advanced methods, like: SARIMA (Seasonal Autoregressive Moving Average) models, TQSAR (Two-Quarter Smoothed Annualized Rate) method, HP (Hodrick-Prescott) filter smoothing method, BSM (Basic Structural Model), HEGY test etc. Although these methods process seasonality fluctuations of tourism data in more precise manner, still there is no clear answer to the ways in which seasonality in tourism demand modelling could be better handled.

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MEASURING RETURNS TO EDUCATION: THE CASE OF LATVIA

Svetlana SAKSONOVA*
Kārlis VILERTS**

Abstract

This paper aims to measure returns to education in Latvia and place them in context of data available in other countries. The goals of this paper are to review the literature on returns to education, highlighting the measurement challenges, and, based on the 2011 labour market survey data, estimate private returns to education in Latvia overall as well as by individual characteristics. The main findings are that returns to education in Latvia are close to the European Union average, but lower than in some emerging markets e.g. Lithuania, and that there are statistically significant differences in returns to education depending on a person's gender, ethnicity, field of employment and location.

Keywords: education finance, financial returns to education, determinants of income, regression analysis

JEL classification: I20, I21, J24

1. INTRODUCTION

Returns to education have been extensively analysed in education finance literature and have been used inter alia to explain past economic growth rates, the optimality of resource allocation within education as well as between education and other sectors, the determinants of income distribution and the behaviour of consumers of education (Psacharopoulos, 1985).

This paper focuses on private returns to education, which are usually defined as financial returns that an individual would obtain by achieving a certain level of education[1]. The aim is to provide new and comparable estimates of returns to education in Latvia for the overall population, as well as different subgroups and suggest some directions for future research.

There are broadly two hypotheses that describe how education brings private financial returns. The first, and the one we mostly focus on, is that education improves an individual's human capital, making the individual more productive and resulting in higher wages. The second hypothesis is that education serves mostly as a screening mechanism, by providing credentials to individuals with enough ability to complete a degree. In this theory education

* Faculty of Economics and Management, University of Latvia, Latvia; e-mail: *saksonova.svetlana@gmail.com.*
** Latvia; e-mail: *karlis.vilerts@fsmetta.lv.*

may determine your access to employment but not necessarily your salary. In a cross country study, Van de Werfhorst (2011) finds evidence for the first hypothesis, but not the second one.

Most authors distinguish between private and social returns to education Powdthavee and Vignoles, 2006; Rosen, 2008). Private returns may consist of increased chances of employment; increased labour mobility, and other considerations; however the most commonly used measure is the financial returns i.e. increased earnings. Knowing private returns to education may help a person who has to decide on the desired level of education.

The origins of empirical attempts to measure returns to education can be traced back to the middle of the XX century; however the benchmark for current literature was set by Psacharopoulos (1981), who used a single mathematical model to estimate returns to education for 32 countries. This research has since been updated several times but its two main conclusions remained unchanged.

First, returns to education (returns from one additional year of schooling) in most cases were found to be over 10 per cent, a significant magnitude when compared to historical rates of return for other asset categories and exceeding any estimates of the opportunity cost of capital. Second, returns to education in developing countries tended to be higher than the ones in advanced economies.

A significant amount of research on returns to education has analysed comparable cross-country data sets covering OECD and the EU. For example, Psacharopoulos (2004) as well as Psacharopoulos (2009) provide an extensive summary of estimated returns to education for the European countries. Private returns were found to be higher than social returns, which were also estimated less frequently because estimating social returns requires direct cost data by level of education. Private returns were higher than social returns by an average of 4.4 percentage points when using the most recent and comparable data. The highest returns to education were observed in emerging markets (Poland, Hungary and the Czech Republic), while the lowest ones were observed in Scandinavian countries.

A caveat of such summaries of previous findings is that returns in different countries were estimated in different periods of time. Though reported numbers are still comparable, there may also be theoretical reasons for returns to education to fluctuate. For example, greater development of information and communication technologies should have increased returns to education.

This paper focuses on the measured returns to education, rather than perceived returns to education, which may be different and, also have an effect on schooling decisions. For example, Jensen (2010), in a survey of eighth-grade boys from the Dominican Republic found that perceived returns to education were much lower than measured returns to education and that students who were told about higher measured returns completed more schooling.

Badescu *et al.* (2011) estimate the returns to education and losses suffered by those who quit their education after graduating elementary school for 23 European Union member states (but not Latvia) as well as Norway using the results of the European Community Statistics on Income and Living Conditions. Returns to higher education in Europe turn out to vary widely across countries. For example the return in Sweden is around 19 per cent whereas in Portugal around 68.4 per cent (measured as wage increases following an attainment of the next education level).

The methodology and the findings of Badescu *et al.* (2011) are extensively used in this paper in order to make the estimates for Latvia comparable internationally. As a result, we make several methodological choices. First, we abstract from the costs of obtaining education in the form of tuition costs or foregone wages since comparable data on those is not available.

Some may therefore argue that this paper estimates the wage advantage of individuals with a particular education level. Still, if one assumes foregone earnings to be the main cost of education, then the estimation of wage advantage and returns to education are closely related.

Second, we use several dummy variables for different levels of educational attainment and measure their effect on wages, while controlling for other relevant covariates. The alternative approach used by some researchers is to measure the effect of an additional year of schooling on wages. Our specification is preferable since a year of schooling may involve very different things – e.g. the last year of high school may differ substantially from the last year of college, etc.

Third, following Badescu *et al.* (2011) we largely abstract from issues dealing with endogeneity[2] of education. It is reasonable to assume that individuals with higher ability may choose to attain higher education levels, in which case the estimation of returns to education will be biased since it will also reflect returns from high ability. This "ability bias" has been recognized by Badescu *et al.* (2011) and was discussed in many contributions including the seminal one by Angrist and Krueger (1991).

In order to control for such bias one needs to find an instrument for education – a variable that would be correlated with education, but not correlated with ability (or other omitted variables). This would allow identifying exogenous variation in education and hence the estimation of the true effect of education on wages. Various instruments have been considered: quarter of birth of an individual (Angrist and Krueger, 1991), proximity to the school (Card, 1995), and government policies of school reform (Meghir and Palme, 2005; Aakvik *et al.*, 2010). Another approach has been tried by Blundell *et al.*, 2001 who focus on the effects of higher education in Britain. They "match" individuals according to the observed characteristics, which include ability, family background and demographics and compare outcomes between individuals who pursued higher education and otherwise identical individuals who had the opportunity but did not. However, sufficient data to implement either of these approaches for Latvia is not available yet, rendering the application of instrumental variables or matching techniques impossible[3].

For Latvia, returns to education were previously estimated by Hazans (2003) who analysed the wage differentials for persons with different educational background and found that persons with higher education earn approximately 69 – 80 per cent more than persons with elementary education. He also found gender, ethnicity and the region to have a statistically significant impact on returns to education. Hazans *et al.* (2008) also considered the effect of nationality and parental achievement on educational outcome variables such as the decision to enrol or the completion of a tertiary education (but not wages), documenting a human capital gap with minority populations, which has emerged in Estonia, Latvia, and Lithuania during the period of economic transition and remained significant even after controlling for parental education.

2. ECONOMETRIC MODEL

The model used in this paper follows the one used in Badescu *et al.* (2011). Equation (1) is an OLS regression that estimates the returns to education.

$$W_i = \delta_1 + \delta_2 X_i + \beta_1 ED1_i + \beta_2 ED3_i + \varepsilon_i \quad (1)$$

where W_i is a logarithm of the monthly earnings for the person "i" and $\delta_1$is a constant. Earnings in this case are defined as the official monthly net salary (after taxes).

Vector X_i consists of various variables that affect person's earnings. Individual's age, ethnicity, marriage status, geographical location and gender are factors that have proven to leave an impact on person's earnings. The vector of coefficients δ_2 shows the impact on earnings of each of the previously mentioned variables.

Furthermore, $ED1_i$ is a binominal variable that equals one if the highest obtained education level of the person "i" is elementary school or lower (elementary school in Latvia is finished after the 9th grade). The coefficient β_1 measures the losses of earnings caused by the decision not to obtain higher educational level than elementary school;

Similarly, $ED3_i$ is a binominal variable that equals one if person has obtained higher education. The coefficient β_2 measures the financial returns to education for persons with higher education compared to individuals with lower level of education. Finally, ε_i is the disturbance with the standard assumptions of normal distribution and zero mean.

This regression model is related to two conceptually different frameworks originally proposed by Mincer. The first is the so-called compensating differences framework which assumes individuals with identical abilities and opportunities, perfect credit markets, and perfect certainty. However occupations differ in the amount of schooling required. Because individuals are ex ante identical and forgo earnings while in school, they require a compensating wage differential to work in occupations that require a longer schooling period. The compensating differential is determined by equating the present value of earnings streams net of costs associated with different levels of investment in education (Heckman *et al.*, 2005)

In the second framework, which is more widely used now, individuals are assumed to be heterogeneous. This framework emphasizes life cycle dynamics of earnings and the relationship between observed earnings, potential earnings, and human capital investment, for both formal schooling and on-the-job investment. Note that in this framework (as well as in ours) the focus is on the ex post average growth rate of earnings with schooling.

Education level and earnings are supposed to be positively correlated, so in most cases β_1 is expected to be less than zero and β_2 greater than zero. If there were no correlation between education and earnings or if it were negative, there wouldn't be any financial incentive for a person to undertake higher education.

This paper uses the labour market survey compiled by the Central Statistical Bureau of Latvia (2013). The survey includes the data on age, region where an individual lives, gender, monthly income, ethnicity and many more variables[4].

The variables in the dataset match the requirements set by the econometric model, so the findings can be directly compared to the ones of Badescu *et al.* (2011). A total of 2.229 individual observations are used in estimation.

3. FINDINGS

Table 1 summarizes the estimation results of the OLS regression (1)[5].

The expected positive relationship between an individual's education level and her or his earnings can be found in the data. The findings imply that a person with higher education ceteris paribus earns on average 35.1 per cent more than a person who does not have higher education. On the other hand, individuals who quit education after finishing elementary school earn on average 9.9 per cent less than those who obtain higher than elementary education. Higher education in Latvia seems to give higher returns than secondary education.

Table no. 1 – The Impact of Individual Characteristics on Monthly Earnings in Latvia in 2011 in Percentages

Symbol	Variable	Impact
δ_{21}	Age	1.95
δ_{22}	Age squared	-0.25
δ_{23}	Male	21.21
δ_{24}	Ethnicity	4.31
δ_{25}	Region_Vidzeme	-13.29
δ_{26}	Region_Kurzeme	-1.45
δ_{27}	Region_Zemgale	-1.16
δ_{28}	Region_Latgale	-18.76
$\beta 1$	ED1	-9.94
$\beta 2$	ED3	35.14

Source: Authors' calculations

Age appears to have a positive effect on earnings initially, followed by a negative effect as individuals become older. The peak age group in terms of earnings is from age 35 to 44; while ordinarily the group preceding retirement might be expected to have the highest earning power (45 to 54). The difference might be explained by rapid structural changes in Latvian economy in the last decades leaving older workers with depreciated skills as well as the ongoing consequences of the 2009 economic crisis in Latvia.

The coefficients for the regions of Latvia (Vidzeme, Kurzeme, Zemgale and Latgale) show the difference in average earnings compared to Riga (omitted to prevent multicollinearity). As might be expected, because the majority of economic activity is concentrated in the capital city, individuals in regions have lower earnings power than Riga. The disparity between regions is also significant with Kurzeme and Zemgale only marginally below Riga, while Vidzeme and especially the traditionally depressed region of Latgale lag further behind.

In order to fully interpret the results they must be compared to the ones of other countries. As stated previously, the econometric model and the variables used in this research follow closely those of Badescu *et al.* (2011), therefore the results in principle could be considered comparable except that they are based on samples from time periods several years apart – Badescu *et al.* (2011) rely on the data from 2005 and this study uses the data from 2011.

The returns to education for other countries reported by Badescu *et al.* (2011) are shown in Table 2.

Some of the emerging markets such as Lithuania, Hungary and Slovenia tend to have higher returns to education than advanced economies. Portugal has the highest return in the European Union - 68.40 percent. Advanced Scandinavian countries such as Sweden and Denmark have the lowest returns to higher education. Since after tax earnings are used in the study, lower returns to education in Scandinavian countries may be explained by the more progressive tax systems in these countries with higher earnings increasingly taxed away. Returns to higher education in Latvia are, similar to Estonia, and very close to the European Union average; however they are significantly lower than in some other Eastern European countries.

Table no. 2 – Returns to Education in the European Union and Norway in 2011 in Percentages

Country	Losses due to the Quitting Education after Graduating the Elementary School	Returns to Higher Education
Belgium	-15.4	24.3
Czech Republic	-34.2	44.1
Denmark	-6.9	20.7
Germany	-35.7	32.2
Estonia	-20.3	33.6
Greece	-17.9	22.1
Spain	-15.7	31.3
France	-9.7	42.1
Ireland	-22.3	38.7
Italy	-16.4	27.8
Cyprus	-28.1	38.4
Lithuania	-12.5	55.5
Luxembourg	-31.2	45.6
Hungary	-25.8	60.7
The Netherlands	-16.4	29.8
Austria	-36.5	32.2
Poland	-28.6	45.3
Portugal	-29.8	68.4
Slovenia	-36.0	60.8
Slovakia	-32.2	30.5
Finland	-8.8	31.5
Sweden	-12.9	19.2
United Kingdom	-24.5	30.7
Norway	-11.7	20.0
Full sample of Badescu *et al.* (2011)	-18.2	36.0
Latvia	-9.94	35.14

Sources: Badescu et al. (2011), Authors' calculations

In Latvia losses due to quitting education after elementary school graduation are low compared to Estonia and Lithuania. In the European Union there are only three countries that have lower losses: Denmark, Finland and France. The largest losses due to quitting education after graduating the elementary school in the European Union are in Austria (twice the average of European Union and almost four times the one in Latvia).

Returns to education vary not only between different countries, but between the inner geographic regions as well. We divide the dataset into region-wise groups, so that model (1) can be estimated for each region in Latvia (Vidzeme, Kurzeme, Zemgale, Latgale and Riga).

An alternative strategy would have been to introduce interaction terms between dummy variables on education and on region allowing the return on education to vary by regions and using the entire data sample. However, the approach we adopt has an advantage of potentially excluding some of the unobserved heterogeneity. Individuals in the same region might be similar in terms of their access to employment opportunities, for example, etc. The estimated returns to education for various geographical regions of Latvia are shown in the Table 3[6].

Table no. 3 – Returns to Education in the Regions of Latvia in 2011 in Percentages

Region	Losses due to Quitting Education after Graduating from Elementary School	Returns to Higher Education
Latgale	-9.13	29.46
Zemgale	-17.14	35.83
Kurzeme	-5.44	42.83
Vidzeme	-9.09	35.08
Riga	-6.63	34.78

Source: Authors' calculations

Latgale, Zemgale, Vidzeme and Kurzeme are administrative regions of Latvia, whereas Riga is the capital city. Returns to higher education are significantly above zero for all five regions. The estimate of losses suffered due to quitting education after graduating elementary school is significant only in Zemgale. The main reason why the returns are not significant in other regions is the small number of observations on early dropouts.

Kurzeme has the highest returns to higher education in Latvia (42.83), while Latgale has the lowest one (29.46). Returns in the other three regions are relatively close to the country's average.

Different estimates for different regions are caused by different economic sectors upon which economies of different regions are based. In order to fully understand the variation of returns the economic structure of each region must be analysed, which is beyond the scope of this paper.

When someone decides to follow a certain profession, he or she has to decide whether to enrol in higher education in this field. Therefore returns to education for various different economic sectors can be a helpful auxiliary tool for individuals deciding whether to pursue higher education in this profession.

Splitting the dataset into subsamples by different sectors of employment model (1) can be estimated again. The returns to higher education for different employment sectors in Latvia are shown in the Table 4[7].

Table 4 – Returns to Higher Education for Various Employment Sectors in Latvia in 2011 in Percentages

Employment Sector	Returns to Higher Education
Agriculture, Forestry and Fishery	51.65
Energy industry	31.81
Trade, Accommodation and Food services	32.87
Transport and Information services	24.12
Finance, Insurance, Science and Administrative services	32.57
Real estate	42.62
Public administration and Defence	40.36
Education	42.41
Health and Social care	54.56
Other	24.86

Source: Authors' estimates

The highest returns to education in Latvia are in the Health and Social care sectors in which they reach nearly 55 percent. It implies that in this employment sector a person with

higher education earns on average almost 55 percent more than an individual who does not have higher education.

The lowest return is found in Transport and Information service sector. In this employment sector a person with higher education earns on average only 24 percent more than a person with lower level of education.

The differences between returns to education in different employment sectors are caused by specific requirements that need to be met within each of the sectors and the typical composition of occupations with it. For example, high returns to education in Agriculture, Forestry and Fishery sector may be due to the fact that the majority of labour force in this sector is relatively low-skilled, while the relatively scarce individuals with high levels of education occupy positions that generate most of the value added within the sector. Similarly, high returns to education in Health and Social Care may be generated by the relative scarcity of individuals willing to undertake sophisticated and lengthy training in medicine.

On the other hand, the skill and knowledge needed for daily activities working in the transport and information service sector might be more uniform. For example, everyone who works in IT might need higher education in computer science with the sole possible exception of data entry professionals. One might therefore estimate a low value for returns to education; however, this would not capture the fact that there might be very few vacancies for individuals with low levels of education in these sectors.

The ranking of the professions presented in Table 4 has to be interpreted with a caveat that it is unclear how representative each sample of the professions is. In addition certain sectors may have greater scope for underreporting of salary for reasons of tax avoidance, which can still occur in Latvia.

Thus, geographical locations and the choice of a profession all affect returns to education. However, there are also other factors that should be important. While the geographical location and employment sector are chosen by individuals themselves and can be changed throughout their lives, other factors like gender and ethnicity are unchangeable.

We therefore estimate the OLS regression (1) for subsamples divided by gender and ethnicity. Table 5 shows the returns to higher education for various geographical regions of Latvia divided by the gender.

Table 5 – Returns to Higher Education in Various Regions of Latvia by Gender in 2011 in Percentages

Region	Women	Men
Riga	40.93	25.77
Vidzeme	32.15	41.18
Kurzeme	40.70	46.79
Zemgale	38.93	29.17
Latgale	28.84	31.37
Latvia overall	37.13	33.08

Source: Authors' estimates

The return to higher education in Latvia is nearly 4 percentage points higher for women than men. Thus, while the results of Table 1 suggest a substantial wage gap between men and women (because it shows that men's salaries are more than 20 percent higher), on average, it narrows at higher levels of education. Returns vary widely, when subsamples for

different regions are considered without a common pattern. In Riga and Zemgale men tend to have higher returns to higher education while in Latgale, Kurzeme and Vidzeme the relationship is the reverse. Only returns to higher education turned out to be significantly different from zero, therefore losses due to quitting education after graduating elementary school are not reported.

Latvia is a country with a relatively large share of ethnic minorities in the total population. Therefore it is important to see if returns to education for minorities are different from the ones for Latvians.

Returns to education for Latvians are 30 per cent, whereas for minorities they are 38 per cent. The same relationship across the ethnicities is present in individual regions as well. It is possible that this is due to the fact that ethnic minorities are concentrated in cities (especially in Riga), where wages are generally higher and employment opportunities greater. A more complete interpretation of results would require assessing whether each sample is representative enough in terms of gender, occupations and regional distribution.

4. CONCLUSIONS

This paper measured the effect of higher educational attainment on after tax wages in Latvia. The results of statistical analysis show that these effects are statistically significant and comparable to other results obtained with similar datasets in other European countries.

Our baseline results show that on average a person with higher education earns 35 per cent more than a person who does not have higher education. There are also statistically and economically significant differences in returns to education across different regions, industries, genders and ethnicities.

Specifically, returns to education are the highest in Kurzeme and the lowest in Latgale, which is generally acknowledged to be the most depressed region in Latvia. In this case differences in returns to education may reflect problems in the operation of labour markets or more general economic inequality which prevents individuals with higher education from finding a job that corresponds to their abilities.

We also find that returns to education are higher for women than for men and are also higher for ethnic minorities than for Latvians. This may reflect the fact that individuals from these groups are at a particular disadvantage when they have low levels of education. It also suggests that educational policy has a role to play in ensuring that individuals from all groups and all regions have access to the same quality of education.

Our results also indicate that returns to education vary by industry. In particular, healthcare and social care have the highest return to education while transport and information services have the lowest.

The estimates in this paper can be considered a lower bound of the potential returns to education because they focus only on the private component measured by improvement in earnings ability. However, education generates positive externalities for the society as a whole, which can be quantified using different empirical approaches.

There are several avenues for future research into returns on education in Latvia. The most important one is finding a way to correct for the “ability bias” described previously, which can be accomplished by finding a suitable instrument (i.e. a suitable natural experiment). The effect of parental achievement is also worth analyzing in greater detail. Another caveat of this paper is that it does not control for years spent on the job, which can also be considered a form of investment in human capital and improving productivity.

Higher wages likely accrue to individuals who have worked in their professions the longest. More data is necessary to empirically assess this.

Another useful avenue for further research is a more detailed estimation of opportunity costs of education as well as estimation of social rather than private returns. Given that the state plays a considerable role in the education sector in Latvia, such kind of analysis could aid in the design of a better education policy.

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Notes

[1]. An alternative approach to analysing the efficiency of public education expenditure has been suggested by Aristovnik (2012), who uses data envelopment analysis to show that new EU member states show relatively high efficiency in tertiary education, but lag well behind in the R&D efficiency measures.

[2]. Endogeneity refers to the situation when an explanatory variable (e.g. education) is correlated with the variable not included in the model (unobserved), for example, education may be correlated with ability.

[3]. Other possible solutions include explicitly modelling the link between unobserved and observed variables, which requires making specific assumption on their relationship or attempting to control for unobserved heterogeneity by including variables such as parents' income and education.

[4]. Actual source data is available upon request.

[5]. Only the variables with coefficients significant at 95% confidence level are shown in the table. The variable age takes values from 0 to 8, with 1 signifying age from 0 to 14, 2 – 15 to 24 years, 3 – 25 to 34 years and so on until 8 to signify 75 years and above. Variable "Gender" takes value "1" if the person is male, "0"if female. Variable "Ethnicity" takes value "1" if the person is Latvian, "0" if otherwise

[6]. In the estimation of coefficients for Riga 252 observations were used, for Zemgale 235 observations, for Kurzeme 224 observations for Vidzeme 204 observations and for Latgale 296 observations. The count of the observations in (1) is not the same as the total of observations in the region. The differences are due to the missing information in the survey.

[7]. The employment sectors shown in Table 4 are the ones officially defined by the Central Statistical Bureau of Latvia. All professions are included in one of these 10 employment sectors.

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IMPROVEMENT OF UKRAINIAN INDUSTRIAL COMPANY'S PERFORMANCE DIAGNOSTICS BASED ON ITS LOGISTIC SYSTEM ANALYSIS

Natalya VOZNENKO*
Teodora ROMAN**

Abstract

In the competitiveness environment on external and internal markets the more important role now can be given to company's organizational features and leverages as a set of tools that can work out the best solution to improve enterprise's performance in general. The study aims to create a model of industrial company's performance diagnostics based on evaluating firm's external flows by taking into consideration its financial, marketing, producing and logistic indicators at once. The objective is to divide industrial enterprises into specified groups by statistics cluster analysis in order to diagnose similarities within each group and develop management key-points recommendations to each of the group depending on their logistic system condition.

Keywords: industrial company's performance, cluster analysis, company's external flows diagnostics

JEL classification: M210, O1, O160

1. INTRODUCTION

Internalisation of world's economy and diminishing frontiers for international activities of enterprises give a lot of opportunities to firms on one hand and may cause crucial effects as low quality production, non-competitive goods stock at warehouse and bankruptcy in the long term on the other. In order to profit only the bright side of world globalization trends companies have to search for new methods of organizing their business activities. Company's performance from the point of view of its management system can be evaluated by two criteria: its internal process and external flows effectiveness on the market. The aim of this paper is to sketch Ukrainian industrial enterprises in clusters by examining their external flows at the level of their financial, marketing, producing and logistic indicators and develop management key-points recommendations to each of the group.

* Faculty of International Economic Relations, Simon Kuznets Kharkiv National University of Economics, Kharkiv, Ukraine; e-mail: *voznenko@mail.ru*.

** Faculty of Economics and Business Administration, Alexandru Ioan Cuza University, Iasi, Romania;e-mail: *throman@uaic.ro.*

The study objectives in the respect of presented aim are: 1) to scrutinize existing approaches in industrial company performance diagnostics, 2) to investigate the procedure of cluster analysis implementation, 3) to conduct Ukrainian industrial companies performance diagnostics, 4) to develop management key-points recommendations to each formed cluster.

2. LITTERATURE REVIEW

The literature survey defined different approaches to company's performance evaluation. Theoretical models of solving this type of problems are connected with analysing common or specified data for research. Commonly used the approach of estimating financial position of a company by identifying its financial coefficients state based on data of balance sheet and consolidated company's financial statement (Litovchenko and Golovko, 2012; Tkachova, 2012, p. 39). This type of methods is frequently used due to accessibility the primary data. At the same moment there is another method if the researcher's aim is to take into consideration not only quantitative but also qualitative information, in this case the diagnostics procedure is usually accompanied by interviewing top-managers of an enterprise in order to gain some managerial inside information connected to quality of production, competitor's and own market share and so on (Litovchenko and Golovko, 2012). Different approaches could be classified due to general criterion for evaluation: financial state, economic efficiency, level of competitiveness, aggregated indicator, and business process intensity, strategic system leverage (Table 1).

The problem of evaluating industrial company state needs the modifying scale of variables that can be used to characterize specific segments in order to develop set of tools for improving their market position. While observing existing scientific surveys the authors realized that for working out appropriate recommendations and solutions for companies it is not sufficient to use already existed scales and variables because commonly used approaches couldn't investigate industrial company's external flow components all at once. So, we suggest to compose a model that may estimate financial, material and information parts of external flow of industrial enterprise and scrutinize their mutual influence on dependent variable return on logistic costs as a criterion for enterprise logistic system efficiency in order to group the enterprises into unions with similar characteristics. The research hypotheses are:

H1: Enterprises with the common duration of operating cycle (OC) and level of logistics return (ROLI), implement the same strategy on the market,

H2: There are several types of industrial company's behaviour on the market and it can be measured and predicted by cluster analysis,

H3: Diminishing of Duration of Financial cycle (FC) and increasing Return on Logistic Costs (ROLI) can improve industrial company's market position,

H4: Company's external flow performance due to its components (ROS – the indicator of market activities(the indicator of external information flow) , Duration of Financial cycle (FC) – the financial terms indicator, Duration of operating cycle (OC) – as an indicator of material flow of enterprise) had two way influence on its general logistic system criterion – Return on Logistic Costs (ROLI).

Table no. 1 – Generalized approaches to company's performance diagnostics

Criterion for evaluation	Key-indicator	Company's state	Author
Financial state	Altman's model of company's bankruptcy	Crisis	Guseva (2009)
		Pre-crisis	
		Normal	
		Ideal	
Economic efficiency of company's activities (return)	Return on activities (ROA)	Effective	Tkachova (2012)
	Return on equity (ROE)	Non-effective	
	Return on sales (ROS)		
	Return on investments (ROI)		
Competitiveness (Ratio of competitiveness)	Indicators of financial development	High-competitive	Litovchenko and Golovko (2012)
		Same level of quality/costs ratio	
		Low level of competitiveness	
Aggregated approach	Return	Effective/ non-effective	Litovchenko and Golovko (2012)
	Liquidity	Absolute liquid/ liquid/ non-liquid balance model	
	Activity	Sufficient / non-sufficient duration of Production and Financial Cycles	
	Stability	Absolute financial stability/ Normal / Non-absolute financial stability/ Crisis	
Business process	KPI	High intensity	Litovchenko and Golovko (2012)
		Medium intensity	
		Low intensity	
Strategic system (strategic system leverage)	Marketing leverage	Effective/ non-effective company's strategic management	Litovchenko and Golovko (2012)
	Operating leverage		
	Innovative Management Ratio		
	Finance leverage		

Source: authors development by Gritsenko (2009), Guseva (2009), Tkachova (2012), Litovchenko and Golovko, 2012

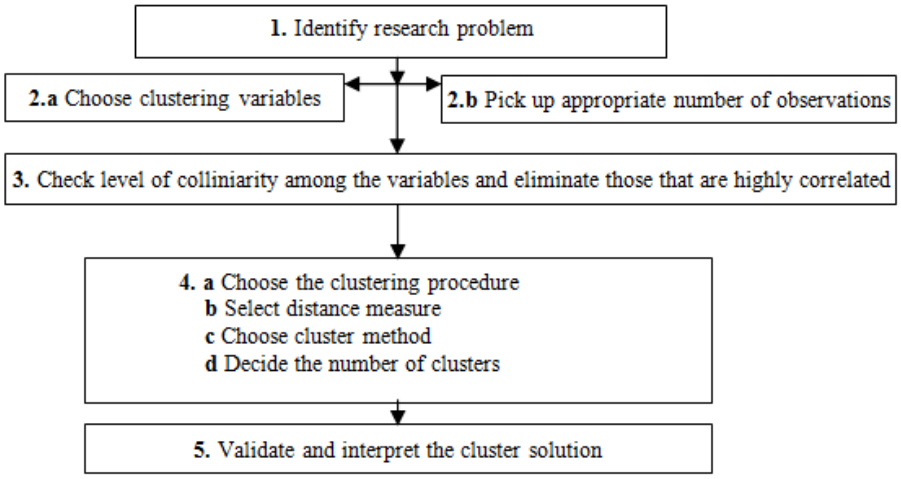
3. CONDUCTED RESEARCH

3.1. Data and methodology

Generally for the purpose of identifying groups of similar objects, scientists use cluster analysis procedure. As Mooi and Sarstedt (2011) defined cluster analysis is a convenient method for identifying homogenous groups of objects called clusters. Model of estimating connections and cluster grouping consists of several steps (Brauksa, 2013; Mooi and Sarstedt, 2011; Dibb, 1999; Kim *et al.*, 1989; Kotler and Keller, 2009; Tonks, 2009) that are presented at Figure 1.

According to Wedel and Kamakura (2000), there are several types of clustering variables and they can be classified into general (independent of products, services or circumstances) and specific (related to both the customer and the product, service and/or particular circumstance), on the one hand, and observable (i.e., measured directly) and

unobservable (i.e., inferred) on the other. In this scientific research general and observable clustering variables had been chosen.



Source: Mooi and Sarstedt (2011)

Figure no. 1 – Cluster analysis procedure

As a rule is that the "independent" clustering variables are associated with one or more "dependent" variables not included in the analysis. Given this relationship, there should be significant differences between the "dependent" variable(s) across the clusters. These associations may or may not be causal, but it is essential that the clustering variables distinguish the "dependent" variable(s) significantly (Mooi and Sarstedt, 2011).

The research with the respect of suggested cluster procedure (Figure 1) obtained the following results. The problem was to identify groups of enterprises with similar level of logistic system development and external flow indicators. Due to this in the following survey the key dependent variables were defined as duration of financial cycle of a company (FC), return on sales (ROS), duration of company's operating cycle (OC), and independent variable is return on logistic costs of enterprise as an indicator of company's logistic system efficiency (ROLI).

Number of observations is usually estimated as 2^m, where m – is the total amount of variables. So, in the present case the total amount of observations has to be no less than 16. The study investigates the performance of 6 industrial Ukrainian enterprises for 2.5 years (totally 60 observations). Each observation consists of 3 months period data gained from official and managerial inside sources, from the 3d quarter of 2012 to the 4th quarter of 2014. All studied enterprises form the potential of second sector of Ukrainian economy. The input data is presented in Table 2.

Table no. 2 – Research input data

Enterprise	Code of data	Variables	
		Code in SPSS	Indicator
FED Corporation LTD	F3-2012; F4-2012; F1-2013; F2-2013; F3-2013; F4-2013; F1-2014; F2-2014; F3-2014; F4-2014	VAR 00002	Return on Logistic Costs (ROLI) – **dependent** variable
Lozovaya Plant Traktorodetal	L3-2012; L4-2012; L1-2013; L2-2013; L3-2013; L4-2013; L1-2014; L2-2014; L3-2014; L4-2014	VAR 00003	duration of financial cycle of a company(FC) – **independent** variable
Kharkiv Plant of Electric Equipment	Z3-2012; Z4-2012; Z1-2013; Z2-2013; Z3-2013; Z4-2013; Z1-2014; Z2-2014; Z3-2014; Z4-2014	VAR 00004	return on sales (ROS) - **independent** variable
Plant Electrotyajmash	E3-2012; E4-2012; E1-2013; E2-2013; E3-2013; E4-2013; E1-2014; E2-2014; E3-2014; E4-2014	VAR 00005	duration of company's operating cycle (OC) - **independent** variable
State Scientific and Producing Union Communar	K3-2012; K4-2012; K1-2013; K2-2013; K3-2013; K4-2013; K1-2014; K2-2014; K3-2014; K4-2014		
State Plant Turboatom	T3-2012; T4-2012; T1-2013; T2-2013; T3-2013; T4-2013; T1-2014; T2-2014; T3-2014; T4-2014		
Total	6 enterprises; 60 cases	4 variables	

3.2. Empirical results

For the research the software SPSS was used. After data standardizing procedure the descriptive statistics analysis had been run. The results are presented in Table 3.

Table no. 3 - Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation	Variance
VAR00002	60	1.00	32.00	16.2500	8.83488	78.055
VAR00003	60	-2633.00	3718.00	-26.6833	1244.38513	1548494.356
VAR00004	60	2.00	32.00	17.3333	10.38034	107.751
VAR00005	60	48.00	2043.00	343.7333	479.61743	230032.877
Valid N (list wise)	60					

Next step is to check the variables for collinearity. For this purpose the correlation analysis had been conducted. The results (Table 4) show the high level of dependence between ROS and FC.

According to the gained data ROS had been eliminated from the developing model. It can be explained as dependence between the level of company's sales and financial terms of cooperation with its suppliers and sales department. It shows us that H4 might be partly confirmed now and the marketing indicator impact on dependent variable ROLI will not be scrutinized. For the further calculations we estimate the dependent variable – ROLI, and independent variables are duration of financial cycle (FC) and duration of production cycle of enterprise (PC). Listed variables can be used now to characterize specific segment – profiling.

Table no. 4 – Correlations

		VAR00002	VAR00003	VAR00004	VAR00005
VAR00002	Pearson Correlation	1	-.211	.476**	-.083
	Sig. (1-tailed)		.053	.000	.265
	N	60	60	60	60
VAR00003	Pearson Correlation	-.211	1	-.244*	-.369**
	Sig. (1-tailed)	.053		.030	.002
	N	60	60	60	60
VAR00004	Pearson Correlation	.476**	-.244*	1	.156
	Sig. (1-tailed)	.000	.030		.116
	N	60	60	60	60
VAR00005	Pearson Correlation	-.083	-.369**	.156	1
	Sig. (1-tailed)	.265	.002	.116	
	N	60	60	60	60

**. Correlation is significant at the 0.01 level (1-tailed).
*. Correlation is significant at the 0.05 level (1-tailed).

For the next step of cluster procedure we had chosen hierarchical method of agglomerate clustering using Euclidian distance measure and Ward's method for the checking procedure. The number of grouped clusters is equal 4 and the results of observations are shown on dendrogram (Figure 2).

After gaining results the next step is to consult the agglomeration schedule (Annex A) to validate the presented number of clusters. Generally to make a decision on final cluster numbers the following rule have to be followed. The appropriate number of clusters is estimated as a deviation between number of cases iteration (59) and the numerical number of case when coefficient in agglomeration schedule changes its meaning dramatically (55). So, in our case the best quantity of clusters are 4. After it we ran ANOVA - one – step statistics to prove the validity of obtained results (Table 5).

On the next step we continue scrutinizing procedure of the number of clusters. We consult cluster membership (Annex B) to interpret the other possible amount of clusters.

Table no. 5 – ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
VAR00003	Between Groups	54412892.150	9	6045876.906	8.182	.000
	Within Groups	36948274.833	50	738965.497		
	Total	91361166.983	59			
VAR00005	Between Groups	6397601.800	9	710844.644	4.954	.000
	Within Groups	7174337.933	50	143486.759		
	Total	13571939.733	59			

To confirm gained results we will calculate clusters centroids by Wards method to evaluate the quality of got information (Tables 6, 7, 8).

Table no. 6 – Initial Cluster Centres

	Cluster			
	1	2	3	4
VAR00002	23.00	24.00	2.00	18.00
VAR00003	9.00	28.00	21.00	2.00
VAR00005	300.00	539.00	2043.00	48.00

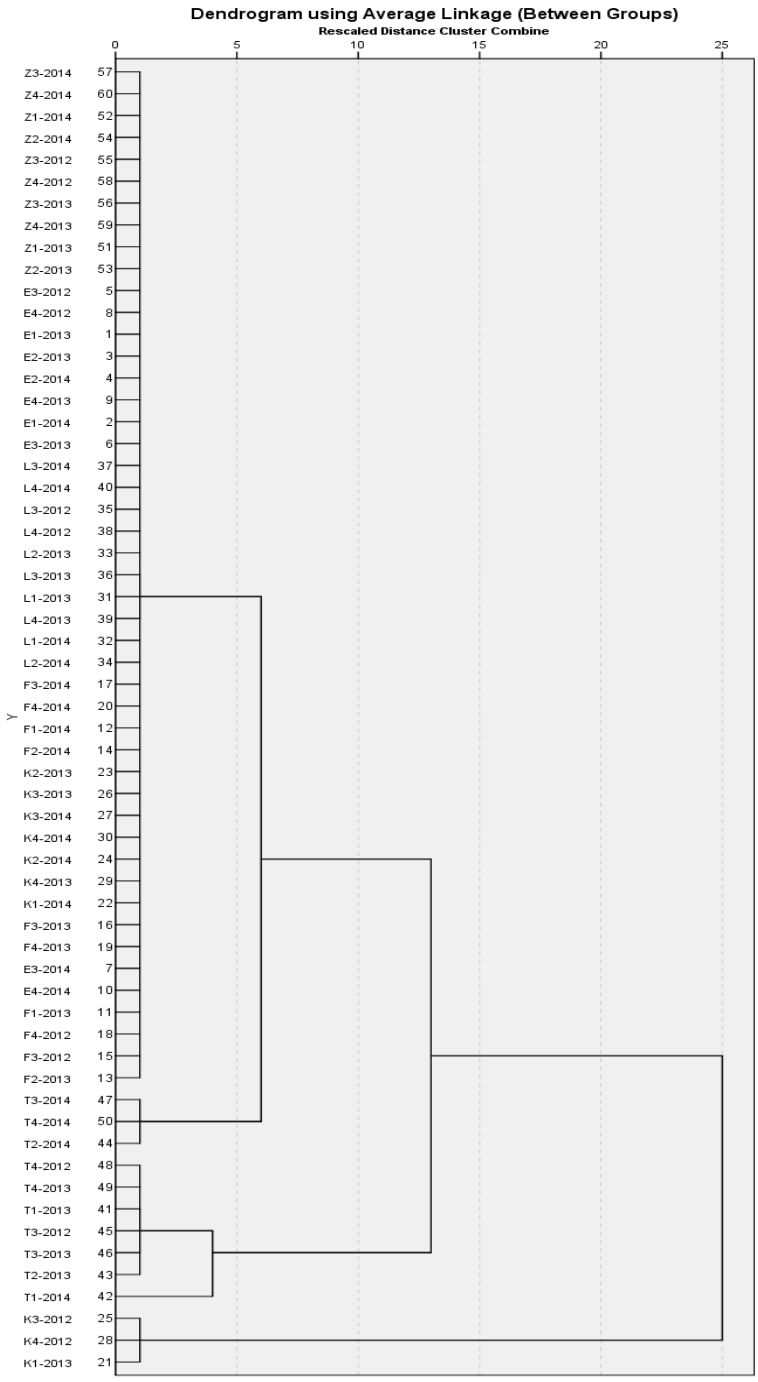


Figure no. 2 – Dendrogram of clusters

Table no. 7 – Iteration History

Iteration	Change in Cluster Centres			
	1	2	3	4
1	28.649	.000	11.543	52.006
2	8.114	.000	.000	6.381
3	9.064	.000	.000	6.145
4	.000	.000	.000	.000

Table no. 8 - Final Cluster Centres

	Cluster			
	1	2	3	4
VAR00002	13.71	24.00	13.00	16.93
VAR00003	8.67	28.00	24.50	20.41
VAR00005	290.24	539.00	2043.00	107.69

After it we initiate final two-steps cluster procedure to estimate the models quality.

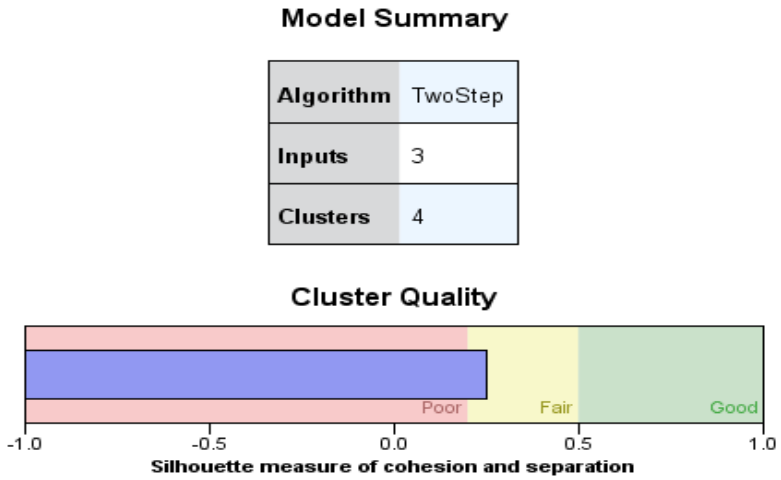


Figure no. 3 – Suggested 4-cluster model quality

Choice for the best clustering solution must be (Dibb, 1999; Tonks, 2009; Kotler and Keller, 2009) made under the following cluster's criteria: substantial, accessible, differentiable, actionable, stable, parsimonious, familiar, relevant, compactness and accountable. The increasing of Silhouette measure proves the appropriate classification gained by hierarchical method (Figure 3).

First of all, the developed model and number of clusters show a high degree of within-segment homogeneity and between-segment heterogeneity. Due to H2, it had been confirmed, though there are several types of industrial company's behaviour on the market and it can be measured and predicted by cluster analysis. So we may state according to developed model there are 4 clusters in the represented 60 cases of observation. It means that H4 was partly confirmed by obtaining the predicted groups.

Based upon conducted research the generalized results can be presented in Matrix (Figure 4). The general parameters for the developed model are level of ROLI and duration of Financial and Operation Cycles.

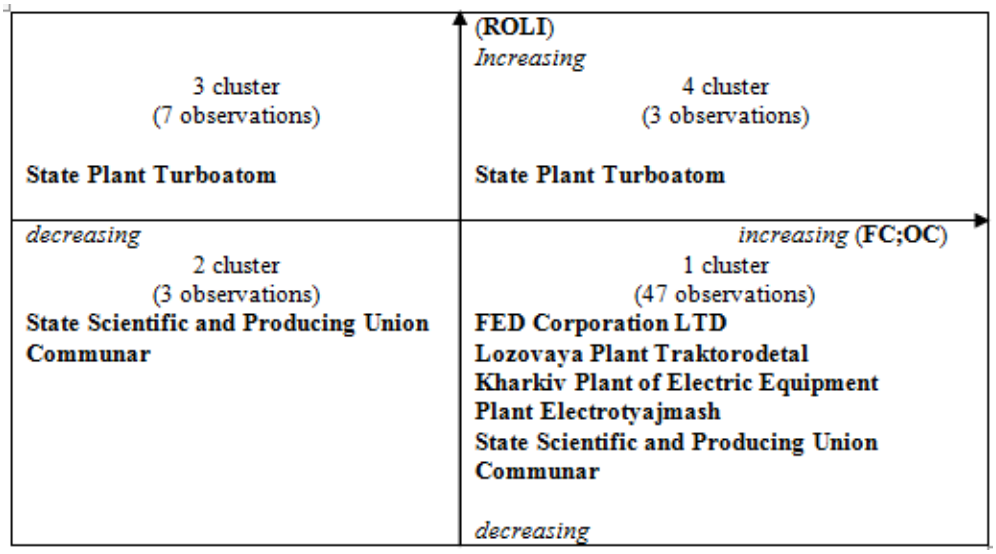


Figure no. 4 – Ukrainian industrial companies logistic system resulted clusters diagnostics Matrix

To sum up, the gained clusters can provide information about the company's market position. The worst cluster from the point of logistic system development and organizing terms and payments with contractors is cluster #1. Enterprises from this cluster can evaluate to cluster #2, which can state the better market position in order to optimize the duration of financial cycle and reconsider the terms of payment. The best strategic position on market is for enterprises of cluster #3, when the company develops steadily and invests in logistics improvement, and at the same moment optimizes its financial and material flow by using sufficient volume of own and borrowed money (sources) for producing renovation. Cluster #4 can be described as interspaced position, there is a situation when you still profit your investments but had stagnated relations with your consumers. So there are two solutions here: to develop into cluster #3 or have degradation into cluster #1.

4. CONCLUSIONS

Due to conducted research hypothesis H1 and H2 had been confirmed totally, H3 and H4 had been confirmed partly due to collinearity between ROLI and ROS. Managerial results of this survey are the gained data about number and key-point characteristics of different segments of Ukrainian industrial enterprises.

Key recommendations for the formed clusters are the following. First cluster has the most observations – 47 cases from total, the industrial companies that have no optimum structure of their financial payments, low estimated ROLI and long duration of operating cycle had been formed the core of this cluster. It proves H1 that stated that enterprises with the common duration of operating cycle (OC) and level of logistics return (ROLI)

implement the same strategy on the market, act the same way. Second cluster has different parameters meaning. The only enterprise of the second cluster is State Scientific and Producing Union Communar for three quarters (9 months period) when it was a stable development of a company and long term contracts under the conditions of prepayment were sighed up with international partners. It proves H3, which stated diminishing of Duration of Financial cycle (FC) and increasing Return on Logistic Costs (ROLI) can improve industrial company's market position. After scrutinizing additional managerial information of the company's performance, we may stress the general grows of key-indicators and can define its market position as stable development. The time when it happens to the studied enterprise it had been clustered at a separated group. Third cluster consists of 7 observations of State Plant Turboatom from the beginning of 3d quarter of 2012 up to the 1st quarter of 2014. This period can be defined as the most profitable one. The company had some long-term arrangements for turbines production. The fourth cluster can be described by 3 observations of State Plant Turboatom, the latest 3 periods (9 month of 2014). At the same moment, these observations can be described as no investments in development and no extra profit, just implementing planned indicators. Analysing the data of this cluster and changes of company's general tactics, grouping these observations was caused by loose of some international contracts and having the "waiting" position now on the market. This enterprise has no competitors on the world market, so now it is only the question of time for new contracts to sign, and the present cluster can be defined as interspaces position.

Future research development direction is to create and assume the theoretically based model of adaptive management of industrial enterprises logistic system that includes diagnostics of its internal and external flows and recommendations to improve its market position according to its life cycle.

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Annexes

Annex A – Agglomeration schedule

Stage	Cluster Combined		Coefficients	Stage Cluster First Appears		Next Stage
	Cluster 1	Cluster 2		Cluster 1	Cluster 2	
1	57	60	.000	0	0	4
2	56	59	.000	0	0	35
3	55	58	.000	0	0	38
4	52	57	.000	0	1	5
5	52	54	.000	4	0	43
6	51	53	.000	0	0	35
7	47	50	.000	0	0	10
8	48	49	.000	0	0	9
9	41	48	.000	0	8	12
10	44	47	.000	0	7	57
11	45	46	.000	0	0	12
12	41	45	.000	9	11	13
13	41	43	.000	12	0	56
14	37	40	.000	0	0	51
15	35	38	.000	0	0	49
16	33	36	.000	0	0	17
17	31	33	.000	0	16	37
18	27	30	.000	0	0	32
19	24	29	.000	0	0	23
20	25	28	.000	0	0	22
21	23	26	.000	0	0	34
22	21	25	.000	0	20	59
23	22	24	.000	0	19	32
24	17	20	.000	0	0	45
25	12	14	.000	0	0	45
26	7	10	.000	0	0	48
27	4	9	.000	0	0	30
28	5	8	.000	0	0	29
29	1	5	.000	0	28	31
30	2	4	.000	0	27	36
31	1	3	.000	29	0	41
32	22	27	25.000	23	18	34
33	11	18	25.000	0	0	40
34	22	23	51.000	32	21	47
35	51	56	100.000	6	2	38

Stage	Cluster Combined		Coefficients	Stage Cluster First Appears		Next Stage
	Cluster 1	Cluster 2		Cluster 1	Cluster 2	
36	2	6	225.000	30	0	41
37	31	39	256.000	17	0	44
38	51	55	275.000	35	3	43
39	32	34	324.000	0	0	44
40	11	15	453.500	33	0	46
41	1	2	568.750	31	36	53
42	16	19	576.000	0	0	47
43	51	52	1016.667	38	5	53
44	31	32	1099.000	37	39	49
45	12	17	1225.000	25	24	52
46	11	13	1483.667	40	0	48
47	16	22	2286.714	42	34	50
48	7	11	3453.750	26	46	50
49	31	35	4974.333	44	15	51
50	7	16	9636.500	48	47	52
51	31	37	9895.250	49	14	54
52	7	12	13476.967	50	45	55
53	1	51	14700.125	41	43	54
54	1	31	20446.033	53	51	55
55	1	7	53312.994	54	52	57
56	41	42	2262016.000	13	0	58
57	1	44	3608888.149	55	10	58
58	1	41	8240165.877	57	56	59
59	1	21	16693680.614	58	22	0

Annex B – Cluster membership

Case	4 Clusters	3 Clusters	2 Clusters
1:E1-2013	1	1	1
2:E1-2014	1	1	1
3:E2-2013	1	1	1
4:E2-2014	1	1	1
5:E3-2012	1	1	1
6:E3-2013	1	1	1
7:E3-2014	1	1	1
8:E4-2012	1	1	1
9:E4-2013	1	1	1
10:E4-2014	1	1	1
11:F1-2013	1	1	1
12:F1-2014	1	1	1
13:F2-2013	1	1	1
14:F2-2014	1	1	1
15:F3-2012	1	1	1
16:F3-2013	1	1	1
17:F3-2014	1	1	1
18:F4-2012	1	1	1
19:F4-2013	1	1	1
20:F4-2014	1	1	1

Case	4 Clusters	3 Clusters	2 Clusters
21:K1-2013	2	2	2
22:K1-2014	1	1	1
23:K2-2013	1	1	1
24:K2-2014	1	1	1
25:K3-2012	2	2	2
26:K3-2013	1	1	1
27:K3-2014	1	1	1
28:K4-2012	2	2	2
29:K4-2013	1	1	1
30:K4-2014	1	1	1
31:L1-2013	1	1	1
32:L1-2014	1	1	1
33:L2-2013	1	1	1
34:L2-2014	1	1	1
35:L3-2012	1	1	1
36:L3-2013	1	1	1
37:L3-2014	1	1	1
38:L4-2012	1	1	1
39:L4-2013	1	1	1
40:L4-2014	1	1	1
41:T1-2013	3	3	1
42:T1-2014	3	3	1
43:T2-2013	3	3	1
44:T2-2014	4	1	1
45:T3-2012	3	3	1
46:T3-2013	3	3	1
47:T3-2014	4	1	1
48:T4-2012	3	3	1
49:T4-2013	3	3	1
50:T4-2014	4	1	1
51:Z1-2013	1	1	1
52:Z1-2014	1	1	1
53:Z2-2013	1	1	1
54:Z2-2014	1	1	1
55:Z3-2012	1	1	1
56:Z3-2013	1	1	1
57:Z3-2014	1	1	1
58:Z4-2012	1	1	1
59:Z4-2013	1	1	1
60:Z4-2014	1	1	1

Instructions for authors

1. Submission of papers

Authors are invited to submit manuscripts reporting recent developments in their field. The paper must be an original unpublished work written in English that is not currently under review by other journals. All papers should be submitted electronically only, via our website (*http://saaic.feaa.uaic.ro/*). There are no submission or publication costs for authors.

Manuscripts should follow the format style of the journal. The papers should not exceed 30 pages, including figures and references. Detailed background information on the submission of papers and reviews can be found in the *Submission section*.

2. Format of papers

Abstract

The abstract will not exceed 150 words, in the Times New Roman font, 9 pts., italic, 0 cm indent. It will mention the aim of the paper, research goals and expected results. Please use a less technical language, able to provide an overview of the paper contents for people who have no special knowledge in the field.

Keywords: at most 5 (Times New Roman, 9 pts.)

JEL classification: JEL1, JEL2, Please find it at the following address: http://aeaweb.org/journal/jel_class_system.html. The codes must be written with two digits, e.g. G21, L13 (Times New Roman, 9 pts.)

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Body of the paragraph - Times New Roman, 10 pts., justified, 0.75 cm indent, line spacing – 1 line.

References to other publications must be in Harvard style (http://libweb.anglia.ac.uk/referencing/harvard.htm).

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[1]. Any notes explaining or commenting certain items in the text shall be placed at the end of the paper and NOT as footnotes (Times New Roman, 9 pts.).

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References

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Note(s) / Annex(es)

1. Any notes/annexes explaining or commenting certain items in the text shall be placed at the end of the paper and not as footnotes (Times New Roman, 9 pts.)