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## From the Editor

This issue of the South East Journal of Economics and Business is an important milestone for us. We encouraged researchers to develop their own ideas. Contributing scholars therefore largely focused on economic and business matters in the SEE region. We strongly believe that the quality of the papers will be well-regarded by theorists, teachers, and practitioners from SEE countries and others around the world.

Ksenja Pušnik and Maks Tajnikar in the paper "Heterogeneity and competitiveness of entrepreneurial processes in the European Union with special attention on Croatia as candidate country" investigate the efficiency of entrepreneurial processes in EU member states and Croatia as a candidate country. The authors follow the model of Davidsson who argues that entrepreneurial activity originates in three waves: the wave of ability, need and opportunity for entrepreneurship; the wave of perceptive ability, perceptive need and perceptive opportunity for entrepreneurship; and entrepreneurial motivation and activity. The results of the analysis of entrepreneurial processes indicate high level of heterogeneity of entrepreneurial processes among EU member states. The authors conclude that the membership of Croatia in EU would not threaten the entrepreneurial processes of this candidate country.

Andreas Westermeier in the paper: "The cost channel of monetary policy transmission" develop the new Keynesian Phillips curve augmented by the cost channel of monetary transmission and analyze the central bank's best monetary policy if the central bank is obliged to minimize inflation. It can be shown that a small change of the cost channel's coefficient might lead from a major increase in interest rates to a major decrease in interest rates and vice versa. Even though the optimal interest

rate might change dramatically, the inflation response is of only marginal effect.

Helmut Braun and Ralph Hotter in the paper titled: "A simple macroeconomic model illustrating rising diamond prices and the durable goods problem" argued that in the worldwide market for gemstone diamonds is full of anomalies and peculiarities. The existence of a monopolistic supply is a necessary condition to prevent the diamond market from breaking down. Using a simple microeconomic model the paper investigates how the monopoly creates prices which increase slowly but continually. In addition, they discuss problems threatening the monopoly. However, the major problem is the durability of the diamond. This may cause the diamond monopoly to be threatened by an uncontrollable competitor, as stated theoretically in the Coase conjecture.

Jelena Minović in the paper: "Empirical analysis of volatility and co-movements in Serbian frontier financial market: MGARCH approach" presents an empirical calculation of volatility and co-movements for selected securities listed at the Belgrade Stock Exchange. It applied multivariate GARCH (MGARCH) models to the analysis of co-movements in the Serbian frontier financial market. For the empirical work, bivariate and trivariate versions of the restricted BEKK, DVEC, and CCC models were used. Empirical results showed that MGARCH models overcome the usual concept of the time invariant correlation coefficient.

Pinar Evrim Mandaci and Guluzar Kurt Gumus in the paper: "Ownership concentration, managerial ownership and firm performance: evidence from Turkey" examines the effects of ownership concentration and managerial ownership on the profitability and the value of non-financial firms listed on the Istanbul Stock Exchange in the context of an emerging market. They measure the firm's performance by Return on Assets and Tobin's Q ratios, where the former measures profitability and the latter the value of the firm. In addition, authors give

detailed information on the main characteristics of the ownership structures of the Turkish firms. After controlling for investment intensity, leverage, growth and size, authors find that ownership concentration has a significantly positive effect on both firm value and profitability, while managerial ownership has a significantly negative effect on firm value.

Igor Stubelj in the paper: "The cost of equity capital on developing equity markets: estimations for selected Slovene companies" estimated the cost of equity capital on a developing equity market. The cost of equity is important; it is crucial in capital budgeting decisions and performance evaluation. It determines the minimum yield the investors require on the invested capital and he uses it as a discount rate to calculate the present value of the expected free cash flows to equity. The paper is tackling the estimation of the cost of equity capital on developing markets with the example of estimation for ten Slovene publicly traded companies.

Cristina Boboc and Oana Calavrezo in the paper: "Wage collective bargaining and employee voluntary quits: A Romanian empirical analysis" analyze Hirschman's "voice-exit" theory on the Romanian labour market. Authors study the relationship between wage collective bargaining and employee voluntary departures. They assess a kernel matching estimator on a recent Romanian survey of 783 firms. Authors highlight that, in Romania, before the integration to the EU, wage collective bargaining implies a weakly significant increase in the probability of experiencing voluntary separations. This result is contrary to the relationship found in empirical studies implemented on developed countries.

Ivanaka Avelini Holjevac in the paper: "Work productivity in the Croatian hotel industry fundamentals and concepts for achieving growth and competitiveness" focus the specific characteristics of productivity and the quality of hotel products and services in the Croatian hotel industry.

The objective of this research is to provide a theoretical definition of the relationship between productivity, quality and competitiveness; analyses and assess long-term trends in productivity in Croatia's entire hotel industry; assess the quality of hotel offerings; analyze and assess productivity in the case of a large Croatian company; and finally, put forward measures to increase the productivity and competitiveness of the Croatian hotel industry.

Alper Aslan and Ferit Kula in the paper: "Hysteresis vs. natural rate of unemployment: One, the other, or both?" re-examine the empirical validity of the hysteresis hypothesis in unemployment rates by education level in 17 OECD countries. For an unbalanced panel, authors employed Pesaran's Cross-Sectional Dependence (CD) and Cross-Sectionally Augmented ADF (CADF) tests. Empirical findings provide evidence favorable to the non-stationarity of unemployment rates according to levels of primary and secondary education attainment in total unemployment, and therefore the existence of hysteresis for these levels of education. There is no evidence of hysteresis for unemployment rates by tertiary education.

Goran Anđelić, Ilija Ćosić and Vladimir Đaković in the paper: "The impact of the globalization on the insurance and reinsurance market of Eastern Europe" analyzed the influence of globalization on the insurance and reinsurance markets of Eastern Europe. The subject of this research is the reflexive relationship between the insurance and reinsurance markets of Eastern Europe and the globalization processes on both micro and macro levels. The research results confirm the significance of the relationship between globalization trends and changes in the insurance and reinsurance markets of Eastern Europe.

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# Heterogeneity and Competitiveness of Entrepreneurial Processes in the European Union with Special Attention on Croatia as Candidate Country

Ksenja Pušnik, Maks Tajnikar \*

## Abstract:

*The paper investigates the efficiency of entrepreneurial processes in European Union member states and Croatia as a European Union candidate country. The authors follow the model of Davidsson (2004), who argues that entrepreneurial activity originates in three waves: the wave of ability, need and opportunity for entrepreneurship; the wave of perceptive ability, perceptive need and perceptive opportunity for entrepreneurship; and entrepreneurial motivation and activity. The authors of the paper argue that the efficiency of the transformations of one entrepreneurship wave to another can be measured by Data Envelopment Analysis (DEA) on the basis of the Global Entrepreneurship Monitor database, which is a new approach to the analysis of entrepreneurial processes. The results indicate high level of heterogeneity of entrepreneurial processes among European Union member states. The authors give special attention to Croatia and conclude that the membership of Croatia in European Union would not threaten the entrepreneurial processes of this European Union candidate country.*

**Keywords:** heterogeneity, competition, entrepreneurial processes, efficiency, data envelopment analysis (DEA), European Union, Croatia, Global Entrepreneurship Monitor

**JEL:** L26, O10

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## 1. Introduction

Two conditions have to be fulfilled in order for the integration of economies into a united economic area to become successful. First, there must not be too many differences in development, economic system and economic policy across economies. Economies cannot differ in their development, economic system and economic policy too much. This allows that economic processes across countries are alike and that those processes of a particular country could be integrated into a united economic area. Second, economies have to preserve their particularities, which make them competitive in the united economic area. Those principles are decisive also for the successful formation of a single market area in Europe in the form of the entrance of new member countries into the European Union, and in the form of the entrance of new member countries into the European Monetary System in particular.

In this paper, the authors are interested in economic processes in the field of entrepreneurship. Therefore, the aim of the paper is to present: i) to what extent the economic processes in the field of entrepreneurship, i.e. entrepreneurial processes, are harmonized across the European Union member states, ii) the variations in those

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processes across countries, and iii) what influences membership in the European Union can have on entrepreneurial processes in new member states. Special attention is given to Croatia as a candidate country of the European Union. The aim of the paper is, therefore, not to investigate country differences in determinants of entrepreneurship processes in the European Union, but to investigate the level of heterogeneity of entrepreneurial processes among European Union countries and its influence on the entrance of new member countries into the European Union.

From this perspective, we measure the “efficiency” of the transformation of one of the three waves of entrepreneurial processes into another in a particular country. In particular, we use Davidsson’s (2004) model of entrepreneurship processes to measure: (i) the efficiency of the transformation of objective determinants of entrepreneurship (i.e. objective ability, need and opportunity for entrepreneurship in a particular country) into perceptive determinants of entrepreneurship (i.e. the perception of individuals of their ability, need and opportunity for entrepreneurship), and ii) the efficiency of the transformation of perceptive determinants of entrepreneurship into entrepreneurial motivation, which transform into entrepreneurial activity. We adopt the Data Envelopment Analysis (DEA) model to measure the efficiency of the above transformations, which is, to our knowledge, a new approach to the analysis of entrepreneurship. The results reveal the level of heterogeneity in entrepreneurial processes among observed countries.

In light of the triggering question, “Are economic processes in the field of entrepreneurship among countries alike?” the analysis in this paper was performed on a cross-country level and was based on the characteristics of the economies of European Union member countries and of Croatia that are important for entrepreneurship, as well as using the Global Entrepreneurship Monitor (GEM) Research data base. The selection of countries was based on the availability of data. The main selection criterion was the participation of countries in the GEM research project, which is a multi-national research program, aimed at describing and analyzing the entrepreneurial process in its early stages (the start-up phase) within a wide range of countries. It began in 1998 and has, since then, provided a very rich database of early-stage entrepreneurship. The following European Union member states participated in GEM research in 2004 and 2006: Belgium, Denmark, Finland,

France, Germany, Greece, Hungary, Ireland, Italy, the Netherlands, Slovenia, Spain, Sweden, and the United Kingdom.

This paper attempts to make three main contributions to the literature. The first is to introduce the concept of economic efficiency into analyses of entrepreneurial processes. This is to our knowledge an original approach to the analysis of entrepreneurial processes, since no research so far has investigated entrepreneurship processes using this methodology. The second is to provide empirical investigation of the entrepreneurial processes’ model developed by Davidsson (2004). The third is to enhance our understanding of differences in the entrepreneurial processes across European countries. An important part of entrepreneurship research investigates determinants of entrepreneurship, also across European countries, yet there has been no empirical research that investigated how efficient those countries are in transforming determinants of entrepreneurship, which have been proven to impact level of entrepreneurship, into entrepreneurial activity. The main supposition of the paper is the following: Entrepreneurial processes can be measured with measures of economic efficiency, in particularly with Data Envelopment Analysis. This allow for identifying differences in entrepreneurial processes across countries.

The paper is organized as follows. First, we discuss the relevant theoretical and empirical literature. The following section offers some new thoughts regarding entrepreneurial processes and its determinants by measuring the efficiency of transformations among the three waves of entrepreneurship across GEM countries. The model of entrepreneurial processes and hypothesis are specified. Next, we present the results of our analysis, and, finally, discuss conclusions.

## *2. Theoretical and Empirical Background*

### *2.1 The models of entrepreneurial processes*

In this paper, the authors follow the stylized findings of Davidsson (2004), which from the entrepreneurship determinants point of view indicate that entrepreneurial activity originates in three waves. The first wave is composed of ability, need and opportunity for entrepreneurship, which are objective determinants in a particular economy. This wave is then transformed into the second wave, which are perceptual determinants, composed of perceptive ability, perceptive need, and



perceptive opportunity for entrepreneurship. All three components of the wave of perceptual determinants are then transformed into the third wave, which are entrepreneurial motivation and entrepreneurial activity. The transformation of the wave of objective determinants to the wave of perceptual determinants and the transformation into the third wave take place in different economies in different ways.

Davidsson's approach was confirmed by Arenius and Minniti (2005), Koellinger, Minniti and Shade (2005, 2007, 2008) and Koellinger and Minniti (2006), whose empirical evidence showed that perceptual variables are significantly correlated with new business creation, and that nascent entrepreneurs rely significantly on subjective and often biased perceptions, rather than on objective expectations of success. More specifically, confidence in one's skills and abilities, fear of failure, knowing other entrepreneurs, and the perception of opportunity are the kinds of perceptual variables that could impact the creation of new businesses. The view that perceptual variables are significantly correlated with new business creation has its origin in early research into how an individual recognizes opportunities for business creation (Shane and Venkataraman 2000; Eckhardt and Shane 2003; Reynolds et al. 2003) and is confirmed by several empirical findings. For example, the evidence of Minniti and Langowitz (2007) and Minniti and Nardone (2007), showed that subjective perceptual variables influence the entrepreneurial propensities of women and account for much of the difference in entrepreneurial activity between the sexes.

The ability to perceive good business opportunities is also assumed to be important for entrepreneurship (Eckhardt and Shane 2003; Shane and Venkataraman 2000; Reynolds et al. 2003). Referring to Shapero and Sokol (1982), Arenius and Kavalainen (2006) discussed the distinction between, on the one hand, actual skills (abilities) and opportunities and, on the other, the perception of skills and opportunities. It is true that there are some doubts regarding the opportunity concept (Davidsson 2003); for example, opportunity is by almost all definitions considered a favourable situation, known to be profitable. From this point of view, individuals cannot know whether or not what they pursue is an opportunity – only successful actions can, *ex post facto*, be marked as opportunities. Since our paper is focused particularly on start-up entrepreneurs, evaluating opportunities in a retrospective way is impossible.

Furthermore, the ability of an individual to enter into entrepreneurship and use the entrepreneurial skills, knowledge and experiences needed for it, can be regarded as a major determinant of entrepreneurship, according to literature (Davidsson 1991; Shane 2000; Shaver and Scott 1991).

The evidence of Tajnikar and Pušnik (2008), who first used the model of Davidsson (2004) to investigate the determinants of Entrepreneurship in Slovenia and other countries participating in the Global Entrepreneurship Monitor (GEM) research in 2004, show that (i) strong perceptions of ability for entrepreneurship are linked to a high percentage of the population capable of entrepreneurial activity i.e., population aged between 18-64 years and male, (ii) strong perceptions of the need for entrepreneurship are related to high unemployment and high income disparity, and (iii) strong perceptions of opportunity for entrepreneurship are determined by high expenditures on R&D and innovation and on the transfer of R&D from universities to firms. In all the countries investigated, the level of nascent entrepreneurship should have been higher with regard to observed perceptual determinants of entrepreneurship, considering countries which are the most "efficient" from an entrepreneurship point of view. It is, however, evident that, in numerous countries, high levels of migration, wages and education, as well as a prevalent service industry, do not also create high perceptions about entrepreneurship that would encourage individuals to start new businesses. Differences in efficiency between countries with regard to the transformation of perception of needs into actual entrepreneurial activity could also be explained by differences in GDP per capita, differences in the influence of perceptions on entrepreneurial activity by the GDP, and differences in the entrepreneurial culture in each country.

## 2.2 Determinants of entrepreneurial processes

The aim of the paper is to investigate how "efficient" were the transformations of one of the abovementioned waves of determinants of entrepreneurship into another. In terms of "efficiency" the authors measure also the heterogeneity of entrepreneurial processes across members of the European Union, which should not be large, in order to enable the co-existence of entrepreneurship in the single European market. The authors also intend to discover particularities of entrepreneurial processes in a particular country, which

enables a country comparative competition advantages in a single European market. The aim of the paper is not to discover determinants of entrepreneurship but to measure the impact of determinants on entrepreneurship. Therefore, the selection of potential determinants of entrepreneurship was based on an empirical literature review. We also presume, based on the findings of previous research, that entrepreneurial processes across countries are not alike. In the following theoretical and empirical review, we, therefore, intend to present: i) to what extent researchers have identified and argued the heterogeneity of entrepreneurial processes, and ii) which determinants have proven to have significant impact on entrepreneurial processes and the direction of their impact.

The choice of entrepreneurship determinants plays a crucial role in the empirical analysis of the transformation of different waves of entrepreneurship into others presented in this paper. The authors of this paper hypothesized the influence of the entrepreneurship determinant on entrepreneurial activity and its direction on the empirical findings in the entrepreneurship literature. Following the findings of Davidsson (2004), we have to specify objectively determinants which i) express ability, need and opportunity for entrepreneurship, ii) measure individuals' perceptions of ability, need, and opportunity for entrepreneurship, and iii) measure entrepreneurial motivation and entrepreneurial activity. The choice of entrepreneurship determinants has to consider the appropriate direction of the influence of entrepreneurship determinants on entrepreneurial activity.

In general, entrepreneurship literature can be classified into two main streams: one examining the supply-side and one examining the demand-side. This distinction has been introduced by Henriquez et al. (2002) and was also made by Thurik and Grilo (2005). The demand-side literature examines, on a macro level, historically and culturally determined framework conditions, such as market sources, political and institutional frameworks etc., while the supply-side studies focus on the availability of skilled and motivated individuals to occupy entrepreneurial roles, such as the effects of human capital, norms, etc. On the demand side, technological developments—those which could be measured by an innovation index—increase competition among new businesses. Further, a strong service-sector presence in an economy is often accompanied by a high level of entrepreneurship. On the supply side, factors that

influence the level of entrepreneurship refer, in large part, to the size, spread and composition of the population; population growth, density and mobility; age structure; unemployment; and immigration. Unemployment can serve as a push factor for entrepreneurship at the micro-level, while, on the macro-level, a high level of unemployment in a depressed economy can also have a negative impact on opportunities for entrepreneurship.

Other classifications of determinants of entrepreneurship can be found in the literature. While explaining regional differences in entrepreneurial activity in Germany, Sternberg (2005) classified entrepreneurial determinants into three categories: personal (e.g., gender, age, education, experience, attitudes), macro-social environment or network (e.g. contacts with other founders, integration in personal network), and regional-contextual (general or start-up-related conditions) (see also Sternberg and Wennekers 2005). Grilo and Thurik (2004) have proposed the Eclectic Framework of entrepreneurship, first introduced in Audretsch, Thurik, Verheul, and Wennekers (2002), in order to provide a unified framework for understanding and analyzing what determines entrepreneurship. The Eclectic Framework of entrepreneurship integrates the different strands from the relevant fields into a unifying framework. At the heart of the Eclectic Framework is the integration of factors shaping the demand for entrepreneurship on the one hand, with those influencing the supply of entrepreneurs on the other (Grilo and Thurik 2005a, p. 2).

While using the Eclectic framework, Grilo and Thurik (2004; see also Grilo and Thurik 2005b and 2008) investigated the influence of demographic variables such as gender, age and education level, a set of explanatory variables, which includes the perception by respondents of administrative complexities, of the availability of financial support, a rough measure of risk tolerance, the respondents' preference to be self-employed and country specific effects on various entrepreneurial engagement levels using survey data from the 15 EU member states, Norway, Iceland, Liechtenstein and the US. The most striking result is that the perception of lack of financial support has no discriminative effect across the various levels of entrepreneurial engagement, while perception of administrative complexities plays a negative role only for high levels of engagement.

In general, determinants of entrepreneurial activity include economic as well as technological, demographic, social and cultural factors. Numerous researchers have established that, on an individual level, age, gender, race,

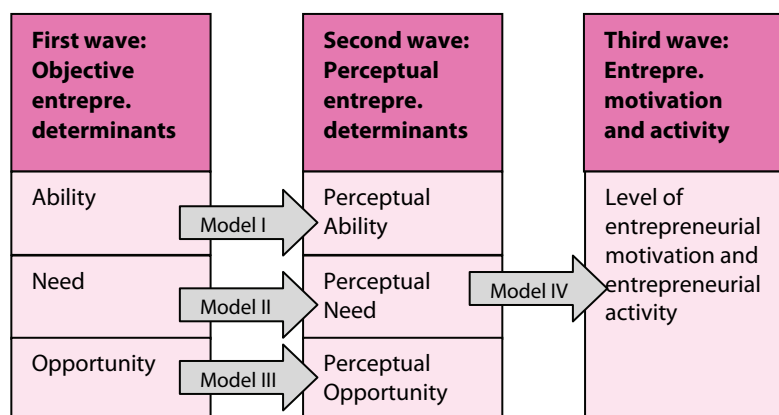
education, earnings, capital assets, previous professional experience, marital status, professional status of parents, and other factors are important drivers (Douglas and Shepherd 2002; Wagner 2003; Blanchflower 2004; Grilo and Thurik 2004; Grilo and Irigoyen 2006). Furthermore, research has shown that men are more likely to be engaged in the entrepreneurship process than are women (Minniti, Arenius, and Langowitz, 2005; Arneus and Kavalainen 2006; Tominc and Rebernik 2006), and that individuals between 25 and 45 years of age are most likely to be entrepreneurs (Reynolds, Hay, and Camp 1999). Blanchflower, Oswald and Stutzer (2001) and Grilo and Irigoyen (2006) found that increased age has a generally negative influence on entrepreneurship, although Delmar and Davidsson (2000) found empirical evidence showing a positive relationship between entrepreneurship and age. Uhlaner and Thurik (2004; see also Arenius and De Clercq 2004), Blanchflower (2004) argued that this is valid in Europe while, in the US, the relationship between the level of education and the self-employment rate is positive; the empirical evidence of Davidsson and Honig (2003) and Delmar and Davidsson (2000) also pointed to a positive relationship between entrepreneurial activity and education (see also Shane 2000; Shaver and Scott 1991). Furthermore, culture seems to be an important determinant of entrepreneurship (Hofstede et al. 2004).

The authors base their analysis on the theoretical assumption that entrepreneurial processes vary widely across countries, the reason being differences in determinants that determine the formation of entrepreneurship across countries (De Wit and Van Winden 1989; Acs, Audretsch, and Evans 1994; Blanchflower 2000; Audretsch and Thurik 2000 and 2001; Carree et al. 2002; Parker and Robson 2004), also in Europe (e.g. Noorderhaven et al. 2004; Grilo and Thurik 2004a, 2004b, 2005a, 2005b, 2008; Grilo and Irigoyen 2006). The origins and determinants of entrepreneurship span a wide spectrum of theories and explanations (Kihlstrom and Laffont 1979; Barreto 1989; Brock and Evans 1989; Gavron, Cowling, Holtham, and Westall 1998; OECD 1998; Blanchflower 2000; Carree, Van Stel, Thurik, and Wennekers 2002; Verheul et al. 2002; Blanchflower 2004; Wennekers, Uhlaner, and Thurik 2002; Arneus and De Clercq 2004; Alvarez 2005; Arenius and Minniti 2005). However, there is no single theory of entrepreneurship, although more and more theory-driven research is emerging (Davidsson 2006).

### 3. Hypothesis, Model Specification and Data

In this paper, we were interested in whether there were country differences across European Union member states and Croatia as a European Union candidate country regarding the entrepreneurial processes. For this research question to be answered, we measured to what extent the determinants of entrepreneurship transform into entrepreneurial activity. In particular, we are interested in the following questions: i) to what extent the objective determinants of entrepreneurship, which express the ability, need and opportunity for entrepreneurship, i.e. the objective characteristics of the environment, transform into perceptual determinants of entrepreneurship, which express personal perceptions and judgements about objective determinants of actual entrepreneurship, i.e. objective ability, need and opportunity for entrepreneurship, and ii) to what extent the perceptual determinants of entrepreneurship transform into entrepreneurial motivation and entrepreneurial activity. The framework of the model and the specification of variables are presented in Figure 1. The selection of variables is based on the research findings summarized in Chapter 2. On the basis of theoretical and empirical findings on entrepreneurial processes we presume that objective determinants of entrepreneurship influence the perceptual determinants of entrepreneurship and that perceptual determinants of entrepreneurship influence entrepreneurial motivation and entrepreneurial activity. The analysis is performed on the country level. According to data availability, the following European Union countries are included in the analysis along with Croatia: Belgium, Denmark, Finland, France, Germany, Greece, Hungary, Ireland, Italy, the Netherlands, Slovenia, Spain, Sweden, and the United Kingdom.

In our study, objective abilities were measured by the percentage of the total population between 18 and 64 years of age as a proxy for the size of the population, the percentage of the male population as a proxy for the gender, and gross enrolment ratio in secondary education as the percentage of the relevant age group (the variable "secondary education"), gross enrolment ratio in post-secondary education as the percentage of the relevant age group (the variable "post-secondary education"), and public expenditure on education as a percentage of GDP as proxies of education as ability for entrepreneurship. Objective needs were measured by the GINI index as a proxy of income disparity, unemployment



**Figure 1.** Models of determinants of entrepreneurship

rate as percentage of labour force, relative growth of unemployment with regard to economic growth and net migration. Objective opportunities were measured by gross domestic expenditure on R&D as a percentage of GDP, technology transfer from universities to firms, business expenditure in R&D, total expenditure in R&D per capita, R&D workers in business per capita, and trade (export plus import) to GDP ratio. Data on these objective determinants of entrepreneurship were obtained from international data sources such as the World Bank, the International Monetary Fund, the United Nations and Eurostat.

We used data on perceptive determinants of entrepreneurship, entrepreneurial motivation and entrepreneurial activity from the adult population GEM survey. This data are based upon representative samples of randomly selected adult populations, ranging from 1,000 to almost 27,000 individuals, which were surveyed in each GEM country in 2004 and 2006.

The GEM survey allowed us to identify the following perceptual variables, which make up the second wave of entrepreneurial determinants:

- Perception of ability: To measure confidence in their skills, respondents were asked whether they believe they have the knowledge, skill, and experience required to start a new business.
- Perception of need: Respondents were asked whether they believe that most people in their country would prefer that everyone had a similar standard of living.
- Perception of opportunity: Respondents were asked whether they thought that good opportunities for starting a business would exist in the area where they lived in the next six months following the survey.

The GEM survey allowed us also to identify two main motivators for entrepreneurial behaviour: wanting to

exploit a perceived business opportunity (opportunity entrepreneurs) and being pushed into entrepreneurship because all other options for work are either absent or unsatisfactory (necessity entrepreneurs). The GEM identified both groups by asking all respondents involved in entrepreneurial activity whether they were involved because of a business opportunity or because they had no better employment alternative. The first motive was measured by the Opportunity TEA Index, where opportunity is the major motive (number of adults 18-64 years old per 100 involved in opportunity entrepreneurship through a nascent firm or new firm or both). The second motive was measured by the Necessity TEA Index, where necessity is a major motive (number of adults 18-64 years old per 100 involved in necessity entrepreneurship through a nascent firm or new firm or both).

The GEM estimates the entrepreneurial activity as overall level of involvement in early-stage entrepreneurial activity by calculating the total entrepreneurial activity (TEA) index as the sum of nascent entrepreneurs (people in the process of starting a new business) and new business owners. We used the TEA index as the variable for entrepreneurial activity in observed countries, so the prevalence rates of early-stage entrepreneurial activity in each country were equal to the sum of nascent entrepreneurs (those individuals between 18 and 64 years of age who have taken some actions to create new businesses) and new businesses (owner-managers of firms who have paid wages for more than three months and fewer than 42 months).

The efficiency of transformation of objective determinants of entrepreneurship to perceptive determinants, and the transformation of perceptive determinants into entrepreneurial motivation and entrepreneurial activity were measured by the nonparametric linear programming method Data Envelopment Analysis (DEA) (e.g., Zhu 2003; Daraio and Simar 2007; Fried, Lovell, and Schmidt 2008; Thanassoulis, Portela and Despić 2008). In this paper, constant returns to scale (CRS) input-oriented DEA models were applied, because we are interested in how much of the inputs (objective characteristics of) a particular country has to possess in order to achieve a certain level of perceptions about abilities, opportunities and need for entrepreneurship, and how much of the inputs (perceptions) a particular country has to possess in order

to achieve a certain level of entrepreneurial activity, respectively. Our study's research questions lead us to measure only technical inefficiency and not also cost efficiency.

Since DEA is a nonparametric linear programming method that examines the relationship between the analyzed process's inputs and outputs, we specified four models (see Figure 1). Each model presents one part of entrepreneurial processes. Models I-III estimate the transformation efficiency of the first wave of entrepreneurship determinants into the second wave. The input variables of these models are indicators of objective determinants of entrepreneurship (i.e. objective ability in Model I, objective need in Model II and objective opportunity in Model III), while the output variables are the indicators of perceptual determinants of entrepreneurship (i.e. perceptive ability in Model I, perceptive need in Model II and perceptive opportunity in Model III). Model IV assesses the transformation efficiency of the second wave of determinants into entrepreneurial activity and motivation. In this model, input variables are indicators of perceptual determinants of entrepreneurship, while output variables are indicators of entrepreneurial motivation and entrepreneurial activity.

Empirical research was limited by the availability of data and the limitations of the DEA method. As we have mentioned above, the selection of country and variables depended particularly on the GEM data source and also on the availability of other data sources. The main disadvantage of the DEA

	Transformation from first wave of determinants into second wave			Transformation from second wave into third wave	Average rank
	Ability Model I	Need Model II	Opportunity Model III	TEA index Model IV	
Ireland	0,999	1,000	1,000	1,000	1,000
Greece	1,000	0,817	1,000	0,915	0,933
Croatia	1,000	0,799	1,000	0,891	0,922
Spain	0,802	1,000	1,000	0,787	0,897
Denmark	0,761	0,773	0,892	0,949	0,844
United Kingdom	1,000	0,534	0,824	1,000	0,839
Netherlands	0,739	1,000	0,686	0,847	0,818
Hungary	0,464	1,000	0,710	1,000	0,793
France	0,696	1,000	0,475	1,000	0,793
Slovenia	0,807	0,939	1,000	0,398	0,786
Italy	0,663	0,864	0,798	0,703	0,757
Belgium	0,763	1,000	0,684	0,539	0,746
Sweden	0,788	0,883	0,647	0,605	0,731
Germany	1,000	0,673	0,248	1,000	0,730
Finland	0,670	0,609	0,597	0,973	0,712

Source: Own calculations.

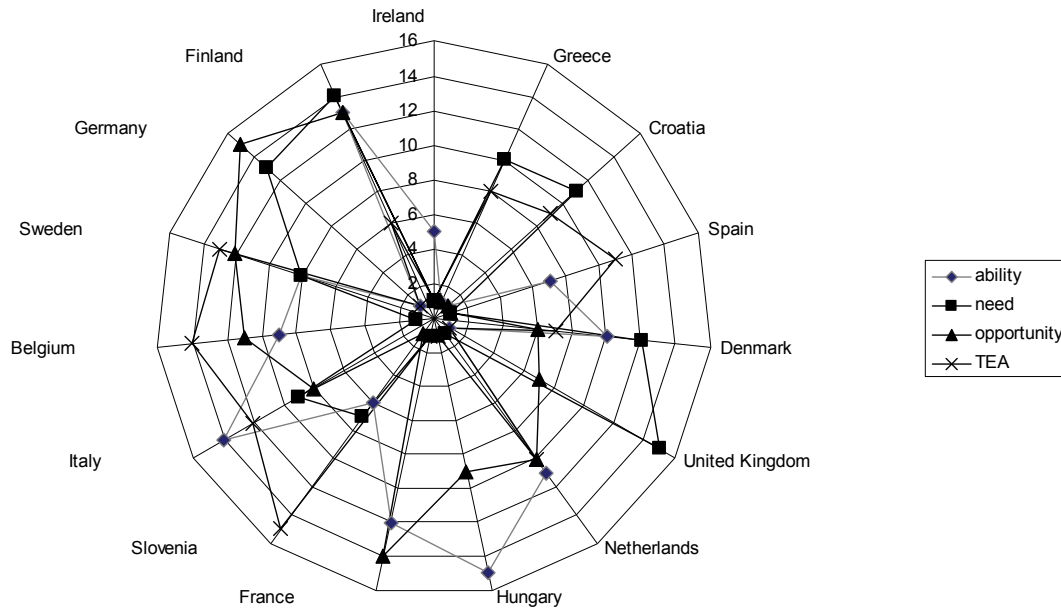
**Table 1:** Transformation efficiency of entrepreneurship determinants' waves of selected European GEM countries in 2004.

	Transformation from first wave of determinants into second wave			Transformation from second wave into third wave	Average rank
	Ability Model I	Need Model II	Opportunity Model III	TEA index Model IV	
Spain	0,814	1,000	1,000	1,000	0,953
Croatia	1,000	1,000	1,000	0,793	0,948
Ireland	0,877	1,000	0,915	1,000	0,948
Slovenia	0,811	1,000	0,854	1,000	0,916
Greece	0,837	0,741	0,972	1,000	0,887
United Kingdom	0,862	0,689	1,000	0,968	0,880
Hungary	0,749	0,980	0,790	1,000	0,880
Denmark	0,635	0,804	1,000	1,000	0,860
Netherlands	0,639	1,000	0,772	0,917	0,832
Finland	0,632	0,671	1,000	1,000	0,826
France	0,591	1,000	0,583	0,911	0,771
Sweden	0,742	0,829	0,766	0,633	0,742
Italy	0,764	0,875	0,769	0,474	0,720
Germany	0,676	0,766	0,401	0,997	0,710
Belgium	0,606	0,664	0,312	0,599	0,545

Source: Own calculations.

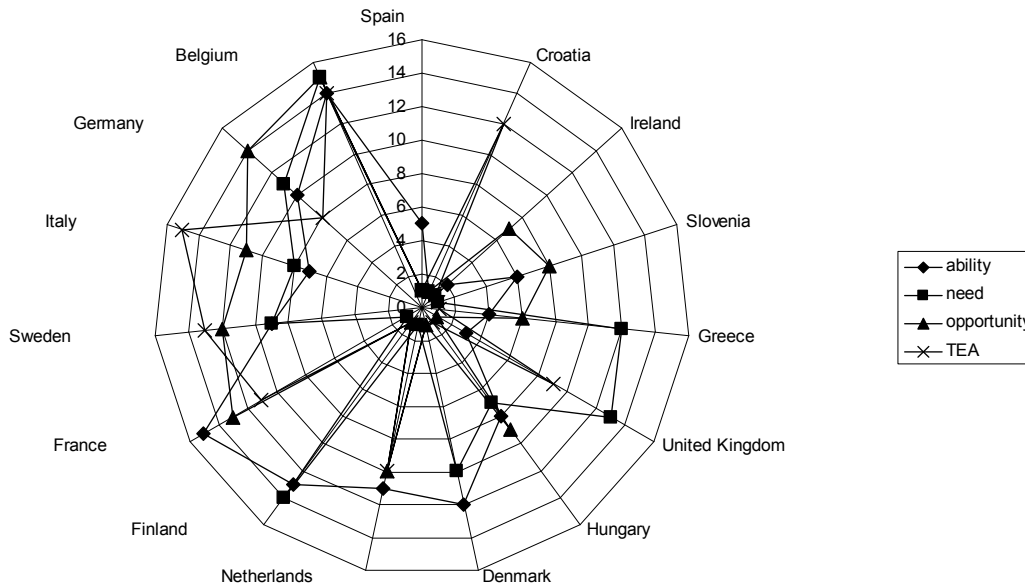
**Table 3** Transformation efficiency of entrepreneurship determinants' waves of selected European GEM countries in 2006.





Source: Table 2, own calculation.

**Figure 2:** Ranking of selected European GEM countries according to transformation efficiency of entrepreneurship determinants' waves in 2004.



Source: Table 3, own calculation.

**Figure 3:** Ranking of selected European GEM countries according to transformation efficiency of entrepreneurship determinants' waves in 2006.

model is its sensitivity with regard to heterogeneity among investigated units, i.e. countries. These limitations have to be considered in the interpretation of the results.

#### 4. Results

The efficiency of transformations of one wave of entrepreneurship into another among the selected

countries in 2004 and 2006 are presented Table 1 and Table 2, respectively. Efficiency scores range from 0 to 1, where efficiency scores of 1 indicate that a country is the most efficient in transforming a particular wave of entrepreneurship relative to another country in the sample, while an efficiency score of 0 indicates that a particular country is inefficient. For example, the efficiency score of Denmark in Column "Ability" in Table 1

shows that this country would create the same level of perceptual ability only with 76 percent of the values of objective ability for entrepreneurship if this determinant of entrepreneurship influenced the creation of perceptions about the ability for entrepreneurship in this country in the same way and to the same extent as in one of the following countries: Greece, Great Britain, Germany or Croatia. The transformation efficiency of objective ability into the perceptive ability of Denmark lagged behind those countries by an average of 34 percent.

On the basis of the results presented in Table 1 in Table 2, we ranked countries according to efficiency in transforming determinants of entrepreneurship waves into each other in selected European GEM countries. The efficiency ranking is presented in Figures 2 and 3.

## 5. Conclusions and Discussion

The results of the analysis allow us to conclude that the European countries can be classified into four groups according to the characteristics of entrepreneurial processes, which indicates the large heterogeneity of entrepreneurial processes across countries of the European Union. The first group is composed of countries that are efficient both in transformation of the objective circumstances that are important for entrepreneurship into perceptions about abilities, needs and opportunities for entrepreneurship and in the transformation of those perceptions into entrepreneurial activity. In those countries, objective circumstances create strong perceptions about abilities, needs and opportunities for entrepreneurship, which are later strongly reflected in entrepreneurial activity. This group includes countries such as Ireland, Greece, Croatia, and the United Kingdom in 2004 and Spain, Ireland, and Slovenia in 2006. The second group is composed of countries where perceptions of ability, needs and opportunities for entrepreneurship are reflected in entrepreneurial activity, yet these perceptions do not grow efficiently from the objective determinants of entrepreneurship. This group is composed of countries like Slovenia, Belgium, and Spain partly in 2004 and Croatia partly in 2006. The third group is composed of countries where the objective determinants create perceptions about entrepreneurship, but these perceptions are not efficient in leading to entrepreneurship. Included in this group are Hungary, France, Germany, Finland, Denmark partly, the Netherlands, and Italy in 2004 and France, Germany, Greece partly, the United Kingdom, Hungary, Denmark,

Netherlands, and Finland in 2006. The fourth group represents countries where individuals do not perceive objective circumstances for entrepreneurship as advantageous for entrepreneurship, and even if they did, would not actually start new businesses. Our evidence suggests that Sweden in 2004 and Belgium and partly Sweden and Italy in 2006 are in this group.

The efficiency rankings of countries disclosed particular stability between 2004 and 2006. Many countries were in the same group in 2006 as in 2004, which indicates that the characteristics of entrepreneurial processes in a particular country were determined by factors that were not changing greatly during the analyzed period. A significant shift between groups is evident only in Greece, Belgium and the United Kingdom, which registered decreases in the efficiency of the creation of perceptions for entrepreneurship.

There is a group of countries where perceptions for entrepreneurship were reflected to a large extent in entrepreneurial activity in 2004, yet these perceptions did not grow into entrepreneurial activity efficiently. Slovenia is in this group of countries. However, in 2006 Slovenia significantly improved the creation of entrepreneurship, while in 2004 the entrepreneurial process in no other countries were similar to the entrepreneurial process in Slovenia. In 2004, the creation of perceptions for entrepreneurship was inefficient to a large extent in Finland and Germany, yet they managed to create a high level of entrepreneurship. However, there was no country in 2006 with such characteristics in its entrepreneurial process. The highest efficiency scores in creating both the perceptions for entrepreneurship and the creation of entrepreneurial activity were evident only for Ireland in 2004.


Croatia is a country with relatively efficient entrepreneurial processes. Croatia was among the most efficient countries in our sample with the most efficient entrepreneurial processes both in 2004 and 2006. Although the "efficiency" of transformation of perceptions about abilities, needs and opportunities for entrepreneurship into actual entrepreneurship activity decreased in recent years, Croatia remained among the countries with the most efficient entrepreneurial processes in general. In 2004, Croatia were relatively less efficient in creating the perception of need for entrepreneurship, yet in 2006 Croatia was among the most efficient countries also with regard to this wave of the entrepreneurial process. The interesting insight of the results is that Croatia has a unique entrepreneurial

process, which is not similar to the entrepreneurial processes in any of the analyzed countries of the European Union. Namely, Croatia is not a benchmark for other countries in any part of entrepreneurial processes for encouraging entrepreneurial processes although it is among the most efficient countries.

The results of the efficiency of entrepreneurial process regarding the type of entrepreneurship indicate that perceptive needs were the least exploited perceptual determinants for entrepreneurship in Croatia in 2004. Namely, the level of necessity entrepreneurship should have been higher in Croatia in 2004 with regard to economic circumstances. However, in 2006 perceptions of need for entrepreneurship started to create entrepreneurial activity to a larger extent than in 2006. Therefore, Croatia was denoted by new characteristics of entrepreneurial processes in 2006, namely that perceptions about determinants of entrepreneurship create a relatively low level of opportunity entrepreneurship, where the exploitation of perceived business opportunity is a major motive for entrepreneurship.

On the basis of the results we can expect that Croatia will preserve intensive entrepreneurial processes within the single European market and that European competition will not prevent the creation of new businesses in this country. We can also conclude that entrepreneurial processes in Croatia are very specific in comparison to European Union countries, which presents certain comparative advantages for this candidate country. However, those advantages can be lost if Croatia becomes like other European Union countries with regard to entrepreneurial processes.

As we have mentioned above, the paper presents a first attempt to investigate the heterogeneity and competitiveness of entrepreneurial processes across countries empirically by adopting Davidsson's (2004) model of entrepreneurial processes and the DEA method. Possible ways of deepening and expanding the investigation of heterogeneity and competitiveness of entrepreneurial processes in European union could include the following: i) adopting second stage analysis, which would allow for the investigation of determinants of each wave of the entrepreneurial process, ii) measuring the efficiency of entrepreneurial processes' transformation by more sophisticated DEA models, and iii) using the time serial GEM data base. The development of the GEM data base would also allow for the use of

more relevant indicators of some entrepreneurship determinants. 

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# The Cost Channel of Monetary Policy Transmission

Andreas Westermeier \*

## Abstract:

**Abstract:** *In this paper, we develop the new Keynesian Phillips curve augmented by the cost channel of monetary transmission and analyze the central bank's best monetary policy if the central bank is obliged to minimize inflation. It can be shown that a small change of the cost channel's coefficient might lead from a major increase in interest rates to a major decrease in interest rates and vice versa. Even though the optimal interest rate might change dramatically, the inflation response is of only marginal effect.*

**Keywords:** Cost Channel, Monetary Transmission, Monetary Policy

**JEL:** E31, E52

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## 1. Introduction

Economists always try to analyze price reactions due to changes in monetary policy. In many cases the transaction mechanism takes place within the so-called *Black Box*. The change in monetary policy (the input) is known as well as the price reaction (the output). But the mechanism itself remains unknown. One mechanism may be the so-called *cost channel* of monetary transmission. The cost-channel is located on the supply-side of the economy. The basic idea beyond is that an increase of interest rates makes credits dearer and therefore the cost of production increases as well. This increase in cost of production is passed on to the consumer via an increase in prices.

The model starts with the standard *new Keynesian Phillips curve*<sup>1</sup>, in which inflation is explained by the expected inflation rate and marginal costs. In accordance with Galí and Gertler (1999) as well as with Galí, Gertler and López-Salido (2001) the past inflation rate is - beside the expected (future) inflation rate - taken into account as an additional explanatory variable of inflation. Within this framework the model is augmented by introducing the interest rate as an additional cost factor in order to obtain

the augmented *new Keynesian Phillips curve* with the cost channel.<sup>2</sup>

In the following, we will develop the standard model and analyze the central bank's best monetary policy if the central bank is obliged to minimize inflation. It can be shown that a small change of the cost channel's coefficient might lead from a major increase in interest rate to a major decrease in interest rate and vice versa. Even though the optimal interest rate might change dramatically, the inflation response is only marginally affected.

## 2. The Model

This section introduces a model containing the interest rate as an inflation determining element. We start with a

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<sup>1</sup> See C. E. Walsh (2003).

<sup>2</sup> See for example Christiano, Eichenbaum and Evans (1997) and Chowdhury, Hoffmann and Schabert (2006).

new Keynesian Phillips curve and augment this model in a second step with the cost channel.<sup>3</sup>

Three main assumptions underlie the basic model:

1. endogenous change of capital is ignored and therefore not included in the production function.<sup>4</sup>
2. the market is determined by the competition of monopolistic firms<sup>5</sup> with sticky prices.<sup>6</sup> Firms cannot change their prices periodically. Therefore, the price once set is fixed for an uncertain number of periods.
3. Monetary policy is reduced to setting nominal interest rates.

The two actors in this model are households maximizing their utility and firms maximizing their profits.

## 2.1. Households

The utility function  $U_t$  of the households is given by the following equation:

$$U_t = E \sum_{i=0}^{\infty} \beta^i \left[ \frac{C_{t+i}^{1-\sigma}}{1-\sigma} + \frac{\gamma}{1-b} \left( \frac{M_{t+i}}{P_{t+i}} \right)^{1-b} - \chi \frac{N_{t+i}^{1+\eta}}{1+\eta} \right] \quad (1)$$

Utility is determined by the composite consumption good  $C_t$ , real money balances  $M_t/P_t$  and leisure  $1-N_t$ .<sup>7</sup>  $\sigma$  is the elasticity of consumption,  $b$  is the elasticity of money and  $\eta$  is the elasticity of work.  $\beta$  is the discount rate. The consumption good  $C_t$  is produced by a continuum of firms, where firm  $j$  produces good  $j$ . The consumption good  $C_t$  can be formalized as:

$$C_t = \left[ \int_0^1 c_{jt}^{\frac{\theta-1}{\theta}} dj \right]^{\frac{\theta}{\theta-1}} \quad (2)$$

$\theta$  represents the price elasticity of demand for the individual goods. Suppose the prices for the final goods are given by  $p_{jt}$ , the households demand for good  $j$  and the aggregate price index  $P_t$  are given by:

$$c_{jt} = \left( \frac{p_{jt}}{P_t} \right)^{-\theta} C_t \quad (3)$$

<sup>3</sup> See Woodford (2003) and Walsh (2003) for the exact derivation of the model.

<sup>4</sup> See Cogley and Nason (1995) as well as McCallum and Nelson (1999).

<sup>5</sup> See Dixit and Stiglitz (1997).

<sup>6</sup> See Calvo (1983).

<sup>7</sup>  $N_t$  is the time devoted to work.

$$P_t = \left[ \int_0^1 p_{jt}^{1-\theta} dj \right]^{\frac{1}{1-\theta}} \quad (4)$$

In the beginning of period  $t$  households start with the cash holding  $M_t$ . They also receive the wage income  $W_t N_t$  as cash payment at the beginning of each period. Households can spend their money on consumption  $P_t C_t$  or deposits  $D_t$  yielding an interest of  $R_t$ . In addition, the households receive their deposits at period  $t-1$ ,  $R_{t-1} D_{t-1}$ . The household's budget constraint is therefore given by:

$$P_t C_t \leq W_t N_t - D_t - M_t + M_{t-1} + R_{t-1} D_{t-1} \quad (5)$$

Households maximize their utility function 1) under the budget constraint 5). In equilibrium with a positive nominal interest rate, the following (Euler) equations must hold.<sup>8</sup>

$$C_t^{-\theta} - \beta E_t \left( \frac{R_t P_t}{P_{t+1}} \right) C_{t+1}^{-\theta} \quad (6)$$

$$\frac{\chi N_t^{\eta}}{C_t^{-\sigma}} = \frac{W_t}{P_t} \quad (7)$$

$$\frac{\gamma \left( \frac{M_t}{P_t} \right)^{-b}}{C_t^{-\sigma}} = \frac{i_t}{1+i_t} \quad (8)$$

Equations 6) represent the optimal intertemporal allocation of consumption. In equation 7) the marginal rate of substitution between leisure and consumption equals the real wage and in equation 8) the marginal rate of substitution between money and consumption equals the costs of holding money.

## 2.2. Firms

In the following, we focus on the firms. We assume a production function with constant economies of scale:

$$c_{jt} = Z_t N_{jt}, \quad E(Z_t) = 1 \quad (9)$$

$N_{jt}$  is the time devoted to work,  $Z_t$  as an aggregated production error term, capital is - as already mentioned above - neglected. The demand curve is given by

$$c_{jt} = \left( \frac{p_{jt}}{P_t} \right)^{-\theta} C_t \quad (10)$$

We also adopt staggered price setting.<sup>10</sup> Only the fraction  $1-\omega$  may change their prices in the period, while the fraction  $\omega$  leaves the prices unchanged. The firms minimize the costs of production under the restraint of the production function. In real terms, this problem can be written as:

<sup>8</sup> See Holman (1998) and Parker (2006).

<sup>9</sup> See equation 3.

<sup>10</sup> See Calvo (1983).

$$\min_{N_t} \left( \frac{W_t}{P_t} \right) N_t + \varphi_t (C_{jt} - Z_t N_{jt}) \quad (10)$$

which leads to the following first order condition

$$\varphi_t = mc_t = \frac{\frac{W_t}{P_t}}{Z_t} \quad (11)$$

Firms chose  $p_{jt}$  to maximize their profits. The profit function is given by:

$$Profit = E_t \sum_{i=0}^{\infty} \omega^i \Delta_{i,t+1} \left[ \left( \frac{p_{jt}}{P_{t+1}} \right) c_{j,t+1} - mc_{t+i} c_{j,t+1} \right] \quad (12)$$

The coefficient  $\omega^i$  is the degree of price stickiness,

$\left( \frac{p_{jt}}{P_{t+i}} \right) c_{j,t+i}$  represents the revenues and  $mc_{t+i} c_{j,t+i}$  the production costs.  $\Delta_{i,t+1}$  is a discount factor and can be

written as  $\beta^i \left( \frac{C_{t+i}}{C_t} \right)^{-\theta}$  with  $\beta^i$  as a subjective discount

factor and  $\left( \frac{C_{t+i}}{C_t} \right)^{-\theta}$  as the marginal rate of substitution of intertemporal consumption. Using the demand curve,

$c_{jt} = \left( \frac{p_{jt}}{P_t} \right)^{-\theta} C_t$ , leads to the following equation:

$$Profit = E_t \sum_{i=0}^{\infty} \omega^i \Delta_{i,t+1} \left[ \left( \frac{p_{jt}}{P_{t+1}} \right)^{1-\theta} - mc_{t+i} \left( \frac{p_{jt}}{P_t} \right)^{-\theta} \right] C_{t+i} \quad (13)$$

Following Walsh (2003) the above equation can be rewritten to obtain an expression for the aggregate inflation:

$$\pi_t = \beta E_t \pi_{t+1} + \bar{k} \widehat{mc}_t \quad (14)$$

with  $\bar{k} = \frac{(1-\omega)(1-\omega\beta)}{\omega}$ . The equation above is the *new Keynesian Phillips curve*, which includes the expected inflation rate in addition to the marginal costs. The coefficient  $\bar{k}$  shows how the discount factor  $\beta^i$  and the price stickiness factor  $\omega$  influence the inflation rate  $\pi$ . In accordance with Galí und Gertler (1999) as well as with Galí, Gertler and López-Salido (2001) the *new Keynesian Phillips curve* is augmented by a backward looking element and has the following form:

$$\pi_t = \left( \frac{1}{\delta} \right) [\beta \omega E_t \pi_{t+1} + (1-\lambda) \bar{k} \widehat{mc}_t + \lambda \pi_{t-1}] \quad (15)$$

The assumption beyond this augmentation is that the fraction  $\lambda$  of firms which might change their prices in the period simply adopt their prices by following the simple rule:  $p_{jt} = \pi_{t-1} p_{t-1}^*$ . Firms therefore adjust their prices

according to the inflation rate of the last period. Equation 15) can be simplified to:

$$\pi_t = \lambda_f E_t \pi_{t+1} + \lambda_b \pi_{t-1} + \chi \widehat{mc}_t \quad (16)$$

### 3. The Cost Channel

Hicks (1979) was among the first to argue that the short-term interest rate might be considered a factor of costs of production. This argument was later considered by Barth and Ramey (2001), who argue that changes in the interest rate change the credit condition.<sup>11</sup>

Christiano, Eichenbaum and Evans (2005) assume that firms have to finance their production with credits. The costs of production equal the factor prices multiplied with the nominal interest rate. Since labour is the only factor of production, firms have to take out a loan of  $W_t N_t$  to pre-finance the production. The nominal interest rate is given by  $R_t$ . Labour costs are therefore given by  $R_t^v W_t$ . The parameter  $v$  measures the strength of the cost channel. If  $v=0$  the cost channel is absent, if  $v=1$  the wage bill is completely financed via credits.<sup>12</sup> In accordance to

$$mc_t = \frac{W_t/P_t}{Z_t}, \text{ the real marginal costs can be written as:} \\ mc_t = \frac{R_t^v W_t/P_t}{Z_t} = \frac{R_t^v W_t}{Z_t} = R_t^v S_t \quad (17)$$

By making use of a log-linear approximation,  $\hat{s}_t + v \hat{R}_t$ , the *new Keynesian Phillips curve* can be rewritten as:

$$\pi_t = \lambda_f E_t \pi_{t+1} + \lambda_b \pi_{t-1} + \chi_1 s_t + \frac{\chi_1 v}{\chi_2} \hat{R}_t \quad (18)$$

As we can easily see in equation 18), a rise of interest rates also increases the inflation. This is contrarily to the demand side where an increase in interest rates should decrease inflation. The current empirical studies show<sup>13</sup> that the inflationary process of increasing interest rates is only alleviated and not overcompensated.

<sup>11</sup> See also Bernanke and Gertler (1995).

<sup>12</sup> See Tillmann (2008).

<sup>13</sup> See for example Barth und Ramey (2001), Rabanal (2003), Gaiotti and Secchi (2004), Dedola and Lippi (2005), Kaufmann and Scharler (2005), Chowdhury, Hoffmann and Schabert (2006) as well as Ravenna and Walsh (2006).

#### 4. Monetary Policy

What is the effect of the cost channel on the monetary policy of a central bank? In the following we assume that the central bank has the objective to assure monetary stability. The primary objective of our central bank is therefore an inflation rate of almost zero.<sup>14</sup> In the following we show the influence of the cost channel on inflation targeting in the presence of a productivity shock of  $u=1$ . To analyze the reaction of inflation, I approximate equation 6)<sup>15</sup> around a steady-state inflation of zero and obtain:

$$\hat{c}_t = E_t \hat{c}_{t+1} - \frac{1}{\sigma} (\hat{R}_t - E_t \pi_{t+1}) + u \quad (19)$$

If we neglect investment and public spending, consumption  $C_t$  equals production  $Y_t$ . Consequently, the variation of production from the trend equals the variation of consumption from the trend,  $\hat{y}_t = \hat{c}_t$ . Equation 19) can be rewritten as:

$$\sigma \hat{y}_t = \sigma E_t \hat{y}_{t+1} - (\hat{R}_t - E_t \pi_{t+1}) + u \quad (20)$$

For the analysis of the optimal monetary policy, we assume that marginal costs may be represented by the output gap  $\hat{y}_t$ . If we make use of equation 18), we can write:

$$\pi_t = \lambda_f E_t \pi_{t+1} + \lambda_b \pi_{t-1} + \gamma_1 \hat{y}_t + \chi_2 \hat{R}_t \quad (21)$$

Plugging equation 20) into equation 21), we obtain:

$$\pi_t - (\lambda_f + \gamma_1) E_t \pi_{t+1} + \lambda_b \pi_{t-1} + \gamma_1 E_t \hat{y}_{t+1} - (\gamma_1 - \chi_2) \hat{R}_t + \gamma_1 u \quad (22)$$

Since the central banks objective is zero inflation, we only analyze the relationship between  $\hat{R}_t$  and  $u$  and assume that the other terms equal zero. In the equilibrium the following equation must hold  $(\gamma_1 - \chi_2) \hat{R}_t = \gamma_1 u$ . Without the cost channel the equation would be only  $\gamma_1 \hat{R}_t = \gamma_1 u$ . Due to the cost channel the central bank has to raise the interest rate higher without the cost channel, as long as  $\gamma_1 > \chi_2$ . The

<sup>14</sup> For example the European Central Bank is obliged to assure an inflation rate of below 2 %. Ravenna and Walsh (2006) show that it is not possible to close the output gap and to assure an inflation rate of zero simultaneously if the central bank is obliged to minimize the output gap and the inflation. In the model setting of Surico (2008) multiple equilibria are possible if the central bank assigns some positive weight to the output gap. In the following we neglect the output gap and concentrate only on the inflation rate.

<sup>15</sup> Equation 6 is given by

$$C_t^{-\sigma} = \beta E_t \left( \frac{R_t P_t}{P_{t+1}} \right) C_{t+1}^{-\sigma}$$

required change in interest rates equals  $\gamma_1 - \chi_2$ . The optimal change in interest rates in dependence of the cost channel is shown by the following figure.

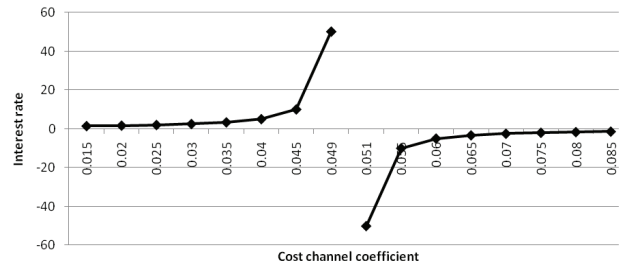


Figure 1: Optimal interest rate

We assume  $\gamma_1=0,05$  and vary the cost channel coefficient  $\chi_2$  between 0,015 and 0,085. If the cost channel coefficient is 0,015, an interest rate change of about 1,43 % is required to assure an inflation rate of zero. With an increasing cost channel coefficient, the optimal interest rate change also increases and is almost infinity if the cost channel approaches 0,05. But as soon as the cost channel coefficient is greater than  $\gamma_1$  the optimal interest rate change turns out to be negative. Starting with an negative interest rate of almost infinity, the optimal interest rate change increases with an increasing cost channel coefficient and is about -1,43 % if the cost channel coefficient is 0,085. Because of  $\gamma_1 - \chi_2$  as misspecification of the cost channel coefficient, the inflation is only influenced slightly. Suppose that the cost channel coefficient is 0,049 and  $\gamma_1$  is 0,05. The optimal interest rate change would be 50 %. But if we assume a cost channel coefficient of 0,051, the central bank would set an interest rate change of -50 %. Due to  $\gamma_1 - \chi_2$  the inflation in the first case is decreased by 0.05 percentage points, while in the second case the inflation is increased by 0.05 percentage points and therefore only marginally affected.

The central bank therefore should rather set a lower interest rate than the optimal interest rate. As long as the estimated cost channel coefficient is close to the real cost channel coefficient, the optimal interest rate would evokes a rather small inflation, but with an increasing difference between the estimated cost channel coefficient and the real cost channel coefficient the interest rate increases. A lower interest rate smoothes this effect. We assume  $\gamma_1 = 0,4$ , the real  $\chi_2 = 0,5$  and  $u = 0,2$ . The optimal interest rate would therefore be 0,8 %. In the following figure, we show how the inflation



rate is affected if the central bank chooses different interest rates and the cost channel coefficient varies between 1 and 0.

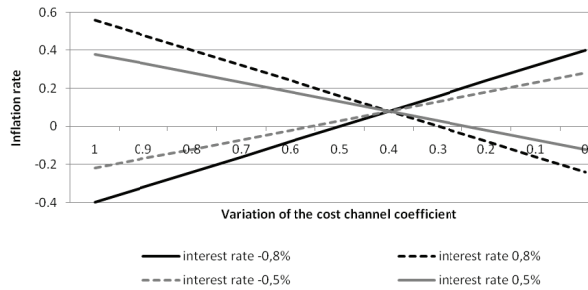



Figure 1: Inflation rate and different interest rates

If  $\chi_2 = 0,5$ , the central bank should choose an interest rate of -0,8 % to obtain an inflation rate of zero. If the central bank assumes a cost channel coefficient of 0,5, but the real cost channel coefficient is different from 0,5, the inflation rate increases with the difference between the real cost channel coefficient and the assumed cost channel coefficient.<sup>16</sup> The smaller the interest rate, the smaller the inflation rate. Even though a small interest rate does not lead to zero inflation if the real and the assumed cost channel coefficient are identical, the inflation rate is minimized if the real and the assumed cost channel coefficient are different.<sup>17</sup>

## 5. Results

We used the *new Keynesian Phillips Curve* to analyze the optimal monetary policy if the central bank objective is an inflation of zero. The optimal interest rate to assure zero inflation is rather small if the difference between  $\gamma_1$  and  $\chi_2$  is rather big and increases with an increasing  $\chi_2$ . As soon as  $\chi_2$  becomes greater than  $\gamma_1$  the optimal interest rate changes dramatically from positive to negative. Even though the optimal interest rate might change dramatically if  $\chi_2$  is close to  $\gamma_1$  a misspecification of the cost channel and therefore a “wrong” interest rate only influences the inflation rate slightly and therefore a small deviation from a zero inflation rate occurs. The central bank should rather set a small interest rate in order to smooth the inflation rate caused by a “wrong” optimal interest rate. 

<sup>16</sup> In our scenario the assumed cost channel coefficient is 0,5 and the real cost channel coefficient varies between 1 and 0.

<sup>17</sup> Tillmann (2009) arrives through a different model setting to the same conclusion. Under uncertainty the central bank sets interest rate less aggressively than under certainty.

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# A Simple Microeconomic Model Illustrating Rising Diamond Prices and the Durable Goods Problem

Helmut Braun, Ralph Hotter \*

## Abstract:

***The worldwide market for gemstone diamonds is full of anomalies and peculiarities. Gemstone diamonds are often purchased because they are expensive. After the end of the 19th century the diamond market was controlled by a worldwide monopoly, and later by a cartel which in turn was firmly controlled by the former monopolist – De Beers. The existence of a monopolistic supply is a necessary condition to prevent the diamond market from breaking down. Using a simple microeconomic model the paper investigates how the monopoly creates prices which increase slowly but continually. In addition, we discuss problems threatening the monopoly. However, the major problem is the durability of the diamond. This may cause the diamond monopoly to be threatened by an uncontrollable competitor – previous purchasers, as stated theoretically in the Coase conjecture.***

**Key words:** diamond market, pricing policy, monopoly, Coase conjecture

**JEL:** D4, L1, L7

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## 1. The Problem

In 1805 the German economist Julius Count Soden emphasised:

*“If a diamond, as in Eldorado, rolled on the streets, then it would surely lose the greatest part of its comparative value, though indeed not all of its positive value. It would have the value of gleaming pebbles. But scarcity increases the degree of its comparative value; for this reason the Crown of Portugal has all its diamonds from Brazil which exceed a certain weight and a certain size deposited in the Royal treasury. If this treasury were opened, the diamonds would indeed not lose their positive value, but a major part of their comparative value.”<sup>1</sup>*

Thus, economists recognised the importance of physical scarcity and stockpiling diamonds as well as aspects of so-called social valuations incorporated in the value of use or positive value. With reference to Henry Storch (1815), John Rae identified an inclination of all men

to flaunt luxury. In regard to diamonds Rae (1834) asserted:

*“The diamond is at present chiefly a luxury; should art ever succeed in giving it will a crystalline structure to simple carbon, so as to convert it into that substance, it would pass from the rank of luxury, and would too contribute largely to the real wants. The estimation in which it is held serves at*

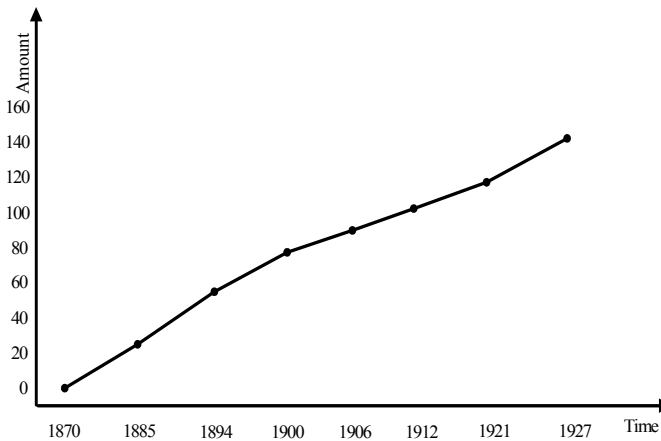
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<sup>1</sup> Soden, J. (1805), Vol. 1, § 46, pp. 44-45; translated by J. S. Chipman (2005), p. 165.

present to turn the attention of ingenuity to such a project."<sup>2</sup>

After the first discoveries of diamonds in 1867 in Southern Africa, from 1870 onwards the market supply of uncut diamonds changed dramatically.



Source: Braun, H. (2004), p. 166.

Figure 1: Cumulated Diamond Production in Millions of Carat (1870-1927)

How could producers deal with this potential supply disaster? Soon the economic implications were recognised, as Frederick Boyle said as early as 1872:

*"You cannot drown the market with an article only appertaining to the highest luxury... without swift and sudden catastrophe. These things require the most delicate manipulation... they need a hand to hold them back or loose them as occasion asks."*<sup>3</sup>

This statement already contained all the elements of the crucial structure of the diamond market: the diamond was identified as a pure luxury good and not appropriate for being traded on a normal market.<sup>4</sup> It might be considered consistent with the "spirit of the age" that a manipulation of the supply-side of the market was suggested in order to protect the market from a disastrous collapse, but a sophisticated analysis of the diamond market will create the same suggestion: this market has to be run by a strong monopoly or, perhaps, by a stable cartel which can act in the same way as a monopolist supplier. The essence of the monopolist's strategy is simple: in economic downturns diamonds must be held back to support prices and in bullish markets more stones must be released to bind excess cash.

Following this economic concept, the gemstone diamond market expanded during the last century, strongly controlled by the De Beers company, which had organised a cartel to act like a monopolist in the worldwide diamond market. But the paper shows that this expansion will come to a sudden end at a yet unknown point in the future because the existence of the monopoly is based on a fundamental paradox: The problem of the monopolistically organised supply is, however, *not* the stability of the cartel or the diamond producers which belong to it. Any problem caused by an action of an external producer could be controlled by the common interest of a stable market and rising prices. The central problem is in fact the economic success of the monopoly which sold millions of carat of the extremely durable commodity "diamond". If those buyers open any functioning secondary market in order to capitalise on the rising prices offered by the "official" gemstone market, it is possible that there will be a run on selling diamonds, causing prices to plummet to a low competition equilibrium. Thus, the high price of the luxury good will be shown to be an illusion in terms of its value, and the commodity will be shown to be a mundane one.

## 2. The Anomaly of the Commodity "Diamond"

Veblen (1899) concluded that price was the most relevant attribute of jewels<sup>5</sup> which were purchased **because** they were expensive and not because they were cheap.<sup>6</sup> According to Veblen, any purchase of luxury goods by an individual is not determined by the isolated use provided by the good itself to the buyer. On the contrary, the purchase of this good is designed to give a strong signal to other individuals that the buyer is wealthy enough to buy and display such an apparently "useless" but expensive luxury good. The driving forces behind this behaviour are an inter-individual comparison and the individual's own satisfaction at other people's jealousy of the wealth and the social status represented by conspicuous consumption.<sup>7</sup> Therefore, the demand for luxury goods for conspicuous consumption is a phenomenon of socially interdependent demand functions. Thus, economists can not use a simple aggregation of pure individual demand functions to show an increased market demand. Veblen's aggregation of

<sup>2</sup> Rae, J. (1834), pp. 292.

<sup>3</sup> Frederick Boyle, 1872, quoted by: Rotberg, I. R. (1988), p. 181.

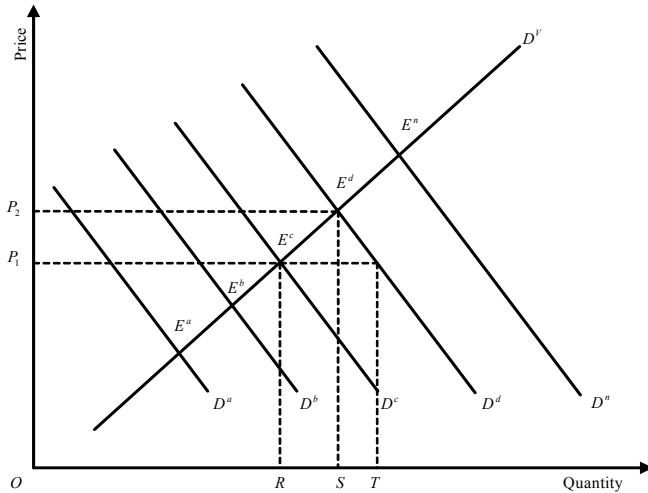
<sup>4</sup> Rayo, L., (forthcoming).

<sup>5</sup> Veblen, T. (1899).

<sup>6</sup> Lenzen, G. (1966), p. 194.

<sup>7</sup> Veblen, T. (1899).

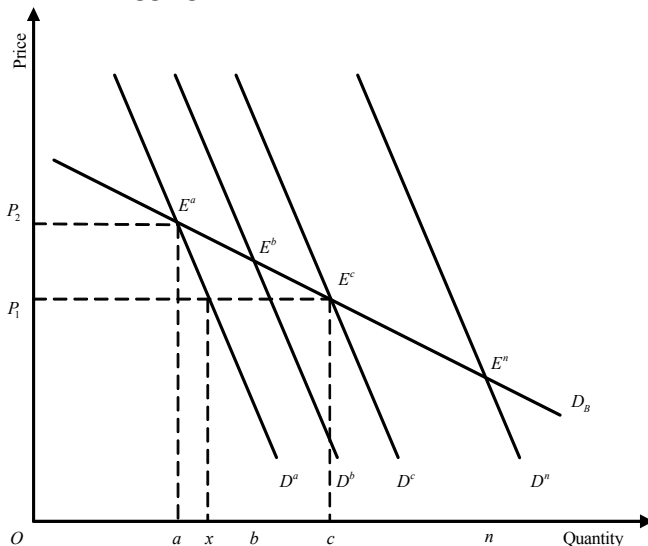
individual demand functions referring to conspicuous goods shows an upward sloping aggregated demand curve:



Source: Leibenstein H. (1950), p.202.

Figure 2: Demand for Luxury Goods Following the Veblen-Effect

Additionally, some individuals prefer to imitate the hordes of like-minded people. Their decisions in regard to the consumption of and demand for goods follow a “bandwagon” effect, defined by social interaction which is linked to the quantities of a commodity consumed by a social class. If any variation in the price of the good is assumed to be relevant, the typical bandwagon effect creates an aggregated demand curve as follows:



Source: Leibenstein H. (1950), p.195.

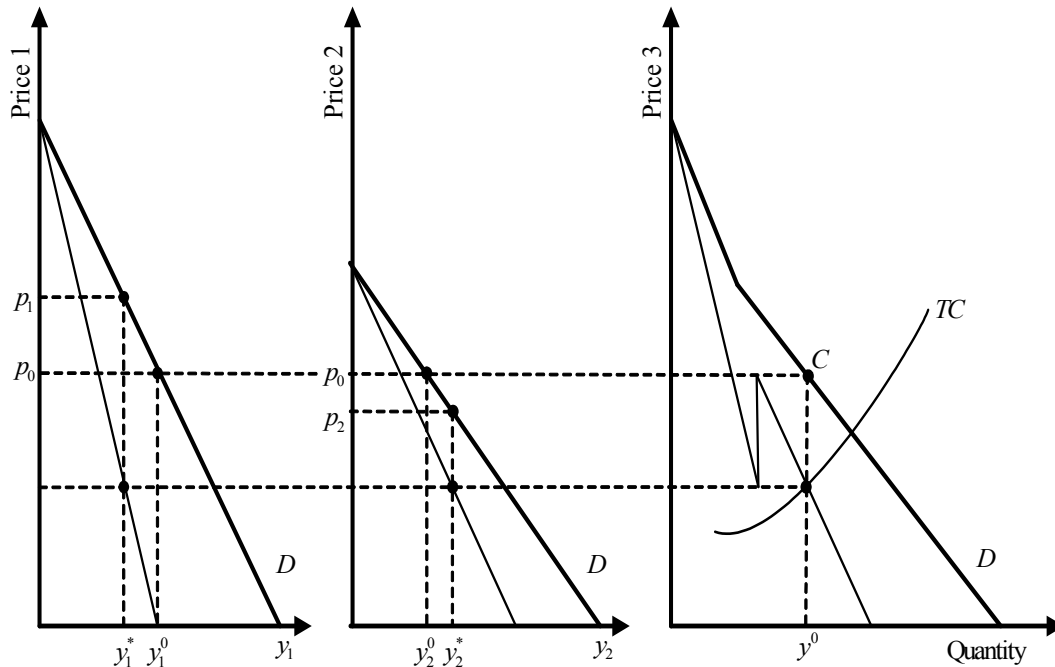
Figure 3: A (Nominal) Price Sensitive Bandwagon Effect

If a lot of individuals are already consuming a specific good, it follows that more individuals would also like to

consume this good – *without* looking at the (nominal) price of the good.<sup>8</sup> In this case, the demand curve is a parallel line to the quantity axis for any price fixed externally. The result of a downward sloping curve for a bandwagon effect can be explained by growing wealth within a society. If wealth, measured in terms of real wealth after adjustment for any inflationary effects, grows faster than the nominal price of diamonds, the same shape of the demand curve is the result. Now, the *real* price of diamonds decreases in comparison with the growth of real wealth. This has the consequence that many more people can purchase a diamond, which seems cheap in comparison to their growing income and wealth. The bandwagon effect seems to stand in contradiction to the Veblen-effect in a static analysis, but two aspects are able to unite both effects in a dynamic analysis: the first aspect is provided by the bandwagon effect of joining the horde of those individuals who already practise conspicuous consumption of a specific luxury good, e.g. gemstone diamonds. After someone has been incorporated into the social group which he has been able to join by purchasing the specific luxury good for conspicuous consumption, the “new member of this class” tries to effect an upgrade of his social status within this class by purchasing the same good, but a more expensive model, bigger and of better quality. Thus, the consumer is “in style”. He has understood the preferences of individuals in the bandwagon horde and now he can improve his position within the group by purchasing more expensive units of the given luxury good. He can thus elevate his status above that of those members of the horde who do not belong to the preferred social group.

The aggregation of the individual demand curves for the bandwagon case, which is sensitive to rising quantities of a good and not sensitive to price, as well as the aggregation of the individual demand curves for the Veblen-effect-case, which is sensitive to rising prices, can, therefore, be linked in an additive way, resulting in a market demand curve. This market demand for diamonds rises in an upward curve, depending on rising prices and quantities offered. The incline of the total demand curve depends on the price-quantity elasticity caused by Veblen’s price-effect in respect of the pure quantity-elasticity caused by the bandwagon effect, or in the “real-price (because of growing wealth)–quantity elasticity, respectively. However, both effects show a common result, invariant to the tangible elasticity of the effects: in

<sup>8</sup> Leibenstein, H. (1950), pp. 183-187; Bagwell, L. S./Bernheim, D. (1996).



**Figure 4:** Partial Markets and Price Differentiation

time prices will rise due to growing demand, even if the quantity offered is absorbable by a rising level of wealth indicating individual purchase power.<sup>9</sup> The rising level of wealth is, therefore, a central element. Rising prices of diamonds in regard to the Veblen-effect as well as demand for greater quantities of diamonds as a result of the band-wagon-effect can be financed by the members of a prospering society in which income and wealth rise more quickly than the demand for essentials.

Now we shall try to explain why De Beers, who for a long time as the worldwide diamond monopoly and later the "strong hand" of the worldwide diamond cartel, is able to create a slow but steady growth in gemstone diamond prices in spite of a steadily growing supply.<sup>10</sup>

### 3. The Gain of Total Market Control: A Simple Microeconomic Model

#### 3.1. Pricing on Partial Markets

The cartel organised by De Beers sets the monopoly price for the commodity, allocates the monopoly output among the member companies, and determines how the monopoly profits are to be shared. Therefore, De Beers

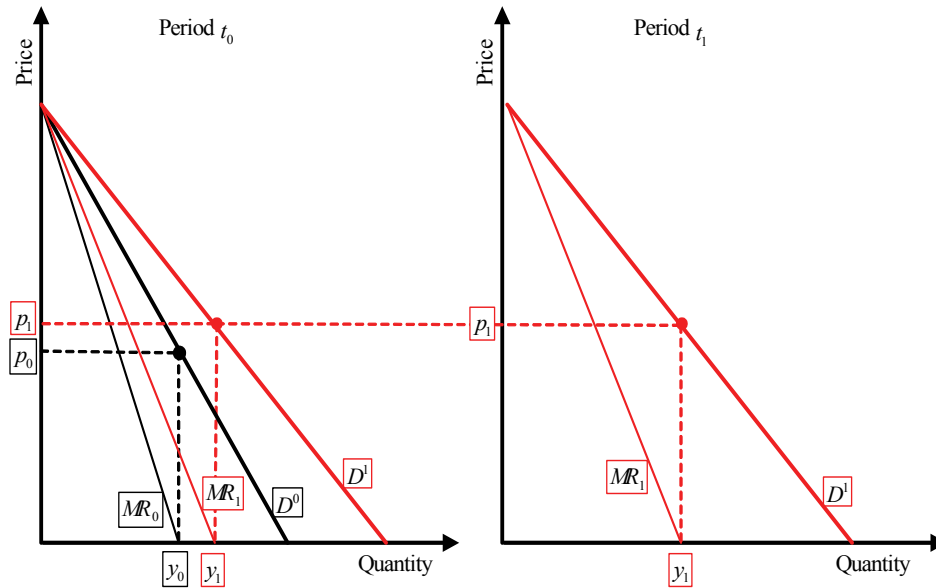
maintains full vertical control of the production and the distribution. For the examination of the price-setting mechanism on the diamond market, we will have to consider the objective of constantly rising prices over a period of time.<sup>11</sup> As De Beers controls all sales activities, De Beers is able to establish different prices. Therefore, De Beers controls the market supply by making different types of diamonds available to consumers. In order to be able to practise first-degree price discrimination, the monopolist is supposed to know the exact shape of each consumer's demand curve and be able to charge the highest price that each consumer would pay for each unit of the product. It must be impossible for the consumers from the low-price market to resell on the high-price partial market, as such arbitrary dealings would lead to a collapse.

The analysis of the existing gemstone diamond market reveals a lack of horizontal price differentiation in terms of the fact that the price of a gemstone diamond of a given size and quality is different for different geographically separate markets. The vertical price differentiation in terms of charging different prices for different gemstone diamond qualities is the only important assumption taken for the purpose of the above model.

<sup>9</sup> Braun, H. (2004), pp. 170-171.

<sup>10</sup> An empirical, and similar discussion is presented by In December, Diamonds are Forever: Empirical evidence of counter-cyclical pricing in a durable goods market

<sup>11</sup> Referring empirical pricing, look at Yoeli: [http://home.uchicago.edu/~eyolie/EY\\_thesis.pdf](http://home.uchicago.edu/~eyolie/EY_thesis.pdf).



**Figure 5:** Periodical Price Setting from Period  $t_0$  to Period  $t_1$

Regarding the real sales system with its variety of different diamond qualities and pricing possibilities, it can be assumed that the diamond market consists of a large number of small partial markets. In order to be able to abstract the activities and for modeling purposes we will consider a monopoly divided into two partial markets. The profit and marginal profit functions for both markets of the classical monopolistic firm are:

$R_1 = p_1 y_1$  and  $R_2 = p_2 y_2$  where  $R$  is the total revenue;

$$MR_1 = p_1 + y_1 \cdot \frac{dp_1}{dy_1} = p_1 \cdot \left(1 + \frac{1}{\eta_1}\right) \text{ and}$$

$$MR_2 = p_2 + y_2 \cdot \frac{dp_2}{dy_2} = p_2 \cdot \left(1 + \frac{1}{\eta_2}\right)$$

where  $MR$  are marginal revenues and  $\eta$  demand elasticity.

The total market revenue function of the price differentiating monopoly is:<sup>12</sup>

$$P = R_1(y_1) + R_2(y_2) - C(y)$$

By differentiating partially and setting equal to zero, we obtain the first-order constraint:<sup>13</sup>

<sup>12</sup> The terms  $y = y_1 + y_2$  and  $C$  indicate the total production costs.

<sup>13</sup> the partial derivative of  $P$  is:

$$\frac{\partial P}{\partial y_1} = \frac{\partial R_1}{\partial y_1} - \frac{\partial K}{\partial y} \cdot \frac{\partial y}{\partial y_1} = 0 \text{ and}$$

$$\frac{\partial P}{\partial y_2} = \frac{\partial R_2}{\partial y_2} - \frac{\partial K}{\partial y} \cdot \frac{\partial y}{\partial y_2} = 0$$

$$\frac{\partial R_1}{\partial y_1} = \frac{\partial R_2}{\partial y_2} = \frac{\partial C}{\partial y}$$

$$p_1^* \cdot \left(1 + \frac{1}{\eta_1}\right) = p_2^* \cdot \left(1 + \frac{1}{\eta_2}\right)$$

This means that the marginal profits on every partial market must be equal, the sum being equal to the marginal cost of the total market. This implies that the monopolist has to set different prices on each partial market. The prices on the partial markets would be equal only if the elasticity of the demand is identical. The addition of both would result in a kinked aggregated monopoly demand curve and the monopolist would choose  $C$  as the optimal point with price  $p$  and quantity  $y$ . This amount is divided into the partial markets at  $y_1$  and

$y_2$ , implying that the marginal profits in market 2 are higher than in market 1. The monopolist will thus lower the quantity available in market 1 and raise the quantity in market 2 until the marginal costs are equal.

Now we have to analyse the monopolist's negatively sloped demand curve for a partial market. The results can easily be applied to every other existing partial market and will then be aggregated to a total market demand curve. A classic monopolist must lower the price of the

and we furthermore assume that

$$\frac{\partial y}{\partial y_1} = \frac{\partial y}{\partial y_2} = 1$$

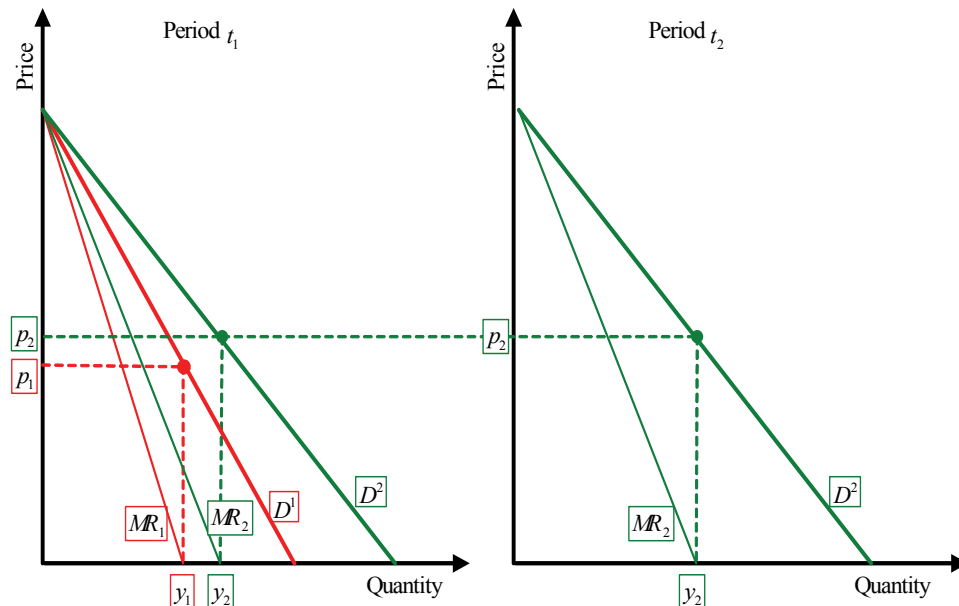


Figure 6: Periodical Price Setting from Period  $t_1$  to Period  $t_2$

commodity in order to sell more of it. Thus the marginal revenue curve lies below his demand curve.

De Beers, however, has periodically to take into consideration the illusion of value. In terms of the consumers' expectations and the monopolist's fundamental strategy of forcing the price level constantly upward, the monopolist will diverge in the short term from the classic monopoly theory and set a demand curve that possibly does not maximise profits (optimal  $MR$ ), even if demand slacks off. This occasional action, even if generating negative profits, allows one to fulfill consumers' expectations regarding price expectations and the future increasing value of the commodity, which is the main task of the monopolist. The growing supply of the commodity forces the monopolist to adopt a strategy in order to be able to enlarge the market demand and to offer an increasing quantity of the product over a period of time.

As the price of the commodity has to rise in the following period and the market demand has to increase at the same time, the monopolist will consequently set the new demand curve for the period  $t_1$  slightly flatter than in the period  $t_0$ . He is now able to charge a higher price  $p_1$  at a higher level of demand  $y_1$ . In the period  $t_2$  the monopolist will start at the price level  $p_1$  from the last period and set a new demand curve for the period  $t_2$ , which now has to be somewhat flatter than in the period  $t_1$ . Again the new price  $p_2$  for the period  $t_2$  will be

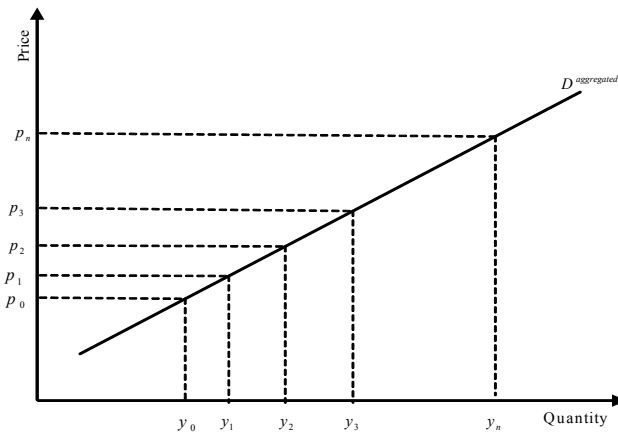
higher than  $p_1$  and the level of demand  $y_2$  will be higher than  $y_1$ .

The market operator analysed here can and will set the monopolistic demand curve to follow his constraints and his long-term strategy, since as a monopolist he has on the one hand total vertical market power and the ability to control all trading situations, and on the other hand perfect knowledge of present and future consumer demand.

### 3.2. Aggregated Upward-sloping Demand Curve and Price Restrictions

The periodical view of the monopolistic demand curve leads us directly to the construction of the *aggregated demand curve over time*. The monopolist chooses one price  $p_n$  and the corresponding quantity  $y_n$  for the period  $t_n$ . Thus the price-quantity-combination is realised and fixed. In order to analyse the long-term impact on the market, we look at the aggregated demand curve over  $n$  periods. It can be seen that this curve is identical to the curve of the Veblen-effect, but now a price-quantity combination is defined over time and not over the demand curves of different consumers as with conspicuous consumption. In addition, the demand curve here is identical to the supply curve of the monopolistic firm.



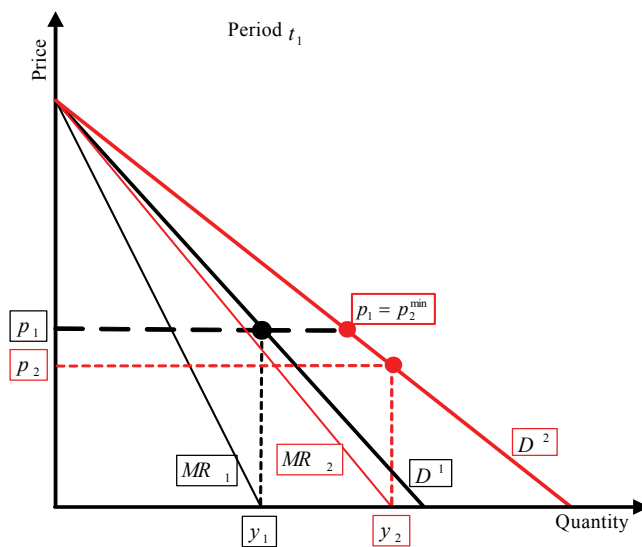


Source: Adapted from Reekie, W. D. (1999), p. 304.

**Figure 7:** The Aggregated Demand Curve for  $n$  Periods

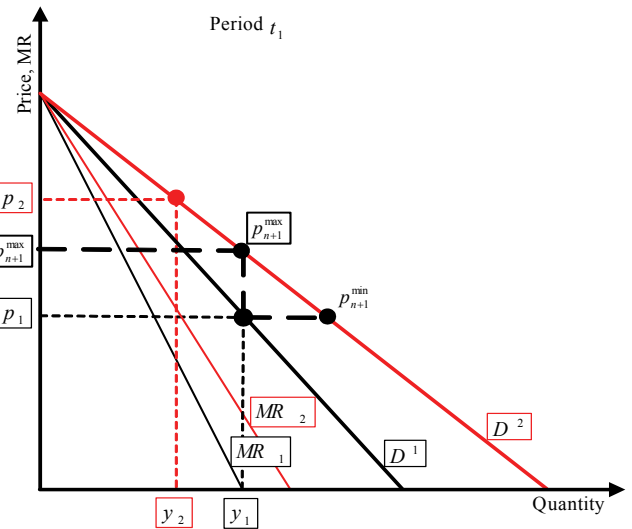
The aggregation of all price-quantity combinations results in an upward sloping aggregated demand curve, which corresponds to the empirical analysis of aggregated demand in the past. By setting his demand curve for a partial market periodically, the monopolist manages to constantly raise prices and at the same time enlarge the market demand in the long term.

The monopolist, however, faces important restrictions and constraints regarding opportunities to set the future demand curve for the period  $t_{n+1}$ . Lowering the price  $p_2$  in the period  $t_2$  below the former price level  $p_1 = p_2^{\min}$  will cause a high extension of demand, which would accomplish the monopolist's goal and increase his marginal profits MR.



**Figure 8:** Consequences of a Lower Price Limit

This might have a short-term positive effect, but with regard to the long term the decrease in the commodity's price will destroy consumers' expectations and destroy any illusion of value. Furthermore, price cuts will affect the Veblen-benefit of conspicuous consumption, particularly through an increase in demand. The monopolist will lose his reputation of being able to ensure steadily increasing prices and will in the long term therefore lose all his market power. After this analysis of a lower price limit we shall explore the case of an upper price limit and its consequences. Increasing the price in the period  $t_{n+1}$  above the level of  $p_{n+1}^{\max}$  would lead to a short-term decrease in demand, forcing the monopolist to operate below his optimal MR rate and intersect with the expanding demand strategy.



**Figure 9:** Consequences of an Upper Price Limit

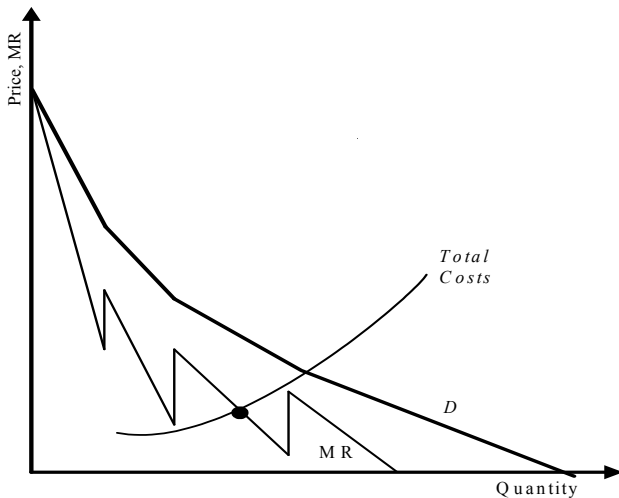
On the other hand, as implied by the effects discussed above, the relatively high price of a commodity will lead to bandwagon and Veblen-effects and cause an increase of consumer demand in the future. The risk of speculative bubbles<sup>14</sup> becomes inherent and the monopolist will face an uncontrollable threat to his market. Again, he will lose his reputation, which in the long term leads to the loss of all market power and thus to a market collapse.

In terms of price setting strategies, the monopolist has to act carefully within narrow limits ( $p_{n+1}^{\max} > p_{n+1} > p_1 = p_2^{\min}$ ) in order not to threaten the

<sup>14</sup> The analysis of the diamond market as a possible rational bubble in detail is not subject to the analysis here.

illusion of value and lose his reputation. By acting within the described limits the monopolist will effect a constant and slow long-term increase of price levels.<sup>15</sup> This strategy is the only way to prevent a market collapse caused either by negative consumer expectation or by speculative bubbles.

The analysis used so far has considered the periodic linear monopolistic demand curve for a *partial* market. Now the partial market's demand curves will be added to an aggregated periodic curve in order to obtain the monopolist's total market demand curve. In order to abstract the diamond market with its very high number of partial markets it is necessary to analyse a simplified model with four partial markets, which have been specially selected for modeling purposes. The horizontal addition of the four partial-market demand curves results in a kinked total market demand curve, whereby the marginal revenue has a jump discontinuity<sup>16</sup>.



**Figure 10:** An Aggregated Periodic Demand Curve for the Total Market

If we now regard a large number of partial markets instead of the four analysed partial markets, and the associated total market demand curve, we obtain a convex downward sloping price-quantity relation, similar to the classic theoretical monopolistic market demand curve as is common in any microeconomic analysis. The Marginal Revenue curve  $MR$  will also be downward sloping and convex and the jump discontinuities seen in the four-markets case will disappear in the case of an infinite number of partial markets.

#### 4. How the Monopoly Could be Threatened by Aggressors

Monopoly power would be a purely short-term phenomenon if there were no barriers to prevent entry into the industry. When the monopolist sets his price above the competitive level and restricts output in order to maximise profits, the excess profits can create incentives for competitors to enter the market.<sup>17</sup> Although the monopolist has installed highly effective tools of market demand and supply control, gemstones do have, however, *one* attribute the monopolist cannot control: since a diamond is a natural product, there is a high probability that in the future new supplies of the commodity will be found and exploited; and thus the monopolist does not know whether other potentially competitive producers will try to enter into the market<sup>18</sup>. While the analysis so far has used the static equilibrium theory, the change over time still has to be discussed. While there may be a monopoly market in one period, new competitors can arise in the following period, offering similar products at lower prices and causing a transformation of the market into an oligopoly market.<sup>19</sup>

Let us suppose that new deposits of gemstone diamonds were found, new diamond mines were opened and the new, aggressive, competitor would refuse to accept and collude with the De Beers cartel. Let us then suppose that a new aggressor enters the market, who is approximately the same size as the monopolist. He thus has more or less unlimited financial capability, possesses a large stockpile of the commodity in question and faces the same political, juridical and environmental constraints as the monopolist. The aggressor's goods in stock and in actual production are assumed to be normally distributed and perfectly differentiated, just as the monopolist's commodities are. This means that the competitor will not restrict his attack to a single partial market but will attempt to hit the monopolist simultaneously in all partial markets, i.e. the total market. We assume that the consumers are indifferent to the product supplier as the products have the same quality, size and appearance, i.e. they do not have preferences for any particular supplier.<sup>20</sup> For the purpose of the analysis, the monopolist  $C_1$  and the new player intruding into the market  $C_2$  should both

<sup>15</sup> The constraints imposed by the vertical axis (regarding price  $p$  and  $MR$ ) and the horizontal axis (regarding quantity  $y$ ) are not important.

<sup>16</sup> Schumann/Meyer/Ströbele (1999), p. 286.

<sup>17</sup> Quirk, J. P. (1987), p. 352.

<sup>18</sup> Detail are discussed by Rayo,

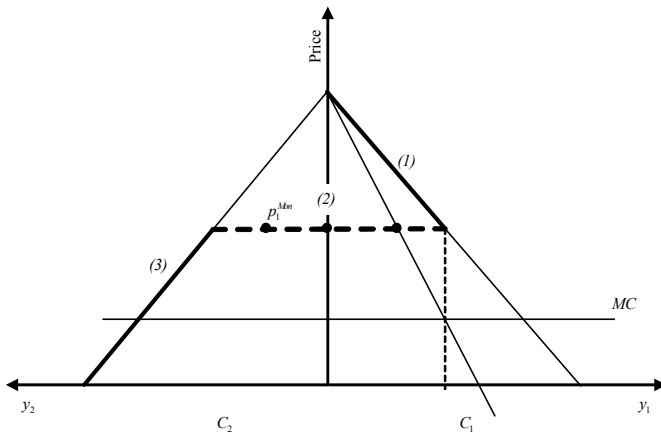
<sup>19</sup> Watson, D. S. (1972), p. 364.

<sup>20</sup> For our modeling purposes here we assume that we are dealing with a single identical commodity.



possess an identical commodity with no restrictions on capacity.

It is, however, very difficult for the outsider to determine the output of the monopolist, as sales figures and sales information might be unavailable. It would thus be better to use the market price as the deciding factor, since price information is usually publicly available. The model governing this case is known as "Bertrand competition"<sup>21</sup> and assumes that the firms involved do set their prices and let the market demand determine the quantity sold. The company  $C_2$  has to forecast and determine the price set by the former monopolist in the market. Varian assumes that market prices have to be higher than marginal cost (if  $MC$  are higher than  $p$ , the firm would increase profits by producing less) and the companies are selling identical commodities.<sup>22</sup>



Source: Adapted from Schumann/Meyer/Ströbele (1999), p. 350.

Figure 11: The Case of a Bertrand Equilibrium

If firm  $C_2$  reduces its price  $p_2$  by the small amount  $\varepsilon$  and the other firm  $C_1$  keeps its price fixed at the monopoly price level  $p_{mon} > p_2$ , all of the consumers will prefer to purchase the commodity from  $C_2$ , i.e.  $C_2$  will take away all market output from  $C_1$ . The next step will be a price cut by company  $C_1$ , followed by alternating price reduction sequences which lead to the "Nash-Bertrand equilibrium".<sup>23</sup> Varian notes that any price higher than the marginal cost rate cannot be in

equilibrium on the market, and that the only steady equilibrium is the competitive one.<sup>24</sup>

With regard to the total diamond market, the aggressor will offer all diamonds at a lower price level than the former monopolist, and as a consequence, consumers will now purchase from the aggressor. This leads to a price cut of De Beers on the total market, forcing the aggressor into alternating price reduction sequences to the marginal cost level.

The Bertrand model is based on the assumption that the marginal cost structures of the two competitors are identical which, however, might in reality not be true. This would be the case if at least one of the firms, in the analysed period  $n$ , were to reach its production capacity limit. In this case the second firm  $C_2$  would achieve extra profits and the market price would repeatedly flow between  $p = MC$  and  $p = p_{Monopoly} - \varepsilon$ .<sup>25</sup> With

regard to the gemstone market, in the analysis it has already been assumed that an unrestricted competitor faces no capacity limits as he has at his disposal huge stockpiles of the commodity and is thus always able to offer the demanded quantity.

The company with a lower marginal cost rate  $MC$  would be able to push the second company out of the market if it faced no production capacity restrictions and applied an appropriate pricing policy. Let us now consider the gemstone diamond market with two competitors. It is very likely that they both have different cost structures<sup>26</sup> with regard to only the pure periodical production of the commodity. But the maximum demanded quantity for the period  $n$ , in which the attack takes place, can easily be supplied using the existing stockpiles. In addition the competitors have enough goods in stock to supply any periods  $n + x$ , so that we can assume for our model a rate of marginal costs of practically zero and thus conclude that both competitors will remain in the market selling at a competitive price.

Such an attack by an equally powerful aggressor might be able to make the market collapse, since a price cut from the monopoly price level to the competitive price level will destroy the attained illusion of value and scarcity of gemstone diamonds. This will lead to a market collapse because of the negative expectations of

<sup>24</sup> Varian, H. R. (1990), pp. 461-462.

<sup>25</sup> Schumann/Meyer/Ströbele (1999), pp. 350-351.

<sup>26</sup> Without using empirical data, it can be assumed that two multinational "global player" companies with different production plants face different cost structures and thus have different marginal cost rates, caused by legislation, geographical, social factors etc.

<sup>21</sup> Bertrand, J. (1883) p. 503.

<sup>22</sup> Varian, H. R. (1990), p. 462.

<sup>23</sup> Schumann/Meyer/Ströbele (1999), p. 349.

consumers. In the De Beers case, the large stockpile causes very low marginal costs and thus leaves De Beers as the former monopolist, as well as the unrestricted competitor acting in the duopoly market with almost zero profits. We assume now that one of the market actors continues a "price war". This will lead in the long term to negative profits and destroy the gemstone diamond market. Due to the very delicate market actions taken by De Beers in order to control consumer demand, the illusion of value will break down instantly, forcing consumers to leave the market and perhaps look for other substitutes.

If an unrestricted outsider, who is now assumed to be an equal competitor, enters the market, refuses to cooperate with the monopolist by entering the cartel and attacks the monopoly on the total market, this will cause the breakdown of the market. In terms of the classical monopoly theory, there would be no problem, as the outsider would achieve profits equalling marginal costs, and would thus simply lose any surplus profits he would have achieved inside the cartel. The theoretical monopolistic market would switch to become a competitive market, attracting more and more dealers. The diamond market works mainly because of the consumers' expectations of future price stability, and therefore a price cut to competitive price levels will not leave the outsider with profits equalling marginal costs but will cause negative profits leading to the market exit of both the unrestricted outsider and the De Beers monopolist. The only possible solution for the unrestricted outsider would be to join the cartel and to collude with the monopolist.

### 5. Emergence of a Secondary Market for Second-Hand Diamonds as a Fundamental Attack

The rise of an uncontrolled secondary market of gemstone quality diamonds would be the most important threat to the monopoly.<sup>27</sup> In order to control the "actors" of the market and the diamond supply, De Beers installed an efficient market control mechanism. But how could they prevent consumers from reselling their diamonds, which, in terms of microeconomic theory, would lead to important price cuts to the competitive price level and in consequence to a market collapse? It has been already stated that De Beers controls the vertical sales and supply chain, from the working of its own or the

cartel's mines to the wholesaling sightholder and, therefore, to the smallest jeweler. However, it is obvious that there will be attempts to suppress diamond dealing outside the cartel. The monopolist will use his market power to prevent consumers establishing a secondary market, in addition to any commercial outsider-firm. History has taught us that jewelers will not pay the market price of a "new" diamond to a customer who wants to resell his "used" diamonds. Instead he will be offered a much lower price.<sup>28</sup>

But the gemstone diamond is a long-term durable commodity facing no kind of technical abrasion or depreciation within a given time. Compared to durable commodities where a functioning second-hand market operates, there are no quality differences between a "new" and a "used" diamond. This implies that any "used" diamond is supposed to have the same attributes as a new one. Hence, the "used" diamond is a perfect substitute for a new one as long as no other restrictions, e.g. emotional ones, are given. If a "used" diamond from a private stockpile enters the market, consumers can be assumed to be indifferent to the choice of product. But this plausible assumption gives any second-hand diamond supplier an "aggressor's" position, just like an emerging external producer. If the number of (private) second-hand diamond suppliers is adequately large, these suppliers may act as a very huge outsider, who is uncontrollable due to the vast amount of independent, individual decisions on the market. The quantities accumulated over past decades or even centuries and now held in private stock are subject to an analysis of the emergence of an uncontrolled secondary gemstone diamonds market.

Let us suppose that a certain proportion of the diamonds never enters the market again for various reasons, for example, if the commodity is being used as a personal, emotional gift.<sup>29</sup> In this case a high social or

<sup>27</sup> Braun, H. (2004).

<sup>28</sup> According to *Fuchs*, price offers were at maximum one third of the market value. *Fuchs*, A. (1997), pp. 8-9. The low offered price level for "used" diamonds applies only if consumers attempt to make cash. If an end-consumer wishes to buy a new, bigger diamond, he is offered the intrinsic value equalling the market price. By this, De Beers even manages to perpetuate the illusion of value. It can be assumed that the huge number of different diamond quality classes makes it almost impossible for the consumer to determine the fair value of his gemstone diamond, and thus the creation of a second-hand market can be avoided. *Braun*, H. (2004), p. 180. This problem occurs even if any reliable certifications of the physical attributes of any gemstone diamond do exist. The certification qualifies the "4-C" (carat, cut, colour, clarity) only and not the price associated with the certified bundle of quality-dimensions. Because almost every diamond is unique, a representative "market-price" could be not given exactly.

<sup>29</sup> For cardinal versus ordinal quality of goods see *Kamenica*, E. (2008):

psychological entry barrier does exist, i.e. a proportion of consumers will never be willing to sell diamonds from their family estate.<sup>30</sup> But whereas the monopolistic market is entirely controlled by one company, which also has perfect controlling mechanisms for its distribution channels, the occurrence of a “used” diamonds secondary market would impose a series of problems. It would hardly be possible to control the sales on an emerging secondary market, especially with regard to new distribution methods, such as internet auctions, etc.. Let us assume now that consumers want to realise the increase in value of the commodity as generated by De Beers’ illusion of value in cash. In that case a huge number of participants would enter the market, equipped with an almost infinite quantity of diamonds and a marginal cost rate  $MC$  of almost zero. This rate of marginal costs can be assumed to be zero, since we can suppose that the consumer as a seller now is not obliged to mine for the goods, nor does he have expensive stockpiling costs, but rather he holds the commodity ready for sale in what were formerly “safe hands”, e.g. the family’s estate.

Let us suppose that a large number of consumers will enter the market and that they offer a high number of stones of various different qualities and cuts. This implies that the privately held stockpile accumulated over decades or even centuries is a perfectly differentiated supply in regard to the size and the quality of the diamonds now privately offered. For the purpose of our model, it might be interesting to assume that all the small, private suppliers use, for example, a single trading platform outside the monopolistic organised cartel. Thus they act like a huge unrestricted outsider with unlimited stockpiles, threatening the monopoly. Thus the secondary market itself, as long as it does not collude with the cartel, acts like an unrestricted outsider because De Beers will not be able to “punish” the secondary market or force it to trade within the cartel.

We previously discussed the market impact of such an attack with respect to an outsider of approximately the same size as the monopolist. The secondary market, as regards the attack on the monopolistic market, can be

seen as far bigger, thus forcing the monopolist to the competitive price level in a very short time. In view of the fact that the complete financial and product resources of the secondary market must be far higher than De Beers’s resources, it can be concluded that De Beers as the former unrestricted and powerful monopolist will switch now into the position of a restricted and limited potential competitor in terms of financial resources and production capacities. The strategies discussed above of enlarging the produced amount or the buy-back actions cannot work from the moment when the secondary market emerges<sup>31</sup>. This will force De Beers into the position of the restricted outsider who must either cooperate with the secondary market or be pushed outside the market. As a consequence, cooperation implies a drop in the former monopolistic price of gemstone diamonds to a new competitive price level equalling Marginal Cost and thus being almost zero – as it is the valid bottom price for the private sales on the secondary market under total competition.

If the monopolist gives up his value-illusion strategy and consumers expect a drop in price, they will try to sell their commodities as quickly as possible and thus enter the secondary market as soon as possible. The De Beers monopolist will hardly be in a position to buy all gemstone diamonds offered on the increasing secondary market in order to maintain control of it, as he will face financial limits of his own. Hence the monopolist will be obliged to lower prices in order that sales do not stop entirely and, therefore, the price of the commodity will fall to the competitive price level equalling the marginal cost rate  $MC$ , in our case zero, which leads to a total market collapse. Hence the illusion of value and scarcity of gemstone diamonds – as a Veblen commodity as well as an asset – is destroyed.

## 6. Rational Consumer Expectations and the Case of the Coase Conjecture: the Durable Goods Monopolist Becomes his Own Rival

In order to explain the marketing strategy of the durable goods monopolist, it is important to analyse consumer behavior. As the value-consistent strategy of keeping prices rising continually – if slowly – depends on consumer participation with respect to future prices, the

<sup>30</sup> As long as the huge amount of former consumers hold gemstone diamonds in stock, including personal gifts as well as diamonds regarded as investment assets, and those consumers form a non-rational, amorphous mass of persons where everyone acts following his own interests, the threat for the market remains relatively low, and the illusion of scarcity and value applies. This analysis will concentrate on the effects of an initial ignition leading to a re-organisation of the end-consumers now willing to sell off, for different reasons, their stockpiled diamonds. Some of the reasons leading to a change in the “stockpiling strategy” could be economic depressions, emergency sales because of poverty or so on.

<sup>31</sup> Assuming that the accumulated amounts of gemstone diamonds in private hands and the financial power of all end-consumers are added together, it is useful for the modelling purposes to suppose infinite stocks and financial power.

monopolist will be forced to fulfill rational consumer expectations in order not to cause a lethal market collapse.

In an equilibrium situation for rational expectations, the monopolist is maximising profits, given the correctly perceived expectations of consumers who are rightly expecting that the monopolist will behave in this manner in every contingency. That means that each side of the market constructs correct expectations about how the other would behave in any situation, even in situations that may never actually occur.<sup>32</sup> For our model of the gemstone diamond market we assume that there are no production costs and no capacity constraints. In addition the product does not depreciate and retains all its qualities. In such a case Stokey assumes that there is an inverse demand function for the services of the commodity, the monopolist uses an infinite planning horizon, and the total stock of the goods in the hands of consumers – the potential players on a secondary market – is viewed as the situation variable of the model. At each date, consumers form expectations about the total stock of the commodity that will have been sold by each date in the infinite future.<sup>33</sup>

Furthermore, Stokey assumes that the monopolist knows the function which describes how the end-consumers' expectations are formed. Given this function, he chooses a sales strategy that maximises the present discounted value of its future profit stream. If this sales strategy fulfils the end-consumers' expectations, the result is a rational expectations equilibrium. Given any continuous, increasing path for the stock satisfying appropriate margin conditions, an expectation function can be constructed that constitutes a rational equilibrium. Furthermore, the function constructed shows that the consumers' expectations depend continuously on the current stock. This shows De Beers's dilemma, since De Beers has to keep huge quantities of diamonds in stock in order to be able to interact in the case of an attack by an outside producer. With their stockpiling policy De Beers are balancing on a knife's edge. Even if continuity of the expectation function is required, the assumption that expectations are fulfilled has no implications for the observed path of sales.<sup>34</sup>

In the case of a product giving rise to goodwill or, in the present case, to a reputation for the main seller on the market, the monopolist might take a dynamic view and

sacrifice current positive revenues in order to improve future profits. In a durable goods market there is an inter-temporal link on the demand side, which is associated with the durability of goods held by the consumers. Assuming that the lifetime of a commodity exceeds a so-called *basic period indicating the length of time between price revisions*<sup>35</sup>, the goods offered by the monopolist in two different periods are "*substitutes rather than complements*"<sup>36</sup>. A customer who buys a durable article today is unlikely to purchase the same commodity in the following period since the commodity does not depreciate. The dynamic theory of monopoly behaviour must take into account the fact that the market players cannot sign contracts to guarantee that the future price levels of their product will be above a certain level. If a commitment to future prices were possible, the time path of prices would usually not be the one which brought a demand which could maximise the discounted stream of revenues minus costs.<sup>37</sup> The conditions for a dynamically consistent consumption plan are correct price anticipation of consumers and no possibility of the monopolist deviating from the price path expected by the consumers in order to increase the expected present value of his remaining profit.<sup>38</sup>

Coase developed a model for a monopolist who sells a durable commodity.<sup>39</sup> Coase assumes that a seller facing one potential consumer with private information about his valuation cannot extract more than his own reserve value. This holds true, as the seller is unable to credibly commit to not lowering his price in subsequent periods if his previous offers were rejected. As this is rationally anticipated, even a buyer with a very high valuation is better off by initially rejecting a high price if the loss from delaying his purchase becomes sufficiently small. The monopolistic supplier of a single, indivisible item can clearly do better if he can muster several interested buyers and induce active competition amongst them. Jean Tirole states the most central problem of the gemstone market:

*"[...] a durable-good monopolist creates his own competition. By selling today, he reduces demand tomorrow. As we will see, to sell to the residual demand, the monopolist lowers the price tomorrow. But consumers ought to expect a*

<sup>32</sup> Stokey, N. L. (1982), pp. 112-113.

<sup>33</sup> Kamenica assumes that consumers can assess the ordinal but not cardinal quality of products. Kamenica, E. (2008), pp. 2127 – 2249.

<sup>34</sup> Stokey, N. L. (1982), p. 114.

<sup>35</sup> Tirole, J. (1990), p. 72.

<sup>36</sup> Tirole, J. (1990), p. 72.

<sup>37</sup> Gul, F./Sonnenschein, H./Wilson, R. (1986), pp.155-156; Bulow, J. (1982).

<sup>38</sup> Gul, F./Sonnenschein, H./Wilson, R. (1986), p.156.


<sup>39</sup> Coase, R. (1972), pp. 143-149.

price decrease and hold back on their purchases today. These rational expectations hurt the monopolist."<sup>40</sup>

Tirole sets up a model where the linear demand curve stems from a continuum of consumers with unit demands and willingness to pay within the period  $[0,1]$ . The monopolist charges the monopoly price  $p_{Mon} = (1 + \delta)/2$  for the first period and all those consumers will buy, whose willingness per period to pay exceeds  $1/2$ . Regarding the second period, the monopolist now faces a new residual demand  $D(p) = 1/2 - p$  from all those consumers left and where the willingness to pay is less than  $1/2$ . This leads the monopolist to lower his price to  $1/4$  and thus some consumers would have wanted to refrain from purchasing in the first period. The prospect of a price cut tomorrow changes the monopolist's demand curve today, leading the consumers' willingness to pay  $1/2 + \varepsilon$

<sup>41</sup> to receive a surplus of  $\varepsilon(1 + \delta)$  if they buy naively<sup>42</sup> or a surplus of  $\delta(1/4 + \varepsilon) > \varepsilon(1 + \delta)$  if they wait.<sup>43</sup>

Gul/Sonnenschein/Wilson proved the Coase conjecture formally for general demand structures requiring only stationary consumers' strategies.<sup>44</sup> The monopolist has the option to accelerate the process by offering today the price of the next period, thereby advancing the acceptance dates of subsequent consumers considering the cost, being the same as the foregone higher profit for those consumers accepting today. The benefit would be the interest on the monopolist's present value of continuation, now made to arrive a day earlier. Exercising this option must be disadvantageous for the monopolist, as this would require equilibrium. Here Gul/Sonnenschein/Wilson note that the cost must exceed the benefit. As the length of the period shrinks, the rate of price decline will be limited, or otherwise consumers will rather prefer to wait than to accept the current price. Assuming that the rate of acceptance is limited, then the continuation value must shrink to zero as the length of the period shrinks. If the period is sufficiently short, then the consumers will all prefer to delay purchasing and the monopolist is forced to allow subsequent prices to converge with his unit

cost.<sup>45</sup> Supposing that both the monopolist and the consumers live infinitely long and the commodity, like a diamond, is infinitely durable, the monopolist will suffer from the consumers' rational expectations that he will flood the market. A monopolist who can change his price very quickly loses his monopoly power, with consumers expecting him to charge prices at the competitive level.<sup>46</sup> A durable goods monopolist who sells his product has less market power, or, as in the present extreme case, no market power at all. Thus the monopoly of the future is competing with a monopoly of today, and this competition immediately drives the price down to a competitive level.<sup>47</sup> The above-mentioned conditions apply perfectly to the gemstone diamond market and illustrate the most important problem the monopolist faces. It is evident that the market price will fall to the competitive level, and therefore create a total market collapse, as the rate of marginal costs is almost zero if unlimited stockpiles are assumed. 

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<sup>40</sup> Tirole, J. (1990), p. 73.

<sup>41</sup> It is assumed that  $\varepsilon$  is small and positive.

<sup>42</sup> For the diamond case the actions taken might not only be naively but emotionally driven.

<sup>43</sup> Tirole, J. (1990), p. 82.

<sup>44</sup> Gul, F./Sonnenschein, H./Wilson, R. (1986), pp.168-170.

<sup>45</sup> Gul, F./Sonnenschein, H./Wilson, R.(1986), p.169.

<sup>46</sup> Tirole, J. (1990), p. 83.

<sup>47</sup> Carlton, D./Perloff, J. (1994), pp. 650-653.



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# Empirical Analysis of Volatility and Co-movements in Serbian Frontier Financial Market: MGARCH Approach

Jelena Z. Minović\*

## Abstract:

***This article presents an empirical calculation of volatility and co-movements for selected securities listed at the Belgrade Stock Exchange (www.belex.rs). It applied multivariate GARCH (MGARCH) models to the analysis of co-movements in the Serbian frontier financial market. For the empirical work, bivariate and trivariate versions of the restricted BEKK, DVEC, and CCC models were used. Empirical results showed that MGARCH models overcome the usual concept of the time invariant correlation coefficient. Additionally, the results show that the conditional variances and covariances between returns on the Serbian financial market exhibit significant changes over time.***

**Keywords:** Volatility, conditional covariance, multivariate GARCH models, maximum likelihood estimation, two-step estimation.

**JEL:** C1, C3, C4, C5;

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## 1. Introduction

Volatility plays an important role in controlling and forecasting risks in various financial operations (Wang and Yao, 2005). I estimated the generalized autoregressive conditional heteroscedasticity (GARCH) model in order to capture the time-varying variances of my data from the Belgrade stock exchange in the univariate case (Minović, 2007a). I was then motivated to extend these models to the multivariate dimension. The goal of this article is to present an application of multivariate GARCH (MGARCH) models to the analysis of variances and covariances in the Serbian frontier financial market (Minović, 2007b). The main goal of this article is to show that MGARCH models overcome the usual concept of the time invariant correlation coefficient. It is often the case in finance that the covariance between some two series is of interest, just as the variances of the individual series themselves. While univariate descriptions of GARCH models (see Bollerslev, 1986) are useful and important, the problems of risk assessment, asset allocation, hedging in futures markets and options pricing, portfolio Value at Risk, and CAPM betas estimates require a multivariate

framework (Wang and Yao, 2005). This is because all the aforementioned problems require covariances as inputs. MGARCH models specify equations for how the variances and covariances move over time. There are many examples in which empirical multivariate models of conditional heteroscedasticity can be used fruitfully. An illustrative list includes the following analysis (Tse, 2000): portfolio optimization (Kroner and Claessens, 1991), pricing of assets (Hafner and Herwartz, 1998) and derivatives, computation of the Value at Risk (Rombouts and Verbeek, 2004; Bauwens and Laurent, 2004), futures hedging (Park and Switzer, 1995; Yang and Allen, 2004; Bera et al., 1997; Lien and Luo, 1994), volatility transmitting (Karolyi, 1995) and asset allocation,

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estimation systemic risk in banking (Schröder and Schöler, 2003), determination of the leverage effect (De Goeij and Marquering, 2004; Kroner and Ng, 1998), estimation of the volatility impulse response function (Hafner and Herwartz 1998, 2006; Elder, 2003), nonlinear programming (Altay-Salih, Pinar and Leyffer, 2003), hedging the currency exposure risk (Kroner and Sultan, 1991; Valiani, 2004), calculation of the minimum capital risk requirements for portfolio of assets (Brooks et al., 2002), determining misspecification tests for MGARCH models (Tse and Tsui, 1999), modeling of the changing variance structure in an exchange rate regime (Bollerslev, 1990), applying MGARCH models in the analysis of individual financial markets (Minović, 2007b).

MGARCH models used in this article are as follows: the restricted version of BEKK (named after Baba, Engle, Kraft and Kroner, initially due to Engle and Kroner, 1995), diagonal vector ARCH model (DVEC, initially due to Bollerslev, Engle and Wooldridge, 1988), and the Constant Conditional Correlation Model (CCC, by Bollerslev, 1990). For the empirical work, the restricted BEKK, DVEC, and CCC models are preferable. This is because they are much easier to estimate, while maintaining a sufficient level of generality. These models are relatively simple in comparison to the unrestricted models version, which allows one to achieve reliable estimates of variances and covariances.

The BEKK model: Engle and Kroner (1995) proposed a quadratic formulation for the parameters that ensured a positive definiteness conditional variance-covariance matrix ( $\Sigma_t$ ), which became known as the BEKK model (Brooks et al., 2003). In this model, the number of parameters grows linearly with the number of assets. Therefore, this model is relatively parsimonious and suitable for a large set of assets (De Goeij, 2004). The BEKK model is in the form:

$$\Sigma_t = C_0 C_0' + \sum_{k=1}^K \sum_{i=1}^q A_{ki}' \varepsilon_{t-i} \varepsilon_{t-i}' A_{ki} + \sum_{k=1}^K \sum_{i=1}^p B_{ki}' \Sigma_{t-i} B_{ki}, \quad (1.1)$$

where  $C_0$  is a lower triangular matrix and  $A_{ki}$  and  $B_{ki}$  are  $N \times N$  parameter matrices. Based on the symmetric parameterization of the model,  $\Sigma_t$  is almost surely positive definite provided that  $C_0 C_0'$  is positive definite (Tsay, 2005). The necessary condition for the covariance stationarity of the BEKK model is having the eigenvalues, i.e. the characteristic roots of

$$\sum_{i=1}^q \sum_{k=1}^K (A_{ik}^* \otimes A_{ik}^*) + \sum_{i=1}^p \sum_{k=1}^K (B_{ik}^* \otimes B_{ik}^*) \text{ less than one in}$$

modulus. Hence, the process can still render stationary even if there exists an element with a value greater than one in the matrix. Obviously, this condition is different from the stationary condition required by the univariate GARCH model, that is, the sum of the ARCH and GARCH terms has to be less than one (Brooks, 2002).

The diagonal VEC<sup>1</sup> (DVEC) model: Under the diagonal VEC (DVEC) model, each variance-covariance term is postulated to follow a GARCH-type equation. The model can be written as follows (Tse and Tsui, 1999, and Brooks, 2002):

$$\sigma_{ij,t} = c_{ij} + \sum_{h=1}^p a_{hij} \varepsilon_{t-h,i} \varepsilon_{t-h,j} + \sum_{h=1}^q b_{hij} \sigma_{t-h,ij} \quad 1 \leq i \leq j \leq k \quad (1.2)$$

where  $c_{ij}$ ,  $a_{hij}$  and  $b_{hij}$  are parameters. The DVEC multivariate GARCH model could also be expressed as an infinite order multivariate ARCH model, where the covariance ( $\sigma_{ij}$ ) is expressed as a geometrically declining weighted average of past cross products of unexpected returns, with recent observations carrying higher weights.

The Constant Conditional Correlation (CCC) Model: Bollerslev (1990) suggested a multivariate GARCH model in which all conditional correlations are constant and the conditional variances are modeled by univariate GARCH models. This is the so-called Constant Conditional Correlation Model (CCC) (Tse and Tsui, 1999). Thus the CCC model is given by

$$\sigma_{ii,t} = c_i + \sum_{h=1}^p a_{hi} \varepsilon_{t-h,i}^2 + \sum_{h=1}^q b_{hi} \sigma_{t-h,i} \quad i = 1, \dots, k \quad (1.3)$$

$$\sigma_{ij,t} = \rho_{ij} \sqrt{\sigma_{ii,t} \sigma_{jj,t}} \quad 1 \leq i < j \leq k \quad (1.4)$$

$$\rho_t = \rho = [\rho_{ij}], \rho_{ii} = 1 \quad (\text{Bauwens et al., 2006, and Tse, 2000}), \quad (1.5)$$

where  $\rho_t$  is the  $N \times N$  conditional correlation matrix of  $\varepsilon_t$  and  $\rho_t$  is symmetric with unit diagonal elements. The dynamic of the covariances ( $\sigma_{ij}$ ) is determined only by the dynamics of the two conditional variances ( $\sigma_{ii}$ ). There are  $N(N-1)/2$  parameters in (Bauwens et al., 2006).

In this article, I estimated multivariate (bivariate and trivariate) GARCH models: the restricted version of BEKK, diagonal vector ARCH model (DVEC), and Constant

<sup>1</sup> VEC is the column-stacking operator.



Conditional Correlation Model (CCC) for daily log returns of the BELEX15 index, Hemofarm and Energoprojekt stocks for the one year period from October 2005 to October 2006. Daily returns are measured by the log-differences of closing prices. The analyzed stocks are listed at the Belgrade Stock Exchange ([www.belex.rs](http://www.belex.rs)). The methods for estimation parameters used are maximum log-likelihood (in BEKK and DVEC models) and a two-step approach (in CCC model). Prior to multivariate GARCH analysis, univariate GARCH analysis was performed. I used four steps in building a volatility model for each of the analyzed return series. The first step was to specify a mean equation by testing for serial dependence in the data, and building an ARMA model for the return series so as to remove any linear dependence. The second step was to use the residuals of the mean equation to test for ARCH effects. The third step was to specify a volatility model when the ARCH effects were statistically significant and perform a joint estimation of the mean and volatility equations. This allowed us to conclude that the right model for BELEX15 index is the ARMA(1,1)-GARCH(1,1), for Hemofarm stock is the ARMA(2,2)-IGARCH(1,1), and for Energoprojekt stock the ARMA(0,0)-GARCH(1,1) model. Finally, in the fourth step I checked the fitted models carefully: the Ljung-Box statistics of standardized residuals and its squared values showed that the models are adequate for describing the conditional heteroscedasticity of the data. After a bivariate and trivariate conditional heteroscedasticity model had been fitted, I used the Ljung-Box statistics (Q-test) of standardized residuals, those of the squared residuals, and of the cross product of standardized residuals to check for the model's adequacy. The overall result is that MGARCH models perform well statistically.

The hypotheses are: the conditional variances of stock returns on the Serbian financial market are very unstable

over time; the conditional covariances between returns for the both stocks and the index on the Serbian financial market exhibit significant changes over time.

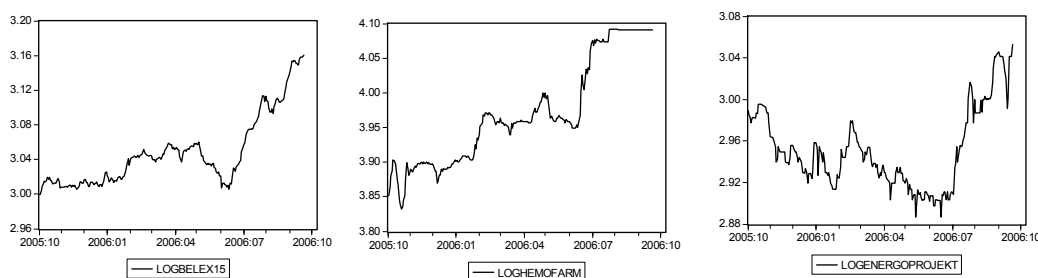
The rest of the paper is organized as follows. At the beginning of the second section I present data, and analyze its stationarity. The rest of Section 2 presents ARIMA processes, and univariate GARCH analysis. At the beginning of the third section I present the results of empirical calculation for bivariate version BEKK, DVEC and CCC models for log returns of BELEX15 index and Hemofarm stock. Then I discuss the final results (variances and covariances plots) of the empirical calculation for bivariate version models mentioned above but now for log returns of the BELEX15 index and Energoprojekt stock. The rest of Section 3 presents the empirical results of the trivariate version of BEKK, DVEC and CCC models. Section 4 concludes the paper. Appendix A presents tables and graphs used for the analysis.

## 2. Results of Estimation of Univariate GARCH Models

### 2.1. Data and Descriptive Statistics

BELEX15 tracks free float capitalization of the 15 most liquid, continuously traded stocks. The maximum weight for each component is limited to 20%. BELEX15 is calculated and published both with intraday and closing values. The index base period is October 1, 2005, and the base value was 1,000.00 index points (<http://www.sinteza.net/>). BELEX15 is not adjusted for paid dividends, and is not protected from the dilution effect that appears as a result of the dividends' payout (<http://www.belex.rs>).

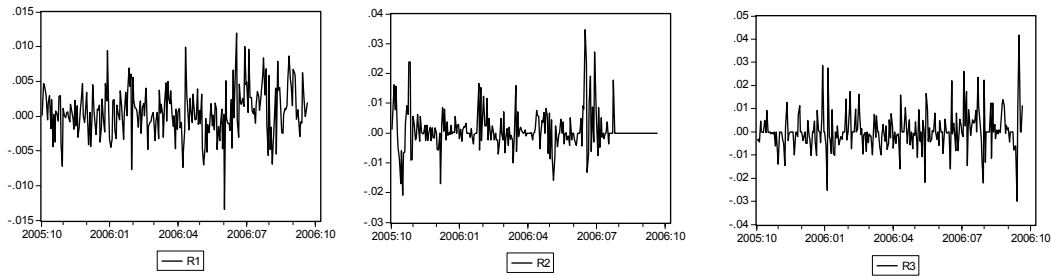
"Hemofarm Concern" is the biggest pharmaceutical company in Serbia. We observe from Figure 2.1 that in



**Figure 2.1:** The data graph for log BELEX15 index, log Hemofarm stock and log Energoprojekt stock, respectively.

Series	ADF Test	level	Critical Value	H <sub>0</sub>
log BELEX15	-0.32	5%	-3.43	can not be rejected
dlog(BELEX15)	-13.28	5%	-3.43	<i>rejected</i>
log Hemofarm	-1.98	5%	-3.43	can not be rejected
dlog(Hemofarm)	-12.73	5%	-3.43	<i>rejected</i>
log Energoprojekt	-1.22	5%	-3.43	can not be rejected
dlog(Energoprojekt)	-17.16	5%	-3.43	<i>rejected</i>

**Table 2.1:** The results of testing for a unit root for BELEX15 index, Hemofarm and Energoprojekt stocks. The null hypothesis H<sub>0</sub>: unit root exists in the process; The alternative hypothesis: the process is stationary.



**Figure 2.2:** The graphs of daily log returns of the BELEX15 index ( $r_1$ ), Hemofarm ( $r_2$ ) and Energoprojekt ( $r_3$ ) stocks, respectively.

July 2006 the price of Hemofarm stock rapidly grew. This happened because German Shtada Company bought 67% stocks of Hemofarm. After that, the price curve is flat, which means that the price of Hemofarm stocks was not changing.

The “Energoprojekt” company is one of the most important firms in Serbia in the construction industry. The company got a contract in Nigeria valued at 151 million Euros in February 2006. We see that as the first peak of the price jump on Figure 2.1. After that, the price again goes down until July 2006, when positive business results raise investment in Energoprojekt stock, with a constant positive price trend from then on. Possible reasons for this are the previous underpricing of Energoprojekt’s fundamentals compared to similar companies in the Balkan region and the entrance of new funds to the Belgrade Stock Exchange without a broad offer of high quality stocks. Additionally, management of “Energoprojekt” was focused on activities which supported its stock price.

Now, I test the stationarity of my series. This will be done by testing for the presence of a unit root using the Augmented Dickey Fuller test (ADF). The results of testing for a unit root are presented in Table 2.1. Now, I test if log BELEX15 index, log Hemofarm and log Energoprojekt, and its first difference (log return) are stationary.

From the table above we can see that the Augmented Dickey-Fuller test statistic for log BELEX15, log Hemofarm, and log Energoprojekt series are greater than the -3.43 critical value, so we conclude that the null hypothesis of a unit root presence cannot be rejected. I proceed with unit root testing for the first difference. An ADF test of log return for the BELEX15 index, log return for Hemofarm, and log return for Energoprojekt stocks are smaller than the critical value -3.43, so we infer that the null hypothesis of an existing unit root should be rejected and the alternative hypothesis of stationarity cannot be rejected. Thus, series log BELEX15 index, log Hemofarm, and log Energoprojekt stocks have one unit root, hence their first differences (log returns) are stationary. For this reason, it is the usual practice to work with the logs of the changes (i.e. the first differences) of a series rather than the series itself. Let  $r_{1t}$  be the log return series of the BELEX15 index,  $r_{2t}$  the log return series of Hemofarm stock and  $r_{3t}$  the log return series of Energoprojekt stock. On Figure 2.2 we plot the daily log returns of my series.

We observe in Figure 2.2 that the log returns of BELEX15 index, Hemofarm and Energoprojekt stocks offer evidence of the well known volatility clustering effect. It is a tendency for volatility in financial markets to appear in bunches. Large returns (of either sign) are expected to follow large returns, and small returns (of either sign) to

Series	Mean	Max	Min	Std. Dev.	Skewness	Kurtosis	JB	Prob	Obs
log BELEX15	3.05	3.16	3.00	0.04	1.22	3.69	68.05	0.00	252
log Hemofarm	3.97	4.09	3.83	0.08	0.45	2.01	18.72	0.00	252
log Energoprojekt	2.95	3.05	2.89	0.04	0.75	2.88	23.96	0.00	252
$r_1$	0.00	0.01	-0.01	0.00	0.03	4.22	15.58	0.00	252
$r_2$	0.00	0.03	-0.02	0.01	1.29	8.59	398.00	0.00	252
$r_3$	0.00	0.04	-0.03	0.01	0.74	7.20	207.83	0.00	252

**Table 2.2:** Descriptive statistics of log BELEX15, log Hemofarm and log Energoprojekt series and their first differences (log return series), where  $r_1$  is log return for the BELEX15 index and  $r_2$  is log return for Hemofarm stock, and  $r_3$  is log return for Energoprojekt stock.

BELEX15					Hemofarm				Energoprojekt			
Variable	Coeff.	S.E.	t-Stat	Prob.	Coeff.	S.E.	t-Stat	Prob.	Coeff.	S.E.	t-Stat	Prob.
C	0.0006	0.0004	1.6265	0.1051	0.0008	0.0004	1.9726	0.0497	0.0003	0.0005	0.4853	0.6279
AR(1)	0.7851	0.1254	6.2597	0.0000	1.6347	0.0270	60.4803	0.0000	-	-	-	-
AR(2)	-	-	-	-	-0.8903	0.0317	-28.0701	0.0000	-	-	-	-
MA(1)	-0.6385	0.1562	-4.0870	0.0001	-1.6229	0.0397	-40.8643	0.0000	-	-	-	-
MA(2)	-	-	-	-	0.8971	0.0416	21.5816	0.0000	-	-	-	-
AIC	-8.5342				-7.3657				-6.7493			
SIC	-8.4921				-7.2952				-6.7353			
F-Stat	8.0886 (0.0004)				10.7233 (0.0000)				<b>D-W stat</b> = 2.1405			
JB	18.8513 (0.0001)				545.7911 (0.0000)				207.8295 (0.0000)			

**Table 2.3:** Estimate mean equation for log return of the BELEX15 index, Hemofarm and Energoprojekt stocks.

follow small returns (Brooks, 2002). Additionally, the observed cluster in each series tend to occur simultaneously. This motivates an application of a bivariate and trivariate GARCH model (Franke et al., 2005).

I tested my distributions of log series and of log returns against normal distribution, using descriptive statistics (Table 2.2). Each series has positive skewness which means that these distributions have a long right tail. The kurtosis for each series of log returns exceeds 3, so the distributions of these series are peaked (leptokurtic) relative to the normal. Hence, the kurtosis of log Hemofarm and log Energoprojekt stocks is less than 3; these distributions are flat (platykurtic) relative to the normal. We found that the values of Jarque-Bera normality tests are very high and probabilities are significantly low for each series of log returns so the null hypothesis of a normal distribution should be rejected. Thus, each of these series is not normally distributed.

## 2.2. ARIMA Analysis

Considering the correlograms, I will try to estimate the correct model for log returns. It can be deduced that, for log return of the BELEX15 index, the first two, and fifth autocorrelation coefficients, and the first two partial

autocorrelation coefficients, are significant. In the case of log return for Hemofarm, the first and seventh autocorrelation coefficients and the first, sixth, and seventh partial autocorrelation coefficients are significant. But, considering the correlogram for Energoprojekt stock, I observed that there are no autocorrelation and partial autocorrelation coefficients that are significant, and the Ljung-Box test statistics is insignificant, as well (see Minović, 2007c).

Here, I perform an Autoregressive Moving Average (ARMA) analysis for the log returns in order to obtain a residual series which is free of serial correlation. I specify and estimate ARMA models which minimize the information criteria.

In Table 2.3, I report coefficients, standard errors, t-Statistics, probabilities, Akaike's and Schwartz's Criteria, F-Statistics and the Jarque-Bera (JB) normality test. The standard errors and associated t-values reported in this thesis are calculated using the quasi-maximum likelihood methods of Bollerslev and Wooldridge (1992), i.e. the standard errors are robust to the density function underlying the residuals (Baur, 2004).

Considering the correlogram of the data, I have tested several combination ARMA( $p,q$ ). With the probabilities pretty low and Akaike (AIC) and Schwarz (SIC) criteria the

series	The Ljung-Box Statistics								ARCH-LM(5) test	
	Q(2)	Q(5)	Q(9)	Q(36)	Q <sup>2</sup> (2)	Q <sup>2</sup> (5)	Q <sup>2</sup> (9)	Q <sup>2</sup> (36)	F-stat	Obs*R <sup>2</sup>
<b>BELEX15</b>	0.655 (0.721)	2.780 (0.734)	4.290 (0.891)	26.559 (0.874)	2.726 (0.256)	4.121 (0.532)	6.496 (0.689)	26.178 (0.885)	0.726 (0.604)	3.666 (0.598)
<b>Hemofarm</b>	1.453 (0.484)	7.483 (0.187)	11.491 (0.244)	34.857 (0.523)	33.866 (0.000)	47.446 (0.000)	72.915 (0.000)	86.635 (0.000)	6.613 (0.000)	29.775 (0.000)
<b>Energoprojekt</b>	1.848 (0.397)	2.209 (0.820)	3.406 (0.946)	26.659 (0.871)	10.437 (0.005)	13.065 (0.023)	13.852 (0.128)	26.716 (0.870)	3.138 (0.009)	15.099 (0.010)

**Table 2.4:** The Ljung-Box statistics of standardized residuals and squared standardized residuals in ARMA models and tests for ARCH effect.

best for ARMA(1,1) (all the other tested models showed much poorer performance) process, I conclude that the right model for log BELEX15 index is **ARIMA(1,1,1)**. Akaike's criterion suggest the ARMA(6,6) model, and Schwarz's criterion suggest the ARMA(2,2) model for log return of Hemofarm stock. SIC correctly identifies an ARMA model, whereas AIC tends to over fit the model (Altay-Salih, 2003). Then, according to SIC criterion I chose the ARMA(2,2) process for log return of Hemofarm stock. I then concluded that the right model for log Hemofarm stock is **ARIMA(2,1,2)**. For Energoprojekt stock, not one autocorrelation and partial autocorrelation functions are significant and the Ljung-Box test statistics is never significant. I found that ARMA(0,0) is the most suitable, i.e. the right model for log return of Energoprojekt stock is the white noise process. I then concluded that the right model for the series of log Energoprojekt stock is **ARIMA(0,1,0)**.

The residuals obtained from the ARMA models for each series are not normally distributed (Table 2.3), because the normality assumption is rejected at the 5% significance level if  $JB > 5.99$  (Vogelvang, 2005). However, even if the distribution of the residuals is not normal, the estimates are still consistent under quasi-maximum likelihood (QML) assumptions (EViews 5 User's Guide, 2005). Obviously, the residuals have to be tested for the absence of autocorrelation. With the Ljung-Box (Q) test, I tested whether the residuals behave like a white noise process (Vogelvang, 2005). Table 2.4 reports the  $Q(m)$  and  $Q^2(m)$  statistics for each series.

It is evident from the table above that the Q-statistics for squared residuals across all lag lengths are significant for Hemofarm stock and we infer the presence of ARCH effects. The Q-statistics for squared residuals across all lag lengths for BELEX15 index are not significant and ignore the existence of ARCH effects. But the heteroscedasticity in BELEX15, Hemofarm, and Energoprojekt is also observed in the plots of the actual values of residuals. From Table 2.4 we see that is only one significant autocorrelation on lag 2 in squared residuals in the ARMA

model for Energoprojekt stock. It is evident an ARCH effect exists for Energoprojekt stock. On the other hand, the Lagrange multiplier (LM) test (Table 2.4) shows strong ARCH effects for Hemofarm stock with the test statistic  $F = 6.613$ , the  $p$ -value of which is zero; and an ARCH effect for Energoprojekt stock with test statistic  $F = 3.138$ , the  $p$ -value 0.009. This test then shows no ARCH effect for the BELEX15 index with test statistic  $F = 0.726$  and  $p$ -value 0.604.

### 2.3. Univariate GARCH Models

Although the ARCH model is simple, it often requires many parameters to adequately describe the volatility process of an asset return. For instance, consider the daily log return of Hemofarm stock. An ARCH(10) model is needed for the volatility process according to partial autocorrelation functions (see Minović, 2007c). Some alternative models must be sought (Tsay, 2005). According to the partial autocorrelation function I found that an ARCH(2) model is needed for the volatility process of Energoprojekt stock. For the BELEX15 it is then possible not to have an ARCH component but a GARCH one. The GARCH is more general, i.e.  $GARCH(p,0) = ARCH(p)$ .

The detected presence of ARCH effects necessitates the use of a more dynamic and flexible GARCH specification to explicitly model the conditional variance and covariance of residuals (Vogelvang, 2005). GARCH is more general and better than the ARCH process, so I proceeded with the estimation of the GARCH (volatility) model (estimated parameters are in Table A1 in AppendixA).

From Table A1 in Appendix A it is evident that coefficients for ARMA processes are highly significant except constant coefficients which are insignificant for BELEX15 and Hemofarm. Thus, the results for BELEX15 show that all coefficients in the variance equation are positive and statistically significant at the 10% level. BELEX15 satisfies the GARCH (1,1) model.

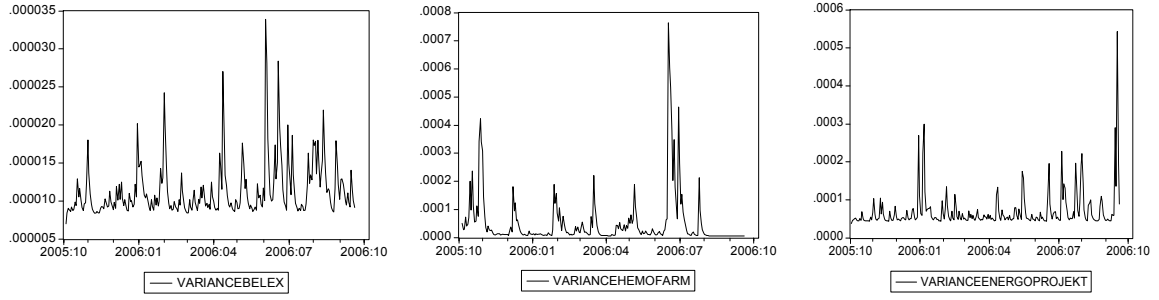


Figure 2.3 plots the GARCH variance series for the BELEX15 index, Hemofarm, and Energoprojekt stocks.

A joint estimation of the ARMA(1,1)-GARCH(1,1) model for BELEX15 gives

$$r_t = 0.8207 r_{t-1} - 0.6918 \varepsilon_{t-1} + \varepsilon_t, \quad (2.1)$$

(0.1050)                      (0.1376)

$$\hat{\sigma}_t^2 = 4.06 \cdot 10^{-6} + 0.1446 \varepsilon_{t-1}^2 + 0.5030 \sigma_{t-1}^2. \quad (2.2)$$

(2.14 \cdot 10^{-6})                      (0.0700)                      (0.2226)

From the volatility equation (BELEX15), the implied unconditional variance of  $\varepsilon_t$  is

$$\frac{4.06 \cdot 10^{-6}}{1 - 0.1446 - 0.5030} = 1.1521 \cdot 10^{-5}. \text{ This value is the same}$$

as  $S.E.^2 = (0.003395)^2 = 1.1526 \cdot 10^{-5}$ . This confirms the adequacy of the GARCH(1,1) model.

The results in Table A1 for Hemofarm show that all coefficients are statistically significant, with the sum of GARCH parameters close to unity, for example  $a_{ii} + b_{ii} \approx 1$ . This suggests the persistence of ARCH effects in the datasets and, hence, implies that the current information remains important for forecasts of conditional variances at all horizons (Yang and David, 2004). This special type of GARCH model is termed as Integrated GARCH (IGARCH). In order to examine the IGARCH process, I applied the Wald test. First, I formulated the null hypothesis: the sum of the ARCH and GARCH coefficients is very close to one. According to the results of the Wald test ( $F = 0.249$ ,  $p = 0.618$ ;  $p > 5\%$ ) the null hypothesis was not rejected. Hence, I conclude that log returns of Hemofarm follow the IGARCH process.

A joint estimation of the ARMA(2,2)-IGARCH(1,1) model for Hemofarm gives

$$r_t = 1.0251 r_{t-1} - 0.3326 r_{t-2} - 0.9907 \varepsilon_{t-1} + 0.4318 \varepsilon_{t-2} + \varepsilon_t, \quad (2.3)$$

(0.1964)                      (0.1289)                      (0.1749)                      (0.0992)

$$\hat{\sigma}_t^2 = 3.45 \cdot 10^{-6} + 0.6632 \varepsilon_{t-1}^2 + 0.4351 \sigma_{t-1}^2. \quad (2.4)$$

(1.61 \cdot 10^{-6})                      (0.2644)                      (0.0970)

From Table A1 for Energoprojekt we see that the constant term in the mean equation is not significant, the

constant term in the variance equation is significant the 10% level, the ARCH term is significant at 5% and the GARCH term is not significant.

A joint estimation of the ARMA(0,0)-GARCH(1,1) model for Energoprojekt gives

$$r_t = \varepsilon_t \text{ (white noise process)}, \quad (2.5)$$

$$\hat{\sigma}_t^2 = 3.10 \cdot 10^{-5} + 0.2691 \varepsilon_{t-1}^2 + 0.2985 \sigma_{t-1}^2. \quad (2.6)$$

(1.60 \cdot 10^{-5})                      (0.1066)                      (0.2503)

Although the GARCH term is insignificant, I decided to include it, because with the GARCH model I eliminate autocorrelation at lag 2 in the correlogram of squared residuals which was shown by the ARCH(1) model. We know that GARCH(1,1) is equal to ARCH( $\infty$ ) and because of that it removes autocorrelation. I have tested several combinations of GARCH( $p,q$ ) models such as ARCH(2), GARCH(2,1), and GARCH(1,2). Each model was inconsistent, i.e. I found that GARCH(1,1) is the most suitable one.

Thus, the BELEX15 index follows the ARMA(1,1)-GARCH(1,1) model, Hemofarm stock follows the ARMA(2,2)-IGARCH(1,1) model, and Energoprojekt stock follows the ARMA(0,0)-GARCH(1,1) model. The fitted models can be checked by using the standardized residual and its squared process. The Ljung-Box statistics (Table A2 in Appendix A) of standardized residuals and those of its squared show that the models are adequate for describing the heteroscedasticity of the data.

I applied the ARCH test on the standardized residuals to see if there are any ARCH effects left. Both the F-statistic and the LM-statistic are very insignificant, suggesting no ARCH effect up to order 5 or 10 for each series, the BELEX15 index, Hemofarm, and Energoprojekt stocks (Table A2 in Appendix A).

In addition to visual inspection, Figure 2.3 tells us that the GARCH variance series exhibits significant changes over time for both stocks and index. Therefore, these



	BEKK			DVEC			CCC		
	Coeff.	S.E.	z-Stat	Coeff.	S.E.	z-Stat	Coeff.	S.E.	z-Stat
<b>MU(1)</b>	-0.0003	0.0003	-0.8476	-0.0001	0.0002	-0.2762	-0.0002	0.0002	-0.6594
<b>MU(2)</b>	-0.0006	0.0001	-7.3142	-0.0005	0.0001	-4.9307	-0.0006	0.0002	-2.6514
<b>OMEGA(1)</b>	0.0008	0.0006	1.2669	0.0000	0.0000	1.3918	0.0000	0.0000	1.3900
<b>BETA(1)</b>	0.9665	0.0404	23.9362	0.5044	0.2825	1.7854	0.4300	0.3335	1.2891
<b>ALPHA(1)</b>	0.1888	0.0558	3.3810	0.1356	0.0770	1.7606	0.1583	0.0994	1.5919
<b>OMEGA(2)</b>	0.0000	0.0001	-0.0174	0.0000	0.0000	-0.0224	0.0000	0.0000	-1.0774
<b>BETA(2)</b>	0.8452	0.0073	115.4843	0.7091	0.0123	57.5014	0.7095	0.0113	62.6936
<b>ALPHA(2)</b>	0.7468	0.0429	17.3895	0.5775	0.0560	10.3148	0.5761	0.0498	11.5765
<b>OMEGA(3)</b>	0.0000	0.5845	0.0000	0.0000	0.0000	-0.8696	-	-	-
<b>BETA(3)</b>	-	-	-	0.5980	0.1394	4.2893	-	-	-
<b>ALPHA(3)</b>	-	-	-	0.2798	0.0830	3.3711	-	-	-
Log likelihood	2076.330			1915.184			2470.535		
Avg. log likelihood	8.3723			7.7225			9.9618		
Number of coeff.	<b>9</b>			<b>11</b>			<b>8</b>		
AIC	-16.6720			-15.3563			-19.8592		
SIC	-16.5445			-15.2005			-19.7458		
HQC	-16.6207			-15.2936			-19.8135		

**Table 3.1** reports the coefficients, standard errors, z-statistics, log-likelihood and information criteria for restricted bivariate BEKK, DVEC, and CCC models. The standard errors represent the variance-covariance matrix of the maximum likelihood estimates of the model coefficients.

variances are very unstable over time. A plot of GARCH variances of the BELEX15 index, Hemofarm and Energoprojekt stocks reveals that the BELEX15 index has been more volatile than Hemofarm and Energoprojekt stocks. Thus, the hypothesis about instability of the conditional variances of returns on the Serbian market cannot be rejected.

### 3. Multivariate GARCH (MGARCH) Models

For the multivariate application I start with the bivariate case. In the first part of this section I use data of daily log returns for the BELEX15 index and Hemofarm stock, and in the second part I use data of daily log returns for the BELEX15 index and Energoprojekt stock. The data set covers the period from October 3, 2005 to October 6, 2006. For both univariate and multivariate (bivariate and trivariate) GARCH models, the unknown model parameters are estimated using the Berndt-Hall-Hausman (BHHH) algorithm<sup>2</sup>. Additionally, EViews 4.1 does not support estimation of MGARCH models, so I extended EViews with new subprograms. This required utilization of informatical methods (programming). Although, the new version of Eviews (6.0) supports multivariate GARCH modeling through regular program menus and commands, manually writing a program gives

<sup>2</sup> This algorithm uses the first derivatives of the quasi-maximum likelihood (QML) with respect to the number of parameters that are contained in multivariate GARCH models. This is an iterative procedure; The BHHH algorithm needs suitable initial parameters (Brooks et al, 2003).

us more freedom and flexibility. For all calculations in my programs for bivariate and trivariate versions, the number of iteration is 100 and convergence criterion is  $1 \cdot 10^{-5}$  which ought to be considered a procedure with high precision.

#### 3.1. Bivariate GARCH Models (BELEX15 and Hemofarm)

For the parameter estimation I use the maximum-likelihood approach in the BEKK model as well as in the bivariate DVEC model. The estimation of multivariate GARCH models is commonly done by maximizing a Gaussian likelihood function. Even if it is unrealistic in practice, the normality assumption may be justified by the fact that the Gaussian quasi-maximum likelihood (QML) estimator is consistent provided the conditional mean and the conditional variance are specified correctly (Brooks, 2002). For the parameter estimation in the CCC model I use the first step (a mean and volatility part) of a two-step approach (the second step is the correlation part). The two-step estimation approach has been developed to increase computational efficiency, and has apparently been used more often in practice (Wang and Yao, 2005).

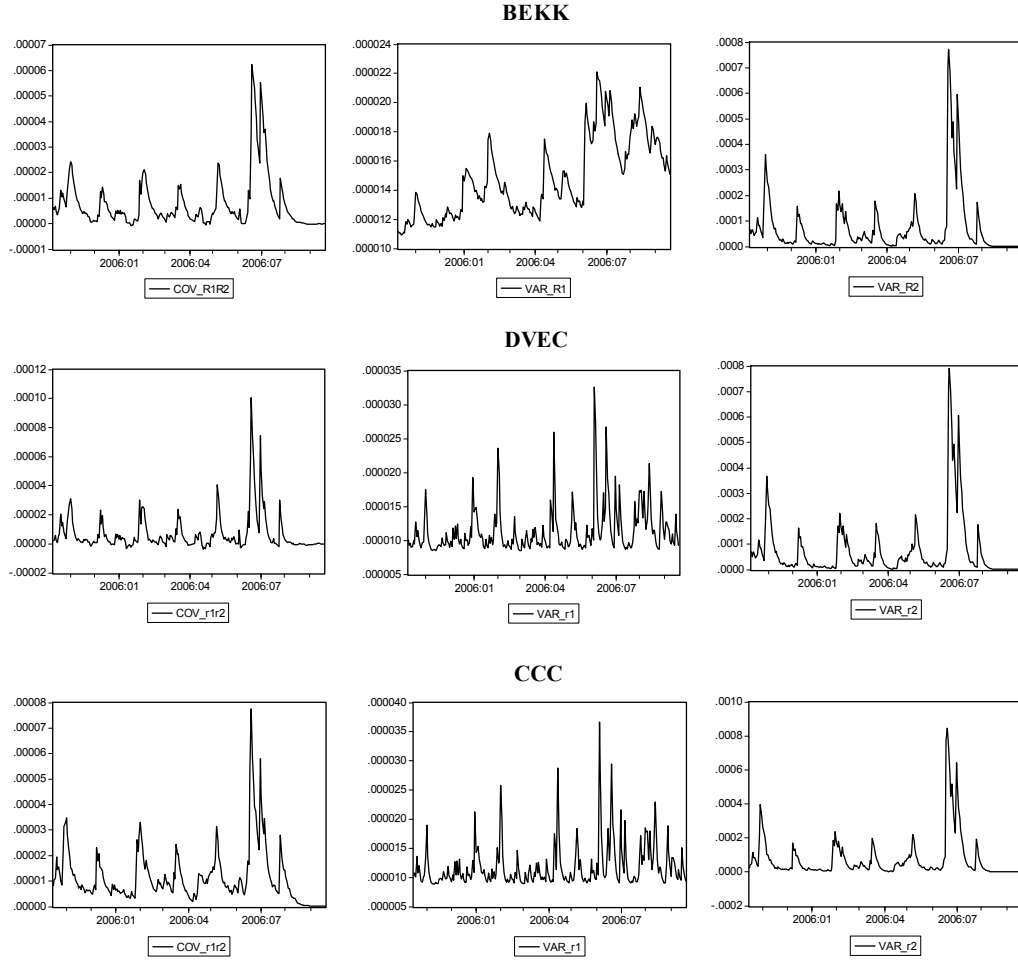
Using estimated parameters from Table 3.1, we obtain the mean equations of the BEKK(1,1) model:

$$r_{1t} = \varepsilon_{1t}, \quad (3.1)$$

$$r_{2t} = -0.0006 + \varepsilon_{2t}, \quad (3.2)$$

(0.0001)





**Figure 3.1:** Estimated conditional covariance and variances of daily log returns for the BELEX15 index and Hemofarm stock in the restricted BEKK, DVEC, and CCC models, respectively.

where  $\varepsilon_t$  is the shock, or innovation, of the series at time  $t$ . The mean equation of the BELEX15 index satisfies a white noise process. Standard error terms are reported in the parentheses. In the DVEC model the estimated parameters OMEGA(1), OMEGA(2) and OMEGA(3) are insignificant, and in the CCC model the estimated parameters OMEGA(1) and OMEGA(2) are insignificant. Now, I present volatility equations for the restricted BEKK, DVEC, and CCC models, respectively.

The restricted bivariate BEKK model is in the form:

$$\hat{\sigma}_{11,t} = 0.0008^2 + 0.1888^2 \varepsilon_{1,t-1}^2 + 0.9665^2 \sigma_{11,t-1}, \quad (3.3)$$

(0.0006)                      (0.0558)                      (0.0404)

$$\hat{\sigma}_{21,t} = 0.1888 \cdot 0.7468 \varepsilon_{1,t-1} \varepsilon_{2,t-1} + 0.9665 \cdot 0.8452 \sigma_{21,t-1}, \quad (3.4)$$

(0.0558-0.0429)                      (0.0404-0.0073)

$$\hat{\sigma}_{22,t} = 0.7468^2 \varepsilon_{2,t-1}^2 + 0.8452^2 \sigma_{22,t-1}. \quad (3.5)$$

(0.0429)                      (0.0073)

Where  $\sigma_{11,t}$ ,  $\sigma_{33,t}$  are time-varying variances of log returns on the BELEX15 index and Hemofarm stock, respectively. Then,  $\sigma_{21,t}$  is covariance between log returns of the BELEX15 index and Hemofarm stock. Although in the equations above the sum of the ARCH and GARCH terms is greater than one, this fact does not matter, because the stationary condition in multivariate cases is different than the stationary condition in the univariate case.

Using the parameters from Table 3.1, we obtain the mean equations of the DVEC(1,1) model:

$$r_{1t} = \varepsilon_{1t}, \quad (3.6)$$

$$r_{2t} = -0.0005 + \varepsilon_{2t}, \quad (3.7)$$

(0.0001)

The volatility equations are:

$$\hat{\sigma}_{11,t} = 0.1356 \varepsilon_{1,t-1}^2 + 0.5044 \sigma_{11,t-1}, \quad (3.8)$$

(0.0770)                      (0.2825)

$$\hat{\sigma}_{21,t} = 0.2798 \varepsilon_{1,t-1} \varepsilon_{2,t-1} + 0.5980 \sigma_{21,t-1}, \quad (3.9)$$

(0.0830)                      (0.1394)

$$\hat{\sigma}_{22,t} = \underset{(0.0560)}{0.5775} \varepsilon_{2,t-1}^2 + \underset{(0.0123)}{0.7091} \sigma_{22,t-1}, \quad (3.10)$$

Again, in equation (3.10) the sum of the ARCH and GARCH terms is greater than one, the condition of stationarity is not broken. This is the bivariate case and the condition of stationarity is not the same as in the univariate case.

Using the parameters from Table 3.1, we obtain the mean equations of the CCC(1,1) model:

$$r_{1t} = \varepsilon_{1t}, \quad (3.11)$$

$$r_{2t} = \underset{(0.0002)}{-0.0006} + \varepsilon_{2t}, \quad (3.12)$$

The fitted volatility model is:

$$\hat{\sigma}_{11,t} = \underset{(0.0994)}{0.1583} \varepsilon_{1,t-1}^2 + \underset{(0.3335)}{0.4300} \sigma_{11,t-1}, \quad (3.13)$$

$$\hat{\sigma}_{21,t} = \rho \sqrt{\sigma_{11,t} \sigma_{22,t}}, \quad \rho = 0.4917, \quad (3.14)$$

$$\hat{\sigma}_{22,t} = \underset{(0.0498)}{0.5761} \varepsilon_{2,t-1}^2 + \underset{(0.0113)}{0.7095} \sigma_{22,t-1}. \quad (3.15)$$

The correlation coefficient between log return for the BELEX15 index and log return for Hemofarm stock is  $\rho$ . We observe that this CCC model reduces to two univariate GARCH(1,1) models. In this case, the two volatility processes are not dynamically related.

### 3.2. Analysis of the results

In the multivariate case I propose to examine the standardized residuals, squared standardized residuals as well as the cross products of the standardized residuals. My results show that the residual-based diagnostics provide a useful check for model adequacy (Tse, 2002).

The standardized residuals for log return of the BELEX15 index and log return of Hemofarm stock are calculated as:

$$\hat{z}_1 = (r_1 - \hat{\mu}_1) / \sqrt{\sigma_{11}}, \quad (3.16)$$

$$\hat{z}_2 = (r_2 - \hat{\mu}_2) / \sqrt{\sigma_{22}}. \quad (3.17)$$

The cross product of residuals for log return of the BELEX15 index and log return of Hemofarm stock are calculated as:

$$\hat{z}_1 \hat{z}_2 = (r_1 - \hat{\mu}_1)(r_2 - \hat{\mu}_2) / \sqrt{\sigma_{11} \sigma_{22}}. \quad (3.18)$$

If the model is correctly specified, the standardized residuals should not be correlated, and identically distributed random variables with mean zero and variance one (EViews 5 User's Guide, 2005).

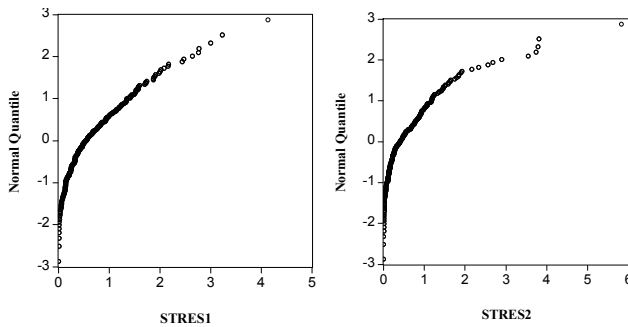
Q(36)	BELEX15	Hemofarm	Cross product of res
BEKK(1,1)	27.767 (0.835)	44.024 (0.168)	-
DVEC(1,1)	22.098 (0.967)	49.318 (0.069)	-
CCC(1,1)	23.158 (0.952)	49.509 (0.066)	-
Q <sup>2</sup> (36)			
BEKK(1,1)	30.973 (0.706)	59.588 (0.008)	34.877 (0.522)
DVEC(1,1)	24.612 (0.925)	84.041 (0.000)	31.903 (0.664)
CCC(1,1)	26.172 (0.886)	57.897 (0.012)	-

**Table 3.2:** The Ljung-Box statistics for the standardized residual series, squared standardized residual series and cross product of standardized residuals for log return of BELEX15 index and log return of Hemofarm stock, where the number in parentheses denotes p-value.

The values of Q-statistics with high  $p$ -values of the squared standardized residual series for log return on the BELEX15 index imply that there are no ARCH effects. Therefore, the Q-statistics and significantly low (less than 10%)  $p$ -values of the squared standardized residual series for log return on Hemofarm stock imply that we have autocorrelation. It is an expected result because in the univariate case Hemofarm satisfies the IGARCH process, indicating that volatility shocks are quite persistent (EViews 5 User's Guide, 2005).

The Q-statistics for the cross product of standardized residual series and very high  $p$ -values (grater than 10%) suggest no ARCH effects in the covariance equation (i.e. we don't have autocorrelation) for log returns of the BELEX15 index and Hemofarm stock in the BEKK and DVEC models. The covariance equation in the CCC model does not contain terms with the cross product of residuals.

The goodness-of-fit of a multivariate GARCH model can also be assessed by calling the generic plot function on a fitted "mgarch" object. There is significant deviation in the tails from the normal QQ-line for both residuals (Figure 3.2). Thus it seems that the normality assumption for the residuals may not be appropriate (Zivot and Wang, 2006).



**Figure 3.2:** The QQ-plot of standardized residuals of the BELEX15 index (stres1) and Hemofarm stock (stres2) plotted against normal distribution in MGARCH models.

As mentioned before, the estimates are still consistent under the quasi-maximum likelihood (QML) assumptions, if the distribution of the residuals is not normal. In addition to visual inspection of the plots, Figure 3.1 tell us that the BEKK, DVEC, and CCC give results that are similar in covariances and variances. A plot of the GARCH volatilities of the BELEX15 index and Hemofarm stock reveals that the BELEX15 index is more volatile than Hemofarm stock. From figures for covariances it is evident that correlation between log returns for the BELEX15 index and Hemofarm stock is very unstable over time. We observe the greatest peak in the period of June-July 2006, when the company Shtada bought stocks of Hemofarm. In all the figures that show plotted covariances as well as all those with variances of daily log returns of Hemofarm stock we can see significant autocorrelation. This is because Hemofarm, in the univariate case, follows the IGARCH process. In fact, the changes in the conditional variances are modelled quite well.

The restricted BEKK model has seven free parameters, while the DVEC model has nine free parameters. Indeed, the restricted BEKK model is nested within the DVEC model. The CCC model and the restricted BEKK model are non-nested within each other. Although the CCC model has a smaller number of parameters than the BEKK and DVEC models, it is not nested within these two models (Tse and Tsui, 1999).

Comparing the likelihood values for the different models with a differing number of parameters may not be fair. Therefore, to make a fair comparison, I use the Akaike Information Criterion (AIC, Akaike 1973), Schwartz Information Criterion (SIC, Schwartz 1978) and Hannan-Quinn Criterion (HQC), which are standard tests of comparison between GARCH models in the literature (Altay-Salih, 2003). SIC is strongly consistent (but inefficient) and AIC is not consistent, but is generally more efficient. In other words, SIC will asymptotically

deliver the correct model order, while AIC will deliver on average too large a model, even with an infinite amount of data. On the other hand, the average variation in the selected model orders from different samples within a given population will be grater in the context of SIC than AIC. Overall, then, no criterion is definitely superior to others (Brooks, 2002). The smaller the statistic, the better the model fit (Altay-Salih, 2003).

Based on the AIC, SIC and HQC tests (Table 3.1), we can say that CCC(1,1) performs better than both DVEC(1,1) and BEKK(1,1) specifications, although all three provide a solution to the same multivariate GARCH estimation problem. Furthermore, the BEKK model seems to do better than the DVEC representation, based on all three information criteria.

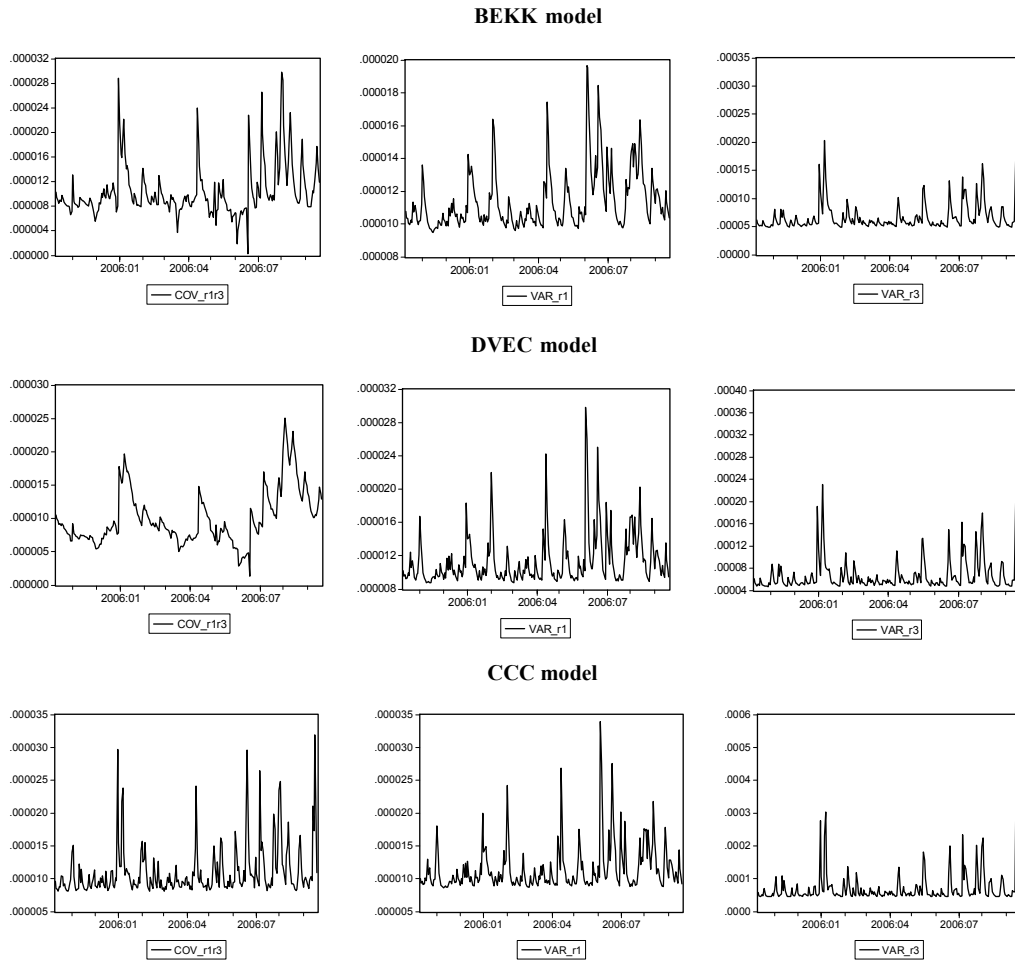
However, according to z-statistics on Table 3.1 I cannot say that the CCC model outperforms the BEKK and DVEC. Based on these statistics I cannot choose the most convenient model. Thus, Information Criteria (AIC, SIC, and HQC) are not appropriate criteria for choosing a model with the best performance in the multivariate case. In other words, these tests cannot be used for comparison between multivariate GARCH models.

To sum up, it can be said that the above presented model classes are promising, and estimation does work even for moderate dimensions  $N$ . Especially the models for  $N = 2$  show good results and may be general enough. In general, I can say that these analyzed models yield good results.

### 3.3. Bivariate GARCH Models (BELEX15 and Energoprojekt)

Here, a similar procedure was repeated, but now for the BELEX15 index and Energoprojekt stock. For detailed results see the references (Minović, 2007b). Here I present only the final graphs of my calculation and modeling.

If we compare figures for conditional variances among the above presented model we will conclude that the BEKK, DVEC, and CCC give results that are similar in variances. These figures show that the BELEX15 index has always been more volatile than Energoprojekt stock. Therefore, if we compare figures for conditional covariances we will see that the BEKK, DVEC, and CCC give results that have different covariances. We observe from all the figures of covariances and from figures of Energoprojekt's variances that the first pick were in January-February 2006, when the Energoprojekt company signed a significant contract in Nigeria.



**Figure 3.3:** Estimated conditional covariance and variances of daily log returns for the BELEX15 index and Energoprojekt stock in the restricted BEKK, DVEC and CCC models, respectively.

Additionally, it is evident that correlation between log returns for the BELEX15 index and Energoprojekt stock is very unstable during that time.

### 3.4. Trivariate Case

In this part we consider trivariate GARCH models, and we use the data of daily log returns for the BELEX15 index, Hemofarm stock and Energoprojekt stock, respectively. I used a program for modeling the restricted version of the trivariate BEKK model, and I extended this program on the trivariate case of the DVEC and CCC models.

I found that the correlation coefficients (only the first measure of correlation) between log returns of the BELEX15 index and Hemofarm stock is 0.49; that between log returns of the BELEX15 index and Energoprojekt stock is 0.40; and that between log returns of Hemofarm and Energoprojekt stocks is about 0.02. This means that these

two stocks are not correlated. Let  $r_{1t}$ ,  $r_{2t}$ , and  $r_{3t}$  be the log return series corrected for autocorrelation in the mean of the BELEX15 index, Hemofarm, and Energoprojekt stocks, respectively.

The methods for estimation parameters used are maximum log-likelihood and the two-step approach. Although the maximum log-likelihood method can be used for all three models (BEKK, DVEC and CCC), for CCC representation we estimate parameters using the first step of the two-step approach. It is enough because the CCC model uses a constant correlation coefficient, and the second step should be used only when the correlation coefficient is time dependent.

However, in order to choose the best model, diagnostic tests should be calculated. For diagnostic checking I used the Ljung-Box statistics of standardized residuals and those of its squared, and of the cross product of standardized residuals (Table 3.4 and 3.5). We observe that in the trivariate case we have an ARCH effect

	BEKK			DVEC			CCC		
	Coeff.	S.E.	z-Stat	Coeff.	S.E.	z-Stat	Coeff.	S.E.	z-Stat
<b>MU(1)</b>	-0.0003	0.0002	-1.4536	-0.0001	0.0002	-0.3216	-0.0001	0.0002	-0.6120
<b>MU(2)</b>	-0.0006	0.0001	-8.1946	-0.0003	0.0002	-1.6585	-0.0006	0.0001	-8.4620
<b>MU(3)</b>	-0.0005	0.0007	-0.7305	-0.0003	0.0006	-0.5244	-0.0003	0.0006	-0.5453
<b>OMEGA(1)</b>	0.0017	0.0004	4.8070	0.0000	0.0000	1.9624	0.0000	0.0000	1.3449
<b>BETA(1)</b>	0.7826	0.0879	8.9069	0.5216	0.1549	3.3679	0.4973	0.3058	1.6260
<b>ALPHA(1)</b>	0.3495	0.0739	4.7325	0.2006	0.0709	2.8288	0.1479	0.0913	1.6192
<b>OMEGA(2)</b>	0.0000	0.0000	0.0519	0.0000	0.0000	3.0426	0.0000	0.0000	-9.3533
<b>BETA(2)</b>	0.8416	0.0058	144.5231	0.6827	0.0168	40.5688	0.7085	0.0010	70.8697
<b>ALPHA(2)</b>	0.7682	0.0373	20.6101	0.5952	0.0623	9.5593	0.5820	0.0534	10.8965
<b>OMEGA(3)</b>	0.0016	0.0006	2.4940	0.0000	0.0000	2.6601	0.0000	0.0000	5.1316
<b>BETA(3)</b>	0.6814	0.1607	4.2397	0.3052	0.2135	1.4291	0.2269	0.1382	1.6417
<b>ALPHA(3)</b>	0.4283	0.0975	4.3925	0.2479	0.1152	2.1518	0.2539	0.1057	2.4011
<b>OMEGA(4)</b>	0.0001	0.0002	0.2752	0.0000	0.0000	5.6805	-	-	-
<b>BETA(4)</b>	-	-	-	0.6431	0.0690	9.3175	-	-	-
<b>ALPHA(4)</b>	-	-	-	0.2545	0.0692	3.6794	-	-	-
<b>OMEGA(5)</b>	-0.0055	0.0210	-0.2643	0.0000	0.0000	2.2551	-	-	-
<b>BETA(5)</b>	-	-	-	0.3899	0.2062	1.8905	-	-	-
<b>ALPHA(5)</b>	-	-	-	0.1765	0.0716	2.4647	-	-	-
<b>OMEGA(6)</b>	0.0003	0.3462	0.0010	0.0000	0.0000	-0.1434	-	-	-
<b>BETA(6)</b>	-	-	-	0.4663	0.2539	1.8363	-	-	-
<b>ALPHA(6)</b>	-	-	-	0.3630	0.1137	3.1918	-	-	-
Log likelihood	2886.269			2697.955			3534.373		
Avg. log likelihood	11.8290			11.5792			14.4851		
Number of coeff.	<b>15</b>			<b>21</b>			<b>12</b>		

**Table 3.3** contains the coefficients, standard errors, z-statistics, log-likelihood, and information criteria for trivariate BEKK, DVEC and CCC models.

<b>Q(36)</b>	<b>BELEX15</b>	<b>Hemofarm</b>	<b>Energoprojekt</b>
<b>BEKK</b>	25.628 (0.900)	44.451 (0.158)	31.161 (0.698)
<b>DVEC</b>	23.205 (0.951)	43.256 (0.189)	34.341 (0.548)
<b>CCC</b>	22.976 (0.955)	40.311 (0.247)	26.675 (0.871)
<b>Q<sup>2</sup>(36)</b>			
<b>BEKK</b>	29.221 (0.781)	58.530 (0.010)	38.323 (0.365)
<b>DVEC</b>	24.128 (0.935)	47.444 (0.096)	40.719 (0.270)
<b>CCC</b>	26.468 (0.877)	83.197 (0.000)	34.328 (0.548)

**Table 3.4:** The Ljung-Box statistics of standardized residuals and those of its squared for log return of the BELEX15 index, log return of Hemofarm and log return of Energoprojekt stocks, where the number in parentheses denotes p-value.

<b>Q<sup>2</sup>(36)</b>	<b>BELEX15-Hemofarm</b>	<b>BELEX15-Energoprojekt</b>	<b>Hemofarm- Energoprojekt</b>
<b>BEKK</b>	30.429 (0.730)	32.122 (0.654)	34.498 (0.540)
<b>DVEC</b>	31.550 (0.680)	27.746 (0.836)	32.244 (0.648)

**Table 3.5:** The Ljung-Box statistics of cross product of standardized residuals, where the number in parentheses denotes p-value.

in variance equation of Hemofarm stock, except for the DVEC model. The Q-statistics for checking whether there are any ARCH effects left in the residuals show that autocorrelation is not significant in variance equations for log returns of the BELEX15 index and Energoprojekt stock.

From Table 3.4 it is evident that there are no ARCH effects in covariance equations for the BEKK and DVEC models for pairs BELEX15-Hemofarm; BELEX15-Energoprojekt, and Hemofarm-Energoprojekt. Thus, checks of the models show that they are appropriate: Q-statistics show that the models are adequate for describing the conditional heteroscedasticity of the data.

It is important to note that the DVEC model would be the most appropriate model, because only that one does not show the ARCH effect for the Hemofarm stock. The BEKK and CCC models have a smaller number of parameters and they are much easier to estimate than the DVEC model. Thus, the most 'complicated' model proved to be the best model.


The graphs of conditional variances (Figure A2 in Appendix A) for daily log returns of the BELEX15 index, Hemofarm and Energoprojekt stocks in our three considered models are very similar to graphs in the bivariate case, and even in the univariate case. All variances in all three models are highly unstable. Also, the graphs of conditional covariances (Figure A1 in Appendix A) between chosen securities are very similar to graphs in the bivariate case. It is evident that correlations between log returns of stocks and index are very unstable over time. Thus, the hypothesis about instability of the conditional covariances between returns on the Serbian financial market cannot be rejected. In Figure A1, the restricted BEKK and DVEC give results that are similar for all pair log returns of stocks and index, but those of the CCC model are very different, with covariance being positive and not of a negligible magnitude, especially in the case of Hemofarm and Energoprojekt stocks. In Figure A1 we observe that Hemofarm and Energoprojekt stocks are uncorrelated; this plots around zero on the graph.

#### 4. Conclusion

This article presents an empirical calculation of multivariate GARCH models (BEKK, DVEC, and CCC) in bivariate and trivariate versions, on the Serbian financial market. Detail econometric time-series analysis via ARIMA-GARCH modeling, and via MGARCH modeling is presented. I illustrated my approach by applying it to daily returns of the BELEX15 index, Hemofarm, and Energoprojekt stocks. I showed that even DVEC, CCC, and restricted version of BEKK models with a reduced number of parameters give results that are accurate to an acceptable degree. All analyzed models (BEKK, DVEC, and CCC) show similar behavior in variances and covariances. The overall result is that models perform well statistically. Empirical results showed that MGARCH models overcome the usual concept of the time invariant correlation coefficient. Additionally, the results indicate that the conditional variances and covariances between returns on the Serbian financial market exhibit significant changes over time.

Future research should examine the impact of the world financial crises on the volatility of stock prices, and co-movements between stock returns in Serbia.

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## Appendix A

### A.1. Univariate case

BELEX15					Hemofarm				Energoprojekt			
Mean Equation												
	Coeff.	S.E.	z-Stat	Prob.	Coeff.	S.E.	z-Stat	Prob.	Coeff.	S.E.	z-Stat	Prob.
C	0.0004	0.0003	1.2485	0.2118	0.0003	0.0003	1.0360	0.3002	-3.59E-05	0.0004	-	0.9321
AR(1)	0.8207	0.1050	7.8197	0.0000	1.0251	0.1964	5.2189	0.0000	-	-	-	-
AR(2)	-	-	-	-	-	0.1289	-	0.0099	-	-	-	-
					0.3326		2.5797					
MA(1)	-	-	-	0.0000	-	0.1749	-	0.0000	-	-	-	-
	0.6918	0.1376	5.0265		0.9907		5.6630		-	-	-	-
MA(2)	-	-	-	-	0.4318	0.0992	4.3539	0.0000	-	-	-	-
Variance Equation												
C	4.06E-06	2.14E-06	1.8971	0.0578	3.45E-06	1.61E-06	2.1436	0.0321	3.10E-05	1.60E-05	1.9376	0.0527
ARCH(1)	0.1446	0.0700	2.0644	0.0390	0.6632	0.2644	2.5086	0.0121	0.2691	0.1065	2.5243	0.0116
GARCH(1)	0.5030	0.2226	2.2597	0.0238	0.4351	0.0970	4.4873	0.0000	0.2985	0.2503	1.1926	0.2330
R-squared			0.060127		0.057546			-0.001224				
Adjusted R-squared			0.040945		0.030285			-0.013335				
S.E. of regression			0.003395		0.006381			0.008321				
Sum squared resid			0.002825		0.009853			0.017173				
Mean dependent var			0.000641		0.000912			0.000253				

**Table A1:** A joint estimation of the mean and volatility equations.

series	The Ljung-Box Statistics		ARCH-LM(5) test		ARCH-LM(10) test	
	Q(36)	Q <sup>2</sup> (36)	F-stat	Obs*R <sup>2</sup>	F-stat	Obs*R <sup>2</sup>
<b>BELEX15</b>	25.590 (0.901)	26.319 (0.881)	0.265 (0.932)	1.351 (0.930)	0.423 (0.934)	4.356 (0.930)
<b>Hemofarm</b>	29.038 (0.788)	23.685 (0.943)	0.084 (0.995)	0.432 (0.994)	0.146 (0.999)	1.518 (0.999)
<b>Energoprojekt</b>	26.447 (0.878)	22.156 (0.966)	0.799 (0.551)	4.028 (0.545)	0.606 (0.808)	6.183 (0.800)

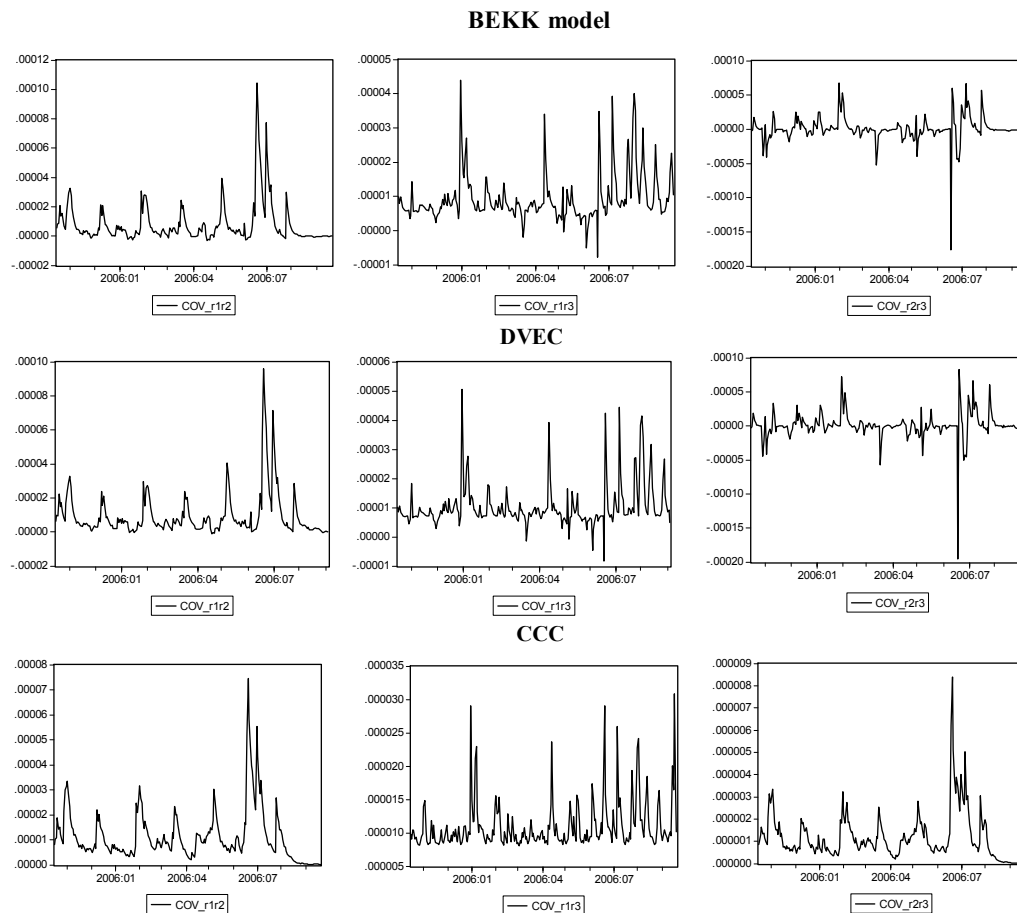
**Table A2:** The Ljung-Box statistics and ARCH-LM test of order 5 and 10.

## A.3. Bivariate case: BELEX15-Energoprojekt

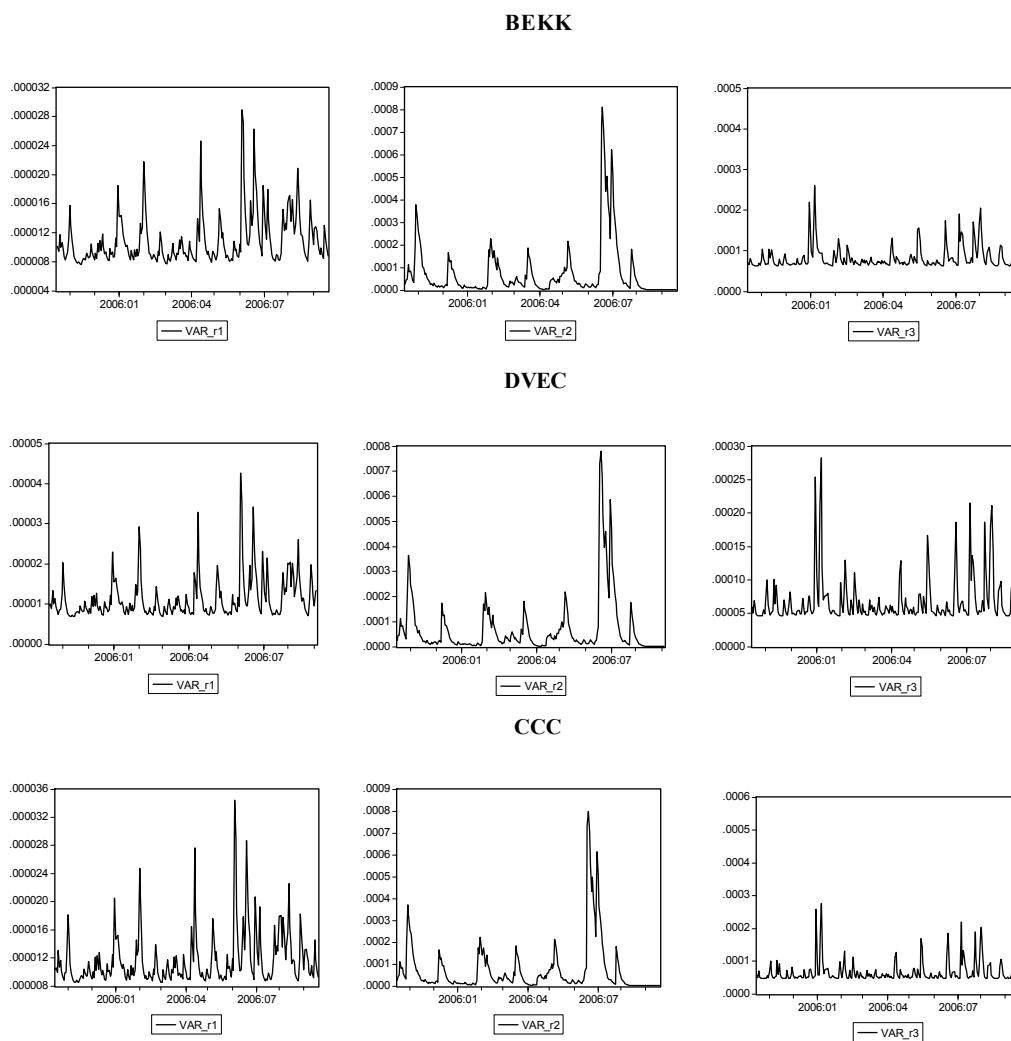
	BEKK			DVEC			CCC		
	Coeff.	S.E.	z-Stat	Coeff.	S.E.	z-Stat	Coeff.	S.E.	z-Stat
<b>MU(1)</b>	-0.0001	0.0002	-0.2416	-0.0001	0.0002	-0.3789	-0.0001	0.0002	-0.3406
<b>MU(2)</b>	-0.0002	0.0006	-0.3331	-0.0002	0.0006	-0.3662	-0.0002	0.0006	-0.4069
<b>OMEGA(1)</b>	0.0016	0.0008	2.0002	0.0000	0.0000	1.3749	0.0000	0.0000	1.4123
<b>BETA(1)</b>	0.8521	0.1414	6.0261	0.5346	0.2837	1.8848	0.4635	0.3172	1.4610
<b>ALPHA(1)</b>	0.2340	0.0993	2.3559	0.1183	0.0751	1.5748	0.1430	0.0905	1.5798
<b>OMEGA(2)</b>	0.0018	0.0007	2.5470	0.0000	0.0000	1.0459	0.0000	0.0000	4.4940
<b>BETA(2)</b>	0.7506	0.1255	5.9801	0.4656	0.1721	2.7051	0.2638	0.1479	1.7840
<b>ALPHA(2)</b>	0.3638	0.0729	4.9884	0.1709	0.0635	2.6903	0.2793	0.1124	2.4852
<b>OMEGA(3)</b>	0.0042	0.0010	4.2815	0.0000	0.0000	2.7116	-	-	-
<b>BETA(3)</b>	-	-	-	0.8899	0.0809	11.0067	-	-	-
<b>ALPHA(3)</b>	-	-	-	0.0414	0.0282	1.4648	-	-	-
Log likelihood	1926.456			1930.583			2366.001		
Avg. log likelihood	7.7680			7.7846			9.5403		
Number of coeff.	<b>9</b>			<b>11</b>			<b>8</b>		
AIC	-15.4634			-15.4805			-19.0161		
SIC	-15.3359			-15.3247			-18.9028		
HQC	-15.4120			-15.4178			-18.9705		

Table A3: Estimation results for the three bivariate models BEKK, DVEC, and CCC for log return series of BELEX15 index and Energoprojekt stock

## A.4. Trivariate case



Figures A1: Estimated conditional covariances for daily log returns of BELEX15 index - Hemofarm stock (cov\_r1r2); BELEX15 index - Energoprojekt stock (cov\_r1r3); Hemofarm - Energoprojekt stocks (cov\_r2r3), respectively in restricted BEKK, DVEC and CCC models.



**Figure A2:** Estimated conditional variances of daily log returns on BELEX15 index ( $var_{r1}$ ), Hemofarm stock ( $var_{r2}$ ) and Energoprojekt stock ( $var_{r3}$ ), respectively in the trivariate BEKK, DVEC and CCC models.



# Ownership Concentration, Managerial Ownership and Firm Performance: Evidence from Turkey

Pinar Evrim Mandacı, Guluzar Kurt Gumus\*

## Abstract:

***This study examines the effects of ownership concentration and managerial ownership on the profitability and the value of non-financial firms listed on the Istanbul Stock Exchange (ISE) in the context of an emerging market. We measure the firm's performance by Return on Assets (ROA) and Tobin's Q ratios, where the former measures profitability and the latter the value of the firm. In addition, we give detailed information on the main characteristics of the ownership structures of the firms in our sample and find that ownership of Turkish firms is highly concentrated. In addition, the unlisted holding companies have the highest average percentage of shares, which supports the belief that individuals or families establish the holding companies in order to control their listed firms. After controlling for investment intensity, leverage, growth and size, we find that ownership concentration has a significantly positive effect on both firm value and profitability, while managerial ownership has a significantly negative effect on firm value.***

**Keywords:** Corporate governance, ownership concentration, managerial ownership, firm performance, Turkey

**JEL:** G34; G15

**DOI:** 10.2478/v10033-010-0005-4

## 1. Introduction

Good corporate governance depends on the combination of the protection of the rights of investors and proper ownership concentration. It has been observed that ownership concentration is high in less developed countries, where the rights of investors are not protected due to the outright lack of or insufficient regulation provided by the relevant laws (see Shleifer and Vishny, 1997 and La Porta et al., 1999). The relationship between ownership structure and firm performance provides an idea about the effectiveness of alternative corporate governance mechanisms.

Grossman and Hart (1986) argued that when the ownership structure of a firm is overly diffused, shareholders are not motivated to monitor management decisions closely, because the benefits that they can attain are mostly lower than the cost they would have to afford to control the managers. Yet, this setting may influence performance negatively. On the other side, Shleifer and Vishny (1986) argued that when the

ownership structure is concentrated, shareholders will control the activities of the managers easily, thereby avoiding inefficiency in management, and improving firm performance. However, according to the agency theory, Jensen and Meckling (1976) argued that high concentration may simultaneously lead major shareholders to give priority to their own interests, and

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subsequently agency problems<sup>1</sup> may occur between the shareholders and managers. In order to minimize agency problems, shareholders have to endure agency costs<sup>2</sup>. In addition, according to them, managerial ownership prevents conflicts of interest between the managers and owners and increases the value of the firm. Significant managerial ownership can align managers' interests with those of the outside shareholders so that managers can have strong incentive to pursue value-maximizing behavior (alignment effects). In contrast, Demsetz (1983) argued that too large an ownership stake by managers could potentially lead them to worry more about their own interests, not those of outside shareholders, hence decreasing the firm's value (entrenchment effects).

In this paper we aim to measure the effects of managerial ownership and ownership concentration on the profitability and value of Turkish non-financial firms listed on the Istanbul Stock Exchange (ISE). In Turkey, the listed corporations are mostly owned by families. Standards of corporate governance and investor protection are lower in Turkey than in the U.S. and other major countries. Hence, we hope that this study will add an interesting dimension to the relation between these variables and performance in a developing country under a poor governance system.

Our paper is organized as follows. The second part consists of a literature review. In the third part, data and summary statistics are presented. Methodology and empirical results are presented in the fourth part, and the final part offers concluding comments.

## 2. Literature Review

Although initially Berle and Means (1932) suggested a positive correlation between ownership concentration and performance, some of the following studies did not observe a relation between these two variables (see Demsetz, 1983; Demsetz and Lehn, 1985 and etc). The study by Demsetz and Lehn (1985) that examined the relationship between accounting profit rate and percentage of shares owned by the five and ten largest shareholders where ownership structure is treated as an endogenous variable found no evidence of a relation between these variables for U.S. companies. They argued that although greater ownership concentration results in

stronger incentives to monitor, the expected gain from active monitoring and the cost of alternative ownership structures vary across firms. Morck et al. (1988) ignored the endogenous issue and similar to Demsetz and Lehn (1985) found no significant relation in the linear regressions they calculated by using accounting profits and Tobin's Q as an alternative measure of performance. Shleifer and Vishny (1997) argued that making the ownership structure relatively centralized could promote the shareholder's controlling ability and therefore the existence of the big shareholder was favorable to the growth of a company's value. Himmelberg et al. (1999) argued that the empirical findings might be the result of unobservable firm heterogeneity, which might affect both ownership concentration and performance. These unobserved exogenous firm characteristics might induce a spurious relationship between Tobin's Q and ownership concentration. They found no relation between these two variables after estimating firm fixed effects. Loderer and Martin (1997) and Demsetz and Villalonga (2001) found no influence of ownership concentration on performance for U.S. firms. Their finding is consistent with the view that while exacerbating some agency problems, diffuse ownership also yields compensating advantages that generally offset such problems. On the other hand, Morck et al. (1988) and Hiraki et al. (2003) for Japanese firms, and Gorton and Schmid (2000) for German companies, found a positive relation between ownership concentration and firm value.

In addition to studies on developed countries, most of the studies for developing countries found a positive relation between ownership concentration and performance. Claesses and Djankov (1999) examined Czech companies and argued that the more concentrated the ownership, the higher the firm's profitability; this finding signified the same positive relation as indicated in studies on Czech firms by Claessens (1997) and Weiss and Nikitin (1998). However, their findings were ambiguous when the type of ownership was taken as the control variable. Similar to their previous study in 1997, Xu and Wang (1999) examined Chinese listed firms and found a positive correlation between the shareholding ratio of the first five and ten big shareholders and performance. Sun et al. (2002) proved that relatively bigger holding companies and other big shareholders which had a certain concentration degree could help improve the performance of Chinese firms. Barberis et al. (1996) also found a positive relation for Russian firms. Joh (2003), who examined Korean firms, found that after controlling

<sup>1</sup> It is likely that managers may place personal goals ahead of corporate goals (Gitman, 2006: 20).

<sup>2</sup> The costs borne by stockholders to maintain a governance structure that minimizes agency problems and contributes to the maximization of owner wealth (Gitman, 2006: 20).



firm and industry characteristics, firms with low ownership concentration recorded low profitability. Yammeesri et al. (2006) examined Thai non-financial firms, and as the literature proved previously, found a positive association between concentrated ownership and performance. Similarly, Omran et al. (2008), in their studies on a group of Arab countries (Egypt, Jordan, Oman, Tunisia), found that ownership concentration was positively correlated with various performance measures, and that large-size firms were more likely to achieve better performance. However, parallel to the findings of Demsetz and Lehn (1985), and Himmelberg et al. (1999), Chen et al. (2005) found for Hong Kong firms that concentrated ownership was not associated with better operating performance or higher firm valuation. Comparably, Gunasekarage et al. (2007) proved that ownership concentration is negatively related to firm performance in China when market-to-book ratio is used as a performance indicator. Gursoy and Aydogan (2002) examined the impact of ownership concentration and ownership mix on firm performance of Turkish non-financial firms between 1992 and 1998 and found that higher concentration led to better market performance but lower accounting performance. They used price-to-earnings ratio and stock returns to measure market performance.

There are many studies with contending results on the relationship between managerial ownership and performance. Among them, Jensen and Meckling (1976) stated that when managerial ownership increased, conflict would decrease and performance would increase. In contrast, Fama and Jensen (1983) and Stulz (1988) argued that greater stock ownership by managers increased the power of the internal owners and decreased the power of the external owners in terms of influencing performance. Morck et al. (1988) found a significant non-monotonic relationship between Tobin's Q and board member ownership. Accordingly, the relation increases between 0% and 5%, decreases between 5% and 25%, and increases beyond 25%. Their outcomes were also significant when some control variables such as R&D and advertising ratios, leverage, size, growth and industry dummies were included in models. However, they were not significant when accounting profit rates were used as an alternative performance measure. Similar to the study of Morck et al. (1988), McConnel and Servaes (1990), Hermalin and Weisbach (1991), Cho (1998) and most recently Florackis et al. (2009) found a positive relation for low levels of

ownership and a negative relation for high levels of ownership. Yet, unlike Morck et al. (1988), McConnel and Servaes (1990) found that this relationship was also significant when they used accounting profits instead of Tobin's Q. In contrast to other studies, Florackis et al. (2009) found a negative relationship by using a semi-parametric estimation approach. As in Morck et al. (1988), Holderness et al. (1999) found a significant positive relation between firm performance and managerial ownership within the 0% to 5% range of managerial shareholdings; but in contrast to Morck et al. (1988), they did not find a statistically significant relation beyond 5%. Demsetz and Lehn (1985), Loderer and Martin (1997), and Himmelberg et al. (1999) as well as Demsetz and Villalonga (2001) did not find a significant relation between managerial ownership and performance. Most of those studies examined the association between insider ownership and performance account for the endogeneity of ownership structure except Morck et al. (1988) and McConnel and Servaes (1990). Demsetz and Villalonga (2001) examined US firms and their evidence supported the belief that ownership structure was endogenous but belied the belief that ownership structure affected firm performance. They argued that if there were compensating advantages in a firm, there would be no systematic relation between managerial shareholdings and firm performance. In addition, they argued that it might indicate that this relationship depends on location, special local laws and governance practices. There is no study which examines the relationship between managerial ownership and the performance of Turkish firms.

As can be seen from the above, the empirical results on the effects of managerial ownership and ownership concentration on firm performance are conflicting. In addition, the previous studies focused mostly on large industrialized countries, which completed their institutionalization process; therefore, their outcomes might not be relevant for developing countries. In this study, we try to fill this gap by examining this issue for a developing country, namely Turkey.

### *3. Data and Summary Statistics*

Our sample includes all non-financial firms listed on the ISE in the year 2005. The number of firms in our sample is 203. We excluded banks and leasing, investment, insurance and holding companies since their financial tables are different from non-financial firms. We

collected data on market values of the sample firms from the Monthly (December) Bulletins of the ISE. We used annual company reports issued by the ISE to obtain data on ownership structure (ownership concentration, managerial ownership, etc.). We obtained the remaining data by using the balance sheets and income statements from the ISE's website.

In line with previous studies (such as Morck et al., 1988; McConnel and Servaes, 1990 and etc.), we also focused on one year of data by taking into consideration the fact that the ownership structure of the firm does not vary frequently. In addition, the International Financial Reporting Standards have been applied in Turkey since the beginning of 2005. The firms are required to incorporate the new standards and to prepare more detailed annual reports which provide more data to finance researchers and consequently facilitate the analysis of firms' ownership structures. Hence, this study takes 2005 to be the starting line.

Table 1 depicts the number of the different types of shareholders of the present study's sample firms operating in different industries. According to this table, individuals and families, unlisted holding companies and unlisted non-financial firms pre-dominate the ownership positions in the sample firms. Furthermore, this

predominance is mostly seen in the textile industry. Additionally, most of the shareholders are foreign companies in the food industry, listed holding companies in the metal products industry and listed non-financial firms in the stone and soil industry. The ownership positions of the state, foundations and labor unions are very low compared to other parties.

Table 2 denotes the average percentage of shares held by the owners of the sample firms in different industries. The highest average percentage of shares is held by unlisted holding companies, which supports the belief that individuals or families establish the holding companies in order to control their listed firms. It is followed by the unlisted non-financial firms and individuals and families respectively.

Table 3 depicts the proportion of shares held by the Board members and managers as well as their relatives. In Turkey it is often observed that the family members are the CEOs, Boards of Directors or top managers of the firms. As a result, management control is in the hands of these family members (see Yurtoğlu, 1998 and Demirağ and Serter, 2003). Table 3 denotes that CEOs, Boards of directors and top managers have almost 8.38% of shares outstanding. And their relatives have almost 3% of the outstanding shares. Board members and general

Industries	Individual	Holding Comp. (listed)	Holding Comp. (unlisted)	Non-financial (listed)	Non-financial (unlisted)	Financial (listed)	Financial (unlisted)	Foreign	State	Foundations/ Retirement Funds	Labor Unions
Food	14	3	9	1	10	-	-	9	1	1	1
Textile	31	4	14	4	15	3	1	1	-	-	1
Wood and Paper	9	4	10	4	7	-	-	4	1	1	-
Chemical	7	3	8	1	9	-	-	5	1	5	1
Stone and Soil	7	6	5	6	10	2	3	6	3	7	1
Metal Main	7	3	5	1	3	-	1	1	2	1	1
Metal Products	13	9	13	1	10	-	-	8	1	1	-
Other Manufacturing Firms	1	-	2	-	-	-	-	1	-	-	-
Technology	4	-	2	-	-	-	-	3	1	1	-
Education, Sport and Health	3	-	-	-	4	-	-	1	-	-	1
Telecommunication	2	-	2	-	1	1	1	2	1	-	-
Wholesale and Retail	10	5	6	2	8	-	-	2	-	1	-
Electricity and Construction	4	-	2	2	5	1	1	2	-	1	-
<b>Total</b>	<b>112</b>	<b>37</b>	<b>78</b>	<b>22</b>	<b>82</b>	<b>7</b>	<b>7</b>	<b>45</b>	<b>11</b>	<b>19</b>	<b>6</b>

**Table 1:** The Number and Types of Shareholders of Non-financial Firms in Different Industries (Year 2005)

Industry	Number of Firms	Ind/Family	Holding			Non-financial firm			Financial Firm			Foreign	State	Foundations retirement funds	Labor unions/ Cooperatives
			Listed	Unlisted	Total	Listed	Unlisted	Total	Listed	Unlisted	Total				
Food	24	14.56	3.81	9.40	13.21	0.38	10.25	10.64	0.00	0.00	0.00	18.35	0.99	3.22	0.01
Textile	35	29.06	3.39	15.54	18.93	2.85	9.84	12.69	3.36	0.22	3.58	2.46	0.00	0.00	0.23
Wood and Paper	17	6.98	13.19	19.96	33.15	11.23	9.07	20.30	0.00	0.00	0.00	7.64	2.28	0.05	0.00
Chemical	22	6.74	7.45	19.27	26.72	3.65	10.87	14.52	0.00	0.00	0.00	11.44	2.36	2.87	3.65
Stone and Soil	26	8.03	7.98	6.71	14.69	12.77	7.38	20.15	0.37	2.95	3.32	14.42	0.66	8.62	0.01
Metal Main	13	5.95	11.21	20.11	31.32	4.41	9.63	14.04	0.00	0.24	0.24	0.40	1.32	0.10	1.62
Metal Products	25	5.97	14.04	24.20	38.23	0.89	8.94	9.83	0.00	0.00	0.00	15.72	0.01	0.18	0.00
Other Manufacturing Firms	3	9.44	0.00	31.73	31.73	0.00	0.00	0.00	0.00	0.00	0.00	5.13	0.00	0.00	0.00
Technology	8	24.77	0.00	13.66	13.66	0.00	0.00	0.00	0.00	0.00	0.00	19.21	10.57	1.88	0.00
Education, Sport and Health	6	15.58	0.00	0.00	0.00	0.00	54.81	54.81	0.00	0.00	0.00	2.36	0.00	0.00	0.00
Telecommunication	4	7.73	0.00	28.77	28.77	0.00	0.00	0.00	0.00	0.02	0.02	19.54	18.80	0.00	0.00
Wholesale and Retail	15	16.63	7.68	12.32	20.00	4.74	12.07	16.81	0.00	0.00	0.00	9.30	0.00	0.00	0.00
Electricity and Construction	5	10.78	0.00	14.25	14.25	6.76	27.64	34.40	5.08	0.22	5.30	2.27	0.00	1.24	0.00
<b>Average</b>		<b>13.53</b>	<b>7.07</b>	<b>15.64</b>	<b>22.71</b>	<b>4.43</b>	<b>10.60</b>	<b>15.02</b>	<b>0.75</b>	<b>0.44</b>	<b>1.19</b>	<b>10.40</b>	<b>1.49</b>	<b>1.92</b>	<b>0.54</b>

**Table 2:** Ownership Structure of Non- financial Firms in Different Industries (in %, Year 2005)

managers have a considerable share in the technology industry (24.05 percent). The average of openness-to-public is 33 percent within sample firms.

Table 4 gives the percentage of shares owned by the largest three, five and ten shareholders for the sample firms in different industries. It shows that the largest shareholder has around 48 percent of shares, which indicates that one person or an institution has almost half of a listed company. The averages for the largest three, five and ten are 61.27; 64.20 and 65.93 respectively. Moreover, the highest ownership concentration is in *education, sport and health* industry for the largest shareholder and in the telecommunication industry for the largest three, five and ten shareholders.

Industry	Share of Board Members and General Manager	Share of Family Members	Open-to-Public (%)
Food	9.70	1.70	38.16
Textile	15.87	7.76	33.35
Wood and Paper	4.54	3.16	29.65
Chemical	2.79	0.92	31.89
Stone and Soil	4.87	2.36	30.11
Metal Main	2.06	2.95	44.78
Metal Products	4.22	0.56	30.77
Other Manufacturing Firms	9.44	0	53.69
Technology	24.06	0.40	30.06
Education, Sport and Health	12.71	1.80	27.25
Telecommunication	7.73	0	25.15
Wholesale and Retail	11.35	3.38	37.21
Electricity and Construction	4.63	0.19	31.77
<b>Average</b>	<b>8.38</b>	<b>3.05</b>	<b>33.48</b>

**Table 3:** Managerial Ownership in Non-financial firms (in %, Year 2005)

Industry	Ownership Concentration			
	Top 1 Shareholder	Top 3 Shareholders	Top 5 Shareholders	Top 10 Shareholders
Food	40.48	56.75	58.57	59.77
Textile	38.00	54.76	60.25	65.74
Wood and Paper	49.20	65.19	67.96	69.87
Chemical	52.98	66.37	68.05	68.28
Stone and Soil	53.06	65.39	68.69	69.56
Metal Main	47.33	53.10	54.10	55.03
Metal Products	52.87	66.32	67.88	68.62
Other Manufacturing Firms	38.04	46.31	46.31	46.31
Technology	54.28	68.17	70.08	70.08
Education, Sport and Health	63.43	69.16	72.43	72.90
Telecommunication	59.01	69.35	74.39	80.63
Wholesale and Retail	42.12	60.46	62.20	62.47
Electricity and Construction	36.43	55.23	63.75	67.83
<b>Average</b>	<b>48.25</b>	<b>61.27</b>	<b>64.20</b>	<b>65.93</b>

**Table 4:** The Ownership Concentration Rates for Non-financial Firms (in %, Year 2005)

We used two measures of performance as dependent variables, Return on Assets (ROA) and Tobin's Q ratios, where the former measures profitability and the latter the value of the firm. We used two independent variables, the percentage of shares held by the largest three shareholders and the percentage of shares held by the managers. We observed that the studies on Turkish firms (such as Gursoy and Aydogan, 2002 and Demirağ and Serter, 2003) prefer using the share of the largest three shareholders to measure ownership concentration. Depending on these previous studies as well as our outcomes about the concentration rates presented in

Table 4, we used the percentage of shares held by the largest three shareholders to measure ownership concentration. Our control variables are the investment intensity, leverage, growth and size which are assumed to have an effect on firm performance. In addition to these we employ industry dummy variables in order to point out whether the performance measures differ across industries. The study's variables and their definitions are presented in Table 5.

Dependent Variables	Definition
TOBIN'S Q	Market value of assets (total debt plus market value of equity)/ total assets
ROA	Net Income/Total Assets
Independent Variables	
CON3	Total share of the largest three shareholders in the firm
OWNER	Managerial Ownership: Percentage of Shares Owned by the managers
Control Variables	
CAPEXP	Capital Expenditures/Sales (investment intensity)
DEBTTA	Total Debt/Total Equity (Leverage)
GROWTH	Average growth in net sales over three-year period (2003-2005)
SIZE	Logarithm of total assets
INDUSTRY DUMMIES	Education-health; electricity; food-beverage; chemical-petroleum-plastic; metal products-machinery; wood-paper-printing; non-metal mineral products; technology; textile-leather; wholesale and retail trade; transportation.

**Table 5:** Variables and Definitions

	ROA	TOBIN'S Q	CAPEXP	DEBTTA	GROWTH
Mean	0.054	1.435	0.084	0.245	0.117
Maximum	0.592	5.842	3.602	0.775	2.451
Minimum	-0.388	0.360	-8.408	0.0001	-0.620
Std. Dev.	0.118	0.791	0.816	0.179	0.353

**Table 6:** Descriptive Statistics

	ROA	CON3	OWNER	CAPEXP	DEBTTA	GROWTH	SIZE
ROA	1						
CON3	0.223	1					
OWNER	0.083	-0.222	1				
CAPEXP	0.081	-0.077	-0.048	1			
DEBTTA	-0.277	-0.1624	0.094	0.030	1		
GROWTH	0.281	0.005	-0.095	0.108	-0.043	1	
SIZE	0.177	0.119	-0.163	-0.038	0.133	0.035	1

\*\*\*, \*\*, \* indicate 1 %, 5 % and 10 % significance.

**Table 7A.** Correlation Matrix (between ROA and independent variables)

	TOBINSQ	CON3	OWNER	CAPEXP	DEBTTA	GROWTH	SIZE
TOBINSQ	1						
CON3	0.161	1					
OWNER	-0.085	-0.212	1				
CAPEXP	0.108	-0.076	-0.050	1			
DEBTTA	-0.364	-0.142	0.059	0.028	1		
GROWTH	0.180	0.003	-0.089	0.108	-0.028	1	
SIZE	-0.126	0.215	-0.302	-0.055	-0.046	0.083	1

\*\*\*, \*\*, \* indicate 1 %, 5 % and 10 % significance.

**Table 7B.** Correlation Matrix (between Tobins Q and independent variables)

The descriptive statistics for variables are presented in Table 6. For the year 2005, the average ROA was 0.05 while the highest ROA was 0.59. Mean of Debt-to-Total Assets indicates that Turkish companies prefer financing their companies with capital instead of debt. The highest standard deviation belongs to capital expenditures and Tobin's Q, showing the highest variance among companies.

Tables 7 A and B show the correlation matrix for each dependent variable. The correlation coefficients among independent variables are low. Additionally, correlation coefficients between independent and dependent variables are consistent with the direction of the relation and coefficients found in the regressions analysis.

#### 4. Methodology and Empirical Results

We applied multiple regression analysis to measure the effects of ownership concentration and managerial ownership on firm performance. We developed two different groups of hypotheses on the relationship of

ownership concentration and managerial ownership with firm performance. In parallel to most of the previous studies on developing countries, we expected a positive relationship between ownership concentration and firm performance. Since the ownership concentration is high in Turkey, the shareholder can easily control the managers and force them to focus on the maximization of the shareholders' wealth. Agency theory suggests that when the managerial ownership increases, the conflict of interest between the managers and owners will decrease and firm performance will increase. Although most of the previous studies did not observe a relation between managerial ownership and firm performance, in line with the theory, we expected a positive relationship between them. The hypotheses of the study are stated below;

H1<sub>0</sub>. The ownership concentration is not significantly related to firm performance.

H1<sub>1</sub>. The ownership concentration is positively correlated to firm performance.

H2<sub>0</sub>. The level of managerial ownership is not significantly related to firm performance.

H2<sub>1</sub>. The level of managerial ownership is positively correlated to firm performance.

Different models were constructed to explore the effects of the independent variables. In models where the ROA and TOBINSQ are the dependent variables, first all variables other than industry dummies were included in the analysis, and then the industry dummies were included to investigate the industry effects on firm value and profitability. The four models of the study are presented below.

Model 1:

$$ROA_i = \beta_0 + \beta_1 CON3_i + \beta_2 OWNER_i + \beta_4 CAPEXP_i + \beta_5 DEBTTA_i + \beta_6 GROWTH_i + \beta_7 SIZE_i + \varepsilon_i$$

Model 2:

$$ROA_i = \beta_0 + \beta_1 CON3_i + \beta_2 OWNER_i + \beta_4 CAPEXP_i + \beta_5 DEBTTA_i + \beta_6 GROWTH_i + \beta_7 SIZE_i + D_i + \varepsilon_i$$

Model 3:

$$TOBINSQ_i = \beta_0 + \beta_1 CON3_i + \beta_2 OWNER_i + \beta_4 CAPEXP_i + \beta_5 DEBTTA_i + \beta_6 GROWTH_i + \beta_7 SIZE_i + \varepsilon_i$$

Model 4:

$$TOBINSQ_i = \beta_0 + \beta_1 CON3_i + \beta_2 OWNER_i + \beta_4 CAPEXP_i + \beta_5 DEBTTA_i + \beta_6 GROWTH_i + \beta_7 SIZE_i + D_i + \varepsilon_i$$

Table 7 presents the regression results for ROA and Tobin's Q. In Models 1 and 2, we used ROA as a measure of profitability and found a significant positive effect among the largest three shareholders on firm profitability in the models in which the dummies were excluded. Debt-to-total assets and growth variables also had significant effects in all models. Additionally, the dummy for the education industry has a significant effect, but managerial ownership and capital expenditures did not have an effect on profitability. When we added the dummy variables in the model, the adjusted R<sup>2</sup> increased to 0.276 from 0.182.

In Models 3 and 4, we used Tobin's Q as an indicator of firm value and found that the largest three shareholders had a significant positive effect, and that managerial ownership had a significant negative effect on firm value. When we included the dummy variables, we did not find a significant relationship between managerial ownership and firm value. In addition, Debt-to-total assets and size variables were the other factors that affected firm value negatively. Capital expenditure and growth did not have a significant effect on firm value. The model with dummy variables of industries pointed out the significant effects

of education, food and beverage and wholesale industries on firm performance. After we included the industry dummies, the adjusted R<sup>2</sup> increased to 0.34 from 0.18.

The positive relationship between ownership concentration and performance supports the study of Shleifer and Vishny (1997) who state that since investor protection is low in developing countries, ownership concentration is accepted as an alternative corporate governance tool in these countries. Our findings are also parallel to previous studies on developing countries such as Barberis et al. (1996), Claesses and Djankov (1999), Joh (2002), Yammeesri et al. (2006). However, our result on

the relationship between the ownership concentration and profitability is the opposite of that of Gursoy and Aydogan (2002) which found a negative relationship between ownership concentration and profitability. The findings on the effects of managerial ownership are much more conflicted in the literature. Our finding does not support the agency theory. The negative relation between managerial ownership and firm value might be explained by Demsetz (1983), who argued that too much managerial ownership could potentially lead managers to worry more about their own interests, and not those of outside shareholders, hence decreasing firm value.

## 5. Concluding Comments

The empirical results on the effects of managerial ownership and ownership concentration on firm performance are conflicting. Previous studies focused mostly on large industrialized countries, which completed their institutionalization process and therefore, their outcomes might not be relevant for developing countries. In this study, we try to fill this gap by examining the effects of ownership concentration and managerial



Regressor	ROA		TOBINSQ	
	Model 1	Model 2	Model 3	Model 4
CON3	0.001 1.976**	0.001 (1.546)	0.006 1.656*	0.007 (2.056)**
OWNER	0.0002 0.469	-0.0002 (-0.464)	-0.003 -0.844	-0.007 (-2.091)**
CAPEXP	0.011 1.006	0.011 (1.053)	0.082 1.126	0.067 (1.019)
DEBTTA	-0.169 -3.194***	-0.121 (-1.986)**	-1.504 -4.074***	-1.003 (-2.535)**
GROWTH	0.080 3.086***	0.067 (2.471)**	0.352 1.991**	0.285 (1.613)
SIZE	0.037 2.284**	0.034 (1.930)*	-0.320 -2.288**	-0.400 (-2.833)***
Education-Health		0.158 (2.304)**		2.214 (4.977)***
Electricity		-0.089 (-1.528)		0.208 (0.544)
Food-Beverage		-0.004 (-0.089)		0.617 (2.099)**
Chemical-Petroleum-Plastics		0.026 (0.527)		0.319 (1.005)
Metal Products-Machinery		0.004 (0.106)		0.059 (0.205)
Wood-Paper-Printing		-0.037 (-0.824)		0.103 (0.351)
Non-Metal Products		0.044 (0.973)		0.475 (1.609)
Technology		0.093 (1.286)		0.543 (1.158)
Textile-Leather		-0.037 (-0.937)		0.119 (0.463)
Wholesale And Retail Trade		0.012 (0.257)		0.541 (1.731)*
Transportation		0.111 (1.411)		0.541 (0.799)
C	-0.281 -2.145**	-0.248 (-1.770)*	4.043 3.522***	4.257 (3.742)***
Adjusted R2	0.182	0.276	0.180	0.341

\*\*\*, \*\*, \* indicate 1 %, 5 % and 10 % significance.


**Table 7:** Regression Results

ownership on the performance of Turkish firms listed on the ISE in the context of a developing country. We measured firm performance by ROA (Return on Assets) and Tobin's Q, where the former measures profitability and the latter firm value. We tried to test the relationships between these performance measures and the percentage of shares owned by the largest three shareholders, and the percentage of shares held by board members and general managers. In addition to these independent variables, we used control variables including investment intensity, leverage, growth and size

and industry dummies, which are assumed to have an effect on firm performance.

In addition, we analyzed the ownership structure of the sample firms and found that the highest average percentage of shares was held by the unlisted holding companies, unlisted non-financial firms and individuals and families, respectively, which confirms the widespread belief that in Turkey individuals or families set up their unlisted firms in order to control their listed companies. Supporting the studies of Gursay and Aydogan (2002) and Gönenç (2004), we found that the ownership of Turkish firms is highly concentrated. Our regression results show that ownership concentration has a significant positive effect on both firm value and profitability. This result may support the idea of Schleifer and Vishny (1997) who state that since investor protection is low in developing countries, ownership concentration is accepted as an alternative corporate governance mechanism in these countries. On the other hand, in contrast to the agency theory, we found a negative relation between managerial ownership and firm value, which might support the argument of Demsetz, who states that too much managerial

ownership could potentially lead managers to worry more about their own interests and decrease firm value. The finding does not support the idea of Jensen and Meckling (1976), who argue that as managerial ownership increases, the conflict between the managers and owners will decrease and performance will increase. The results of the study suggest that Turkish firms can increase their performance by increasing their ownership concentration and by decreasing managerial ownership.

We believe, despite the uniqueness of the results, that this study proves that the subject deserves greater attention and more detailed analysis. We did not add other agency variables such as the number of independent directors, board composition, etc., since the full data is not available in annual reports. Future studies might collect this data by directly contacting the firms. In addition, future studies might include financial firms and holding companies. 

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# The Cost of Equity Capital on Developing Equity Markets: Estimations for Selected Slovene Companies

Igor Stubelj \*

## Abstract:

***The article sheds light on the estimation of the cost of equity capital on a developing equity market. The cost of equity is important; it is crucial in capital budgeting decisions and performance evaluation. It determines the minimum yield the investors require on the invested capital and we use it as a discount rate to calculate the present value of the expected free cash flows to equity. The aim of this paper is to tackle the estimation of the cost of equity capital on developing markets with the example of estimation for ten Slovene publicly traded companies. The estimated cost of capital for the selected Slovene companies is between 9,7% and 13,7%.***

**Keywords:** cost of equity capital, CAPM, return, risk

**JEL:** G12, G31, G32

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## 1. Introduction

The cost of equity capital is important; it determines the minimum yield investors require on invested capital. We use the cost of equity to discount to present value the expected cash flows that belong to equity investors. We use the cost of equity capital to estimate the residual income of a company; i.e. the added value that belongs to the equity investors (Stubelj at al. 2009). The yield at the level of the cost of capital is not an added value for a company; it is a cost. It is the investors' capital investment repayment for the lost opportunities and the risk.

The equity capital does not "work" for free. We must pay a certain price to its owners. It is a scarce good. In aggregate it is limited to the amount that people in the whole world are willing to save (invest). The task of earning the cost of capital is not a question of company financing, as many managers believe. To earn the cost of capital is the market mandate (Stewart 1999).

In the oft-cited publication *Stocks, Bonds, Bills, and Inflation*, Ibbotson and Sinquefeld wrote: "Estimating the cost of capital is one of the most important and difficult tasks performed by financial analysts. There is no clear consensus on the best way to approach this problem.

Because of the impact that the cost of capital can have on valuation and financial decision making, the analyst should typically use at least two methods to derive the cost of equity" (Ibbotson Associates 1997, in Borgman and Strong, 2006, p. 7).

The cost of equity capital estimation is especially problematic and difficult on developing markets. Most of the models, CAPM included, are based on historical data. In developing financial markets (like the Slovenian) there is a short time series of usable data. Estimation with some models used for developed financial markets is impossible.

The purpose of this paper is to summarize the theory, present relevant research in the field, and present the available methods for cost of equity capital estimation and their suitability for use on developing capital markets. The aim is to tackle the estimation of the cost of

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equity capital on developing markets with the example of estimations for ten publicly traded Slovene companies.

The paper is organized as follows. After the introduction the theoretical background of equity capital estimation is presented. In addition, we explain the estimation's methodology and the results. Finally, we present conclusions.

## 2. Theoretical Background

A primary division of equity capital is into common and preferred, which means that companies can get equity capital with the issue of either common or preference shares. Companies can raise common equity also by retaining earnings. If a company raises equity by issuing new shares it must also cover the issue costs, which represent an additional cost the company must earn. For this and other reasons few mature firms issue new shares (see Brigham and Ehrhardt 2005, p. 311).

The equity raised by retained earnings also bears a cost; it is not costless. It is the opportunity cost of the investor who can get dividends from his part of the net income and invest the capital somewhere else. The investor expects a relevant risk adjusted return or the return of an investment which bears comparative risk.

The cost of preferred equity is simple to calculate when the market price is known because of fixed obligations (fixed dividends). A difficult task is the estimation of the cost of common equity. Many models and techniques have been developed to estimate the cost of equity capital, such as: the Capital Asset Pricing Model (CAPM) (Black 1972, Lintner 1965, Ross 1976, Sharpe 1964), the Fama and French Three Factor Model (Koller e.a. 2005, Estrada 2005), the Arbitrage Pricing Theory, among others. Mishra and O'Brien (2004) have studied the empirical perspective on the issue of global investors' cost of capital for an emerging market investment.

### 2.1. The Estimation of the Cost of Common Equity Capital with the CAPM (Capital Asset Pricing Model)

The CAPM states that the required return for investors is the sum of the risk-free rate and the market risk premium, multiplied by beta. Beta defines the risk contribution of the added stock to a well diversified portfolio. The CAPM supposes that all investors hold a combination of a risk-free investment and a well diversified (market) portfolio. In such case they reach a maximum return with a minimum risk. The proportion of

the diversified portfolio and risk-free investment an individual holds depends on his risk inclination (aversion). The CAPM is based on strong assumptions. Despite the critics, it is the most favored and widely used method for the cost of equity capital estimation (see Bruner et al. 1998, Graham and Harvey 2001, Brigham and Ehrhardt 2005). Interesting results were yielded in a study Gunnlaugsson (2006) made on the validity of the CAPM on the small Icelandic stock market. They indicate that the CAPM has worked well in the small Icelandic stock market and that it, or the beta coefficient, does explain returns better than on larger foreign stock markets. A strong relationship between the beta and stock returns was found in the research. Further, the stock returns with high betas were higher than one would expect, according to the CAPM. The limitations of the research are that it was tested on small number of shares (27) and a short time series of data was used. McNulty et al. (2002) found three central shortcomings of the CAPM: a) the validity of beta, b) the reliance of historical data and c) the indifference of holding period (Zellweger 2007, p. 1).

The primary conclusion of the CAPM (Eq.1) is that the relevant risk of an individual stock is its contribution to the risk of a well diversified portfolio. The CAPM is calculated as follows:

$$r_i = r_f + \beta \cdot (r_m - r_f), \quad (1)$$

where  $r_i$  is required rate of return on investment,  $r_f$  is risk-free rate of return,  $\beta$  is measure of the market risk,  $r_m$  is market rate of return,  $(r_m - r_f)$  is market risk premium.

A lot of models used in finance use a risk-free investment which bears a known risk-free rate of return as a base. The first step is the estimation of the risk-free rate of return. When we estimate the risk investment we expect a risk-free rate of return and an extra return for bearing the risk. Consequently, the first problem to deal with is the evaluation of the risk-free rate of return. The question is which asset is risk-free. Every asset has a life period in which it must earn an expected return. With the increasing probability that the return of the asset in its life period will be different from that expected the risk increases. In finance we define the risk as a deviation of the actual from the expected return. In financial circles we call investments risk-free when the actual return is equal to the expected return. The probability of default must be equal to zero and reinvestment must always be possible.

When we estimate a cost of capital and when we determine a risk-free rate we must pay attention to the life period of the asset. The equity capital invested in a

firm has an unlimited life. So, it is recommended to use an asset with a long life as a risk-free investment. A good approximation of a risk-free investment can be a long-term government bond. We must be careful that the bond we use (usually a 10 to 30 year to maturity bond) is liquid. In this case its yield can be a good approximation of a risk-free rate for current market conditions.

In special cases we can use the government bond of a developed equity capital market. In such a case we must consider different inflation rates in different countries. The inflation indexed bond has solved this problem. We add the expected country inflation to the real bond yield and this represents a risk-free rate of return.

The next step is the estimation of the market risk premium. In their study, Ferson and Locke found that the estimation of the market risk premium is much more important than the estimation of the beta coefficient (Ferson and Locke 1998). Bigger errors in the cost of capital estimations are the outcome of the errors in the estimation of the market premiums. This means that the analysts must improve the methods of market risk premium estimation, which is based on historical data. Bartholdy and Peare found out that we must use the same approximation for the market portfolio when we estimate the market risk premium and the beta. Using different approximations most likely yields a biased estimate (Bartholdy and Peare 2000).

The market risk premium is mathematically expressed as the difference between the market and the risk-free return. We have different options to evaluate the market risk premium: (1) from the expectations of different investors or from an expert's recommendations, (2) from historical data (past returns), (3) from the expected returns, which is the forward looking market risk premium.

Because every investor has his own expectation about the adequate market risk premium, we can calculate a market risk premium as a weighted average of the different investors' expected premiums. This method is rarely used in practice; estimated premiums are very volatile and short-term (Damodaran 2006, p. 38).

In case the investors' risk aversion did not change significantly in the past we can say that the historical risk premium is a good proxy for the expected risk premium. We calculate the historical risk premium from a long-term series of assets' (stocks and bonds) historical returns. The market risk premium is calculated as the difference of the average of stocks and risk-free bonds' annual returns for long-term periods. For some developed markets we have

historical data of returns for eighty or more years. The time period used is important. Some experts advocate shorter time periods with the argument that the risk premium scientifically changes in time. Using a shorter period of time we obtain a more realistic estimation. On the other hand, shortening the time series increases the sample standard error. The differences in errors are so big that the use of shorter periods is not reasonable (Damodaran 2006, p. 39). This is proved by the research of Koller et al. (2005). From the data of the last 100 years they did not find statistically significant trends in market risk premium changes. The premium was very volatile; it reached 18% in the fifties and 0% in the seventies. In absence of trends and because of the intense volatility of the premium it is recommended to the longest periods possible.

The calculation of historical risk premiums is limited to financial markets with a long history of data. For developing financial markets the time-series of past returns is too short to calculate market risk premiums.

It is possible to estimate the risk premium without using past data with the Gordon Growth Model for the valuation of shares. This is the implied equity premium or forward-looking risk premium. The method is based on a presumption that the entire market is properly valued. Fama and French (2002) have studied net incomes and dividends' growth rates on the American financial market between the years 1951 and 2000. They estimated a 2,55% future risk premium.

The question is which is the proper market risk premium for the Slovene market? It is certainly higher than for a mature equity market; the Slovene equity market is a developing market. The liquidity of stocks rose in the last years in Slovenia, but is still low in comparison with developed financial markets, if we compare the turnover of the market capitalization for more liquid stocks. The market capitalization of the three biggest companies represents 50% of the entire market capitalization of shares which trade on the Ljubljana stock exchange, measured on 5th April 2007 (Stubelj 2009). The Slovene equity capital market is relatively inefficient, similar to other segments of the Slovene financial market (Dolenc 2007), and has been mostly driven (at least at its beginning) by privatization transactions (Dolenc 2006).

### *The estimation of beta from historical data*

The conclusion of the CAPM is that the only relevant risk of an individual stock is its contribution to the risk of a



well-diversified portfolio. We measure the risk contribution of an individual stock to a well-diversified portfolio with the beta coefficient. For a market portfolio  $\beta=1$ . An investment with  $\beta=1$  is of average risk, with  $\beta<1$  less risky and with  $\beta>1$  more risky than an investment of average risk. We define beta with the following equation.

$$\beta = \frac{Cov_{i,m}}{\sigma_m^2}, \quad (2)$$

where  $Cov_{i,m}$  is covariance between returns of the investment and a market portfolio,  $\sigma_m^2$  is variance of returns of a market portfolio.

We usually calculate beta using linear regression. Beta is a slope in the linear regression equation where the dependent variable is the past returns of an individual investment and the independent variable is the past returns (a proxy) of a market portfolio. Different financial institutions such as Thomson Financial, Bloomberg and Yahoo calculate betas with slightly different methods and their betas for the same shares are different. Analytics usually use 4 to 5 years of monthly returns, while some prefer 52 weeks of weekly returns (Brigham and Ehrhardt 2005, p. 153). Robert Merton (1980) in his research proved that the use of shorter periods of returns improves the results. But the Merton theory is illusive. The use of daily or weekly returns is problematic when the trading of a share is not frequent. In a period of no trading the illiquid share will have a return equal to zero. But this doesn't mean that the price of the share is stable. The more frequent the periods of non-trading, the more the value of beta is biased and pushed downward. It is recommended to use monthly returns (Koller et al. 2005, p. 309). For use of beta in the CAPM model we suppose that the future beta will be equal to the calculated past beta. Other methods for beta evaluation are: fundamental betas, accountant betas, industrial betas and valuation with the combination of these models. For the explanation of these models see Damodaran (2006). Because of the short history of data and the small number of comparable companies most often these methods are either impossible or difficult to use in developing equity markets.

An interesting method is the beta estimation method, developed and issued by Borgman and Strong (2006). They have used a combination of the CAPM and Gordon dividend growth model. Evaluated betas using this method are useful for fast changing industries where past performance is not a good proxy for the future. The model developed by Borgman and Strong is based on the

presumption that due to market competition we can affirm that companies in the long run will have net incomes on the level of capital costs. This means that the expected return in the long run will be equal to the return on equity capital ROE. Here the problem is the evaluation of the growth rate of dividends. The authors have used the expected growth rate from the Value Line database. This is the growth rate forecasted from financial analytics. For most developed markets forecasted growth rates didn't exist and this is an obstacle to the use of this model. For the estimation of beta some financial institutions, Bloomberg for example, use smoothing. These are corrected betas and are pushed toward 1. The aim of smoothing is to reduce the estimation error.

## 2.2. The Evaluation of the Cost of Equity Capital with the Expected Discounted Equity Cash Flows

We start with the dividend-Gordon Growth Model to calculate the equity capital required rate of return. This holds on presumption that the market is in balance. In this case the expected return is equal to the investors' required return of equity capital (Brigham and Ehrhardt 2005, p. 317).

For this calculation we need three input variables: the current stock price, the current dividend, and the expected growth rate, which is difficult to evaluate. When the growth of the company was stable in the past it is possible to suppose the same trend for the future. In practice we seldom find stable past growth and we must be very careful with such estimation. We can estimate the future growth rate with the retained earnings model. The future growth of dividends is the product of ROE and the share of retained earnings. For the future growth of dividends we can consider the financial institutions' estimations. In some databases we can find analyses for bigger companies around the world and American corporations. Different studies show that the specialists' forecasts are a good evaluation of future growth (Harris 1986, p. 66).

When we expect that the future growth rate will change in the future we can evaluate the expected cost of equity capital with a two or multi-stage model. This especially holds for fast growth companies for which we expect that the growth will diminish and stabilize in the next few years.



### 2.3. Other Models for the Estimation of the Cost of Equity Capital

An interesting model is the three factor model that was developed in 1992 by Fama and French (Koller et al. 2005, Estrada 2005). The model is based on the statement that the return on equity capital is inversely correlated with the size of the company (market capitalization) and positively correlated with the ratio of book to market value of the company equity capital.

The well known APT model (Arbitrage Pricing Theory) model can include more than one factor to explain the relationship between risk and return. Rather than specifying that the required stock returns depend on one factor, namely the rate of return on the market in the CAPM, one could define required and realized rate of returns on individual stock as a function of various fundamental economic factors (Brigham and Ehrhardt 2005, p. 197). This model is theoretically very interesting but not very applicable in practice.

Nagel, Peterson and Prati (2007) have conducted empirical tests on different cost of equity estimation methods based on historical returns. In the direct comparisons of these methods they have found that the best ex-ante estimation method available to financial managers is essentially the CAPM with beta restricted to one; that is, a naïve model where the cost of equity capital equals the risk-premium added to the risk-free rate.

### 3. Estimation of the Cost of Equity Capital for the Selected Slovene Companies

We have selected ten publicly traded companies. The companies are traded on the Ljubljana Stock Exchange and their stocks are listed in the prime and standard equity market. All ten are part of the stock exchange index SBI20 and form the index with five other stocks. We selected these stocks on the basis of data availability and their liquidity. These are the most liquid stocks with the data available for the last four years, the time period we used to calculate the beta coefficients. The selection and the estimation of the equity capital just for the liquid stocks is a limitation of our research.

Considering the conclusions of relevant research and established facts we decided on CAMP, being the most widely used method for the cost of equity capital estimation, and the most relevant for the properties of

the Slovene equity capital market, which is small with a short history of available data, all described in the theoretical part. The use of a more complex model with more input variables will increase the estimation error. For the estimation with CAPM we need three input variables; (1) risk-free rate of return, (2) market risk premium and, (3) beta coefficient.

#### Risk-Free Rate of Return

We have calculated the risk free rate as the sum of the Yield to Maturity of a 30-year inflation indexed US Treasury Bond and the upper limit of the ECB target inflation. We have used the ECB target inflation rate as the best estimate of the future inflation in Slovenia (EMU area). We expect that the future inflation in Slovenia will be in line with this target.

$$r_f = YTM_a + i = 2,6\% + 2\% = 4,6\% \quad (5)$$

where  $r_f$  is risk free rate,  $YTM_a$  is Yield to Maturity of a 30-year inflation indexed US Treasury bond (Federal Reserve Bank of St. Luis 2009),  $i$  is the ECB target inflation rate (<2%) (ECB 2009).

#### Market Risk Premium

Different methods for the market risk premium are explained in the theoretical part but we are limited here. No expert reports for the expected market risk premiums exist. For most emerging markets a long history of data is not available. In Slovenia we have data for just about 15 years and this data is under question because of big changes in the market in the period of transition and the low liquidity of the market. We decided to calculate the risk premium using the method we have found on the Damodaran web site (2009). The method calculates the market risk premium based on a market risk premium of a mature US market, adding a country risk premium. Slovenia has a rating Aa2, that is 1% point of additional premium for default risk. The additional premium for default risk is calculated as a difference between the yields to maturity of a Slovene Treasury bond and US treasury bond. According to Damodaran, the adjusted market risk premium for the US market is 5% and the global average of equity to bond market volatility is 1,5.

The calculation of the additional country risk premium for Slovenia:

$$RP_s = PT_m \cdot \left( \frac{\sigma_{gd}}{\sigma_{go}} \right) = 1\% \cdot 1,5 = 1,5\%, \quad (3)$$

where  $RP_s$  is the additional risk premium for the Slovene market on the risk premium for a mature US market,  $PT_m$  is the additional default risk premium,  $\sigma_{gd}$  is the standard deviation of stock returns for the global market, and  $\sigma_{go}$  is the standard deviation of bond returns for the global market.

To get the risk premium for the Slovene market we have added the above calculated additional country risk premium for the Slovene market to the risk premium for the US market.

$$RP = (r_m - r_f) = RP_{zt} + RP_s = 5\% + 1,5\% = 6,5\%, \quad (4)$$

where  $RP$  is  $(r_m - r_f)$  is the market risk premium for the Slovene market,  $RP_{zt}$  is the market risk premium for the US market,  $RP_s$  is the additional risk premium for the Slovene market on the risk premium for a mature US market.

#### Measure of the Market Risk-beta

We have estimated the beta coefficient from the past data. With regard to the data available on the Slovene capital market, using a more complex model will increase the estimation error. We have used a linear regression analysis. The independent variable was the proxy of the market portfolio return. The dependent variable was the market stock return. We have used the return of the market Index SBI20 which illustrates the Slovene equity market. We downloaded daily data on index and share prices from the Ljubljana Stock Exchange (2009) web site for the last four years (from January 2005 to January 2009).

Analytics advocate different time intervals of returns for the calculation of beta. For the purpose of reducing subjectivity we have calculated the average  $\beta$  out of the three estimated betas with a different choice of data. We have used the data for the past four years in cases of intervals of 20 trade day returns, two years of data in cases of ten trade day returns and one year of data in cases of five trade day returns. Analytics usually use monthly or weekly returns. With the change of intervals on trading days we simplified the calculation. With this

change we eliminate the disturbances of non-trading days. We have calculated the share and index returns with the equations below. The date of the end of the previous interval is also the date of the start of the next interval.

Market index interval return

$$r_i = \frac{V_{0+t}}{V_0} - 1 \quad (6)$$

where  $r_i$  is the interval market index return,  $V_0$  is the value of the index on the interval start date,  $V_{0+t}$  is the value of the index on the interval end date,  $t$  is the length of the interval in days; 5, 10 or 20.

Interval market return of stock

$$r_i = \frac{P_{0+t}}{P_0} - 1 \quad (7)$$

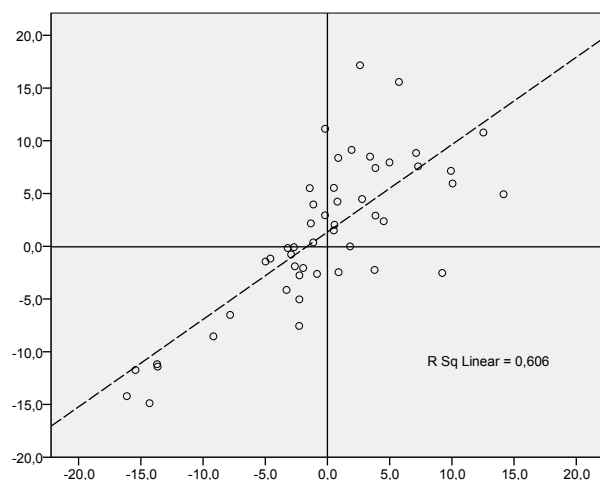
where  $r_i$  is the interval market return of stock,  $P_0$  is the market value of stock on the interval start date,  $P_{0+t}$  is the market value of stock on the interval end date, and  $t$  is the length of interval in days; 5, 10 or 20.

In the example below we can see the regression analysis for the beta estimation of the pharmaceutical company Krka, d.d. stock with the 20 trading days intervals of returns.

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
1 (Constant)	,013	,007		2,045	,046
SBI20	,829	,097	,779	8,506	,000

Dependent variable: Krka, d.d.

**Table 1:** Results of the linear regression for the estimation of beta of the stock of the pharmaceutical company Krka, d.d. with 20 trading days intervals of returns.



**Figure 1:** Scatter plot; dependent variable marker returns of Krka, d.d., independent variable market returns of SBI20

From the above linear regression we can write the following equation.

$$\hat{R}_{KRKA} = \alpha + \beta \cdot R_{SBI20} = 0,013 + 0,829 \cdot R_{SBI20} \quad (8)$$

where  $\hat{R}_{KRKA}$  is the expected market return of the stock Krka, d.d.,  $R_{SBI20}$  is the return of the market index SBI20,  $\alpha$  is the intercept,  $\beta$  is the slope – beta coefficient. We have done the test of variance (F test) and found that the differences between betas, estimated with the use of different time intervals of returns, are not statistically significant (see Table 2). However we have used the average betas for our estimation.

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	,037	2	,019	,376	,690
Within Groups	1,346	27	,050		
Total	1,384	29			

**Table 2:** The analysis of variance for the betas estimated with the use of different time intervals

In developed markets like the US market we can also calculate betas with the above method or we simply just look for the betas on the web pages of Bloomberg, NYSE, Damodaran online or other financial web sites.

We have estimated all the input variables for the CAPM.

$$r_{KRKA} = r_f + \beta_{KRKA} \cdot (r_m - r_f) = 4,6\% + 0,86 \cdot 6,5\% = 10,2\% \quad (9)$$

where  $r_{KRKA}$  is the required rate of return on Krka, d.d.,  $r_f$  is the risk-free rate of return,  $\beta_{KRKA}$  is the measure of the market risk for Krka, d.d.,  $r_m$  is the market rate of return,  $(r_m - r_f)$  is  $RP_{ZT} - RP_S$  the market risk premium.

Company	$\beta_{20}$	$\beta_{10}$	$\beta_5$	Average $\beta_i$	$r$ (%)
Aerodrom Ljubljana, d.d.	1,20	1,34	1,31	1,28	12,9
Gorenje, d.d.	1,12	1,25	1,25	1,20	12,4
Intereuropa, d.d.	1,14	1,14	1,14	1,14	12,0
Istrabenz, d.d.	1,42	1,39	1,39	1,40	13,7
Krka, d.d.	0,83	0,88	0,88	0,86	10,2
Luka Koper, d.d.	1,23	1,32	1,32	1,29	13,0
Mercator, d.d.	0,80	0,77	0,77	0,78	9,7
Petrol, d.d.	1,16	1,26	1,26	1,23	12,6
Pivovarna Laško, d.d.	1,00	0,73	0,73	0,82	9,9
Sava, d.d.	0,91	0,99	0,99	0,96	10,8
Weighted average	1,02	1,04	1,03	1,03	11,3

**Note:** We used market capitalization of selected companies as of January 31th 2009 as weights for calculation of weighted average.

**Table 3:** Estimated cost of equity capital for selected Slovene companies


#### 4. Conclusion

The aim of this paper was to tackle the estimation of the cost of equity capital on developing markets with the example of estimation for ten Slovene publicly traded companies.

The cost of equity capital is the risk adjusted return the investors require on invested capital. In the company's valuation the cost of equity capital is used as a discount factor for estimation of the present value of expected cash flows that belong to equity investors.

Especially problematic is the estimation of the cost of capital on developing financial markets. CAPM and most of models are based on historical data. Developing capital markets like the Slovenian market have a short history of available data which makes estimation with some models in use on mature financial markets impossible. Beside this, the data is very volatile. The intense volatility of data is the consequence of changes in the business environment. In the last fifteen years of adaptation to a capital market and in the last years to the global financial market in Slovenia many changes occurred. Models for the cost of equity capital estimation are suitable for companies in developed capital markets. For the estimation we chose the CAPM, which has been criticized because of the hard presumptions on which the model is based. Surveys indicate that despite the critics it is the

most widely used and reliable method for the cost of equity capital estimation (see Bruner et al. 1998, Graham and Harvey 2001, Brigham and Ehrhardt 2005). In the CAPM we used the average  $\beta$  that was calculated on the basis of three estimated betas with a different choice of stock return intervals. In calculating betas we have used 20, 10 and 5 trade day returns. This helped to reduce the subjectivity in choosing the intervals and eliminated the disturbances of non-trading days.

We have estimated that the cost of equity capital for the selected Slovene companies is between 9,7% and 13,7%. The limitation is that we have estimated the cost of equity capital for the selected and most liquid stocks on the market. 

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# Wage Collective Bargaining and Employee Voluntary Quits: A Romanian Empirical Analysis

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## Abstract:

***In this paper, we analyze Hirschman's "voice-exit" theory on the Romanian labour market. In other words, we study the relationship between wage collective bargaining and employee voluntary departures. We assess a kernel matching estimator on a recent Romanian survey of 783 firms. We highlight that, in Romania, before the integration to the European Union, wage collective bargaining implies a weakly significant increase in the probability of experiencing voluntary separations. This result is contrary to the relationship found in empirical studies implemented on developed countries.***

**Keywords:** Romania, wage collective bargaining, employee voluntary separation, propensity score matching estimation

**JEL:** J22, J3, J5

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## 1. Introduction

This paper investigates Hirschman's "voice-exit" theory on the Romanian labour market by analyzing the relationship between wage collective bargaining and employee voluntary departures in Romania in 2006. Up to now, Romanian wage collective bargaining has mainly been analyzed from a descriptive point of view. Our contribution is empirical. We want to check with Romanian data if (as found in the literature for developed countries) there is a negative relationship between collective bargaining and voluntary job quits. We implement a kernel matching estimator on a very recent and original dataset of 783 Romanian firms.

The International Labour Organisation (ILO) defines collective bargaining as "voluntary negotiations between employers or employers' organisations and workers' organisation with a view to the regulation of terms and conditions of employment by collective agreement" (ILO Convention n° 98). Collective bargaining is used as a method to improve terms and conditions of employment (wages, working time, training and education, safety, health and equal treatment).

The contribution of the present study lies in its analysis of the impact of wage collective bargaining on

voluntary employee flows. We focus on voluntary employee turnover because it is a key concern for both Romanian firms and employees. Industry publications estimate annual turnover rates of between 22 and 50 percent worldwide. This can substantially raise recruitment and training costs and contribute to reduced service quality and productivity when firms lose experienced employees. High voluntary turnover rates may also indicate that employees are dissatisfied with pay and working conditions and in the long run can cause

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individuals to lose pay and miss out on advancement opportunities (Cappelli and Neumark, 2004). Voluntary turnover is thus an important measure of how collective bargaining affects both labour costs and employee behaviour.

Some special features of the Romanian industrial relations system should be mentioned in order to understand the results of our work. We use data from the European Industrial Relations Observatory (EIRO). In Romania, the legal framework for collective bargaining is laid down in a particular law on collective agreements (law n° 130/1996 on Collective Agreements). At the beginning of the 90s most countries of Central and Eastern Europe introduced new labour laws which included the legal foundations for the creation of a new collective bargaining system. In Romania, we have the 2003 Labour Code. Data on the Romanian collective bargaining coverage is not available. Romania has a relatively decentralized bargaining system with company bargaining dominant. Collective bargaining at a national level sets national minimum pay and conditions which apply across the whole economy. Negotiations also take place in a substantial number of industries and companies. But it is only where trade unions are strong at the company level that significant improvements are negotiated. Overall the law provides detailed rules for collective bargaining. Union density is relatively high in Romania, between 30 and 35%. The structures are fragmented with five separate confederations, each with a substantial number of affiliated structures which are very decentralized. Many local union groupings do not belong to any of the main confederations and where they do the links may be weak.

Collective bargaining in Romania does not appear to be similar to any particular country, although findings in other Central Eastern Europe countries revealed several comparable changes and continuities (Trif, 2005). In contrast to most Central Eastern Europe countries, in Romania employers are obliged to initiate collective bargaining process in all companies with more than 21 employees, and there is an extension mechanism at each level. Also, the perception of an increase of the State's influence on the terms of the conditions of employment after 1989 was not found in other Central Eastern Europe countries. Differences in collective bargaining among countries are likely to be determined to a certain extent by the dissimilarities in the legislation, national inherited legacies and progress with economic reforms (Aro and Repo, 1997; Clarke, Cremers and Janssen, 2003).

There is a well known theory linking the presence of organized labour in firms and employee flows. Freeman and Medoff (1979) and Freeman (1980) analyzed the effect of collective bargaining (trade unionism) on the exit behaviour of workers using the "voice" hypothesis. Freeman (1980) examined the effect of the presence of trade unions on the exit behaviour of workers using the dichotomy of "exit" and "voice" previously proposed by Hirschman (1970). Workers have two possibilities to express their discontent with their working conditions: either leave the firm (exit) or discuss their problem with their employer (voice). Collective bargaining can provide a voice for workers. Voice is embodied in the collective bargaining process to negotiate with the management, so when workers have the institution of a voice to express discontent they should quit the firm less frequently: an inverse relationship should be observed between collective bargaining (union presence) and voluntary worker mobility.

This result is found in several empirical papers on developed countries. We must nevertheless take into account the economic situation. Employees are less likely to quit their jobs when the unemployment rate is high, as their chances to find another job are reduced. OECD statistics show that countries with stronger employment protection legislation have lower levels of employee "churn" with less frequent job changes and longer spells of unemployment (OECD, 2004). For example, for the cases of the U.S. and Germany we find a negative relation between collective bargaining and voluntary job quits in the papers of Batt, Colvin and Keefe (2002), Backes-Geller, Frick and Sadowski (1997), Freeman (1980) and Frick (1996). In the same countries, in a very recent article Doellgast (2008) assesses the relationship between national and collective bargaining institutions, management practices and employee turnover in the U.S. and in Germany in call centres. She found that globally collective bargaining is associated with lower quit rates in both countries. Doellgast (2008) also emphasized that there can be possible differences in the strength of collective bargaining effects on turnover. On Spanish data Garcia-Serrano and Malo (2002) find the same result. They also study the impact of collective bargaining on job flows. An original point about our work is that excepting Frick(1996), Garcia-Serrano and Malo (2002) there is no analysis where the voice effect is present in labour markets with institutional settings that extend the results of collective bargaining to all workers, whether affiliated or not. Delery et al. (2000) found that union effects on



quits disappeared when wages and benefits were included in the equation.

A theoretical study on Hirschman's "voice theory" in Central Eastern Europe was made in a recent paper by Meardi (2007). His analysis is not focused on the Romanian case (he concentrates his work on countries that entered the EU in 2004: Cyprus, the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Malta, Poland, Slovakia and Slovenia) but this work may be interesting and useful in understanding our work. The distinction between what behaviour constitutes "exit" and what constitutes "voice" can be controversial, but a sound operationalization of these concepts is provided by Greskovits (1998). In the 1990s, Greskovits had noted how rather than strikes and riots, workers preferred exit from the labour market, protest voting and rent-seeking. Exit from the formal labour market includes the option for benefits, work in the informal sector and migration.

The increase of wages in the new entrant states of the UE is interestingly roughly inversely correlated to collective bargaining coverage. This means that formal industrial relations are not the driving force behind them. Wage increases are granted not because of the union power but because of exit threats (Meardi, 2007). For 2007, in Romania, national observers considered significant in terms of "voice" expression the following industrial relations events: strike threats at the sector level in mining for health and pay reasons and collective bargaining advances at the company level in the post sector for pay reasons. These events can be contrasted with a pure "exit" based model (EIRO).

The new member states show that even in the most favourable political conditions employment can not be ruled by pure market principles: "exit" strategies turn into labour problems which in turn call for "voice" solutions. Following Hirschman a strong "exit" at a given time prepares a strong voice later. The stricter limits to the freedom of movement of Romanian workers put this country in a different position from the previous accession countries. Exit is less visible and may occur more through informality (informal exit settlements between employees and employers) (Meardi, 2007).

The reminder of the paper is organized as follows. The second Section describes the data and the indicators. The third Section outlines the econometric approach. The forth Section presents the results and the fifth provides conclusions.

## 2. Data and Indicators

In order to analyze the effect of wage collective bargaining on employee departures within Romanian firms, we used a recent survey. The data were collected in 2006 by the Economic and Social Council of Romania in collaboration with the Romanian Ministry of Labour, Social Solidarity and Family. The survey is comprised of a national representative sample of 841 Romanian firms having at least 10 employees. Firms were chosen randomly from a database provided by the Romanian Commerce Registry Office. The originality of the survey is double: first, because it represents one of the few databases analyzing Romanian wage collective bargaining and second, because it contains a number of subjective questions concerning the opinions of Romanian employers.

The survey contains the following information: industry, firm size, geographical region of implementation, ownership, firm legal type, method for establishing wages, intensity of the effects of several national and branch collective bargaining agreements on the collective labour contracts, determinants of wage collective bargaining, evaluation in terms of performance of the workforce, firm size variation rate, employee voluntary separations and determinants of employee voluntary separations. We describe in detail only the variables used during the implementation of the econometric approach<sup>1</sup>.

In this paper we want to establish the impact of negotiating collectively wages on employees' voluntary departures. We create a dummy variable indicating if wages are established inside the firm by collective bargaining (*coll\_negociation* = 1) or if they are settled directly by the employers (*coll\_negociation* = 0). The Romanian law imposes that all firms with at least 21 employees must develop a collective bargaining process, although they are not obliged to reach an agreement. So, even if in our sample firms with at least 21 employees are in the majority this does not imply that all of them negotiate wages collectively. They are only obliged to collectively bargain in general. For example, we can imagine that firms where wages are directly imposed by the employer negotiate collectively other points: working time duration, working conditions, etc.

<sup>1</sup> Appendix 1 presents all dummy variables used in this study.

Our result variable gives the employers' opinions on voluntary departures from their firms. This indicator is binary:  $volunt\_departure = 1$  if employers appreciate that during 2006 employees voluntarily left their firm and  $volunt\_departure = 0$  otherwise.

The firm's industry is given initially at a two-digit level. We aggregate this information in ten classes (each one corresponding to a dummy variable): agriculture; extractive industry; manufacturing industry; electricity, gas and water supply industry; construction; trade; hotels and restaurants; transports; financial intermediation, real estate activities, research and development, operational services and consultancy and assistance and finally, other services (community, social and personal service activities, private households with employed persons, education, health and social work and extra-territorial organizations).

At the firm level, there is a legal obligation to negotiate – although not to reach agreement. The employer is required to initiate the process. This obligation applies where the company has 21 or more employees. As we want to emphasize this threshold of 21 employees, we work with four classes of size: between 10 and 20 employees, between 21 and 49 employees, between 50 and 249 employees and 250 employees and more.

The firm's geographical implementation is given at a four-digit level. We construct eight dummy variables indicating the location of the firm: the North-East region, the West region, the North-West region, the Centre region, the South-East region, the South-Muntenia region, the Bucharest-Ilfov region and the South-West-Oltenia region<sup>2</sup>.

Regarding firms' ownership, we construct seven dummies: private firm with full Romanian capital, private firm with full foreigner capital, private firm with majority Romanian capital, private firm with majority Romanian capital with the rest belonging to the state, private firm with majority foreign capital, public firm with full state capital and public firm with majority state capital.

For the legal type of the firm, we have three dummies: a limited liability company, stock company and other forms. Concerning the firm's size variation rate, we have three dummies indicating if the size of the firm increased between 2004 and 2005: yes, no and it remained still. We also retained five dummies indicating the ways a firm

evaluates the performances of its workforce: does not evaluate the performance of its workers, evaluates the performance for wage reasons, evaluates the performance for job promotion reasons, and evaluates the performance for both wage and job promotion reasons as well as other reasons.

After eliminating firms with missing values for the explanatory variables presented above, our final database contained 783 Romanian firms.

### 3. Econometric Strategy

Firms which negotiate their wages collectively can make the object of a non-random selection process concerning the wage collective bargaining phenomenon and even a process of auto-selection (if negotiating their wages collectively is considered an element of their internal strategy). This induces a selection bias. To circumvent the selection bias, we estimate evaluation models with matching estimators. They were initially developed by Rubin (1974) in order to study the efficiency of medical treatments. These models were mobilized in economics, in particular to test the efficiency of job training programs.

Let us denote by  $T$  a binary variable indicating if the individual received treatment or not ( $T = 1$  if the individual is treated,  $T = 0$  if not). The efficiency of the treatment is measured through the result  $y_i$ . Thus, each individual has two potential results:  $y_0$  (if  $T = 0$ ) and  $y_1$  (if  $T = 1$ ).  $y_0$  and  $y_1$  are never observed simultaneously, since an individual either is treated, or untreated, but never both at the same time. In other words, only the true health of the individual, noted  $Y$ , is observed:  $Y = y_1T + y_0(1 - T)$ .

Only the couple  $(Y, T)$  is observed for each individual. Rubin (1974) defines the average treatment effect as the difference between what would be the health of an individual if he was treated and what it would be if he was not:  $C = y_1 - y_0$ . The average treatment effect is unobservable and individual, and consequently its distribution is not identifiable. Under the independence property  $(y_0, y_1) \perp T$  there is no selection bias.

In the majority of cases, the property of independence is not valid. A solution would be to compare the health of each individual who received the treatment with the health of an identical counterfactual who did not receive the treatment. To identify statistically the counterfactual,

<sup>2</sup> See appendix 2 for a graphic display of the main eight Romanian regions.

an approach consists in building a counterfactual population for which the distribution of a number of observable characteristics ( $X$  – matching variables) is the same as for the group receiving the treatment. Consequently, the property of independence is respected conditionally on observed matching criteria  $(y_0, y_1) \perp T \mid X$ . When many matching criteria must be taken into account in order to achieve conditional independence, finding a counterfactual can be problematic. Rubin and Rosenbaum (1983) solved this problem by showing that conditional independence with the  $X$  variables was equivalent to independence given a propensity score. The propensity score constitutes a one-dimension summary of the matching variables and it is an estimate of the probability of being exposed to the treatment, conditionally on these variables. There are several propensity score matching estimators. They differ not only in the way the neighbourhood for each treatment individual is defined and the common support is handled, but also with respect to the weights assigned to these neighbours. Excepting kernel estimators, we have globally the following matching methods: nearest neighbour matching, calliper and radius matching and stratification and interval matching. The performance of different matching estimators varies case-by-case and depends largely on the data structure at hand (Zhao, 2000). In this work, we use the kernel estimator of Heckman, Ichimura and Todd (1998). More precisely, we use an Epanechnikov kernel  $(F(u) = \frac{3}{4}(1 - |u|^2) \text{ if } |u| \leq 1 \text{ and } F(u) = 0 \text{ otherwise})$  with a bandwidth selection criterion developed by Silverman  $(h_j = 1.364 \sigma_{s_j} n_j^{-1/5} 15^{1/5})$ , where  $\sigma_{s_j}$  is the standard error of the propensity score for the control group and  $n_j$  is the number of individuals inside the control group). For the calculation of the kernel estimator for the treated, each non-treated individual takes part in the construction of the counterfactual of the treated individual. The weight of the non-treated in the constitution of the counterfactual is given according to the distance between their score and the score of a treated individual. In order to calculate the standard error for the kernel estimator we implement a bootstrap technique (1000 draws).

In this paper we work with two categories of firms: firms where wages are negotiated collectively and firms which do not negotiate collectively their wages. The

group of treatment consists of firms which negotiate collectively the salaries and the counterfactual group is sought among firms where salaries are directly established by the employer. Formally, the treatment variable (*coll\_negociation*) is written:

$$coll\_negociation = \begin{cases} 1, & \text{if firms negotiate collectively wages} \\ 0, & \text{otherwise} \end{cases} \quad (1)$$

Our performance variable (*volunt\_departure*) is given by the fact that during 2006 the firm is concerned by voluntary departures. This variable can be written as follows:

$$volunt\_departure = \begin{cases} 1, & \text{if the firm has voluntary departures in 2006} \\ 0, & \text{otherwise} \end{cases} \quad (2)$$

We take into account the following matching criteria: industry, firm size, geographical region of implementation, ownership, firm legal type, evaluation in terms of performance of the workforce, and firm size variation rate. These variables were presented in Section 3.

#### 4. Results

In the first step of the econometric strategy, we estimate the probability for a firm to negotiate collectively wages with a probit regression, by introducing the matching variables presented in Section 4. The distribution of the observed matching criteria is given in Table 1.

As at least one of the modalities of each variable is significant at 10%, we decided to keep all of the modalities. The probit model helps estimating the propensity score for each firm and allows for constructing counterfactuals. These models require a sufficiently important common support. 32 % of firms which negotiate collectively wages have an estimated probability to negotiate collectively wages lower than 0.5, and conversely 22 % of firms that do not negotiate their salaries have a probability of bargaining higher than 0.5. The supports of these two distributions largely overlap. Moreover, as the number of the establishments that did not negotiate their wages is higher, pairing is possible. The results of the probit estimation are described in Table 2.

Variable	Global sample	Sample where Coll_negotiation = 1	Sample where coll_negotiation = 0
<b>Negotiate collectively wages (yes/no)</b>	49.3	100	0
<b>Industry</b>			
<i>Agriculture</i>	5.24	5.7	4.79
<i>Extractive industry</i>	2.55	3.63	1.51
<i>Manufacturing industry</i>	49.94	51.55	48.36
<i>Electricity, gas and water supply industry</i>	3.7	5.96	1.51
<i>Construction</i>	8.56	7.77	9.32
<i>Trade</i>	9.58	8.81	10.33
<i>Hotels and restaurants</i>	3.45	3.37	3.53
<i>Transports</i>	8.05	6.99	9.07
<i>Financial intermediation, real estate activities, etc.</i>	7.41	4.66	10.08
<i>Other services</i>	1.53	1.55	1.51
<b>Firm size</b>			
<i>Between 10 and 20 employees</i>	12.01	7.77	16.12
<i>Between 21 and 49 employees</i>	22.99	17.1	28.72
<i>Between 50 and 249 employees</i>	34.74	33.42	36.02
<i>250 employees and more</i>	30.27	41.7	19.14
<b>Region</b>			
<i>North-East region</i>	13.67	16.58	10.83
<i>West region</i>	14.69	14.25	15.11
<i>North-West region</i>	11.75	4.92	18.39
<i>Centre region</i>	5.87	8.03	3.78
<i>South-East region</i>	13.67	12.18	15.11
<i>South-Muntenia region</i>	13.41	16.84	10.08
<i>Bucharest-Ilfov region</i>	14.69	14.51	14.86
<i>South-West-Oltenia region</i>	12.26	12.69	11.84
<b>Firm ownership</b>			
<i>Private firm with full Romanian capital</i>	71.9	66.58	77.08
<i>Private firm with full foreign capital</i>	8.3	8.29	8.31
<i>Private firm with majority Romanian capital</i>	4.85	3.11	6.55
<i>Private firm with majority Romanian capital and the rest belonging to the state</i>	0.89	1.04	0.76
<i>Private firm with majority foreign capital</i>	6.26	6.74	5.79
<i>Public firm with full state capital</i>	6.51	11.92	1.26
<i>Public firm with majority state capital</i>	1.28	2.33	0.25
<b>Firm legal type</b>			
<i>Limited liability company</i>	52.62	35.23	69.52
<i>Stock company</i>	43.3	59.59	27.46
<i>Other form</i>	4.09	5.18	3.02
<b>Firm size variation rate between 2004 and 2005</b>			
<i>Firm size decreased</i>	33.84	41.71	26.20
<i>Firm size remained still</i>	27.08	25.65	28.46
<i>Firm size increased</i>	35.89	29.27	42.32
<b>Evaluating the performances of the workforce</b>			
<i>Does not evaluate the performance of its workers</i>	36.27	25.65	46.6
<i>Evaluates the performance for wage reasons</i>	27.59	26.94	28.21
<i>Evaluates the performance for job promotion reasons</i>	5.36	7.25	3.53
<i>Evaluates the performance for both wage and job promotion reasons</i>	29.5	38.08	21.16
<i>Other reasons</i>	1.28	2.07	0.5
<b>Voluntary departures (yes/no)</b>	34.1	39.38	28.97
<b>Number of observations</b>	<b>783</b>	<b>386</b>	<b>397</b>

Table 1: Descriptive statistics

Among control variables, we introduced firm size because we consider that it is a main determinant of the retained strategy regarding wage bargaining. We observe

that the probability of wage bargaining increases with firm size. We also introduce sector levels to capture differences in the wage negotiation implementation:

Variable	Estimation	Standard error	
<b>Intercept</b>	0.06	0.29	Ns
<b>Industry</b>			
<i>Agriculture</i>	Ref.		
<i>Extractive industry</i>	-0.38	0.42	Ns
<i>Manufacturing industry</i>	-0.38	0.23	*
<i>Electricity, gas and water supply industry</i>	-0.41	0.43	Ns
<i>Construction</i>	-0.39	0.28	Ns
<i>Trade</i>	-0.32	0.27	Ns
<i>Hotels and restaurants</i>	-0.20	0.34	Ns
<i>Transports</i>	-0.53	0.28	*
<i>Financial intermediation, real estate activities, etc.</i>	-0.58	0.29	**
<i>Other services</i>	-0.60	0.46	Ns
<b>Firm size</b>			
<i>Between 10 and 20 employees</i>	-0.42	0.17	**
<i>Between 21 and 49 employees</i>	-0.24	0.13	*
<i>Between 50 and 249 employees</i>	Ref.		
<i>250 employees and more</i>	0.23	0.14	*
<b>Region</b>			
<i>North-East region</i>	-0.04	0.19	Ns
<i>West region</i>	-0.45	0.19	**
<i>North-West region</i>	-1.40	0.22	***
<i>Centre region</i>	0.13	0.26	Ns
<i>South-East region</i>	-0.44	0.19	**
<i>South-Muntenia region</i>	Ref.		
<i>Bucharest-Ilfov region</i>	-0.38	0.18	**
<i>South-West-Oltenia region</i>	-0.39	0.20	**
<b>Firm ownership</b>			
<i>Private firm with full Romanian capital</i>	Ref.		
<i>Private firm with full foreign capital</i>	0.02	0.18	Ns
<i>Private firm with majority Romanian capital</i>	-0.55	0.25	**
<i>Private firm with majority Romanian capital and the rest belonging to the state</i>	-0.44	0.54	Ns
<i>Private firm with majority foreign capital</i>	-0.11	0.21	Ns
<i>Public firm with full state capital</i>	0.87	0.32	***
<i>Public firm with majority state capital</i>	1.08	0.61	*
<b>Firm legal type</b>			
<i>Limited liability company</i>	Ref.		
<i>Stock company</i>	0.63	0.12	***
<i>Other form</i>	0.12	0.28	Ns
<b>Firm size variation rate between 2004 and 2005</b>			
<i>Firm size decreased</i>	0.42	0.13	***
<i>Firm size remained still</i>	0.06	0.12	Ns
<i>Firm size increased</i>	Ref.		
<b>Evaluating the performances of the workforce</b>			
<i>Does not evaluate the performance of its workers</i>	Ref.		
<i>Evaluates the performance for wage reasons</i>	0.22	0.12	*
<i>Evaluates the performance for job promotion reasons</i>	0.67	0.24	***
<i>Evaluates the performance for both wage and job promotion reasons</i>	0.54	0.13	***
<i>Other reasons</i>	1.08	0.50	**
<b>Max-rescaled R-Square</b>	0.35		
<b>Number of observations</b>	783		

**Table 2:** Determinants of the probability of negotiating collectively wages

wage bargaining is mainly used in specific sectors. The agriculture sector is taken as the reference. Manufacturing, transport and financial intermediation

and estate activities firms have a lower wage bargaining propensity than agriculture firms. Localization in different Romanian regions, ownership and firm legal type are



other determinants of the wage bargaining process. The South-Muntenia region is taken as the reference. Excepting the North-East and the Centre regions, for the other firms the propensity of negotiating wages collectively is less important than for firms located in South-Muntenia. Private firms with majority Romanian capital have a lower probability of wage bargaining than private firms with full Romanian capital. As for public firms with full or majority state capital, they have a more significant probability of negotiating wages. This indicates that wage negotiation is more predominant for public firms. Concerning the legal type of the firm we can observe that stock companies have a more significant probability of wage bargaining compared to limited liability companies.

Regarding the firms' economic performance, we introduce an indicator describing firm size variation rate. Firms with a decrease in their size from 2004 to 2005 have more chances to negotiate salaries collectively than firms for which the size increased. Because the evaluation of workforce performance can describe the internal tensions inside the firm, it is important to take this information into account. Globally, evaluating the performances of the workforce increases the probability for a firm to negotiate wages collectively.

Table 3 presents the results of the estimation of our performance variable. This is the second step of the model. The comparison between firms that do not negotiate their wages collectively and firms that bargain over wages yields the following result: the probability that a firm negotiates wages collectively increases significantly (at 10%) the probability of employee voluntary departures inside the firm. Hence wage bargaining firms increase by 8 percentage points the probability that they will experience voluntary departure of their employees. We can interpret this result as supporting the non-existence of a voice effect through the scope of collective bargaining in the Romanian industrial relations system. This result must be interpreted with caution. The effect is positive and weakly significant (10%). It might change if we control for more firm characteristics and employees' characteristics (wages, occupations, etc.). Table 1 gives the result for the naive estimation: the difference of average voluntary quits for firms which negotiate wages collectively and for firms which do not negotiate wages collectively. This naive estimator emphasizes an increase of 10 points of percentage in voluntary quit behaviour (39.38-28.97). Without controlling for the selection bias associated to

the wage collective negotiation, the effect is stronger. The comparison between the naive estimator and the kernel estimator proves the existence of a selection bias (controlled by our econometric strategy).

Variable	Min	Max	Mean	Standard Error	Student
Employees' voluntary departures	-0.0743	0.2458	0.0884	0.0520	1.70 *

Field: Romanian firms with at least 10 employees. Sample obtained from a file produced by the Economic and Social Council of Romania in collaboration with the Romanian Ministry of Labour, Social Solidarity and Family

Note: \* indicates significance at 10%.

**Table 3:** Kernel propensity score estimator

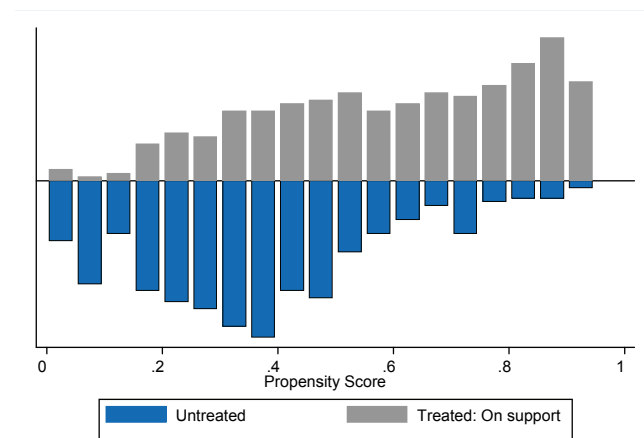
To assess the matching quality we used several tests. They are directly implemented under Stata. First, we use a stratification test. It is proposed by Dehejia and Wahba (1999, 2002). The *pscore* program written by Becker and Ichino (2002) has an algorithm which implements it. Dehejia and Wahba divide observations into strata based on the estimated propensity score such that no statistically significant difference between the mean of the estimated propensity score in both treatment and control group remain. Then they use t-tests within each stratum to test if the distribution of the observable explanatory variables is the same between both groups. For this test, the region of common support is [0.0472842, 0.99084989]. The test indicates that dividing the propensity score distribution into five blocks ensures that the mean propensity score is not different for treated and controls in each block. In our case the balancing property is satisfied. A balancing test checks if the two groups (the treated and their counterfactuals) "look the same" in terms of the variables of the vector  $X$  after the matching on the propensity score. In other words, we tested for equality of each covariate mean between groups within strata of the propensity score.

Second, we use the *pstest* procedure (Leuven and Sianesi, 2003). This test comes originally from Rosenbaum and Rubin (1985) and relies on the examination of standardized differences. The *pstest* procedure calculates several measures of the balancing of the variables in  $X$  before and after matching. In particular, for each covariate it calculates two statistics. On the one hand, it calculates t-tests for equality of means in the treated and



non-treated groups, both before and after matching. T-tests are based on a regression of the variable on a treatment indicator. On the other hand, it calculates the standardized bias before and after matching, together with the achieved percentage reduction in terms of absolute bias. The standardized bias is the difference of the sample means in the treated and non-treated (full or matched) sub-samples as a percentage of the square root of the average of the sample variances in the treated and non-treated groups (formulae from Rosenbaum and Rubin, 1985). In most empirical studies a bias reduction below 3% or 5% is seen as sufficient. In our sample, there is a multitude of values superior to 60%. Hence we can conclude that our model specification is good. As expected, after matching covariates are balanced in both groups we found no significant difference.

Third, as a complement to this test we also use the *psgraph* programme which was also developed by Leuven and Sianesi (2003). Figure 1 illustrates the distribution of the propensity score for the treated and for the untreated. It emphasizes a good overlapping.



Field: Romanian firms with at least 10 employees. Sample obtained from a file produced by the Economic and Social Council of Romania in collaboration with the Romanian Ministry of Labour, Social Solidarity and Family

Note: we used the Stata *psgraph* program (Leuven and Sianesi, 2003).

**Figure 1:** Propensity score

## 5. Conclusion

In this paper we test Hirschman's "voice-exit" theory on the Romanian labour market. We control a possible selection bias associated with the fact that the wage bargaining process is not distributed randomly among firms. After implementing a kernel matching estimator we

find a positive relationship between wage bargaining and employees' voluntary quits within Romanian firms. Nevertheless, this relationship is weakly significant (at 10%). This result is contrary to the findings of empirical studies implemented on developed countries. The Romanian labour market is fundamentally different from labour markets in developed countries. We also study a very particular year (2006), just before Romania's entrance into the European Union. In 2006, significant efforts were made by the whole Romanian economy in order to align itself with EU standards. For this reason, Romania obtained very good economic results in 2006. In this context, employees are most interested in good job opportunities (especially in terms of wages) rather than job stability. Hence our result may also hide some "inefficiency" in dealing with the collective negotiation process at this precise moment. As Meardi (2007) suggests for Central Eastern European countries, in Romania we could be witness to a strong "exit" phenomenon which might be followed by a "voice" phenomenon. Further research should be done after the entrance of Romania into the EU, as we would like to analyze if the "voice-exit" strategy changed after 2007. 

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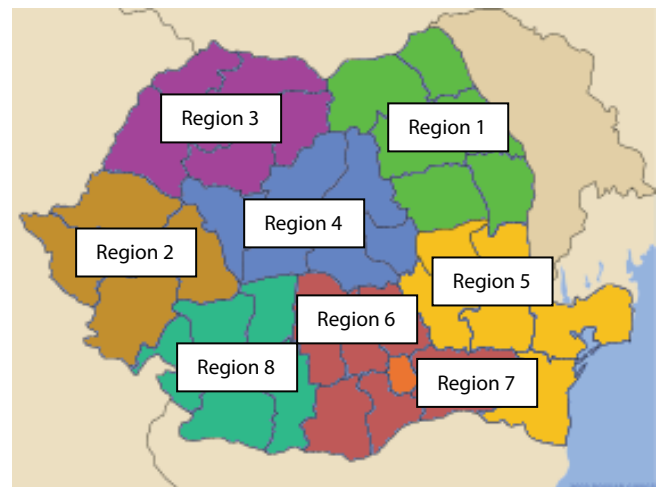
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## Appendix 1: Definition of variables

Variable	Definition
<b>Dependent variables</b>	
<i>volunt_departure</i>	Employers appreciate that during 2006 employees voluntarily left their firm Dummy variable (=1 if yes)
<b>Independent variables</b>	
<i>coll_negotiation</i>	Wages are established inside the firm by collective bargaining Dummy variable (=1 if yes)
<i>size</i>	Four firm size dummy variables (=1 if 10 to 20 employees; 21 to 49 employees; 50 to 249 employees; 250 employees and more)
<i>geographical location</i>	Eight dummy variables (=1 if the North-East region, the West region, the North-West region, the Centre region, the South-East region, the South-Muntenia region, the Bucharest-Ilfov region and the South-West-Oltenia region)
<i>ownership</i>	Seven dummy variables (=1 if private firm with full Romanian capital, private firm with full foreign capital, private firm with majority Romanian capital, private firm with majority Romanian capital and the rest belonging to the state, private firm with

	majority foreign capital, public firm with full state capital and public firm with majority state capital)
<i>legal type</i>	Three dummy variables (=1 if limited liability company, stock company and other forms)
<i>firm size variation rate</i>	Three dummy variables indicating if the size of the firm increased between 2004 and 2005: yes, no and it remained the same
<i>workforce performance evaluation</i>	Five dummy variables (=1 if the firm does not evaluate the performance of its workers, evaluates the performance for wage reasons, evaluates the performance for job promotion reasons, evaluates the performance for both wage and job promotion reasons and other reasons)
<i>industry</i>	The main activity of the firm: 10 dummy variables (=1 if agriculture; extractive industry; manufacturing industry; electricity, gas and water supply industry; construction; trade; hotels and restaurants; transports; financial intermediation, real estate activities, research and development, operational services and consultancy and assistance and finally, other services (community, social and personal service activities, private households with employed persons, education, health and social work and extra-territorial organizations))

## Appendix 2: The eight main Romanian regions



# Work Productivity in the Croatian Hotel Industry – Fundamentals and Concepts for Achieving Growth and Competitiveness

Ivanaka Avelini Holjevac \*

## Abstract:

***Productivity and product and service quality are the foundations upon which an economy builds its competitiveness, effectiveness and efficiency. Research focuses on the specific characteristics of productivity and the quality of hotel products and services in the case of the Croatian hotel industry. The objective of research is to identify and propose measures to increase productivity and improve the quality of the Croatian hotel industry, and in this way, enhance its competitiveness on the world tourism market.***

***The task of this research is to provide a theoretical definition of the relationship between productivity, quality and competitiveness; analyses and assess long-term trends in productivity in Croatia's entire hotel industry; assess the quality of hotel offerings; analyze and assess productivity in the case of a large Croatian company; and finally, put forward measures to increase the productivity and competitiveness of the Croatian hotel industry.***

**Keywords:** productivity, competitiveness, quality, hotel industry

**JEL:** D24

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## 1. Introduction

Work productivity and quality of product and service are the basis on which competitiveness is built in today's highly demanding and dynamic tourism market. Anyone wishing to enter, survive and develop on this market must provide a well-designed tourism product adapted to the growing needs, demands and expectations of modern tourists. Whoever is capable of anticipating tourist needs and demands and exceeding tourist expectations will be enjoy the greatest success. Increasing the competitiveness of the hotel industry will lead to faster growth of the Gross Domestic Product (GDP).

Work productivity and quality are the focus of ongoing economic research, the results of which should serve to raise the level of productivity and product and service quality, which in turn will help increase business excellence and the effectiveness and efficiency of the performance of Croatian hotels. Through research, influential factors are identified together with modern personnel management techniques and methods that make it possible to enhance work efficiency and product

and service quality. Briefly put: through knowledge to excellence.

This paper applies a theoretical and empirical approach to studying work productivity and the quality management of hotel products and services. The objective of this research is to put forward measures and a model for optimizing productivity and the quality of work, and, in this way, boost the competitiveness of the Croatian tourism product on the European and world tourism markets. This objective underlines the need and importance of research.

Research methods: deduction and induction, comparison and decomposition, analysis and synthesis, various statistical methods.

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## 2. People and Quality

*Education is the difference between poverty and wealth.*

Important brands like to stress the amount of handwork that goes into creating a product, as this is what makes the product perfect. For example, “Chanel” (“A woman, a name, a legend”), with its unique, elegant, universally distinctive products, focuses especially on handwork in its marketing – “More than 100 operations, many of them manual, are necessary to bring about in the end a perfect leather product. Elegance means being beautiful both on the inside and out.” Another example is “Van Laack” (the leading manufacturer of top-quality men’s shirts), a synonym for style and individuality, which grounds its quality on the following message: “If our continued reliance on hand-crafting defies the dictates of prevailing economic logic, this is because only hand-finished garments can offer that consummate blend of quality, class and style.”

Therefore, human labour is what is most valued and crucial to product and service quality, in comparison with machine labour. “Hand-made” reflects human creativity and is irreplaceable. People like to brandish their potential and this is a vital factor of work motivation (self-actualization). Developing and rewarding quality is possible only if managers adopt the paradigm that only by developing the potential of all workers involved can total product and service quality be achieved.

Quality is the level at which customer needs, wants and expectations are met, but it can also be applied to the workforce, that is, to employees. Job needs can be grouped into two sets of factors (Clark 1999, p.20-21.):

- Hygiene Factors
- Motivational Factors
- Aesthetic needs
- Self-actualization needs

Meeting all the needs of people at work, employees in the workplace, is extremely complex, because of the influence exerted by the many various factors listed above.

According to a Gallup survey, employees consider the following factors as being crucial to job satisfaction (Clark 1999, p.22.):

- Having the opportunity to doing what they know best, every day
- Having a supervisor or other manager who treats them as human beings at work
- Having their opinion taken into consideration

- Having the opportunity to develop and learn
- Working for an employer whose mission it is to make their jobs important
- Having the material and equipment needed to ensure they can do their jobs properly
- Working for a company that cultivates relations with its employees families (family friendly)

Encouraging the motivation of people at work is the task of personnel management and it is carried out through the function of management (leading) and the function of human potential management (staffing).

In leading, a distinction is made between two opposing theories: Theory X, which is based on the assumption that people do not like to work, and Theory Y, which is based on assuming all of the best attributes of people, that is, that people like to work, seek pleasure, responsibility and creativity in their work (McGregor 1960). According to Theory X, it is possible to increase work efficiency, that is, productivity, through stringent rules, standards, threats and punishments. According to Theory Y, work efficiency is achieved through the delegation of responsibilities and by encouraging creativity, developing intellectual potential, and giving recognition and rewards.

The outcome of Theory X destroys worker motivation and causes productivity to drop, whereas Theory Y fosters work motivation and work productivity.

Work quality and productivity cannot be achieved by intimidating workers with stringent rules. Quality can be ensured only if workers are stimulated to becoming better at doing all the good and worthwhile things that they would otherwise do.

TQM completely changes the way work is organized, the employee-manager relationship and the attitude towards the customer/consumer. In his quality implementation program, Deming provided managers with a 14-point recipe for success (Deming 2000, p. 23-24.):

1. Create constancy of purpose toward the improvement of products and services, with the aim to become competitive, stay in business, and provide jobs.
2. Adopt a new philosophy. We are in a new economic age. Management must awaken to the challenge, learn their responsibilities and take on leadership for change.
3. Cease dependence on inspection to achieve quality. Eliminate the need for inspection on a mass basis by building quality into the product (prevention).

4. End the practice of purchasing on the basis of prices. Instead, minimize total cost. Move towards a single supplier for any one item, based on a long-term relationship of loyalty and trust (partnership).
5. Constantly improve the system of production and service, to improve quality and productivity, and thus constantly decrease costs.
6. Introduce training for every job (everyone must train and learn).
7. Introduce supervision – quality management. The aim of managing (supervising) quality should be to help people, machines and equipment to do a better job. Supervision of management should be improved, as well as supervision of production workers.
8. Drive out fear, so that everyone may work effectively for the company.
9. Remove barriers between departments. People in research, design, sales and production must work as a team, to foresee problems of production and in use that may occur with the product or service (teamwork).
10. Eliminate slogans, exhortations and targets asking for zero defects and new levels of productivity. Such slogans only create an adversarial relationship, as most causes of low quality and low productivity belong to the system itself and are beyond the power of the employees (operators).
11. a) Eliminate work standards (quotas) in production. Substitute leadership.  
b) Eliminate management by objectives. Eliminate management by numbers and numerical results. Substitute leadership.
12. a) Remove barriers that deprive employees (hourly-paid workers) the right to take pride in their workmanship. The responsibility of the supervisor must be quality, and not merely numerical results.  
b) Remove barriers that deprive people (employees) in management and engineering the right to take pride in their workmanship. This means, *inter alia*, abolishing annual performance evaluations, as well as management by objectives (The job must be a source of satisfaction, not a place of coercion).
13. Put in place an intensive program of education and self-improvement.
14. Put everybody in the company to work on accomplishing this transformation. The transformation is everybody's job.

This TQM implementation program places quality and measures for continuously improving quality in the forefront, while focusing on ensuring employee satisfaction and teamwork, making everyone responsible for quality and providing continuous education and training. Notably, all these points underline quality in the function of customer, employee and owner satisfaction that can be achieved by increasing work productivity and competitiveness.

**In conclusion: people/customers are the ones who define what quality is, while people/workers are the ones who deliver this quality.**

**What everyone wants is quality of work and quality of life.**

### 3. Quality Management

According to the European Charter on Quality:

- Quality is a goal, because the organization must precisely meet the needs and expectations of customers and users, if it wishes to be competitive on the market.
- A methodology that promotes participation, because no one can demand loyalty from people without offering and developing in exchange a suitable working environment – quality also means motivation and responsibility, and the organization, its behaviour and work methodology must be based on initiatives and concern for buyers.

Definitions of quality are (Avelini Holjevac 2002, p.8):

- quality reflects the ability of a product or service to consecutively satisfy or exceed customer expectations
- quality means getting what you paid for
- quality is not something that is adapted as a special feature, but rather something that is an integral part of the product or service.

Quality, understood to mean “something good”, is a very old notion. In economic terms, it is linked to the very beginning of human economic activities, and it has existed from the first primitive societies, throughout our entire history, up to the modern day. Namely, there has always existed some type of specification (in later times, standard) against which an inspector of sorts, in behalf of an owner (chieftain, pharaoh, king, entrepreneur, and others), inspected, approved of or discarded a product or service being offered (Noray 1990, p.3 – 12.).



Philip B. Crosby, the man who initiated the quality revolution in American business with his book *"Quality is Free"*, claims and proves that:

"Quality is free. It's *not a gift*, but it is free. What costs money are the *unquality things* – all the *actions* that involve not doing jobs right the first time. If you focus on providing quality, you are likely to increase your profit by a value ranging from 5 to 10 percent of the value of your sales. And that is a lot of money – for free" (Crosby 1996, p.9.).

The catchphrases are: quality is free; it is not a gift (you need to think, organize and do better); unquality incurs costs (not doing it right the first time); quality is the easiest way to increase profits (in conditions of fierce competition and market uncertainty).

Customer-orientation presumes the existence of a flexible structure of organizations that are open towards the market and that can easily adjust to change in the marketplace and change in customer/consumer needs. At the same time, the structure of the organisation should be adjustable to changes within the company as well, that is, in alignment with human and materials resources. Only in this way is it possible to achieve optimum performance and be successful on the market (Success through Quality).

The essence of how to organize quality management is best illustrated by *Crosby's 14-point quality program*: Management commitment and loyalty, Quality improvement teams, Quality measurement (evaluation), Cost of quality, Quality awareness, Corrective measures and activities, Zero Defects planning (establishing a program committee), Manager (supervisor) training, Achieving Zero Defects (Zero Defects Day), Goal setting, Error cause removal, Recognition (Rewarding program), Quality councils, Doing it all over again (Crosby 1996, p.102-111.).

*Total Quality Management (TQM)* is a system for improving and increasing business flexibility, effectiveness and efficiency. TQM seeks to secure and create conditions in which all employees, through joint efforts and with maximum effectiveness and efficiency, can accomplish one goal: to produce products and render services when, where and how the customer and consumer wants and expects them, and getting it right the first time and every time after that.

Quality is best illustrated by the slogan *"We meet your wishes in advance"*. Hence, customer needs, expectations and wants need to be anticipated, prescribed and met in

advance, because quality is defined by the customer (*customer-defined quality*).

Quality and standards form a unity, because standards represent not only a prescribed quality, but also a measurement of the level of quality achieved.

TQM is fully market-oriented and customer driven. In a total quality system, the customer is king, because it is with the customer that the process begins (what the customer wants) and ends (a satisfied customer).

Securing quality means *"getting people to become better at doing all those worthwhile things that they would normally have to do"* (Crosby 1996, p.11.).

Today in conditions of fierce competition and increasingly sophisticated customer demands, quality has become the fundamental factor of market survival, profitability and development of a country's overall economy, its individual branches and organizations. Quality is an advantage and necessity of competitiveness in the marketplace.

The association between productivity and quality is best illustrated by the concept and goal of Total Quality Management (TQM), which means doing the right things or doing things effectively, and doing things right or doing them efficiently. This means producing what the customer wants, seeks and expects, while achieving the highest possible level of work productivity. Increased work productivity should not jeopardize product and service quality, as this goes against the principle of effectiveness and efficiency. The customer should not be put at a loss because of reduced quality caused by cutbacks in the number of employees (staff) and savings in labour costs. To avoid this, work standards must be introduced and adhered to. There can be no product and service quality without work standards; the customer is dissatisfied, the work is dissatisfied, and so is the owner. Therefore, a productivity increase resulting in a drop in quality is not profitable.

#### 4. Measuring Work Productivity and Quality in Croatian Hotels

*Work productivity determines the satisfaction and the quality of the lives of employees.*

The productivity indicator used in the empirical research on work productivity in the Croatian hotel industry and Croatian companies is the number of overnights realized per one employee. This is an indicator that can be easily measured, as the number of overnights



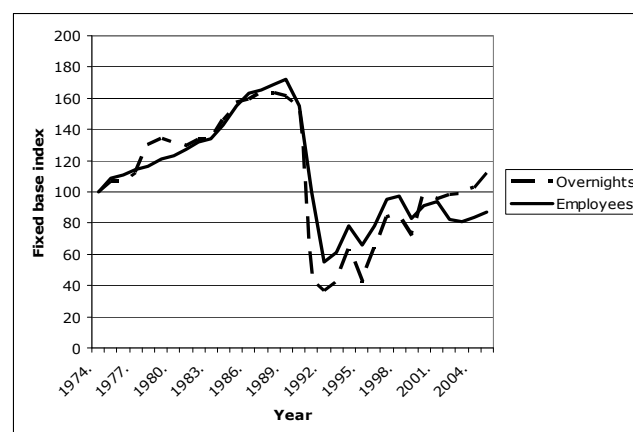
is continuously monitored in terms of statistics. The number of overnights reflects the real scope of business and, unlike a hotel's revenue (turnover), it is not subject to a change in prices. Although it does not reflect the total quantity of hotel products and services, the number of overnights is a good representative of the physical volume of business.

Year	Number of overnights in hotels in '000s	Fixed base index	Hotel employees	Fixed base index
1974	13,373	100	22,137	100
1975	14,350	107	24,135	109
1976	14,280	107	24,651	111
1977	14,989	112	25,151	114
1978	17,436	130	25,572	116
1979	17,948	134	26,709	121
1980	17,521	131	27,127	123
1981	18,194	129	28,125	127
1982	17,773	133	29,201	132
1983	17,764	133	29,696	134
1984	19,486	146	31,608	143
1985	20,975	157	34,308	155
1986	21,219	159	36,097	163
1987	21,986	164	36,611	165
1988	21,768	163	37,498	169
1989	21,552	161	38,021	172
1990	20,716	155	34,406	155
1991	5,904	44	22,205	100
1992	4,983	37	12,091	55
1993	5,729	43	13,468	61
1994	8,433	63	17,178	78
1995	5,587	42	14,669	66
1996	8,551	64	17,198	78
1997	11,247	84	20,956	95
1998	11,388	85	21,457	97
1999	9,605	72	18,304	83
2000	13,164	98	20,054	91
2001	12,735	95	20,904	94
2002	13,130	98	18,187	82
2003	13,217	99	17,863	81
2004	13,745	103	18,673	84
2005	14,964	112	19,277	87

Source: Statistical Yearbooks of the Republic of Croatia (processed data)

**Table 1:** Trends in the number of overnights and employees in hotels in Croatia 1974 – 2005

The fixed-base index graph for the number of overnights and the number of employees in Croatian hotels in the 1974 – 2005 period shows that the number of employees generally increased at a faster rate than the number of overnights (with minor exceptions), resulting in stagnation and a drop in productivity, apart from the last six years in which overnights show an upward trend, whereas employee numbers show a downward trend, leading to increased productivity.



Source: Table 1

**Figure 1:** Trends in the number of overnights and employees 1997-2004 – fixed- base indexes

Three phases are evident in changes in work productivity over a 31-year period (1974 – 2005): from 1974 to 1990 (16 years) work productivity stagnates and in 1990, plummets (Patriotic War); after 1990, productivity begins to increase more or less, although at a considerably slower rate, up until 1999 (9 years), following which productivity increases (during the last six years) at a substantially faster rate, higher than in 1974, the first year of observation, due to a faster rate of reduction in the number of employees relative to the growth rate of overnights, which remains low as a result of low occupancy rates. For example, overnights in 1974 numbered 13,373,000, whereas 30 years later in 2004, this number was 13,745,000 – a mere 3 percent increase, while the number of employees in 1974 and 2004 amounted to 22,137 and 19,277 (a 16 percent drop), respectively, causing work productivity to rise.

## 5. Conclusion

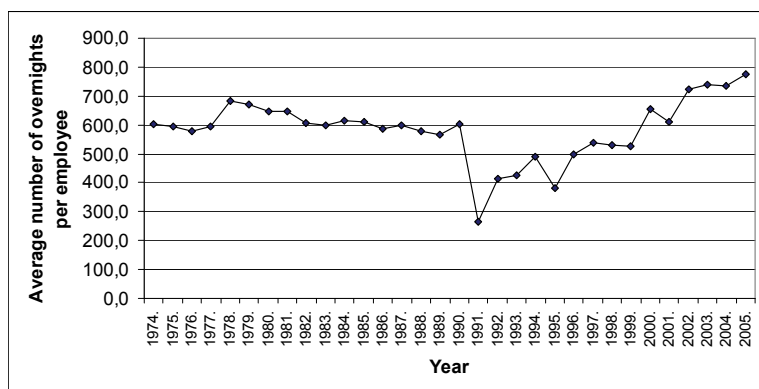
Work productivity and competitiveness determine a country's economic development and material wealth, but also the satisfaction and the quality of the lives of employees, customers, owners and society in general. For this reason, it is necessary to continuously research, analysis and discover new measures and opportunities for increasing work productivity.

The theoretical and applicative approach to studying work productivity in the Croatian hotel industry has underlined all factors upon which the level of work productivity depends. In particular, research has focused on the impact of personnel management, quality management and performance management on work productivity and the competitiveness of the hotel

Year	Number of overnights in hotels in '000s	Occupancy rate %	Hotel employees	Average number of overnights per employee	Fixed base index
1974	13,373	37.3	22,137	604.1	100
1975	14,350	39.2	24,135	594.6	98
1976	14,280	38.2	24,651	579.3	96
1977	14,989	38.3	25,151	596.0	99
1978	17,436	43.2	25,572	681.8	113
1979	17,948	44.0	26,709	672.0	111
1980	17,521	42.4	27,127	645.9	107
1981	18,194	43.2	28,125	646.9	107
1982	17,773	41.1	29,201	608.6	101
1983	17,764	40.0	29,696	598.2	99
1984	19,486	43.1	31,608	616.5	102
1985	20,975	45.0	34,308	611.4	101
1986	21,219	43.0	36,097	587.8	97
1987	21,986	43.0	36,611	600.5	99
1988	21,768	41.7	37,498	580.5	96
1989	21,552	41.2	38,021	566.8	94
1990	20,716	39.7	34,406	602.1	100
1991	5,904	13.1	22,205	265.9	44
1992	4,983	10.2	12,091	412.1	68
1993	5,729	11.5	13,468	425.4	70
1994	8,433	16.9	17,178	490.9	81
1995	5,587	11.1	14,669	380.9	63
1996	8,551	17.3	17,198	497.2	82
1997	11,247	22.8	20,956	536.7	89
1998	11,388	22.9	21,457	530.7	88
1999	9,605	20.4	18,304	524.8	87
2000	13,164	28.5	20,054	656.4	109
2001	12,735	33.1	20,904	609.2	101
2002	13,130	34.6	18,187	721.9	120
2003	13,217	33.2	17,863	739.9	123
2004	13,745	33.0	18,673	736.1	122
2005	14,964	35.4	19,277	776.3	129


Source: Statistical Yearbooks of the Republic of Croatia (processed data)

**Table 2.** Productivity standards: Average number of hotel overnights per employee in hotels in Croatia 1974 - 2005



Source: Table 2

**Figure 2.** Trends in the average number of overnights per employee 1974 - 2005

product and service on the tourism market. Implementing the results of the study may considerably improve work productivity in hotel companies and in the Croatian hotel industry and contribute to the growth and competitiveness of the entire economy of Croatia. 

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# Hysteresis vs. Natural Rate of Unemployment: One, the Other, or Both?

Ferit Kula, Alper Aslan\*

## Abstract:

This paper re-examines the empirical validity of the hysteresis hypothesis in unemployment rates by education level in 17 OECD countries. To this end, for an unbalanced panel, we employed Pesaran's Cross-Sectional Dependence (CD) and Cross-Sectionally Augmented ADF (CADF) tests. Our empirical findings provide evidence favorable to the non-stationarity of unemployment rates according to levels of primary and secondary education attainment in total unemployment, and therefore the existence of hysteresis for these levels of education. There is no evidence, however, of hysteresis for unemployment rates by tertiary education.

**Keywords:** Cross-Sectional Dependence, Hysteresis, Unit Root

**JEL:** C23, E24

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## 1. Introduction

There has been an intense and lively academic and political debate on unemployment in world economies during the last 25 years, notably for European economies. Two major hypotheses on the time series properties of unemployment can be distinguished: the natural rate hypothesis (NRH) and the hysteresis hypothesis (HH). The NRH characterizes unemployment dynamics as a mean reverting process, which means that the unemployment rate tends to revert to its equilibrium in the long run. On the other hand, HH states that cyclical fluctuations have permanent effects on the level of unemployment; therefore, the level of unemployment can be characterized as a non-stationary process.

If the HH holds, then the unemployment dynamic tends to be a non-stationary or unit root process that does not return to its long run equilibrium. This has significant policy implications. High levels of unemployment, if left unattended by the government, may persist and continue to be a serious problem. If the unemployed are unemployed for such a long time, they lose valuable skills, grow incompetent and hence remain unemployable. Thus, unemployment has negative impacts on economic growth, social stability, individual self-confidence, income distribution and individual

morale or altitude. Due to its importance, widespread empirical literature has developed around the topic of unemployment HH (Liew et al. 2009). On the other hand, if unemployment follows the I(0) process, the effects of the shock will merely be transitory, thus rendering the need for policy action less mandatory since unemployment will eventually return to its equilibrium level. The I(0) process has commonly been referred to NRH.

Despite a burgeoning literature on testing HH and NRH (e.g., Blanchard and Summers, 1986; Mitchell, 1993; Song and Wu, 1998; Leon-Ledesma, 2002; Chang et al., 2005) through time series and panel data unit-root

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methodology, there are still some methodological debates associated with the empirical literature.

First of all, the dynamics of the aggregate unemployment rate is neglected in many studies (Gustavsson and Osterholm, 2006). Due to discouraged-worker and added-workers effects, particularly in less skilled workers, new empirical works have started to turn their attention to examining variations in the labor force participation rate and employment rate<sup>1</sup> (e.g., Gustavsson and Osterholm, 2007; Madsen et al., 2008). One other issue that has been addressed in time-series analyses of HH is whether there has been a structural break in the unemployment series. Several studies illustrate that structural breaks could provide an explanation for hysteresis or persistence in the equilibrium rate of unemployment (e.g., Papell et al. 2000; Summers, 2003; Lee and Chang, 2008). The last methodological problem is that cross-sectional dependencies are not taken into account in panel data analysis of HH (e.g., Camarero et al., 2006; Berger and Everaert, 2008). This problem is stated explicitly by Christopoulos and Ledesma (2007). They applied a battery of second-generation panel unit root tests that allow for cross-sectional correlation. Although the data set was the same used in Ledesma's (2002), contrary to Ledesma's findings, the hypothesis of unemployment hysteresis in the EU is rejected. The study shows that, contrary to previous empirical literature, hysteresis does not characterize EU unemployment.

In this paper, we re-examine the informational value of unemployment rates in studies of hysteresis from disaggregated perspectives. In this paper, second generation panel data unit root methodology is employed to investigate the differences between unemployment among workers categorized by their level of educational attainment for 17 OECD countries. This approach allows us to abstract from changes in the composition of the unemployed labor force by focusing on particular educational groups while accounting for the presence of cross-sectional dependence.

The paper is organized as follows: Section II presents the data used. The econometric techniques and the empirical results are discussed in Section III. The final section concludes the paper.

## 2. Data

This study uses unemployment indicators including the percentage distribution of a country's total unemployed according to level of educational attainment. Data for both indicators were collected from the International Labour Organization-ILO (2007) and the World Bank's World Development Indicators (WDI) online database. The major classifications used in the databases are unemployment with primary education (UPE), unemployment with secondary education (USE) and unemployment with tertiary education (UTE). The sample is an unbalanced panel data that comprises 17 OECD countries with a time length that varies between 12 to 27 years. For details about data, please see the Appendix.

## 3. Methodology and Analysis

A traditional testing procedure to empirically examine HH is to apply unit root tests on the unemployment rate. Because hysteresis is consistent with non-stationary unemployment rates, unit root tests provide a convenient methodological framework. Starting with Levin and Lin (1992), much work has also been done on testing for unit roots in panels, including papers by Maddala and Wu (1999), Choi (2001), Im et al., (2003) and others. In addition, as shown in two simulation studies by Banerjee et al. (2004a, 2004b) if panel members are cross-correlated, all these tests experience strong size distortions and restricted power. For this reason, panel unit root tests relaxing the assumption of cross-sectional independence have recently been proposed in the literature by Choi (2002), Bai and Ng (2003), Moon and Perron (2003), Pesaran (2003), Phillips and Sul (2003) and Pesaran (2005).

To check if our sample is characterized by cross-section dependence, Pesaran's cross-sectional dependence test is applied.

Pesaran (2004) presents a simple cross-sectional dependence test (CD) that can be applied to both balance and unbalanced panels. The test is based on the average of pair-wise correlation coefficients ( $\hat{\sigma}_{ij}$ ) of the residuals obtained from the individual augmented Dickey-Fuller (ADF) regression. The CD statistics for an unbalanced panel is computed as:

$$CD = \sqrt{\frac{2}{N(N-1)}} \left( \sum_{i=1}^N \sum_{j=i+1}^N \sqrt{T_{ij}} \hat{\sigma}_{ij} \right) \quad (1)$$

<sup>1</sup> Labor force skill level and expansion of the educational system may affect the employability of workers and hence the cyclicity of both employment and unemployment rates (Murphy and Topel, 1997; Keane and Prasad, 1993; Hoynes, 1999; Gustavsson and Osterholm, 2007; Camarero et al., 2008).

Table 1 contains CD statistics that obtain residuals from ADF estimations with intercept and linear trend regression. The hypothesis of zero cross-section correlation is rejected for all series at the 1%-level of significance.

Test results	UPE	USE	UTE
CD statistic	17.171	22.647	38.377
p-value	(0.000)	(0.000)	(0.000)

**Notes:** The CD statistic is asymptotically normally distributed. The p-values refer to a two-sided test.

**Table 1:** Pesaran's cross-sectional dependence test

A very important issue in panel unit root and also cointegration tests is cross-sectional dependence. In fact, the properties of all panel unit root and cointegration tests are based on the assumption that the error terms are not cross-correlated. Therefore, cross-sectional dependence should be taken into account.

To this end, second generation panel unit root tests can be adopted that reject the cross-sectional independence, including those of Phillips and Sul (2003) and Pesaran (2005), Bai and Ng (2004), Moon and Perron (2004). In this paper, we consider the test defined in Pesaran (2005) to be helpful for small panels<sup>2</sup>.

Pesaran (2005) proposes the following ADF regression with the cross-section averages of lagged levels and first differences of the data:

$$\Delta y_{it} = c_{i0} + c_i t + \beta_i y_{i,t-1} + \sum_{j=1}^p \gamma_{ij} \Delta y_{i,t-j} + \varphi_i \bar{y}_{t-1} + \sum_{j=0}^p \eta_{ij} \Delta \bar{y}_{t-j} + u_{it} \quad (2)$$

where  $\bar{y}_t = \sum_{i=1}^N y_{it} / N$ . The t-ratio of  $\beta_i$  is used as the test statistic for a unit root and is called the cross-sectionally augmented ADF (CADF) statistic. Its critical values have been generated by Monte Carlo and are tabulated in Pesaran (2005). The results reported are the  $Z(N, T)$  version, which is normally distributed under the null hypothesis of the unit root defined as:

$$Z(N, T) = \frac{1}{\sqrt{N}} \sum_{i=1}^N \phi^{-1}(P_{it}) \quad (3)$$

where  $P_{it}$  is the p-value corresponding to the unit root test of the  $i^{th}$  individual cross-section unit.

Table 2 shows the CADF statistics for the UPE, USE and UTE series within our samples. The null hypothesis of a unit root cannot be rejected for the UPE and USE series with all lag specifications. But we are able to reject the null hypothesis of a unit root for the UTE series with 0 and 1 lag specifications.

p	UPE	USE	UTE
0	-0.161 (0.436)	-1.283 (0.100)	-2.696* (0.004)
1	0.880 (0.810)	0.992 (0.839)	-1.545** (0.061)
2	3.856 (1.000)	2.717 (0.997)	1.836 (0.967)

**Note:** p is average lags. p-values in brackets. \* and \*\* indicates significance at the 1% and %10 levels, respectively.

**Table 2:** Pesaran's CADF test

Our results from CADF statistics are consistent with the HH for the UPE and USE series. However, the empirical evidence does not indicate HH for the UTE series for our sample. These results indicate that shocks have permanent effects on unemployment for those with lower levels of educational attainment, while unemployment for those with a higher level of educational attainment tends to revert to its equilibrium in the long run after a shock.


#### 4. Conclusion

We have applied CADF unit root tests to unemployment rates by educational attainment in the total unemployment for 17 OECD countries during the period 1980–2007 with unbalanced panel data. After controlling for educational attainment, we find significant differences between unemployment rates. More specifically, we can conclude that the evidence is favorable to the non-stationary of unemployment rates by primary and secondary education attainment in total unemployment, and therefore the existence of hysteresis in primary and secondary education.

However, we also find that there is no evidence of hysteresis for unemployment rates by tertiary education in total unemployment. The results also point to the

<sup>2</sup> Because Pesaran's method does not require the direct estimation of idiosyncratic components from the data, it can be beneficial for small panels where estimation of factors is difficult (Moon and Perron, 2007).



importance of considering some degree of heterogeneity with educational differences in labour markets. 

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## Appendix

Country	Age	Data availability
Australia	15+	1989-2007
Austria	15+	1985-2007
Belgium	15+	1994-2007
Canada	15+	1980-2007
Denmark	15-66	1994-2007
Finland	15-77	1995-2007
Germany	15+	1996-2007
Italy	15+	1993-2007
Japan	15+	1987-2007
Netherlands	15-64	1995-2007
New Zealand	15+	1990-2007
Norway	16-74	1996-2007
Spain	16+	1980-2007
Sweden	16-64	1987-2007
Switzerland	15+	1991-2007
United Kingdom	15-64	1987-2007
United States	25+	1994-2007



# The Impact of Globalization on the Insurance and Reinsurance Market of Eastern Europe

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## Abstract:

*The analysis of the influence of globalization on the insurance and reinsurance markets of Eastern Europe confirms its significant importance in directing it towards steady increase, reflecting global trends. Special attention in this paper has been dedicated to the new thriving market in the insurance and reinsurance business as a basic indicator of market globalization with special attention to Eastern Europe. Namely, the business environment in Eastern Europe is especially dynamic and complex regarding the phase of altering its social-economic system. The research in this paper covers analysis of insurance and reinsurance markets of Eastern Europe with special attention on this market in the Republic of Slovenia, the Republic of Croatia and the Republic of Serbia from 2000 to 2008. The subject of this research is an overview and analysis of the reflexive relationship between the insurance and reinsurance markets of Eastern Europe and the globalization processes on both micro and macro levels. The main goal of the research is to obtain specific results about the intensity and direction of the influence of globalization processes on the course and direction of development of the insurance and reinsurance markets of Eastern Europe on the one hand, and changes in the insurance and reinsurance markets of Eastern Europe on globalization processes on the other. The basic hypothesis of this research is that there is a distinctive and strong reflexive relationship between the globalization processes and the conditions and state of the insurance and reinsurance markets of Eastern Europe. The applied methodology during the research includes analyses and synthesis methods. The research results undoubtedly confirm the significance of the relationship between globalization trends and changes in the insurance and reinsurance markets of Eastern Europe, hence providing a found and background for further research in this area.*

**Keywords:** Globalization, Insurance, Reinsurance, New markets

**JEL:** G22

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## 1. Introduction

The notion of globalization denotes connections, integrity and interdependence in the world covering economics, sociology, technology and the cultural, political and ecological spheres of life. Globalization has been regarded as dealing with business, a particular approach in organizing financial markets, and nowadays, even a procedure. Thus, it could be adequately understood as a unique process comprising a great number of sub-processes (such as advanced economic interdependence in the world, increased cultural influence, rapid development in the domain of information technology, new management and geopolitical challenges) that contribute the growing

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interdependence between people and business into a unique comprehensive global system. Therefore, globalization, as an established procedure, has numerous aspects, with an emphasis on its economic aspect due to its permanent presence in the basics of globalization itself.

Globalization comprises numerous possibilities and challenges. A greater market denotes greater profit, leading to growing wealth for further investment and development as well as eliminating poverty in many countries. Badly shaped national policy, as well as institutional, infrastructure and trade barriers could seriously limit the abilities of a country to take advantage of globalization. Exact economic information provides the basis for carrying out a successful policy and information collection from different countries allows for the construction of a relative and global picture on the levels of living standards, wealth and poverty (Prekajac 2007, p. 87). In the modern world, every country and company should mightily strive for taking decisions and implementing coherent policy to maximize its efficiency and reduce globalization challenges substantially. Without further explanation of the advantages and disadvantages of globalization, the general intention is to point out the impact of globalization as a worldwide process on the insurance and reinsurance market of Eastern Europe, as well as the possibilities and challenges that insurance and reinsurance companies could face in that particular region.

## 2. *Theoretical Framework*

The influence of globalization as a global process on the course and effects of companies' business activities is one of the best investigated and analyzed issues in the last two decades. The dynamics of changes and conditions induced in the environment by globalization largely determine the ways in which businesses are operating and the forms of the companies' decision making. In the sense of globalization-induced influences on the course and effects of the companies' business operations, these issues are especially important for financial companies, since their activities include diversified structural activity, and they are explicitly influenced by the factors and circumstances in the environment. The special importance of research on the influence of globalization on financial companies is reflected also by the fact that the ways and effects of the business operations of these companies largely define

the entire 'business climate' in the market, which on the other hand directly affects the course and effects of economic and social development in general. Insurance companies as typical representatives of financial activities are of special importance in the market, and it is vital to analyze the influence of the globalization processes on their business operations, both from scientific and practical perspectives. This issue is strongly emphasized in the case of transitional economies of Eastern European countries, since the success of reforms largely depends on the level of order within the financial sphere and its complementariness within international, global courses. These issues were investigated by several authors, and Liedtke Patrick in his article 'What's Insurance to a Modern Economy?' (Liedtke 2007) investigates the connection between the modern courses and trends in the financial market through the prism of insurance activities, with special attention to the ability of insurance companies to adjust themselves to the courses and trends that globalization as a global process stimulates. The conclusions derived by the author could be reduced to the general notion that there is a strong correlative interconnection between globalization and insurance activities and that the trends of globalization are reflected in the insurance business. In his article 'The necessity of restructuring insurance companies of Serbia' Ostojic Sinisa (2004) investigates and confirms the necessity of restructuring the insurance system in the Republic of Serbia and its active inclusion in international processes. In his articles, Marovic Boris also analyzed and empirically confirmed the significance and necessity for the insurance markets of transitional economies to comply with the conditions and trends created and imposed by globalization in the international market.

Special attention has been given to the importance of the risks involved with insurance companies' operations. Namely, adequate transnational risk coverage implies the existence of an efficient global program of insurance activities. Pure risks are usually traded in insurance and reinsurance markets, although more recently the market for pure risk has expanded to include alternative risk transfer mechanisms such as captive insurance companies and securitized insurance instruments (Cummins and Weiss 2000, p. 162).

Traditional theory perceives globalization to be a demanding, lengthy, step-by-step process. The eclectic paradigm (Dunning 1979, 1988) predicts that companies decide to go international when they possess some company-specific advantages. This paradigm is actually a

conglomerate of resource-advantage theory, international trade theory, and transaction cost-analysis theory. Later refinements to the eclectic paradigm (Dunning 1995, 2000) involve business, technological and political developments in the 1990s and try to explain globalization in terms of dynamics. We hypothesize that later stages of globalization, with their increasing positive dynamic position, are one of the most important factors for global development, both in social and business areas. Especially in the financial segment, processes of globalization significantly influence paths and trends in further development.

Bearing this in mind, the paper analyzes the condition on the local markets and the possibilities for the further advancement of the insurance and reinsurance business. Special emphasis has been given to the identification of characteristics of the insurance and reinsurance markets of Eastern Europe, as well as to the role of global insurers and reinsurers in the further growth and development of these markets.

### 3. Current Trends In The Insurance And Reinsurance Global Market

Business globalization of economic areas and the growing interdependence among people worldwide indirectly affects the insurance and reinsurance market, allowing for the creation of 'a global insurer'. Therefore, the globalization of the world economy fosters the globalization of insurance and reinsurance service. However, it is evident that these two procedures were not carried out separately, due to the fact that reinsurance service is international business in nature and nowadays slips across national borders. It is a well-known fact that risk management in insurance companies has been carried out through the application of statistics and probability theory, while deviations from average values which occur as a result of the change in economic conditions, social climate, environment effects, etc., compensate for dispersion of risk over time, space, insurance type, etc. Thus, the spatial dispersion of risk creates the need for international cooperation. Insurance companies offer international service in the form of risk insurance in foreign countries or establish daughter companies abroad while setting up a subsidiary or acquisition of foreign insurance company, which has become a more common practice nowadays. In addition, globalization of insurance and reinsurance service has been initiated by the need for following steady clients in

their ambitious ventures worldwide as well as a constant search for increased profit, which can be accomplished by means of the geographic spread of the insurance and reinsurance business (Cummins and Danzon 1997).

Globalization of the insurance and reinsurance business enables risk diversification and cost reduction, but has become feasible only after liberalization and deregulation of the once strongly protected sector. Many countries are moving away from protectionist policies and state control towards a market approach, especially in the domain of insurance and other financial services. In order to establish a stable, adequately managed and successful sector, the governments strive to deregulate insurance, privatize publicly owned companies and open markets to foreign companies. Demographic changes are the second important reason for emerging multinational insurers and reinsurers. Globalization of the insurance and reinsurance business depends on the challenges the insurers and reinsurers face on their local markets. As a consequence of the globalization of the insurance and reinsurance business, the first transnational insurance and financial companies emerged first in Europe, and include AEGON, AGF, Allianz, AXA, Generali, ING Group, Mapfre, Prudential plc, Skandia, Royal Sun Alliance, and Zurich Financial Services; and thus, subsequently in North America as well: AIG, Aetna, CIGNA, John Hancock, Manulife Financial, MetLife, New York Life, Principal Financial, Prudential, and Sun Life.

The process of the globalization of insurance and reinsurance services combined with ever-growing competition on the insurance and reinsurance market unavoidably leads to increased integration of insurance and reinsurance companies (Plunkett 2007). The process of consolidation, which means merging and joining insurance and reinsurance companies, has been led by the desire to increase market strength, decrease costs and develop economies of scale. The growing consolidation of insurance and reinsurance companies is emerging as the consequence of the fact that only a few of the large insurance groups will have available capital sufficient to achieve global domination since new regulation, including the Sarbanes-Oxley Act in the US and Solvency II in Europe, is going to allow more competitive positions for large insurance companies in comparison with smaller ones; but only a few of them will be able to provide adequate managerial skills to achieve success in all areas of insurance in a more open and competitive environment (in the domain of life insurance, globalization has largely contributed to the

intensification of competition) (Santomero and Cummins 1999).

The consolidation of insurance companies of non-life insurance unfolded slower than insurance companies of life insurance, although the character of non-life insurance in its broadest sense is more global than that of life insurance, especially with regard to determination of premiums in liability insurance as well as capability of global risk distribution. There are a small number of large insurance companies providing a wide range of insurance services to their corporate clients, including services of global insurance of property and liability. The leading global insurance companies in 2008 are represented in Table 1.

Rank	Company	Revenues (2) (mil. USD)	Country
1	Japan Post Holdings	198,700	Japan
2	Allianz	142,395	Germany
3	Berkshire Hathaway	107,786	USA
4	Assicurazioni Generali	103,103	Italy
5	AXA	80,257	USA
6	Munich Re Group	67,515	Germany
7	Nippon Life Insurance	66,621	Japan
8	State Farm Insurance Cos.	61,343	USA
9	MetLife	55,085	USA
10	China Life Insurance	54,534	China

(1) Based on an analysis of companies in the Global Fortune 500. Includes stock and mutual companies.

(2) Revenues include premium and annuity income, investment income and capital gains or losses, but exclude deposits; includes consolidated subsidiaries, excludes excise taxes.

**Source:** Insurance Information Institute,  
<http://www.iii.org/international/rankings/>

**Table 1:** Leading insurance companies in the world in 2008 (1) by revenue (in millions of dollars)

Business concentration is the most apparent in the area of reinsurance, since the ten leading reinsurers signed 60% of the world's reinsurance premiums in comparison with 40% ten years ago. The process of globalization of reinsurance business has been

accompanying ambitions of achieving economies of scale and risk diversification, and thus results in a strong consolidation of reinsurers, realized through merging and joining reinsurance companies, and which directly affects the increasing dependence of insurance companies in the increasingly concentrated global sector of reinsurance.

Below is a list of the leading reinsurance companies in the world from 2008 (Table 2). Due to the ever-changing financial industry, it is difficult to say who the largest reinsurers are currently. For example, in early February 2009, shares in the world's second largest reinsurer, Swiss Re, dropped 28% (the most in 19 years) after appealing to *Berkshire Hathaway* for more than \$2.5 billion to help restore capital as a result of record losses since the financial crisis began.

Rank	Company	Net reinsurance premiums written (mil. USD)	Country
1	Munich Re Group	30,379.7	Germany
2	Swiss Re Group	23,724.3	Switzerland
3	Berkshire Hathaway/General Re Group (1)	11,441.0	USA
4	Hanover Re Group	10,653.2	Germany
5	Lloyd's of London	8,588.2	U.K.
6	SCOR	8,551.4	France
7	Transatlantic Holdings Inc.	4,108.1	USA
8	PartnerRe Ltd.	3,989.4	Bermuda
9	ACE Tempest Reinsurance Ltd. (2)	3,961.0	Bermuda
10	Everest Re Group Ltd.	3,505.2	Bermuda

(1) Combined figures of Berkshire Hathaway Reinsurance Group and General Re Group.

(2) Includes all reinsurance business performed by subsidiaries of ACE Ltd.

**Source:** Insurance Information Institute,  
<http://www.iii.org/international/rankings/>

**Table 2:** Leading reinsurance companies in the world in 2008 by Net reinsurance premiums written (in millions of dollars)

In order to be competitive in the era of globalization, insurance and reinsurance companies should steadily improve their efficiency and productivity, and at the same time their ability to provide insurance and reinsurance services in an efficient way has become a valuable source of competitive advantage (Ghosh and Ariff 2004). Thus globalization leads to launching and developing new insurance products that are global in character but at the same time carefully matched to individually insured clients with the aim of satisfying their demands.

### 3.1 'New trends' in selected Eastern European countries

Since 1989 the markets of selected Eastern European countries, or countries commonly understood as in transition (i.e. selected emerging markets such as the Czech Republic, Poland, Slovakia, Hungary, Slovenia, Croatia, BH, Montenegro and Serbia) have been attracting more and more global insurance and reinsurance companies, which is a consequence of the liberalization, de-monopolization and privatization of national insurance and reinsurance markets, economic and political reforms, creation of conditions for the free flow of capital and workforce, and the achievement of a high average rate of economic growth in these countries as well as the integration of a large number of Eastern European countries into the European Union in 2004 and 2007. The international financial integration of transitional countries results from global and regional integration (Mirdala 2008, p. 221). As the result of these changes and the fact that Eastern European countries provide global insurance companies with a potential for long-term business growth and advancement, during the 90's the insurance business started emerging in these countries, where in the former environment of socialist public ownership and management, it was guaranteed or considered unnecessary. This was primarily due to direct foreign investments by large insurance companies such as *Allianz*, *AXA*, *Prudential*, and *Winterthur* (Hamilton, Pichler-Milanović and Andrews 2005).

Before the significant admission of foreign insurance companies during the 90's, the insurance and reinsurance markets of selected Eastern European countries were dominated by motor vehicle insurance and property insurance. As global insurance and reinsurance companies entered the markets, the publicly owned insurance companies lost their monopoly and the structure of insurance business changed in favor of commercial and life insurance. Global insurers and

reinsurers on the markets of selected Eastern European countries have an opportunity to sell products that have saturated the markets in their parent countries. In addition, in these new markets they have an initial competitive advantage against domestic companies, which is due to their long standing business experience, financial strength and knowledge. The most harmful effects of globalization on insurance and reinsurance markets for global insurers and reinsurers are the examples of very expensive breaks into new markets, both regarding acquisition of existing insurance and reinsurance companies as well as developing selling channel networks. Apart from the above cited advantages of globalization for global insurance companies, it also offers certain advantages for the selected Eastern European countries that allow massive expansion of large insurance and reinsurance companies. Meanwhile, they extend new knowledge, fresh capital, sophisticated insurance products, marketing standards that significantly increase the level of awareness of the customers, adequate capacities for covering huge risks, and expertise for accepting new risk cover. Enhancing the level of confidence in the institution of insurance, they facilitate the level of customer education, which on its side increases demand, especially for products of life insurance, which both the global and local insurance and reinsurance companies benefit from.

A few of the leading insurers, typically former monopolies with publicly owned capital, claim the prevailing share on insurance and reinsurance markets of selected Eastern European countries. This is implied by examples from the two largest markets in the region. In Poland, the prevailing share is owned by the two leading insurers, *PZU* and *Warta*, and in the Czech Republic *Ceska pojistovna* and *Kooperativa*. However, liberalization, i.e. removing the barriers in order to allow foreign insurance and reinsurance companies to enter the markets, harmonized national legislation with EU regulations, a relatively sophisticated system of supervision, and the admission of these countries into full EU membership, contributed to the appearance of insurance companies with foreign capital. The reinsurance market in these countries is characterized by a small number of reinsurers, including the leading reinsurers in the world. *Munich Re*, *Swiss Re*, *ERC Group*, *Partner Re*, *GeneralCologne Re*, *Hannover Re*, *Converium*, *SCOR*, *Lloyd's*, *Everest Re* and *PXRE* are among those present in the region.

Stimulation for globalizing insurance and reinsurance markets in selected Eastern European



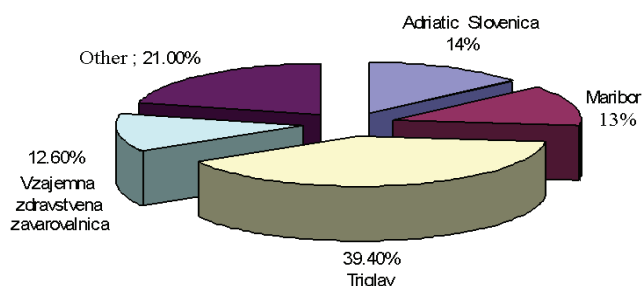
countries will be provided by the need of global insurers and reinsurers to follow their clients outside national borders, as well as the need for constant search after risk diversification and the development of economies of scale. The partial privatization of the social security system, such as retirement and health insurance, creates new business opportunities for experienced and financially strong global insurers in the markets of these countries. Also, the process of the liberalization of insurance and reinsurance markets of selected Eastern European countries, followed by the process of transformation and privatization of former publicly owned insurance companies, as well as the process of consolidation of insurance and reinsurance companies in the markets of these countries, create additional resources for opening these markets for global insurance companies in the coming period as well.

### 3.2 Selected countries of the former Yugoslavia - Slovenia, Croatia, BH, Montenegro and Serbia

Although the same trends characterizing the entire region of Eastern Europe are present in business ventures of insurance and reinsurance companies in the region of the former SFRY, there is a strong need to depict the characteristics of insurance and reinsurance markets in the republics of the former state in more detail, with special attention to the insurance and reinsurance market of the Republic of Serbia.

Regarding the countries of the former Yugoslavia, Slovenia has been the most developed country both generally and in the domain of the insurance and reinsurance market; it is the one country from the former Yugoslavia which currently has full EU membership. When speaking about the conditions of setting up insurance companies, insurers providing services of life and non-life insurance in Slovenia need to obtain initial capital in the amount of € 4.4 million, non-life insurers € 2.4 million, life insurers € 2 million, and reinsurers € 2.4 million (The Insurance Act, No. 109/06, 114/06 and 9/07). On this market there were 16 operating companies, of whom two were reinsurance companies, in 2007. This market is dominated by insurance companies with a majority of domestic capital (it accounted for over 91% of total premium payments), especially in the domain of non-life insurance, but in life insurance as well, which distinguishes Slovenia from the rest of the countries of the former Yugoslavia. The Slovenian insurance market is markedly concentrated since the leading insurance

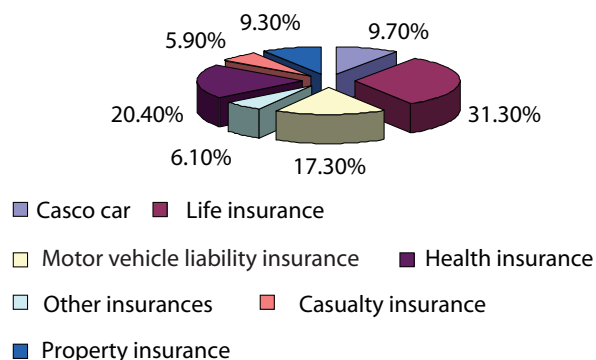
company, *Triglav*, has a market share of over 38%, and the first five insurance companies over 86%, according to the amount of attributed premium (SIA 2008). The collected gross insurance premium structure in Slovenia is shown in Figure 1 and the portfolio structure of insurance is shown in Figure 2.



Source: SIA, Statistical Insurance Bulletin, 2008

Figure 1: Collected gross insurance premiums structure in Slovenia in 2007

In the field of property insurance in 2007, *Triglav* insurance holds 52.6% of the market share, *Zavarovalnica Maribor* holds 18.6% and *Adriatic Slovenica zavarovalna druzba* holds 15.8%. Similarly, in the field of life insurance, *Triglav* holds 43.9%; *Zavarovalnica Maribor* holds 12.1% and *KD Zivljenje* 11.2%. However, in the field of voluntary health insurance, 61.7% of the market is held by *Vzajemna zdravstvena zavarovalnica*, while *Adriatic Slovenica* has 24.3% and *Triglav zdravstvena zavarovalnica* 14%. The Slovenian insurance and reinsurance market in 2007 was characterized by the participation of 305 insurance companies from the EU. Of those, 80 insurance companies (26.2%) were from Great Britain, 31 from Ireland, 31 from Austria, 21 from Italy, 20 from Germany, 19 from Luxemburg and 12 from France (SIA 2008).

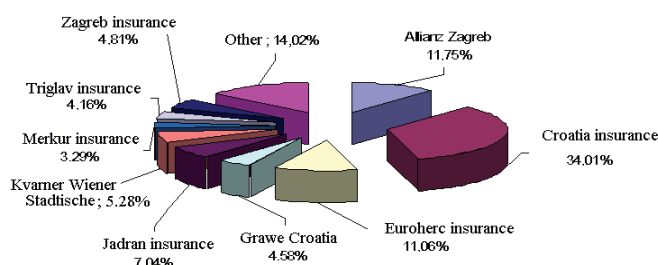


Source: SIA, Statistical Insurance Bulletin, 2008

Figure 2: The portfolio structure of the insurance business in Slovenia in 2007



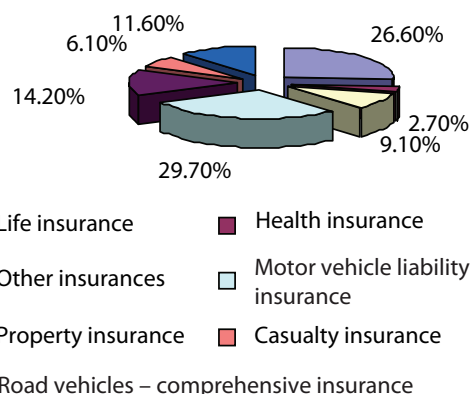
According to the level of development of insurance markets in the countries of the former Yugoslavia, Croatia is in second place after Slovenia. Croatia has the most rigorous requirements for setting up insurance companies in the entire region. Typically, setting up insurance companies dealing with non-life and life insurance require an initial capital of € 145.5 million, for non-life insurers € 25.3 million, for life insurers € 12.3 million, and for reinsurers € 18.9 million (The Insurance Act, No. 151/05). In 2007 there were 26 operating companies; two of them were reinsurers, six life insurers, eight non-life insurers, ten were insurance companies dealing both with life and non-life insurance and one a pool for insurance and reinsurance of nuclear risks on the Croatian insurance and reinsurance market. The founders of the Croatian pool for insurance and reinsurance of nuclear risks are *Croatia osiguranje*, *Croatia Lloyd*, *Helios osiguranje*, *Triglav osiguranje* and *Allianz Zagreb* (Croatian Financial Services Supervisory Agency 2008). The collected gross insurance premium structure in Croatia is shown in Figure 3.



**Source:** Croatian Financial Services Supervisory Agency, Annual report, 2008, [www.hanfa.hr](http://www.hanfa.hr)

**Figure 3:** Collected gross insurance premium structure in Croatia in 2007

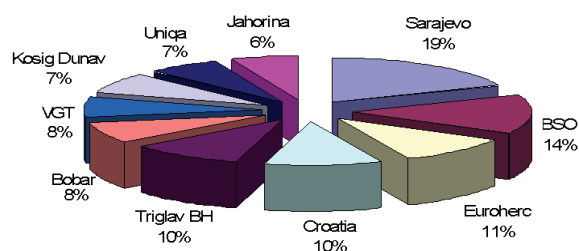
Most are under a foreign ownership. Companies under foreign ownership have predominant positions on the life insurance market, whereas companies established on domestic capital prevail in the domain of non-life insurance. The collected gross insurance premiums in Croatia in 2007 were 1,689 million USD. The insurance market in Croatia, as in Slovenia, is highly concentrated, with the top five insurers holding 63.86% of the market share; in 2007 the leading insurance company, *Croatia osiguranje*, contributed 34.01% to the total of insurance premiums. The portfolio structure of Croatian insurers is shown in Figure 4.



**Source:** Croatian Financial Services Supervisory Agency, Annual report, 2008, [www.hanfa.hr](http://www.hanfa.hr)

**Figure 4:** Portfolio structure of insurance business in Croatia in 2007

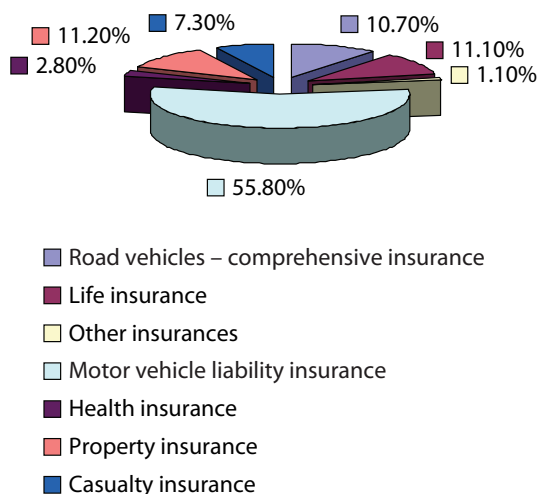
With regard to the requirements of establishing an insurance company in BH, i.e. the conditions necessary for setting up a company, they are the same as in Slovenia, which means that insurers providing services of life and non-life insurance need to have initial capital of € 4.4 million, non-life insurers € 2.4 million, life insurers € 2 million, and reinsurers € 2.4 million (Law on Insurance Companies in Private Insurance, No. 24/05 and Law on Insurance Companies, No. 17/05, 01/06, and 64/06). BH has a very complex legal and institutional framework for such a small insurance and reinsurance market. The insurance and reinsurance business is organized and regulated on the entity level, with the Insurance Agency of B&H providing oversight at the state level. The State Agency harmonizes the entities' legislation and the supervisory work of the entity's agencies, organizes statistics at the state level and represents the country in international relations. In 2007, on the insurance market of BH, including both entities, the Federation of BH and the Republika Srpska, there were 26 operating companies (Federation of BH – 16 and the Republika Srpska – 10) of which one was a reinsurance company, one was a life insurance company, 15 were non-life insurance companies and nine were insurance companies dealing with both life and non-life insurance (Insurance Agency of B&H 2008). Insurance companies in BH are still under domestic majority ownership, but there are ten companies under foreign ownership. The collected gross insurance premium structure in BH is shown in Figure 5.



Source: Insurance Agency of B&H, Statistics of Insurance Market in Bosnia and Herzegovina, 2008

Figure 5: Collected gross insurance premium structure in BH in 2007

The BH market is highly concentrated, with the top five insurers holding 45.98% of the market share; the predominant contribution to the market share is that of the *Sarajevo osiguranje* company. The leading insurance company in the Republika Srpska is *Bobar osiguranje*. The portfolio structure of the insurance business in BH is shown in Figure 6.

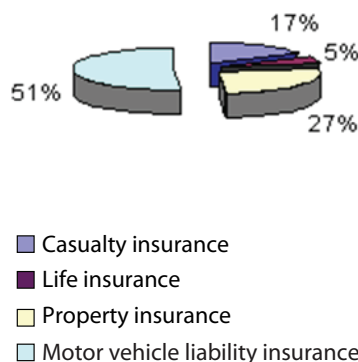


Source: Insurance Agency of B&H, Statistics of Insurance Market in Bosnia and Herzegovina, 2008

Figure 6: The portfolio structure of the insurance business in BH in 2007

In Montenegro, insurers providing services of life and non-life insurance need to have initial capital in the amount of € 32 million, for non-life insurers it is € 27.85 million, for life insurers € 2.22 million, and for reinsurers € 1.95 million (Law on Insurance, No 78/06). In 2006, insurance market premiums rose by 18% and accounted for 2.1% of GDP. Although there are six insurance companies in the country, *Lovcen osiguranje* maintained a dominant market share (70%). The sector is dominated by car insurance (51%), while the life segment, which is less developed, accounts for less than 5% of billed premiums.

An insurance law, establishing an independent supervisory agency, was adopted at the end of 2006. The government passed the law on receivership and liquidation of insurance companies in June 2007, thus completing the legal framework of the insurance and reinsurance sector. The proposed legislation defines the terms of and procedures for receivership, voluntary and judicial liquidation of insurance companies and the rights and liabilities of parties to these proceedings. In addition, three insurance companies have reestablished a mutual guarantee fund (absent since the dissolution of the state union with Serbia). In 2007, the sector expanded further with the entry of two new firms, including the first life insurance company, but the sector remained highly concentrated since the three leading insurers in 2007 held around 98% of the market share, to which the leading *Lovcen osiguranje* contributed with around 66% (SY MNE 2008). The portfolio structure of the insurance business in Montenegro is shown in Figure 7.



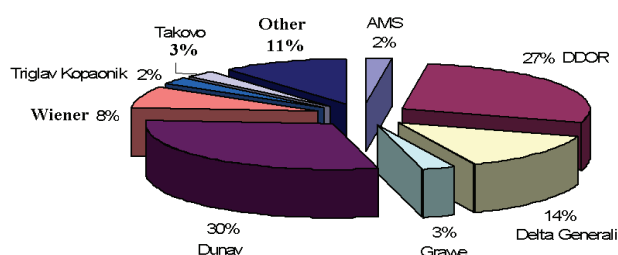
Source: MONSTAT, Statistical Yearbook (SY MNE), 2008

Figure 7: The portfolio structure of the insurance business in Montenegro in 2007

The greatest change to the insurance market of Serbia happened after the passing of the new Insurance Law in 2004 (Insurance Law, No. 55/04 and 70/04). It defines new rules of behavior, so the requirement of initial capital was raised (for example, € 4 million for dealing with life insurance, including retirement insurance, € 4.5 million for dealing with any non-life insurance and € 4.5 million for dealing with reinsurance), in comparison with previous regulations. The National Bank of Serbia was appointed as the supervising body of the entire financial system, including insurance companies and pension funds. Serbia joined the international exchange by allowing insurance companies to invest their assets into foreign financial markets. The general interest of foreign insurance companies to enter

the Serbian insurance market, both through greenfield investments and acquisition of existing insurance companies has been growing steadily as a result of repeated attempts to harmonize the domestic market with European legislation. This interest is specially expressed in the domain of life insurance, which was extremely undeveloped in the period before 2004; its development has been enabled also with the new Insurance Law that considers the possibility of expressing insurance coverage in Euros.

The number of insurance companies rose from 17 in 2006 to 20 in 2007. Of this number, 17 companies engaged in insurance activities only, two in reinsurance, and *DDOR Novi Sad*, a stock company dealing with both insurance and reinsurance. Of the companies engaged in insurance activities, four engaged in life insurance, eight in non-life insurance, and six in both life and non-life insurance operations. From the existing 20 insurance companies (*Credit Agricole Life* is the first insurance company under foreign ownership which represents a greenfield investment), 13 are under private foreign ownership and seven companies under majority domestic ownership. Only one insurance company is in state-social ownership, *Dunav*, which dominates the insurance market of Serbia, together with the privatized *DDOR Novi Sad*. The majority owner of *DDOR Novi Sad* is the Italian insurance company *Fondriaria-SAI*. The contribution of insurers *DDOR Novi Sad* and *Dunav* as two leading insurance companies on the market is 67.8%, *Delta Generali* and *Weiner Stadtische* 18.3%, while the other 12 insurers have 13.8% (Association of Serbian Insurers 2009). The collected gross insurance premium structure in Serbia is shown in Figure 8.

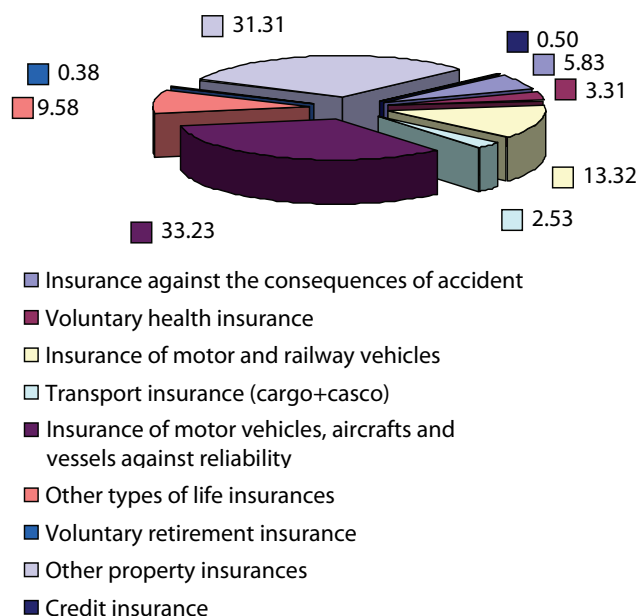


**Source:** NBS, Insurance Sector in the Republic of Serbia – annual report, 2008

**Figure 8:** Collected gross insurance premium structure in Serbia in 2007

Recently three foreign companies took over three domestic insurance companies and became their majority owners: *Triglav* from Slovenia took over the

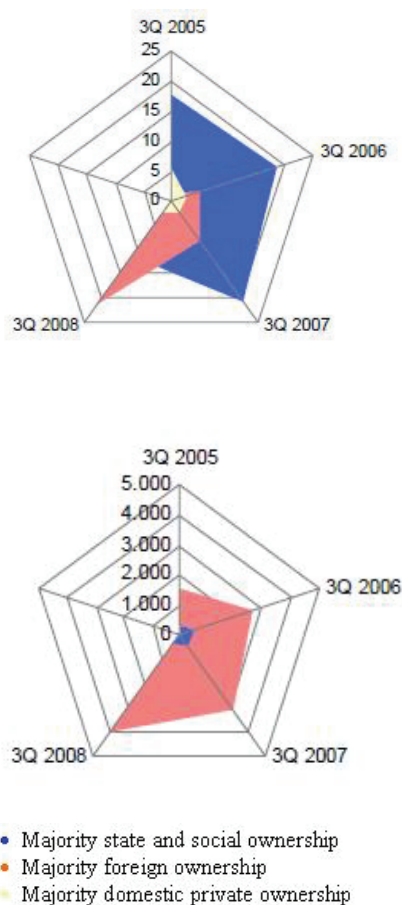
*Kopaonik* insurance company, *Sava* from Slovenia took over the *Polis* insurance company, and *Uniqua* from Austria took over the *Zepter* insurance company. During the first half of 2007, the National Bank of Serbia issued two more greenfield licenses, one for non-life insurance – *Uniqua non-life insurance* and one for *Merkur insurance*, an insurance company dealing solely with life insurance. Beside insurance companies, the sales network comprises 44 legal subjects, 87 entrepreneurs, one travel agency, three banks and 3,982 individuals holding the license of insurance mediator. The portfolio structure of the insurance business in Serbia is shown in Figure 9. Also, non-life and life insurance premiums in the Serbian insurance market are shown in Figure 10.



**Source:** NBS, Insurance Sector in the Republic of Serbia – annual report, 2008

**Figure 9:** Portfolio structure of the insurance business in Serbia in 2007

The developmental potential of the insurance and reinsurance market in Serbia is high. Namely, estimations predict that 50% of the population of 7.5 million could obtain life insurance, but only 350,000 are insured presently, of which 100,000 are insured through pension funds (Association of Serbian Insurers 2009).



Source: NBS, [Insurance Sector in the Republic of Serbia](#) – annual report, 2008

**Figure 10:** Premiums of non-life (RSD bln) and life (RSD mln) insurances in 3Q 2005, 2006, 2007 and 2008

The reasons for undeveloped life insurance in Serbia are the low level of income per capita, i.e. low purchasing power, strong suspicion of insurance as an institution, lack of knowledge about product characteristics and the long-term instability of the national currency. All the abovementioned reasons for the low presence of life insurance in Serbia have been eliminated by passing the Insurance Law in 2004.

### 3.3. Globalization as ideology versus the theory of national markets

The main goal of this paper is to determine the strength of interaction between globalization as a process on the one hand and the circumstances and trends in insurance and reinsurance markets of Eastern Europe on the other, and to describe the main factors that cause changes between these processes. With that

purpose, the authors conducted research on three countries of the former Yugoslavia (Slovenia, Croatia and Serbia), covering the period from 2000 to 2008. The applied methodology during the research includes analyses and synthesis methods.

The processes of globalization have inevitably led to changes in national insurance and reinsurance markets (especially in the transitional economies of Eastern Europe, which is in the phase of altering its social-economical system), but changes in these national markets also indicate certain modifications and new trends in the process of globalization. The subject of this paper and investigation is to analyze and understand the pace, direction and intensity of these changes, with a special focus on the significant interdependences and similarities arising in the national insurance and reinsurance markets of Eastern Europe. The investigation in this paper focuses on selected countries of Eastern Europe (i.e. selected emerging markets such as the Czech Republic, Poland, Slovakia, Hungary, Slovenia, Croatia, BH, Montenegro and Serbia) especially regarding their undoubtedly high potential for adapting to challenging globalization processes. Transitional economies undergo economic liberalization, macroeconomic stabilization where immediate high inflation is brought under control, and restructuring and privatization in order to create a financial sector and move from public to private ownership of resources. These changes affect insurance and reinsurance markets and create a necessity for fundamentally different governmental institutions and the promotion of private-owned enterprises, markets and independent financial institutions.

Therefore, the investigation is conducted with the goal of obtaining specific data about the presence and intensity of the correlation between the insurance and reinsurance market of Eastern Europe and globalization processes, in order to better understand the anticipated changes, so that these markets can finely adjust to the challenges of globalization. The investigation includes the national insurance and reinsurance markets of the Republic of Slovenia, the Republic of Croatia and the Republic of Serbia, since these are social and economic systems in different phases of transition (the Republic of Slovenia is a full member of the European Union, the Republic of Croatia is on its way towards accession to the Union, while the Republic of Serbia is in the process of becoming an EU candidate state). Common to all these regions is the driving ambition to become a full member of the European Union as soon as possible and therefore

to harmonize their national legislation with that of the European Union, meaning that their markets will become a part of the international world market.

Thus, the investigation includes a study of several basic parameters of national insurance and reinsurance markets and aims to answer the following questions:

- 1) *How has the national legislation adjusted to the changes and requirements of the global environment?*
- 2) *What were the challenges that national insurance and reinsurance markets faced in the process of adjusting to global trends?*
- 3) *Are there any similarities and differences between these markets, and what is their importance in terms of their influence on the processes and trends of globalization?*

The investigation covers the period from 2000 to 2008, since it was characterized by intense changes and influence on both the global processes on circumstances and conditions in these markets, and the attempts of national legislation to respond to these challenges as quickly as possible. The investigation is divided into two phases. The first phase comprises comparative analysis and testing of the reflexive relationship and interdependence of selected Eastern European countries (Slovenia, Croatia and Serbia) and EU 15 countries in 2007 based on relevant economic facts and figures. The second phase of the investigation comprises detailed analysis and determination of changes in the intensity and adjustment of the examined insurance and reinsurance markets to the requirements of the global environment.

### **The results obtained from these investigations are the following:**

The insurance and reinsurance markets of Slovenia, Croatia and Serbia are mutually correlated, although their markets are at different stages of development. Namely, their potential for further growth and development based on relevant economic facts and figures is undisputed, especially in contrast to EU 15 countries. Slovenia has the

most developed insurance and reinsurance market of the selected countries, although there is the possibility for its significant advancement regarding EU 15 countries' insurance and reinsurance market data. Hence, in 2007 collected premiums per capita of citizens (mil. USD), collected gross premiums (mil. USD) and collected gross premiums as % of GDP were 1,294; 2,592 and 5.7, respectively, in Slovenia and 3,306; 1,539,968 and 9.16, respectively, in EU 15 countries (Table 3).

	Slovenia	Croatia	Serbia	EU 15
GDP per capita of citizens (USD)	23,000	11,086	5,676	-
Population (in 000)	2,000	4,600	7,500	-
Collected premiums per capita of citizens (mil. USD)	1,294	370	103	3,306
Collected gross premiums (mil. USD)	2,592	1,689	766	1,539,968
Collected gross premiums in % GDP	5.7	3.3	1.8	9.16
Number of insurance societies	16	22	20	4885
Life/Non-life insurance (%)	28.5 : 51	27.31 : 72.69	12 : 88	64 : 36
Regional market share (%)	48.65	31.70	14.38	-

Source: EUROSTAT, Statistics Databases, <http://epp.eurostat.ec.europa.eu>

**Table 3:** Comparative analysis of the countries in region versus EU 15 in 2007

The differences between the insurance and reinsurance markets of Croatia and Serbia are not significant, but they are considerable in comparison to the insurance and reinsurance markets in Slovenia and EU 15 countries. Namely, in 2007 collected premiums per capita of citizens (mil. USD), collected gross premiums (mil. USD) and collected gross premiums in % GDP were 370; 1,689 and 3.3, respectively, in Croatia and 103; 766 and 1.8, respectively, in Serbia (Table 3).

The abovementioned results correspond to different phases of transition and the EU integration processes of Slovenia (insurance and reinsurance market harmonization), Croatia (EU accession process) and Serbia (submission of candidacy for full EU membership). It is necessary to investigate further and in detail the



characteristics and interdependence of the selected insurance and reinsurance markets and the influence of global processes on the circumstances and conditions in these markets. These results are as follows:

1) Since the dynamic changes in insurance and reinsurance markets, the national legislations of the Republic of Slovenia, the Republic of Croatia, and the Republic of Serbia have been adjusted to new conditions. Bearing in mind the fact that before 1990 insurance and reinsurance markets in these countries operated within one country, the system and legislation bases were the same. On a global scale, however, the later period was characterized by accelerated market development, and each country has adjusted to the changes independently. The analysis of legislation in the area of insurance and reinsurance markets indicates the dynamics and complexity of changes in this area.

#### a) The Republic of Slovenia

**Development of prudential supervision in Slovenian insurance** - The beginning was the Insurance Act 1994. The Insurance Act presented for the first time the principles of *guarantee funds, solvency margins, prudent asset management and prudent reserving*.

A supervisory authority was also established, which was essential for the further development of the insurance and reinsurance market. The same rules for insurance and reinsurance companies were established. The legal framework is not completely in line with EC directives with regard to the items of solvency margin. Also, there is no obligation to organize internal audits within insurance undertakings.

The improvements that were implemented in the Insurance Act 2000 were especially important because they created a sustainable climate for globally influenced

insurance and the reinsurance market. Those improvements include the following:

- *a guarantee fund was raised (amounts to almost double the guarantee fund prescribed by the first, second and third EC directives);*
- *not only following the rules of EC directives with regard to solvency margin, but prescribing even stricter ones, etc;*
- *the obligation to organize internal audits within insurance undertakings;*
- *additional control over insurance undertakings constituting an insurance group, etc.*

The stricter rules of the Insurance Act 2000 regarding the solvency margin in accordance with EC directives were necessary to implement because of the globalization driven liberalization process in insurance and reinsurance markets.

The available solvency margin of each insurance company (and pension company) is reduced also by its investments in shares and subordinated debt instruments issued by other insurance undertakings or other financial organizations:

- *in which the insurance undertaking holds a stake of over 10 %;*
- *other than those referred to in the item above, to a volume exceeding 10 % of the insurance undertaking's capital.*

The current Slovenia insurance and reinsurance market is regulated by:

- *The Insurance Act* - official consolidated text (Official Gazette of the Republic of Slovenia, No. 109/06, 114/06 and 9/07),

SLOVENIAN INSURANCE LEGISLATION	IMPROVEMENTS	WEAKNESS (NOT IN LINE WITH EC DIRECTIVE)
Solvency requirement of a reinsurance company	No need for establishing a national solvency	-
Definition of an insurance group	-	Not including non – Member State insurance undertakings
-	-	The definition of a controlling undertaking does not include participating in undertakings

Source: ISA, Annual report 2008

Table 4: Comparison – Slovenian Insurance Legislation: EC Insurance Group Directive



- *The Compulsory Motor Third-party Act* - official consolidated text (Official Gazette of the Republic of Slovenia, No. 110/06),
- *The Health Care and Health Insurance Act* - official consolidated text (Official Gazette of the Republic of Slovenia, No. 72/06),
- *The Insurance Contracts Tax Act* (Official Gazette of the Republic of Slovenia, No. 57/99 and 73/05),
- *The Pension and Disability Insurance Act* - official consolidated text (Official Gazette of the Republic of Slovenia, No. 109/06, 112/06 and 114/06)

The legal framework is especially important concerning insurance groups as a prevailing organizational form of insurance and reinsurance companies' integration (Table 4).

The Decision on Supervision of an Insurance Group (January 2001) prescribes the method of calculating adjusted capital requirements (method 2, i.e. the requirement deduction method, in accordance with Annex I of the Directive 98/78/EC on the supplementary supervision of insurance undertakings in an insurance group) and the detailed content and deadlines for reporting.

#### **b) The Republic of Croatia**

Solutions visible in Croatian insurance legislation are both positive and negative. In the Law on Insurance (passed in 2005) the clauses on the capital of insurance companies, the ways indispensable (guarantee) funds are calculated, and the limitations on investments all should be changed, since the existing solutions are very restrictive and prevent investments into more profitable products. The following changes should also be introduced: regulations on bankruptcy which are consistent with the regulations of the Bankruptcy Law (passed in 1997, complemented in 2006) and easier to realize in practice; regulations on mediators in insurance and the requirements one must meet to practice the insurance business, with special focus on the ways of obtaining licenses requiring higher education; regulations on obtaining approval for the members of the managing board of insurance companies and on authorities of the HANFA (Croatian financial services supervisory agency); a more detailed regulation of life insurance investment products; more detailed regulations on health insurance, etc. Besides HANFA, important institutions in the insurance and reinsurance

market are the Croatian Insurance Bureau and the Croatian Actuarial Association.

Considering the open questions and issues of the insurance and reinsurance industry, it was expected that insurers would emphasize preparations for liberalizing insurance markets from self-responsibility, which started on 1st January 2008. However, most of the insurance companies have focused their considerations of the insurers' actual position on fairly deliberate criticism towards the existing regulations.

The most important regulations for the insurance and reinsurance market in Croatia are:

- *The Insurance Act* (Official Gazette of the Republic of Croatia, No. 151/05),
- *The Act on Compulsory Insurance within the Transport Sector* (Official Gazette of the Republic of Croatia, No. 151/05),
- *The Law on Pension Insurance Companies and Payment of Pension Annuities based on Individual Capitalized Savings* (Official Gazette of the Republic of Croatia, No. 106/99 and 63/00).

The general opinion is that existing regulations and laws do not contribute to more efficient insurance and reinsurance market development in the Republic of Croatia, but significantly interfere and hinder it. Considering the legislation and the state, most of the insurance companies harshly demand introducing changes to tax policy which would accelerate the development of the life insurance industry. Therefore, insurance companies are seriously proposing that employers should be exempted from paying taxes for the life insurance of their employees, which is the case in most countries in the European Union. The problem of faster development of voluntary health insurance could be solved in a similar way.

#### **c) Republic of Serbia**

Implementation of the process of introducing the insurance industry into the legislative framework is decisive and one of the prerequisites of the insurance markets' further growth. There is an evident need to additionally regulate this area (e.g., to place the insurance of self-reliability into a very rigid and clear regulation framework with clear and unique rules that must be observed and whose neglect should be rigorously punished; the role of agencies, representatives, technical

inspections, etc.). When passing certain regulations, it is necessary to be well acquainted with all the particularities of the industry sector in the Republic of Serbia, and to adopt current positive practices in place in surrounding countries.

In the creation of the investment portfolios of insurance companies, there is very intense cooperation between banks and insurance companies (free assets deposition in commercial banks). Insurance companies are forced to invest their free assets through banks, since the other possibilities of investing financial assets in the Republic of Serbia are still undeveloped or they involve a large factor of uncontrolled risk (e.g. trading on the stock market where the income is very uncertain, and especially the small number of firms on the 'A' listing of the Belgrade Stock Exchange). Thus, legislation and sublegal acts which limit investments and deposits of financial assets need to recognize the environment and the possibilities of the market to absorb the needs of insurance companies for the profitable investment of their free assets, as well as the shallow offerings of securities.

The most important regulations for the insurance and reinsurance market in Serbia are:

- *Insurance Law* (Official Gazette of the Republic of Serbia, No. 55/04, 70/04 and 61/05),
- *Property and Personal Insurance Law* (FRY Official Gazette, No. 30/96, 57/98, 53/99 and 55/99 - provisions on compulsory insurance and provisions on public authorizations),
- *Law on Voluntary Pension Funds and Pension Schemes* (Official Gazette of the Republic of Serbia, No. 85/3005),
- *Law on Bankruptcy and Liquidation of Banks and Insurance Companies* (Official Gazette of the Republic of Serbia, No. 61/2005).

Pursuant to the Insurance Law (Official Gazette of the RS, No. 55/2004) and the Law on Supplementing the Law on the National Bank of Serbia (Official Gazette of the RS, No. 55/2004) oversight of insurance activity has been entrusted to the NBS. Thereby the first step was taken towards introducing an integral supervision of the entire financial sector. Central bank independence and autonomy, infrastructure and staff capacity for performing supervisory tasks, as well as connections between banks and insurance companies, were the main advantages in deciding that the NBS be invested with

such authority. Other institutions on the insurance and reinsurance market in Serbia are: the Association of Insurers, the Association for the Insurance Law of Serbia and the Actuarial Association of Serbia.

Within its new function the NBS will carry out supervision of insurance activity; issue licenses for performing insurance, reinsurance, intermediation and agency operations as well as those directly associated with insurance activity; give approval for legally required enactments and actions; adopt regulations prescribed by law; process statistical and other data, and consider complaints filed by the insured and other insurance beneficiaries.

Transparent procedures of decision making and imposing corrective measures, as well as orientation towards the future with a view to continued implementation of financial sector reforms, are the basic principles the NBS will follow in exercising supervision in the insurance domain.

Insurance supervision was entrusted to the NBS for several reasons:

- *relations between banks and insurance companies,*
- *need for consolidated supervision,*
- *pace of implementation of legal regulations,*
- *institutional framework.*

The passing of the new Law on Insurance was a necessary condition for the restructuring of the sector, but it alone is not sufficient. The Law passed on May 21, 2004, came into effect eight days later and the public dispute lasted for two years. It complies with EU directives and international standards.

**2)** Global trends in insurance and reinsurance markets have undeniable influence on the further growth and development of local markets, as well as on the adequate market positioning of both global and local insurance and reinsurance companies. Namely, one of the main effects of globalization on these markets is accelerated liberalization, accompanied by a huge concentration of insurance and reinsurance companies on the local level. Institutional capacities, as well as the adaptability of existing participants on the insurance and reinsurance markets in the countries of the region are of key importance for adjusting to turbulent changes in this commercial sector. They especially influence the ability to respond to newly created business challenges and possibilities.

**a) Republic of Slovenia**

The distinctive changes to the insurance and reinsurance market of the Republic of Slovenia are obvious, especially after its admission into the European Union. Namely, there was a need to create new conditions on this market for the operation of insurance and reinsurance companies. The key challenge is the further liberalization of the insurance and reinsurance market, as well as its implications on further growth and development. Foreign insurance and reinsurance companies can directly operate in the Republic of Slovenia based on the FOS (Freedom of Service System). The global trends of creating unified insurance and reinsurance markets increased competition on this market, with consequences both on the micro and macro levels. However, significant business possibilities for Slovenian insurance and reinsurance companies on the leading markets of EU members have been also created.

**b) The Republic of Croatia**

The liberalization of the insurance and reinsurance market in the Republic of Croatia has increased the dominance of foreign insurance and reinsurance companies in terms of premiums, as well as in the number of active insurance and reinsurance companies. Also, the main characteristic and challenge on this market is the high concentration of the leading insurance companies, which has implications on the development of business operations and to some extent the possibility of market de-monopolization. The Republic of Croatia has addressed the challenge by strengthening the role of the 'Croatian Financial Services Supervisory Agency' (HANFA). The general belief is that HANFA largely contributed to positive developments in the insurance and reinsurance market of Croatia. The role of this agency is particularly notable in market liberalization. The necessity of education and constant perfection of employees in order to achieve competitive advantages among insurance and reinsurance companies in globalized operations is evident. Therefore, an Insurance Institute has been established in the Republic of Croatia, which is the first institute of this type with the primary task of permanently educating, training and informing employees in the area of insurance. The institutional bases are thereby strengthened in order to adequately respond to challenges in the process of accommodation to global trends.

**c) The Republic of Serbia**

The characteristics of national insurance and reinsurance markets largely determine the possibilities to act appropriately to newly created conditions on the global market. The main challenges on these markets are liberalization and concentration, just as on the market of the Republic of Croatia. Also, it is necessary to define general and specific goals that need to be effectively and efficiently implemented through a clearly defined strategy of insurance and reinsurance in the Republic of Serbia. This is the only way to increase competitiveness, i.e. the ability of insurance and reinsurance companies in the Republic of Serbia to adjust to changes largely induced by the intense process of globalization. Also, this would increase the level of the adaptability of insurance companies, especially bearing in mind the particularities of these markets in the Republic of Serbia.

The developmental strategy of the insurance and reinsurance markets in the Republic of Serbia should determine the future model of the insurance and reinsurance market. The strategy needs to be formulated adequately, with special focus on the factors of dynamic surroundings. Also, the influence of globalization on these markets needs to be considered with all its positive and negative side effects. Therefore, when defining the future model of the insurance and reinsurance market it is necessary to bear in mind the following: *problems of insurance privatization; determination of optimum ratio of domestic and foreign capital; existing and new products (domestic, foreign insurers) and domestic insurers on the foreign market.*

The goals that could be accomplished by the implemented insurance and reinsurance strategy are the following:

- *Construction of an efficient insurance and reinsurance protection system;*
- *Transition from extensive insurance and reinsurance market development to intensive development;*
- *Creation of competitive environment;*
- *Application of EU and international standards (accounting, actuary, etc.);*
- *Increasing insurance and reinsurance service quality;*
- *Introduction of new insurance and reinsurance products;*
- *Strengthening public confidence in the institution of insurance;*

- *Raising the level of public insurance and reinsurance knowledge and culture;*
- *Advancement of survey methodology on the insurance and reinsurance market;*
- *Integration of insurance and reinsurance market of Serbia into the regional market and the EU market;*

According to the abovementioned goals that need to be accomplished in order to create an efficient and effective competitive insurance and reinsurance market, both on local and global levels in the phases of implementing insurance and reinsurance strategies in the Republic of Serbia, it is necessary to include the following:

- 1) *Analysis and evaluation of the insurance and reinsurance market;*
- 2) *Choice of the insurance and reinsurance markets' future model, elaboration of key parameters;*
- 3) *Elaboration and introduction of EU standards (Basel II) and international standards (application of STO standards, international accounting and actuary standards);*
- 4) *Developmental stimulation of life and voluntary health and pension insurance;*
- 5) *Integration of insurance and reinsurance market of Serbia with that of the EU;*

While considering the choice of future model of the insurance and reinsurance market, we should keep in mind the following:

- 1) *Market liberalization – full or precisely determined?*
- 2) *Privatization of insurance – pro et contra*
- 3) *Ratio of foreign and domestic capital*
- 4) *Types of insurance (foreign, domestic clients)*
- 5) *Foreign investments in the insurance and reinsurance market of the Republic of Serbia*

**3)** According to the results obtained in this research, it can be concluded that the insurance markets in the Republic of Slovenia, the Republic of Croatia and the Republic of Serbia are mutually correlated, although the markets are at different stages of development. The markets in focus show steady trends of growth and development, especially while adjusting to new conditions due to the process of globalization and concentration. It is also important to understand the causal connection, i.e. the influence of these markets on global trends in this area. The insurance and reinsurance

market of the Republic of Slovenia especially is highly specific, since it is largely part of the integration processes in the EU. Global macroeconomic environment in 2007 was specific and representative because of substantial economic growth in most countries of Eastern Europe, as well as controlled inflation. In 2007 global growth of GDP was substantial. Namely, the insurance and reinsurance market in the Republic of Serbia was stabilized through the creation of an adequate environment, which opened the way for the entry of serious strategic partners of insurance and reinsurance companies with majority foreign ownership. However, despite the sustainable non-development of the insurance and reinsurance market of the Republic of Serbia in comparison with the markets of the countries investigated here, there is considerable potential for the rapid growth and development of these markets (Table 3).

The further advancement in business operations in the Republic of Serbia largely depends on integrative processes as well (admission into the EU). Regional cooperation is a fundamental aspect of Serbia's EU integration (Ristic 2009, p. 117). Therefore, the ability to adapt national legislation in this area is a relevant factor of the growth and development of the insurance and reinsurance market. Also, the comparative advantages of the insurance and reinsurance market in the Republic of Serbia are beyond doubt, especially bearing in mind the existing system of prerequisites for its further growth and development (government regulations, etc.). However, the only way to create stable conditions for the efficient and effective operation of insurance and reinsurance companies is to understand national markets, both in the form of their regional connection and individually, and recognize their particularities.

#### 4. Conclusion


The growing presence of business globalization and its associated consolidation, deregulation, new distribution channels and new customer demands, are only a few of the key forces leading to the reorganization of business dealings of present day insurance and reinsurance companies with regard to capital allocation, product development, processing of damage claims, and enhancement of business efficiency. The truly global approach to insurance and reinsurance business has become more and more important.

Bearing the above mentioned in mind, the emerging markets, including insurance and reinsurance markets of

selected former Yugoslav countries, which are characterized by the continuous process of integration into the global economy, increasingly attract the attention of global insurers. According to current trends in migration from rural to urban areas, business development and concentration of material goods, we could expect growing human victims and material damage as a general trend in the future period, which will present insurance and reinsurance companies with the problem of finding adequate solutions to minimize the impact, with global risk diversification the most efficient one. Across the industry, however, insurance and reinsurance companies face a range of common challenges. They need to develop innovative bundles of products and services to drive top-line growth. They must pay increasing attention to the distribution network, taking into consideration agent relationships, direct selling, and the evolving opportunities that continue to be presented by the Internet. Also, they must keep up with increasing regulatory scrutiny around security and capital requirements, as well as escalating attention to fraud, money laundering, and other wrongdoing if they are to avoid the financial and reputation risk of noncompliance. The results of the first phase of investigation have indicated the correlation, i.e. differences and similarities between the insurance and reinsurance markets of Slovenia, Croatia and Serbia, especially in comparison to the EU 15 countries' insurance and reinsurance market data. These results emphasize the fact that the markets observed are at different stages of development. The insurance and reinsurance market of Slovenia is the most developed, although there is a significant possibility for improvement and synchronization. Furthermore, the insurance and reinsurance markets of Croatia and Serbia have a sound basis for advancement with progress in EU integration processes.

Based on the results of the second phase of investigation, it could be concluded that among the routes and trends of globalization as a process itself, and current changes in the selected national insurance and reinsurance markets of Eastern Europe, there is significant interdependence among the observed samples of the three countries reflected through the dynamism of changes in these markets as a function of their adjustment to the requirements of the global environment. Thus, the national insurance and reinsurance markets of Eastern Europe are susceptible to influences and trends of globalization in the sense of their

enlargement, business specialization and gradual changes in the structure of the insurance businesses.

According to the results obtained, the research confirmed the basic hypothesis, i.e. the relationship between globalization processes and the insurance and reinsurance markets of Eastern Europe is significant and mutually dependent, and suggests future changes and trends. The significance of that relationship is also confirmed by the scope and scale of the crisis which affected insurance and reinsurance markets as well, especially considering that the effects of the crisis rapidly moved from North America across the globe. In that sense, the basic problems that occurred during this research were how to diminish the influence of the growing recession, bearing in mind that concrete investigation was conducted as a function of obtaining specific data and practical profound knowledge about the reflexive relationship between trends of globalization and the insurance and reinsurance markets of Eastern Europe. Consequently, according to the results obtained in this research, the focus of future research in this area should be on testing this reflexive relationship in global recessive business conditions. Global recessive business conditions and their impact on the insurance and reinsurance markets of Eastern Europe should be also considered. 

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