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MULTI–OBJECTIVE OPTIMIZATION OF WELL–BEING IN THE EUROPEAN UNION MEMBER STATES

ABSTRACT

Well-being is of crucial importance for both individual and society as a whole. It is therefore important to quantify performance and progress made by certain states, regions, communities, social groups, and individuals in improving their well–being. The aim of study was to offer a new framework for multi–criteria assessment as well as international comparison of objective well–being. Well–being is a multi–dimensional phenomenon; hence the appropriate indicator system should be capable to identify the most important underlying processes influencing well–being. For our research we have established the indicator system of twelve indicators identifying various dimensions of well–being. Therefore we propose MULTIMOORA, a model which can be used for approaching the objective of societal well–being. It is applied for international comparison of the well-being in the EU Member States. Consequently, it was revealed that Ireland, the Netherlands, Denmark, Austria, France, Cyprus, Finland, Germany, and Belgium have achieved the highest level of well–being as of 2009. At the other end of spectrum, Czech Republic, Lithuania, Slovakia, Bulgaria, Poland, Hungary, Estonia, Latvia, and Romania can be considered as those peculiar with relatively lowest well–being.

Keywords: *welfare state, well–being, sustainable development, MULTIMOORA, multi–objective optimization.*

1. INTRODUCTION

Welfare, well-being, and happiness are issues of crucial importance for both individual and society as a whole. Furthermore, all these phenomena, united under the umbrella of the quality of life, constitute a basis for sustainable development of the aforementioned subjects. Pigou (1920) launched the concept of welfare state. In addition, so called welfare state offers a way to avoid the shortcomings of the liberal market economy identified by Marxists (Gilpin, 2001). It is therefore important to quantify performance and progress made by certain states, regions, communities, social groups, and individuals in improving their quality of life (Pukeliene, Starkauskiene, 2011).

The measurements of quality of life began in 1960s (Pukeliene, Starkauskiene, 2011; Janušauskaitė, 2008). Indeed, the initial insights into the issue were mainly mono–criteria ones and took such indicators as gross domestic product (GDP) per capita as their basis. Such an outlook, however, appeared to be quite an inconsistent one, for it pays attention solely to economic welfare and under certain circumstances can even mistakenly identify processes of

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societal development. The need for multi–dimensional assessment of quality of life is widely acknowledged in recent studies (Pukeliene, Starkauskiene, 2011; D'Acci, 2010; Brauers *et al.*, 2010; Fleurbaey, 2009; Ginevičius, Podvezko, 2009; Brauers, Ginevičius, 2009; Janušauskaitė, 2008; Ray, 2008). Hence, the aim of study is to offer a new framework for multi–criteria assessment as well as international comparison of objective well–being. The object of this study is the European Union (EU) Member States. The research period with some exclusion covers data of year 2009.

The branch of operational research, namely multi–objective decision making (MODM) offers a variety of scientific methods suitable for tackling multi–dimensional comparisons. Indeed, Roy (1996) put the following classification of MODM problems: 1) α *choosing* problem – choosing the best alternative; 2) β *sorting* problem – classifying alternatives into relatively homogenous groups; 3) γ *ranking* problem – ranking alternatives from best to worst; 4) δ *describing* problem – describing alternatives in terms of their peculiarities and features. In our study we will apply MULTIMOORA method for multi–criteria assessment of well–being in the EU Member States. Zavadskas and Turskis (2011) presented an overview of MODM methods.

The Multi–Objective Optimization by Ratio Analysis (MOORA) method was offered by Brauers and Zavadskas (2006). Subsequently, these authors further developed the method (Brauers, Zavadskas, 2010) thus presenting the MULTIMOORA (MOORA plus the full multiplicative form). Numerous examples of application of MULTIMOORA are present. The MULTIMOORA, for instance, was applied in regional development studies, both at national (Brauers, Ginevičius, 2009, 2010; Brauers *et al.*, 2010) and international (Baležentis *et al.* 2010, 2011; Baležentis, Baležentis, 2011b) levels. The theory of dominance (Brauers and Zavadskas, 2011) enables to summarize the ranks obtained from different parts of MULTIMOORA. Moreover, the MULTIMOORA has been updated with fuzzy number theory (Brauers *et al.*, 2011) and 2–tuple linguistic representation (Baležentis, Baležentis, 2011a).

The article is organized as follows. Section 2 discusses welfare and well–being themselves. The following Section 3 presents MODM methods and MULTIMOORA. Finally, the international comparison of well–being is presented in Section 4.

2. WELL–BEING AND MEASUREMENT THEREOF

In the well-being economy, each individual would have to feel good concerning material wealth, entrance to the most essential free goods like water supply, health, life expectancy at birth, education, all kind of security and concerning the environment. With other words, multiple objectives have to be fulfilled.

Well-being "tout court" concerns the well-being of the actual generation. Sustainable or Durable Development means well-being not only for the actual generation but also for the future generations. Indeed: development indicates time, for instance *Developing Countries* means developing over time. After the dictionary *sustainable* means capable of being maintained. In this way the Kyoto agreement is sustainable development accentuated mainly on CO2 emissions. The following Fig. 1 depicts the relationships between these concepts.

Figure. 1. Relationships between different elements of quality of life.

The first attempts to perform international comparison of well–being were initiated by United Nations (UNDP, 1990; 2010). More specifically, United Nations Development Programme is aimed at preparing and maintaining methodology for such indicators as Human Development Index (HDI), Human Poverty Index (HPI) and Gender-related Development Index (GDI). HDI is based on such indicators as adult literacy rate, GDP per capita, life expectancy at birth, education level. There are two types of poverty index: HPI-1 for developing countries and HPI-2 for OECD countries. HPI-1 is based on such indicators as probability of not surviving to age 40, adult illiteracy rate, population not using an improved water source and population below income poverty line. HPI-2 is estimated according to indicators of probability of not surviving to age 60, people lacking functional literacy skills, long-term unemployment, and population living below 50% of median income. GDI is estimated by dissolving above mentioned indexes by gender. Physical Quality of Life Index (PQLI) can also be used for international comparison (Ray, 2008). PQLI is based on illiteracy rate, infant mortality rate and life expectancy.

At the EU level, the initiative *Beyond GDP* was launched in 2007 (European Commission, 2007) aimed at research into estimations of well–being. The need for multi–dimensional measurements of well–being was stressed once again in report of group chaired by J. E. Stiglitz (Stiglitz *et al*., 2009). More specifically, the latter commission concluded that at least the following well–being dimensions should be considered simultaneously:

- Material living standards (income, consumption and wealth);
- Health;
- Education;
- Personal activities including work;
- Political voice and governance;
- Social connections and relationships;
- Environment (present and future conditions);
- Insecurity, of an economic as well as a physical nature.

Considering the aforementioned findings, one can define the two main issues of well–being measurement, namely creation of appropriate indicator system and choice of appropriate aggregation method. The following section, therefore, deals with the former issue.

Well–being is a multi–dimensional phenomenon; hence the appropriate indicator system should be capable to identify the most important underlying processes influencing well–being. For our research we have established the indicator system of twelve indicators identifying various dimensions of well–being. The data from EUROSTAT, European Environmental Agency, and World Health Organization databases mainly covering years 2008–2009 were used for analysis.

The following Table 1 summarizes indicator system for well–being assessment. As one can note, these indicators are expressed in different units, hence the application of multi–objective optimization methods becomes important. The last column of Table 1 indicates the

direction of optimization of each criterion where *max* means that the higher value of indicator is preferable, whereas *min* stands for the opposite.

Table 1. Indicator system for objective societal well–being measurement.

No.	*Indicator*	*Units*	*Direction of optimization*
1.	Median equivalised net income	EUR per capita	max
2.	Unemployment rate	per cent	min
3.	Crude rate of net migration	per 1000 inhabitants	min
4.	Total fertility rate	births per woman	max
5.	Physicians density	per 1 000 inhabitants	max
6.	Life expectancy at birth	years	max
7.	Criminal offences	per 1000 inhabitants	min
8.	Participation rates in education	per cent	max
9.	Total expenditure on social protection	EUR per capita	max
10.	Voter turnout in the most recent elections	per cent	max
11.	Overcrowding rate	per cent	min
12.	GHG emission	tonnes per capita	min

Median equivalised net income can be considered as one of the main indicators defining annual earnings and thus welfare of citizens and the whole nation. Indeed, median income is more robust indicator than average income, for the former is likely to be less impacted by exclusions. Furthermore, equivalisation of income takes into account the number of members of certain household and therefore enables to assess income distribution among breadwinners and their dependants. Similarly, unemployment rate identifies both economic and social situation in certain state, for unemployment is related to increased need in social support (e. g. transfer payments) as well as in increase of social problems (e. g. criminal offences).

Rate of net migration resembles attitude of inhabitants as well as foreigners towards overall situation in certain state: the higher the rate, the higher level of societal well–being is achieved. Total fertility rate is interrelated with materialism–based happiness and life satisfaction (Li *et al.*, 2011). It can be assumed that lower life satisfaction leads to increase in materialism and, therefore, weaker desire to have children (i. e. lower total fertility rate). In addition, higher physicians' density leads to more intensive health care. As a result, values of the next investigated indicator, namely life expectancy at birth, might increase. As Schultz (1981) argued, the increased life expectancy would result in higher amount of value–added generated by inhabitants and make them eager to invest into improvements of their health, education etc.

Criminal offences cover homicide, violent crime, robbery, domestic burglary, motor vehicle theft, and drug trafficking. Obviously, higher number of such misdemeanors somehow limits well–being. Participation rates in education are expressed as a percentage of 15-24 year old population enrolled in any sort of educational institutions. The higher rate of participation in educations leads to increased quality of population (or human capital) and thus higher well–being in the future[4]. Total expenditures on social protection quantify the stability of wel-

[4] Cunado and Perez de Gracia (2011) reported that education impacts happiness both directly and indirectly. Firstly, indirect effect means increased earnings gained after respective improvement of qualification. Secondly, direct effect stands for some sort of self–realization and self–confidence raised due to the acquired knowledge. Moreover, it was revealed that the direct impact of education on happiness does not depend of the level of education (primary, secondary or tertiary).

fare in the society, for persons living in societies with more intensive social support are less likely to fall in panic in case of unemployment of after becoming socially vulnerable in other way. Voter turnout identifies political participation (Segre *et al.*, 2011), and, to some extent, overall satisfaction with current politics[5]. Overcrowding rate is defined as the percentage of the population living in an overcrowded household. A person is considered as living in an overcrowded household if the household does not have at its disposal a minimum of rooms determined by number of household dwellers. Finally, GHG emission identifies environmental pollution. To cap it all, the proposed indicator system identifies various aspects of well–being and thus can be applied for international comparison.

3. MODM METHODS AND MULTIMOORA

Belton and Stewart (2002) defined the three broad categories of MODM methods (Løken 2007): 1) value measurement models; 2) goal, aspiration, and reference level models; 3) outranking models (the French school). A more detailed overview of MODM methods is presented by Guitouni and Martel (1998) and Zavadskas and Turskis (2011).

Value measurement methods are, for instance, SAW (Simple Additive Weighing) introduced by MacCrimmon (1968) and Analytic Hierarchy Process (AHP) was proposed by Saaty (1980, 1997).

The *reference level* approach is applied in such methods as TOPSIS, COPRAS, VIKOR, MOORA, and ARAS. Technique for the Order Preference by Similarity to Ideal Solution (TOPSIS) was introduced by Hwang and Yoon (1981) and modified by applying grey numbers (Lin *et al.* 2008), fuzzy numbers (Wang *et al.* 2003) or Mahalanobis distance (Antuchevičienė *et al.* 2010). Method of Complex Proportional Assessment (COPRAS) (Zavadskas *et al.* 1994) was improved by applying grey number technique (Zavadskas *et al.* 2008a, 2008b) as well as fuzzy numbers (Zavadskas and Antucheviciene 2007), and used in many studies (Ginevičius and Podvezko 2009; Zavadskas *et al.* 2009a). VIKOR method is based on linear normalization (Opricovic and Tzeng 2002, 2004). Cevikcan *et al.* (2009) discussed application of fuzzy VIKOR method. Multi-Objective Optimization by Ratio Analysis (MOORA) method was offered by Brauers and Zavadskas (2006) on the basis of previous researches. This method was further developed (Brauers and Zavadskas 2010) and became MULTIMOORA (MOORA plus the full multiplicative form). New Additive Ratio Assessment (ARAS) method was introduced by Zavadskas and Turskis (2010) and subsequently extended into fuzzy environment (Turskis, Zavadskas 2010).

ELECTRE (Roy 1968; Ulubeyli and Kazaz 2009; Xidonas *et al.* 2009), NAIADE (Munda *et al.* 1995, Munda 1995, 2005), PROMETHEE (Brans and Mareschal 1992; Behzadian *et al.* 2010; Podvezko and Podviezko 2010) are families of MODM methods based on *outranking preferences*.

In this study we will apply the MULTIMOORA method which encompasses value measurement as well as reference level methods. In his book of 2004 Brauers (Brauers 2004a) described the three parts of MULTIMOORA, namely the Ratio System Approach, the Reference Point Approach (but still based on scores), and the Full Multiplicative Form. Some time later but also in 2004 (Brauers, 2004b) he switched over to a Reference Approach with instead of scores uses the ratios found in the Ratio System Approach. In this way dimensionless

[5] Noteworthy, in Belgium, Luxembourg, and Greece voting is compulsory.

measures were obtained. Later on this combination was called MOORA by Brauers and Zavadskas (2006). Finally Brauers and Zavadskas (2010) launched MULTIMOORA. MULTIMOORA is composed of MOORA and of the Full Multiplicative Form of Multiple Objectives. MOORA method begins with matrix X where its elements x_{ij} denote *i*-th alternative of *j*-th objective ($i = 1, 2, \cdots, m$ and $j = 1, 2, \cdots, n$). In this case we have $n = 12$ objectives – indicators – and $m = 27$ alternatives – European Union Member States. MOORA method consists of two parts: the ratio system and the reference point approach.

The Ratio System of MOORA. Ratio system defines data normalization by comparing alternative of an objective to all values of the objective:

$$x_{ij}^{*} = \frac{x_{ij}}{\sqrt{\sum_{i=1}^{m} x_{ij}^{2}}}, \tag{1}$$

where x_{ij}^{*} denotes *i*-th alternative of *j*-th objective (in this case – *j*-th structural indicator of *i*-th state). Usually these numbers belong to the interval [-1; 1]. These x_{ij}^{*} are added (if desirable value of indicator is maximum) or subtracted (if desirable value is minimum) delivering a sum for each alternative in this way:

$$y_{i}^{*} = \sum_{j=1}^{g} x_{ij}^{*} - \sum_{j=g+1}^{n} x_{ij}^{*}, \tag{2}$$

where $g = 1, \cdots, n$ denotes number of objectives to be maximized. Then every outcome per alternative is ranked in a descending order.

The Reference Point of MOORA. Reference point approach is based on the ratios obtained in the Ratio System. The Maximal Objective Reference Point (vector) is found according to ratios found in formula (1). The *j*-th coordinate of the reference point can be described as $r_j = \max_i x_{ij}^{*}$ in case of maximization. Every coordinate of this vector represents maximum or minimum of certain objective. Then every element of normalized responses matrix is recalculated and the ranks are given according to deviations from the reference point and after the Min-Max Metric of Tchebycheff:

$$\min_i \left(\max_j \left| r_j - x_{ij}^{*} \right| \right). \tag{3}$$

Finally, the outcomes per alternative are ranked in an ascending order.

The Full Multiplicative Form and MULTIMOORA. The Full Multiplicative Form method embodies maximization as well as minimization of purely multiplicative utility function. Overall utility of the *i*-th alternative can be expressed as a dimensionless number:

$$U_{i}^{'} = \frac{A_i}{B_i}, \tag{4}$$

where $A_i = \prod_{j=1}^{g} x_{ij}$, $i = 1, 2, \cdots, m$ denotes the product of objectives of the *i*-th alternative to be maximized with $g = 1, \cdots, n$ being the number of objectives (structural indicators) to be maximized and

where $B_i = \prod_{j=g+1}^{n} x_{ij}$ denotes the product of objectives of the *i*-th alternative to be minimized with $n - g$ being the number of objectives (indicators) to be minimized.

Thus MULTIMOORA summarizes MOORA (i. e. Ratio System and Reference point) and the Full Multiplicative Form. Ameliorated Nominal Group and Delphi techniques can also be used to reduce remaining subjectivity (Brauers and Zavadskas, 2010). The theory of dominance (Brauers and Zavadskas, 2011) enables to classify the ranks obtained from the different parts of MULTIMOORA.

4. COMPARISON OF WELL–BEING IN EU MEMBER STATES

The international comparison of well–being was performed on a basis of indicator system defines in Section 2 (Table 1). The MULTIMOORA method, discussed in Section 3, was applied for the analysis. This section presents the results with special focus on the three Baltic States, namely Latvia, Lithuania, and Estonia.

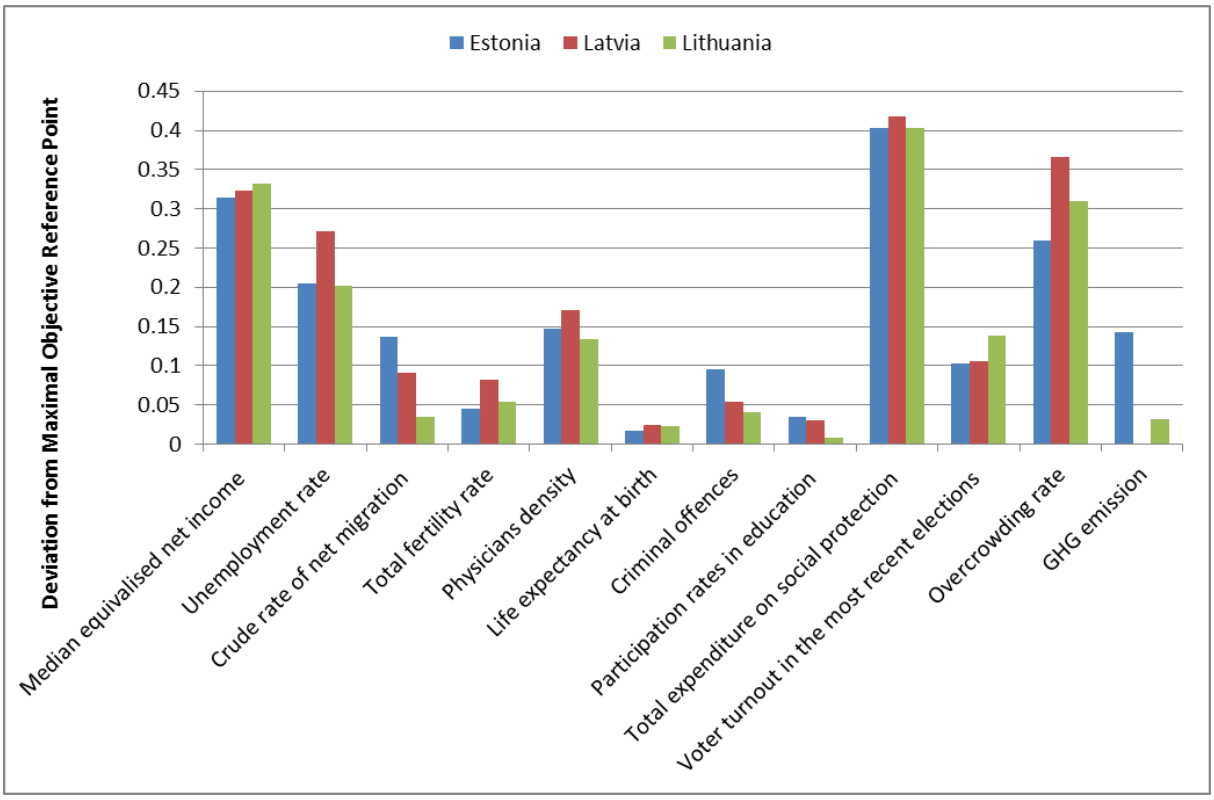
The initial data are summarized in Table 2. It concerns 2008 or 2009 after the availability of the data. As one can see, the indicator of migration was peculiar with negative as well as zero values. Indeed, these values would distort results of the Full Multiplicative Form. Therefore, they are transformed to positive numbers by applying the shifting constant b_j to each *j*-th criterion having at least one negative $x_{ij}^{'}$ value (Ginevičius *et al.*, 2010):

$$x_{ij} = x_{ij}^{'} + b_j , \qquad (5)$$

where $b_j = \min_i x_{ij}^{'} + 0.001$ is the shifting constant.

Hence, Eq. 5 was applied for migration indicator. The latter computation enabled to avoid both negative and zero values and thus perform ranking according to all three parts of MULTIMOORA. The data were normalized by employing Eq. 1 and thus turned into dimensionless numbers. Consequently, Eq. 2 was applied in order to rank the states according to the Ratio System. In addition, EU Member States were ranked with respect to the Reference Point approach (Eq. 3). Furthermore, the deviations from Maximal Objective Reference Point were used to identify strengths and weaknesses of the three Baltic States (Fig. 3). Finally, Eq. 4 was applied in order to rank the countries according the Full Multiplicative Form. The theory of dominance (Brauers, Zavadskas 2011) was applied to summarize the three ranks provided by respective parts of MULTIMOORA into single final rank. The results are presented in Table 3.

Figure. 3.
Deviations from maxima of well–being indicators in the EU for the Baltic States, 2009



As it was mentioned above, Fig. 3 presents comparison of separate well–being indicators for the three Baltic States, namely Estonia, Latvia, and Lithuania. Larger deviation from Maximal Objective Reference Point means that certain state is peculiar with relatively low value of respective indicator (and vice versa for indicators to be minimized). The Baltic States are close to the maximal values in the EU according to participation rate in education and total fertility rate. This suggests that appropriate management of education systems in the region could turn it into competitive, high-technology production oriented hub. In addition, social support could sustain high fertility rates and thus mitigate further demographic problems. Although life expectancy indicator exhibits relative closeness to the maximum in the EU, it is mainly caused by narrow range of its values across EU countries. Indeed, Estonia, Latvia, and Estonia with life expectancy of 75, 72, and 73 years, respectively, have still much to achieve in order to reach 82 years for Italy and Spain. Noteworthy, physicians' density in the region is mediocre and this, alongside with other factors, can be considered as a cause of shorter life expectancy. The three Baltic States are also peculiar with relatively low rates of criminal offences. The low values of median net income and expenditures on social protection indicate poor economic performance. As a result higher levels of unemployment and overcrowding are observed in the three Baltic States. Finally, Latvia is peculiar with the lowest GHG emissions, whereas Estonia exhibits a higher rate. The Baltic States, hence, could cooperate in developing their energetic sectors and promoting renewable energy.

Table 2. Initial data for assessment of well–being in the EU Member States, 2008–2009

	Median equivalised net income (EUR)	Unemployment rate (%)	Crude rate of net migration (per 1000 population)	Total fertility rate (births per woman)	Physicians density (per 1 000 population)	Life expectancy at birth (years)	Criminal offences (per 1000 population)	Participation rates in education (%)	Total expenditure on social protection per capita (EUR)	Voter turnout in national parliamentary elections (%)	Overcrowding rate (%)	GHG emission (tonnes per capita)
Belgium	19313	7.9	5.9	1.82	2.987	80	93.13842	68.9	7568.651	89.2	3.9	11.5725
Bulgaria	2828	6.8	-2.1	1.57	3.635	74	16.57972	52.4	491.6088	60.6	47	7.821285
Czech Republic	7295	6.7	2.7	1.49	3.625	77	33.11769	61.6	2222.625	62.6	26.6	12.69878
Denmark	24933	6	1.8	1.84	3.419	79	87.10212	66.1	10845.74	86.6	7.8	11.06514
Germany	18586	7.8	-0.1	1.36	3.531	80	74.36498	65.1	7462.713	70.8	7	11.21551
Estonia	6209	13.8	0	1.63	3.409	75	38.01601	60.7	1253.348	61.9	41.2	12.56104
Ireland	22432	11.9	-6.2	2	3.187	80	24.51858	61.7	6946.115	67	3.7	14.02125
Greece	11496	9.5	3.1	1.52	6.043	80	37.22124	64.2	4231.627	70.9	25	10.88265
Spain	13300	18	1.1	1.39	3.705	82	51.47766	56.3	4169.84	75.7	3.2	8.020132
France	19760	9.5	1.1	1.98	3.497	81	57.26774	57.8	8029.932	60.2	9.6	8.035651
Italy	15637	7.8	5.3	1.41	4.242	82	45.45321	57.3	5900.946	80.5	23.3	8.17919
Cyprus	17432	5.3	2.3	1.51	2.3	81	9.266803	46.6	3184.118	89	1	11.79733
Latvia	5474	17.1	-2.1	1.32	2.988	72	25.30942	62	752.0687	61	57.7	4.741975
Lithuania	4815	13.7	-4.6	1.55	3.664	73	21.32632	69.3	1231.975	48.6	49	6.450694
Luxembourg	31764	5.1	13.2	1.59	2.862	81	58.30934	42.5	13870.28	100	6.4	23.67579
Hungary	4739	10	1.7	1.33	3.097	74	40.65612	64.6	1645.77	64.4	55	6.652095
Malta	9933	7	-0.4	1.44	3.073	80	33.64206	47	2212.95	93.3	4	6.92925
Netherlands	20156	3.7	2.3	1.79	3.921	81	74.24524	68	8616.805	75.4	1.7	12.06324
Austria	19886	4.8	2.5	1.39	4.749	80	68.84518	55.1	8164.654	81.7	13.2	9.581868
Poland	5097	8.2	0	1.4	2.144	76	28.38879	71.7	1444.178	53.9	49.1	9.876763
Portugal	8282	9.6	1.4	1.32	3.755	79	40.54918	58.9	3131.335	59.7	14.1	7.01809
Romania	2162	6.9	-0.1	1.37	1.9166	73	13.43936	56.9	339.1865	39.2	55.3	6.085415
Slovenia	11864	5.9	5.6	1.53	2.473	79	40.74927	70.4	2753.836	63.1	38	9.515529
Slovakia	5671	12	0.8	1.41	3	75	19.39604	57.5	1337.439	59	39.7	8.019579
Finland	20962	8.2	2.7	1.86	2.735	80	66.9803	69.9	8096.914	65	5.9	12.45439
Sweden	21248	8.3	6.7	1.94	3.583	81	150.0452	65.3	9383.512	82	10.5	6.481391
United Kingdom	16256	7.6	3	1.94	2.739	80	84.81499	48.4	5849.471	65.5	7.2	9.192453

The final ranking is given in the last column of Table 3. It is possible to define the three relative groups of EU Member States: Group 1 consisting of states attributed with ranks 1 to 9, Group 2 encompassing those with ranks 10–18, and Group 3 for the remaining states.

Table 3. Results of multi–objective assessment of well–being in the EU Member States, 2008–2009

Member State	*Ratios*			*Ranks*			
	RS	*RP*	*MF*	*RS*	*RP*	*MF*	***MULTI-MOORA***
Ireland	0.88741	0.220899	21699071239170.3	1	6	1	**1**
Netherlands	0.836532	0.215319	10570913835	3	4	3	**2**
Denmark	0.864383	0.257923	2131676486	2	9	4	**3**
Austria	0.752838	0.197425	1061347888	4	3	5	**4**
France	0.726729	0.186323	1010556702	5	1	6	**5**
Cyprus	0.666578	0.340917	13147479240	6	13	2	**6**
Finland	0.637462	0.195535	873632544.4	7	2	10	**7**
Germany	0.633385	0.215716	883980081.1	8	5	9	**8**
Belgium	0.549913	0.277925	972254487.5	11	10	7	**9**
Malta	0.602377	0.3719	901191048	9	17	8	**10**
Luxembourg	0.591421	0.426223	789486014.2	10	24	11	**11**
Italy	0.526718	0.254243	268638493.9	12	7	15	**12**
United Kingdom	0.448642	0.255885	326449111.8	15	8	14	**13**
Greece	0.508293	0.307499	181845623.5	13	11	16	**14**
Spain	0.393226	0.30947	574893035.3	17	12	12	**15**
Sweden	0.487246	0.466497	549747211.9	14	27	13	**16**
Portugal	0.39762	0.342601	121956013.6	16	14	17	**17**
Slovenia	0.210451	0.354644	42286978.76	20	15	19	**18**
Czech Republic	0.25106	0.371591	38977538.28	18	16	20	**19**
Lithuania	0.202512	0.403196	56020533.05	21	22	18	**20**
Slovakia	0.111578	0.399831	15734703.66	22	20	21	**21**
Bulgaria	0.224664	0.426815	10969502.66	19	25	22	**22**
Poland	0.062333	0.396426	9270241.3	23	19	23	**23**
Hungary	0.01661	0.389994	8415302.381	24	18	25	**24**
Estonia	0.00956	0.402514	7238001.355	25	21	26	**25**
Latvia	-0.02418	0.418506	9104744.697	27	23	24	**26**
Romania	-0.01205	0.431678	1646733.873	26	26	27	**27**

According to our research, Group 1 consisted of Ireland, the Netherlands, Denmark, Austria, France, Cyprus, Finland, Germany, and Belgium. Thus, Ireland has achieved the highest level of well–being (as of 2009). Indeed, such rankings as Quality-of-life index (Economist Intelligence Unit 2005) and HDI (UNDP 2010) also place Ireland at the top of the

EU Member States. In the later years Ireland will certainly loose its first rank given its financial breakdown.

The Group 2 consists of Malta, Luxembourg, Italy, United Kingdom, Greece, Spain, Sweden, and Portugal. As one can note in this group there are many states experiencing serious fiscal crises, e. g. Greece, Italy, Portugal. Hence it is likely that some changes will occur in this group of states.

Finally, the Group 3 encompasses relatively least advanced EU Member States, namely Czech Republic, Lithuania, Slovakia, Bulgaria, Poland, Hungary, Estonia, Latvia, and Romania. We can notice Estonia, Latvia, and Lithuania in this group with the latter being the most advanced one.

The results of suchlike studies could be successfully integrated in the further researches. For instance, the wider comparison of EU Member States, G–20 countries, BRICs, CIVETS (or the *new* BRICs) would provide us with some additional insights on the trends of well–being and thus possible shifts in migration. Moreover, integrated assessment of well–being and economic, ecological, or energetic performance (Cravioto *et al.* 2011) of certain states would also provide with a comprehensive overview of socio–economic development there.

CONCLUSION

In our study we proposed a model for the objective *societal well–being*. It was applied for international comparison of the EU Member States. Ireland, the Netherlands, Denmark, Austria, France, Cyprus, Finland, Germany, and Belgium have achieved the highest level of well–being. In the middle we find Malta, Luxembourg, Italy, United Kingdom, Greece, Spain, Sweden, and Portugal. At the other end of the spectrum, Czech Republic, Lithuania, Slovakia, Bulgaria, Poland, Hungary, Estonia, Latvia, and Romania can be considered as those with relatively lowest well–being. Nevertheless some reservations have to be made for the years studied namely the recession years 2008-2009. Afterwards the outcome of this recession will certainly influence the position of Ireland, Italy, Portugal Spain and Greece. However, no more recent data were available during the preparation of the study.

The discovery and application of an appropriate method, nevertheless, is more valuable than the availability of data, as a general application is made possible. This method is MULTIMOORA, a method that enclose MOORA (i. e. Ratio System and Reference Point) and the Full Multiplicative Form. The advantage of this composed approach is that the composing parts control each other and that all parts are based on dimensionless measures and in this way are escaping from the choice of subjective weights.

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VIŠECILJNA OPTIMIZACIJA BLAGOSTANJA U ZEMLJAMA ČLANICAMA EUROPSKE UNIJE

SAŽETAK

Blagostanje je od ključnog značaja kako za pojedinca tako i za društvo u cjelini. Stoga je važno kvantificirati performanse i napredak određenih država, regija, zajednica, društvenih grupa i pojedinaca kako bi se unaprijedilo njihovo blagostanje. Cilj istraživanja je ponuditi novi okvir za višeciljnu procjenu kao i međunarodnu usporedbu objektivnog blagostanja. Blagostanje je višedimenzionalna pojava; stoga bi prikladni sustav indikatora trebao biti u mogućnosti identificirati najvažnije temeljne procese koji utječu na blagostanje. Za potrebe našeg istraživanja ustanovili smo indikatorski sustav od dvanaest indikatora koji identificiraju razne dimenzije blagostanja. Stoga predlažemo MULTIMOORA, model koji se može koristiti za približavanje cilju društvenog blagostanja. Primjenjuje se u svrhu međunarodne usporedbe blagostanja u zemljama članicama EU. Tako se otkrilo da su Irska, Nizozemska, Danska, Austrija, Francuska, Cipar, Finska, Njemačka i Belgija dosegle najviši stupanj blagostanja od 2009. Na drugom kraju spektra se nalaze Češka, Litva, Slovačka, Bugarska, Poljska, Mađarska, Estonija, Latvija i Rumunjska u kojima je blagostanje najniže.

***Ključne riječi**: socijalna država, blagostanje, održivi razvoj, MULTIMOORA višeciljna optimizacija*

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SPATIAL MAINTENANCE GOODS UNDER MONOPOLY

ABSTRACT

This study addresses the effects of monopolistic firms' location and guarantee time limit on pricing for goods requiring high maintenance expenditure, such as elevators, televisions and computers. A spatial maintenance model of two stages within a guaranteed time limit is outlined in this paper. Based on this model, location, maintenance commitment and pricing are all characterized under a monopoly situation. This paper outlines the optimal price and location for the monopolist. The effects of guarantee time limit on price are discussed.

Keywords: *Market structure, spatial maintenance commitment, guarantee time limit, game theory, monopoly*

JEL Classification: *C61, C72, D4, L1*

1. INTRODUCTION

Maintenance is legally required for many goods, such as elevators, televisions and computers. With a suitable guarantee time limit, a firm can improve profits and significantly encourage consumption. Maintenance has been extensively discussed in the management field and economics (Estelami, Grewal and Roggeveen, 2007; Indounas, 2008; Jin and Kato, 2006; Utaka, 2006). Most research has found a positive relationship between service guarantee and quality, while some research has questioned this relationship (Hays and Hill, 2006) and references therein. A recent paper discussed the price-matching guarantees (PMGs) of retailers and the potential negative effects on consumer perceptions (Estelami, Grewal and Roggeveen, 2007). Research in economics suggests that PMGs can support a mechanism of collusion among the retailers (Corts, 1997; Chen, 1995). The presence of PMGs by one retailer provides a disincentive to other retailers to lower their prices, because retailers' price will be matched by the PMG-offering retailer. Utaka (2006) established a multi-stage model to discuss warranties of durable goods in economics and made some interesting conclusions.

This paper focuses on the maintenance for durable goods with shipping costs. We hope to address the effects of transportation cost on the market under a monopoly and to develop a theory of warranties of durable goods with spatial competitions, since the shipping costs have significant effects on the price and location of firms (Ramcharan, 2009). Based on spatial competitions, optimal pricing strategies and location are addressed and captured. The effects of guarantee time limit on price and profits are characterized. Furthermore, our conclusions are useful for pricing durable goods in second hand markets. There is a vast literature about spatial competitions. Hotelling (1929) initially proposed a model which gives an excellent framework for research into spatial competitions. Vogel (2008) re-

cently addressed product differentiations when spatial competitions were introduced. Loginova and Wang (2009) developed customization with spatial competition and derived some interesting results. Larralde, Stehlé and Jensen (2009) gave explicit solutions to a multi-dimensional Hotelling model with quadratic transportation costs. The Cournot equilibrium was recently addressed in a Hotelling model by Valverde and Escalona (2010). Heywood and Ye (2009) developed the theory of mixed oligopoly in spatial competitions and derived some interesting results about social welfare. Dixon (2010) discussed city planners and architects observing a variety of social phenomena. Chakravorty et al. (2008) investigated energy prices in a linear city. Nie (2010) developed a theory of technology spillover under spatial competitions.

Game theory approaches are employed in this work (Tirole, 1988; Nie, 2009; Anton and Das Varma, 2005; Dudine, Hendle, Lizzeri, 2006; Chen and Zhang, 2009). This paper is organized as follows: The model is outlined and discussed in Section 2. Analysis and main results are presented in Section 3. Optimal price and location are also outlined in Section 3. Some concluding remarks are provided in the final section.

2. THE MODEL

We assume that there is a unique producer in some industry and the monopoly firm faces demand for a corresponding good that requires high expenditure to maintain in the linear city $[0,1]$. We further assume that the guarantee time period is exactly T. Namely, it is free to maintain this product in time T after the consumer buys it. All consumers are uniformly distributed in the linear city. If the guarantee time limit expires, the consumer then has to pay maintenance costs. As an extreme case, $T = 0$ is the case without a guarantee commitment.

The following notations are utilized in this paper:

p and q denote the price and quantity, respectively, of the good requiring high maintenance expenditures for the monopoly firm.

We assume that the probability to be maintained for each good observes an exponential distribution. Namely, the probability to repair at t is $\varphi(t,\lambda) = \lambda e^{-\lambda t}$ for $t \geq 0$, where λ is a constant dependent on the quality of the good and λ^{-1} is the average life expectancy of the corresponding good. The parameter λ depends on the technique of the monopoly firm. We further assume that $0 \leq T \leq \lambda^{-1}$ such that the guarantee time limit is shorter than the average life expectancy. Therefore, the probability to repair this good is from $t = 0$ to $t = t_0$ is $\int_0^{t_0} \varphi(t,\lambda)dt = 1 - e^{-\lambda t_0}$. The information about the product is known to both the producer and the consumers. The life cycle of many types of electronic ***products and other durable goods observes*** this kind of ***distribution.***

The firm locates at $z_1 \in [0,1]$ for sale and at $z_2 \in [0,1]$ for maintenance. The model is composed of two stages. In the first stage, the firm locates both for sale and for maintenance. In the second stage, the firm prices based on the following model.

The marginal cost incurred by production for each product is c_0, and c denotes the marginal cost to repair each time. We assume that the cost to repair the corresponding goods of quantity s each time is $c(s) = cs$. c_t is a constant and linear transportation cost incurred, which is different from that in a recent paper (Larralde, Stehlé and Jensen, 2009). Furthermore, the incurred transportation cost is wholly shouldered by consumers. We always assume that repairing the corresponding goods is cheaper than buying new goods. The quasi-linear consumer utility function, $u(q,T,x)$, in the consumption of good q with location at $x \in [0,1]$ is always employed. We further assume that u is continuously differentiable. The consumer model is presented as follows: Given any price p and guarantee time

limit T, the consumer location at $x \in [0,1]$ chooses d to maximize utility, $d = d(p,T,x)$. The following utility maximization problem (UMP) is given:

$$\max_{d} \quad u(d,T,x) = Ad - \frac{1}{2}d^2 - dp - cd\int_T^{\lambda^{-1}} \varphi(t,\lambda)dt - c_t d\left|x - z_1\right| - c_t d\int_0^{\lambda^{-1}} \varphi(t,\lambda)dt\left|x - z_2\right| \quad (1)$$

In (1), A is a positive constant, which is large enough such that the market size is full. $Ad - \frac{1}{2}d^2$ represents the utility of consumer lying at $x \in [0,1]$ to consumer goods d. dp is the price of goods of quantity d. $cd\int_T^{\lambda^{-1}} \varphi(t,\lambda)dt$ stands for the expenditure to repair in the expected life cycle of goods d. $c_t d\left|x - z_1\right|$ represents the transportation cost to buy goods of quantity d. The term $c_t d\int_0^{\lambda^{-1}} \varphi(t,\lambda)dt\left|x - z_2\right|$ indicates the transportation cost to repair goods of quantity d. $d(p,T,x)$ is the static demand function associated with (1). Denote the total demand $D(p,T) = \int_0^1 d(p,T,x)dx$. Given the price and guarantee time limit, the monopoly firm aims to maximize its objective function or corresponding profits:

$$\max_{p} \pi(p) = pq - cq\int_0^T \varphi(t,\lambda)dt - c_0 q. \quad (2)$$

In addition, for the purpose of tractability, the linear expenditure to maintain and the linear cost function is employed in the above model. The linear transportation cost is employed throughout this work. The results of this paper can be extended to situations without extreme curvature. The following notes are presented, which are satisfied in the above model. Noticeably, (1) indicates $d = A - p - c\int_T^{\lambda^{-1}} \varphi(t,\lambda)dt - c_t\left|x - z_1\right| - c_t\int_0^{\lambda^{-1}} \varphi(t,\lambda)dt\left|x - z_2\right|$, which is the first-optimal condition of (1).

Note 1 Because $\frac{\partial^2 u(d,T,x)}{\partial d^2} = -1$, $u(d,T,x)$ is concave and twice differentiable in d, it guarantees the existence of a unique solution for the consumer. Furthermore, $\frac{\partial u(d,T,x)}{\partial d} > 0$ and $d(p,T,x) > 0$ for all x because A is large enough.

Note 2 Because $d(p,T,x) > 0$, $D(p,T) = \int_0^1 d(p,T,x)dx$ yields $D(p,T) > 0$ for all p and T.

Note 3 From $d = A - p - c\int_T^{\lambda^{-1}} \varphi(t,\lambda)dt - c_t\left|x - z_1\right| - c_t\int_0^{\lambda^{-1}} \varphi(t,\lambda)dt\left|x - z_2\right|$, we obtain that $\pi(p)$ is concave and twice differentiable in p, which guarantees the existence of a unique solution for the above model.

Notes 1 and 3 demonstrate the existence of the unique solution to the above problem. Note 2 guarantees that the consumer consumes a positive quantity in the equilibrium state. If A is large enough, Notes 1 and 2 are met. The model is the extension of maintenance commitment of Nie (2010) to spatial competition. Furthermore, market clearing conditions, $q = D(p,T)$, always satisfy this characteristic because of monopolization.

3. MAIN RESULTS

We first focus on the demand based on (1). The equilibrium, including price and guarantee time limit, is then discussed.

3.1 DEMAND

Here, we capture the solution of (1) , $d(p,T,x)$ and $D(p,T)=\int_0^1 d(p,T,x)d\,x$ with comparative static analysis. We hope to grasp the features if p and T change. For the above model (1)-(2), the following conclusions about the demand functions are established.

Proposition 1 The demand function of the consumers satisfies the relationship $\frac{\partial D(p,T)}{\partial p}<0$ and $\frac{\partial D(p,T)}{\partial T}>0$.

Proof: See Appendix. ■

Remark: Conclusions in Proposition 1 illustrate that both lower price and longer guarantee time limits significantly increase demand, which is consistent with existing evidence (Nie, 2010). $\frac{\partial D(p,T)}{\partial p}<0$ is also the classic conclusion in economics.

Furthermore, according to (1), if the incurred transportation cost is entirely undertaken by consumers, we immediately have $\frac{\partial D}{\partial c_t}<0$. This indicates that lower marginal transportation cost leads to higher demand. Further, lower marginal transportation cost improves the consumers' utility.

The utility function of consumers is then addressed. When guarantee time limit changes, we hope to acknowledge the consumers' utility. Using the envelope theorem, consumer utility is discussed and the following conclusions are achieved.

Proposition 2 $\frac{\partial u}{\partial T}>0$ and $\frac{\partial u}{\partial c_t}<0$.

Proof: See in Appendix. ■

Remark: The above conclusions describe the relationship between the utility function and variables c_t and T. The conclusions in Propositions 1 and 2 simultaneously hold in the general hypothesis satisfying Notes 1 and 2. Longer guarantee time limit, higher utility of consumers and higher marginal transportation costs reduce consumers' utility.

Furthermore, we assert that the explicit function of demand meets

$$\frac{\partial u}{\partial q}=A-q-p-c\int_T^{\lambda^{-1}}\varphi(t,\lambda)dt-c_t\left|x-z_1\right|-c_t\int_0^{\lambda^{-1}}\varphi(t,\lambda)dt\left|x-z_2\right|=0, \quad (3)$$

$$d(p,T,x)=A-p-c\int_T^{\lambda^{-1}}\varphi(t,\lambda)dt-c_t\left|x-z_1\right|-c_t\int_0^{\lambda^{-1}}\varphi(t,\lambda)dt\left|x-z_2\right|. \quad (4)$$

By direct calculation, we obtain $\int_0^1 |x - z_1| dx = z_1^2 - z_1 + \frac{1}{2}$ and $\int_0^1 |x - z_2| dx = z_2^2 - z_2 + \frac{1}{2}$. The following formulation holds.

$$\begin{aligned} D(p,T) &= \int_0^1 d(p,T,x)d\,x \\ &= A - p - c\int_T^{\lambda^{-1}} \varphi(t,\lambda)dt - c_t \int_0^1 |x - z_1| dx - c_t \int_0^{\lambda^{-1}} \varphi(t,\lambda)dt \int_0^1 |x - z_2| dx \\ &= A - p - c\int_T^{\lambda^{-1}} \varphi(t,\lambda)dt - c_t(z_1^2 - z_1 + \frac{1}{2}) - c_t \int_0^{\lambda^{-1}} \varphi(t,\lambda)dt(z_2^2 - z_2 + \frac{1}{2}) \end{aligned} \quad (5)$$

We further have the relation $\frac{\partial D(p,T)}{\partial p} = -1$, $\frac{\partial D(p,T)}{\partial T} = c\varphi(T,\lambda)$,

$\frac{\partial D(p,t)}{\partial c_t} = -(z_1^2 - z_1 + \frac{1}{2}) - \int_0^{\lambda^{-1}} \varphi(t,\lambda)d\ (z_2^2 t - z_2 + \frac{1}{2}) < 0$, $\frac{\partial D(p,T)}{\partial z_1} = c_t(1 - 2z_1)$ and

$\frac{\partial D(p,T)}{\partial z_2} = c_t \int_0^{\lambda^{-1}} \varphi(t,\lambda)dt(1 - 2z_2)$. The following analyses are all based on these formulations.

3.2 EQUILIBRIUM

The equilibrium price and guarantee time limit are addressed. The model is analyzed by backward induction technology. The second stage is considered first. By virtue of market clearing conditions, $q = D(p,T)$, the profit function of the monopolist is

$$\max_p \pi(p) = p\ D(p,T) - cD(p,T)\int_0^T \varphi(t,\lambda)d\ t - c_0 D(p,T). \quad (6)$$

According to (6), the profit function is concave and Note 3 is satisfied, which guarantees the existence and unique solution. The solution is determined by the first-order optimal condition of $\pi(p)$ as follows:

$$\frac{d\pi}{dp} = D(p,T) + p\frac{\partial D(p,T)}{\partial p} - [c\int_0^T \varphi(t,\lambda)dt + c_0]\frac{\partial D(p,T)}{\partial p} = 0. \quad (7)$$

That is,

$$A - p - c\int_T^{\lambda^{-1}} \varphi(t,\lambda)dt - c_t(z_1^2 - z_1 + \frac{1}{2}) - c_t \int_0^{\lambda^{-1}} \varphi(t,\lambda)dt(z_2^2 - z_2 + \frac{1}{2}) - p + [c\int_0^T \varphi(t,\lambda)dt + c_0] = 0.$$

We therefore achieve the optimal price of the monopolist.

$$p^* = \frac{A - c\int_T^{\lambda^{-1}} \varphi(t,\lambda)dt - c_t(z_1^2 - z_1 + \frac{1}{2}) - c_t \int_0^{\lambda^{-1}} \varphi(t,\lambda)dt(z_2^2 - z_2 + \frac{1}{2}) + [c\int_0^T \varphi(t,\lambda)dt + c_0]}{2}. \quad (8)$$

The corresponding profits are

$$\pi(p^*) = p^* D(p^*,T) - cD(p^*,T)\int_0^T \varphi(t,\lambda)d\ t - c_0 D(p^*,T). \quad (9)$$

For the optimal price and the corresponding profits, by virtue of comparative static analysis and the envelope theorem, the following conclusion holds.

Proposition 3 For the equilibrium price, we have $\frac{\partial p^*}{\partial c_t} < 0$, $\frac{\partial p^*}{\partial T} > 0$, $\frac{\partial p}{\partial z_1} = \frac{c_t}{2}(1-2z_1)$ and $\frac{\partial p}{\partial z_2} = \frac{c_t}{2}\int_0^{\lambda^{-1}} \varphi(t,\lambda)dt(1-2z_2)$. For profit function, using the envelope theorem, we achieve the relationship $\frac{\partial \pi}{\partial c_t} < 0$.

Proof: See in Appendix. ■

Remark: in the above demonstration, higher marginal transportation costs lower the price and profit of the firm. Longer guarantee time limit is associated with higher price, which is consistent with PMG. In the relationship $\frac{\partial p}{\partial z_1} = \frac{c_t}{2}(1-2z_1)\begin{cases} >0 & z_1 < 0.5 \\ <0 & z_1 > 0.5 \end{cases}$ and $\frac{\partial p}{\partial z_2} = \frac{c_t}{2}\int_0^{\lambda^{-1}} \varphi(t,\lambda)dt(1-2z_2)\begin{cases} >0 & z_1 < 0.5 \\ <0 & z_1 > 0.5 \end{cases}$, the monopolist's prices are highest when $z_1 = z_2 = 0.5$. Therefore, when location is closer to the middle point, the price increases under equilibrium price. When a firm's location and repairing location are both close to the middle point, demand improves and the monopolist benefits from this location.

We further discuss guarantee limit time T. According to the envelope theorem, the following relationship between a firm's profits and the guarantee limit time T is discussed. Because $\left.\frac{\partial \pi}{\partial p}\right|_{p^*} = 0$, we have

$$\begin{aligned} \frac{\partial \pi}{\partial T} &= \frac{\partial \pi}{\partial p}\frac{\partial p}{\partial T} + \frac{\partial \pi}{\partial D}\frac{\partial D(p,T)}{\partial T} - cD(p,T)\varphi(T,\lambda) \\ &= [p^* - c\int_0^T \varphi(t,\lambda)dt - c_0]\frac{\partial D(p,T)}{\partial T} - cD(p,T)\varphi(T,\lambda). \qquad (10) \\ &= [p^* - c\int_0^T \varphi(t,\lambda)dt - c_0 - D(p^*,T)]c\varphi(T,\lambda) \end{aligned}$$

This analysis is summarized as follows:

Proposition 4 For profit function, if $p^* - c\int_0^T \varphi(t,\lambda)dt - c_0 - D(p^*,T) > 0$, we have $\frac{\partial \pi}{\partial T} > 0$. Otherwise, we have $\frac{\partial \pi}{\partial T} \le 0$.

Remarks: The conclusion in the above proposition illustrates the relationship between the longer guarantee limit time and the firm's profits. If $p^* - c\int_0^T \varphi(t,\lambda)dt - c_0 - D(p^*,T) > 0$ or the demand is small, the firm is apt to longer guarantee a time limit. Otherwise, a longer guarantee time limit reduces the firm's profits.

The first stage is then discussed and the optimal location is focused on. The formulation indicates that $D(p,T)$ should obtain its maximization values at $z_1 = \frac{1}{2}$. $\frac{\partial p}{\partial z_1} = \frac{c_t}{2}(1-2z_1)$ also suggests that p should achieve its maximization at $z_1 = \frac{1}{2}$. We therefore make the conclusion that $\pi(p^*) = D(p^*,T)[p^* - c\int_0^T \varphi(t,\lambda)dt - c_0]$ reaches its maximization at $z_1 = \frac{1}{2}$. Similarly, $\pi(p^*) = D(p^*,T)[p^* - c\int_0^T \varphi(t,\lambda)dt - c_0]$ obtains its maximization at $z_2 = \frac{1}{2}$. The above analysis on the first stage is summarized as follows:

Proposition 5 Under uniform distribution of consumers, the optimal location of both sale and maintenance is the middle point of a linear city.

The two stage model is addressed and the optimal price and location for the monopolist are achieved. The above conclusions are useful for firms that are making location and price decisions.

4. CONCLUDING REMARKS

In this work, the theory of goods requiring high maintenance expenditure under spatial competition is developed for monopoly conditions, and the corresponding results are established. The optimal location and guarantee maintenance patterns are analyzed and compared. To our surprise, the optimal location is at the exact middle point of a linear city. To our knowledge, there exists no literature about spatial competitions on maintenance commitment; this study is the first to addresses this topic.

In this work, shipping costs are shouldered by consumers. If part of this cost is undertaken by the firm, similar techniques are adopted and the corresponding conclusions are achieved. The uniform distribution of consumers is discussed in this work and can be extended to general situations. This paper focuses on rational consumers, while, in many industries, shipping costs may be neglected according to experiments in behavioral economics (Hossain and Morgan, 2006). In summary, the consumers' nonstandard decision regarding shipping costs is a complex topic and will be the focus of our future research.

This paper assumes that complete information about the product is known to both producer and consumers. Incomplete information renders modeling more difficult and will be the subject of our future research.

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APPENDIX

Proof of Proposition 1

We first discuss $d(p,T,x)$, which is the solution to the first optimal conditions of (1). Then, $D(p,T)=\int_0^1 d(p,T,x)dx$ is addressed. $d(p,T,x)$ is the solution of (1) and the first order optimal conditions of (1) are outlined as follows:

$$f=\frac{\partial u(q,T,x)}{\partial q}=A-q-p-c\int_T^{\lambda^{-1}}\varphi(t,\lambda)dt-c_t\left|x-z_1\right|-c_t\int_0^{\lambda^{-1}}\varphi(t,\lambda)dt\left|x-z_2\right|=0.$$

From the above equation, we have $\frac{\partial f}{\partial q}=-1,\frac{\partial f}{\partial p}=-1$ and $\frac{\partial f}{\partial T}=c\varphi(T,\lambda)$. According to the implicit function theorem, there exists the unique explicit function $d(p,T,x)$, which is differentiable and the following relationships hold.

$$\frac{\partial d(p,T,x)}{\partial p}=-\frac{\frac{\partial f}{\partial q}}{\frac{\partial f}{\partial p}}=-1<0,$$

$$\frac{\partial d(p,T,x)}{\partial T}=-\frac{\frac{\partial f}{\partial q}}{\frac{\partial f}{\partial T}}>0.$$

Because $D(p,T)=\int_0^1 d(p,T,x)dx$ and $d(p,T,x)$ is continuously differentiable, we achieve the relationship $\frac{\partial D(p,T)}{\partial p}<0$ and $\frac{\partial D(p,T)}{\partial T}>0$.

Our conclusions are achieved and the proof is complete. We further point out that we can directly employ the comparative static analysis approach to obtain the above results. In general cases, the implicit function theorem seems to be more powerful that the comparative static analysis approach. ■

Proof of Proposition 2

We demonstrate the conclusions using the envelope theorem.

$$\frac{\partial u}{\partial T}=\frac{\partial u}{\partial d}\frac{\partial d}{\partial T}+\frac{\partial u}{\partial T}=cq\varphi(T,\lambda)>0,$$

$$\frac{\partial u}{\partial c_t}=\frac{\partial u}{\partial d}\frac{\partial d}{\partial c_t}+\frac{\partial u}{\partial c_t}=-q\left|x-z_1\right|-q\int_0^{\lambda^{-1}}\varphi(t,\lambda)d\ \left|xt-z_2\right|<0.$$

Our results are obtained and the proof is complete. ■

Proof of Proposition 3

We demonstrate this with comparative static analysis method. By virtue of (8), the comparative static analysis approach indicates the formulations $\frac{\partial p^*}{\partial T}=c\varphi(T,\lambda)>0$,

$\frac{\partial p^*}{\partial c_t}=\frac{-(z_1^2-z_1+\frac{1}{2})-\int_0^{\lambda^{-1}}\varphi(t,\lambda)d\ (z_2^2t-z_2+\frac{1}{2})}{2}<0$, $\frac{\partial p}{\partial z_1}=\frac{c_t}{2}(1-2z_1)$ and

$\frac{\partial p}{\partial z_1}=\frac{c_t}{2}\int_0^{\lambda^{-1}}\varphi(t,\lambda)dt(1-2z_2)$.

According to (9), because $\left.\frac{\partial \pi}{\partial p}\right|_{p^*}=0$, the envelope theorem suggests the following relationship:

$$\frac{\partial \pi}{\partial c_t}=\frac{\partial \pi}{\partial p}\frac{\partial p}{\partial c_t}+\frac{\partial \pi}{\partial D}\frac{\partial D}{\partial c_t}=\frac{\partial \pi}{\partial D}\frac{\partial D}{\partial c_t}=[p^*-c\int_0^T\varphi(t,\lambda)dt-c_0]\frac{\partial D}{\partial c_t}>0.$$

Our results are obtained and the proof is complete. ■

MONOPOL NAD ROBOM S PROSTORNIM ODRŽAVANJEM

SAŽETAK

Ovaj rad se bavi efektima koje lokacija i vremensko ograničenje garancije u monopolističkim tvrtkama imaju na formiranje cijena robe koja zahtijeva visoke troškove održavanja, kao što su liftovi, televizori i kompjuteri. U ovom radu iznosimo model prostornog održavanja u dva stupnja unutar garantiranog vremenskog ograničenja. Na osnovu ovog modela, lokacija, obveza održavanja i formiranje cijena se sve određuju u situaciji monopola. Rad donosi optimalne cijene i lokacije za monopolistu. Raspravlja se i o učincima vremenskog ograničenja garancije na cijenu.

***Ključne riječi**: Struktura tržišta, obveza prostornog održavanja, vremensko ograničenje garancije, teorija igara, monopol*

***JEL klasifikacija:** C61, C72, D4, L1*

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RISK ANALYSIS OF CRITICAL INFRASTRUCTURES USING FUZZY COPRAS

ABSTRACT

Critical infrastructures play a significant role in countries because of the essentiality of nation security, public safety, socioeconomic security, and way of life. According to the importance of infrastructures, it is a necessity to analyze the potential risks to do not allow these risks be converted into events. The main purpose of this paper is to provide a developed framework with the aim to overcome limitations of the classical approach to build a more secure, safer, and more resilient critical infrastructures in order to develop, implement, control. The proposed framework extends conventional RAMCAP (Risk Analysis and Management for Critical Asset Protection) through introducing new parameters the effects on risk value. According to the complexity of problem and the inherent uncertainty, this research adopts the fuzzy COPRAS (COPRAS-F) as a fuzzy multi criteria decision making technique to determine the weights of each criterion and the importance of alternatives with respect to criteria. Case analysis is implemented to illustrate the capability and effectiveness of the model for ranking the risk of critical infrastructures. The proposed model demonstrates a significant improvement in comparison with conventional RAMCAP.

Keywords*: Fuzzy COPRAS, COPRAS-F, Risk analysis, Criticalinfrastructures, RAMCAP*

JEL Classification: *C53, C54, C61, C63.*

1. INTRODUCTION

The countries of all around the world were recently faced with several events generated by various causes in the critical infrastructures sector(Too, 2011, Rudock et al. 2010, Miao et. al. 2010, Darby, 2008, Little, 2005, Yusta et al. 2011, Tofani et al. 2010). They have led to a lot of casualties and major damageto human, machinery, and environment. That is demonstrated by many events which risk connected with security, safety, health, and environment cannot be perfectly avoided.Therefore, miscellaneous methodologies were developed in order to analyze and rank the existing risks (Hsueh et al. 2007, Manik et al. 2008, Zavadskas et al. 2010, Perera et al. 2009,JaskovskiandBiruk, 2011, Kheirkhahet al. 2009).Risk Analysis and Management for Critical Asset Protection (RAMCAP) methodology is one the most well-known methods in this field that were presented by the Department of

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Homeland Security. The RAMCAP method is a function of three components threat (T), vulnerability (V), and consequence (C) (Brashear et al., 2007; ASME-ITI, 2006; Cox, 2009).

Regardless of the relative importance weights of the evaluation criteria, it appearsto be an urgent need for critical infrastructuresto develop a risk assessment methodology to manage the effectivecomponents.

COPRAS(COmplex PRoportional ASsessment) isone of the most application multi criteria decision making (MCDM) methods,which assigns the best alternative among a pool of feasible alternatives by determininga solution with the ratio to the ideal solution and the ratio with the ideal-worst solution (Zavadskas and Kaklauskas, 1996).This technique is employed by various researchers to solve the decision making problems.

Kaklauskas et al. (2006) applied COPRAS to select low-e windows in retrofit of public buildings. Banaitiene et al. (2008) used COPRAS to evaluate the life cycle of buildings. Chatterjee et al. (2011a) developed two COPRAS and evaluation of mixed data methods for materials selection. This paper presents two examples which prove that these two MCDM methods can be effectively applied to solve the real time material selection problems. Zavadskas et al. (2010) used COPRAS for risk assessment of construction projects. Mazumdar et al. (2010) used COPRAS for evaluation appraisal of teacher performance, Karbassi et al. (2008) – for energy savings decisions. Ginevicius et al. (2010) used COPRAS for the model of forming competitive strategy of an enterprise under the conditions of oligopoly market.Podvezko et al. (2010) used COPRAS method for complex evaluation of contracts for construction. Podvezko (2011) compared SAW and COPRAS methods.

Zavadskas et al. (2008) proposed COPRAS-G method in order to select construction project managers.They considered the application of grey relations methodology for defining the utility of alternatives. Madhuri et al. (2010) selected the best web site by applying COPRAS-G method.Zavadskas et al. (2011) COPRAS-G method used for assessment the indoor environment of dwelling houses. Chatterjee et al. (2011b) used COPRAS-G for material selection.

Zavadskas and Antucheviciene (2007) applied fuzzyfied COPRAS method for analysis of regeneration alternatives of derelict buildings of regeneration alternatives of derelict buildings in Lithuania rural areas. Antucheviciene et al. (2011) compared fuzzy COPRAS, TOPSIS and VIKOR methods. Fuzzy logic is able to model theexistinguncertainty.This technique uses linguistic variable instead of traditional quantitative expression, which is a very helpful concept for dealing with situations which are too complex or not well-defined enough (Zadeh, 1965).Therefore, COPRAS-F is developed in order to solve different aspects of priority issues.

In this paper, we extend the approach of COPRAS to develop a risk-based methodology under fuzzy environment. COPRAS-F is adopted because of its capability and efficiency in handling uncertainty, simultaneous consideration of the ratio to the ideal solution and the ratio with the ideal-worst solution, and logical concepts.

The rest of the paper is organized as follows: In Sections 2, the basic structure of the RAMCAP methodology is introduced. Section 3 describes fuzzy theory, including fuzzy logic, fuzzy set, and fuzzy number. In section 4, COPRAS-F is presented. The proposed framework is summarized in Section 5, including risks identification, selection of criteria, and risk evaluation. In Section 6, study for risk evaluation in an illustrative case is presented. The comparison of the proposed model with the conventional RAMCAP is implemented and results are discussed in Section 7. Conclusions are discussed and some shortages of the conventional RAMCAP are listed in Section 8.

2. THE BASIC CONCEPTS OF RAMCAP METHODOLOGY

The RAMCAP methodology provides a systematic process to identify and analyze the significance of potential events associated with critical infrastructures. The RAMCAP process is comprised of seven steps as follows (ASME-ITI, 2006; Brashear et al., 2007):
(1)Asset characterization and screening, (2) Threat characterization, (3) Consequence analysis, (4) Vulnerability analysis, (5) Asset attractiveness and threat assessment, (6) Risk assessment, and (7) Risk management. This steps are depicted in Fig. 1.

Figure. 1. Process of RAMCAP technique

The benefits of conventional RAMCAP, but are not limited to, include (Brashear & Jones, 2010): (i) More efficient management of capital and human resources, (ii) Ability to identify the assets with the greatest need and value of improvement, (iii) rational allocation of resources to maximize the security and resilience enhancement within a finite budget.
According to the conventional RAMCAP technique, risk (R) is determined by the intersection of consequences of the attack (C), the threats of the attack (T) and vulnerabilities to the attack (V). More specifically, risk is formulated as Eq. (1):

$$R = C \times T \times V \tag{1}$$

3. FUZZY THEORY

Adequate knowledge and comprehensive data base on a number of different problems are requested to analyze critical infrastructures. There are a close relationship between complexity and certainty, so that; increasing the complexity lead to decrease the certainty. Fuzzy logic –introduced by Zadeh (1965) - can take into account uncertainty and solve problems where there are no sharp boundaries and precise values. Fuzzy logic provides a methodology for computing directly with words (Zadeh, 1996).

Fuzzy set is a powerful mathematical tool for handling the existing uncertain in decision making. A fuzzy set is general form of a crisp set. A fuzzy number belong to the closed interval 0 and 1, which 1 addresses full membership and 0 expresses non-membership. Whereas, crisp sets only allow 0 or 1.There are different types of fuzzy numbers that can be utilized based on the situation. It is often convenient to work with triangular fuzzy numbers (TFNs) because they are computed simply, and are useful in promoting representation and information processing in a fuzzy environment (Torlak et al, 2011).

A fuzzynumber $\tilde{A}$ on R can be a triangularfuzzynumber (TFN)ifitsmembershipfunction $\mu_{\tilde{A}}(x): R \to [0,1]$ be definedasfollows (SeeFig. 2):

$$\mu_{\tilde{A}}(x) = \begin{cases} 0, & x \le a \\ (x-a)/(b-a), & a \le x \le b \\ (c-x)/(c-b), & b \le x \le c \\ 0, & \text{otherwise} \end{cases} \tag{2}$$

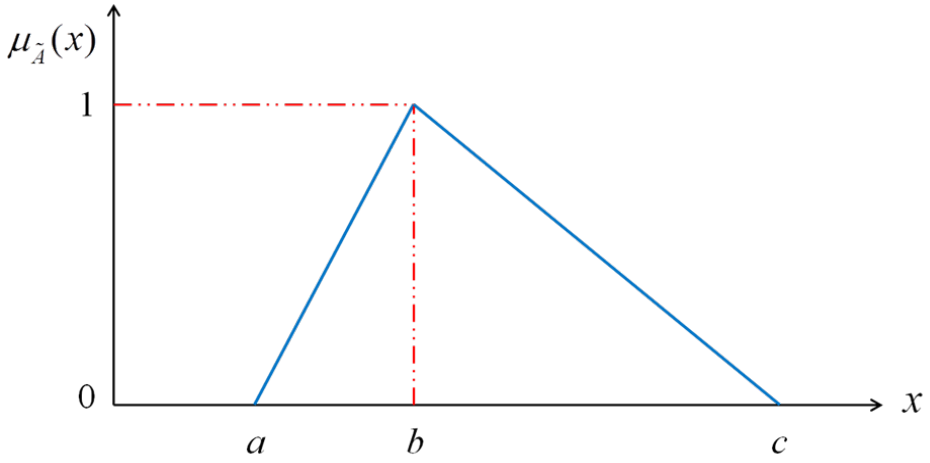


Fig.2. Membershipfunctionof a triangularfuzzynumber $\tilde{A} = (a, b, c)$

4. FUZZY COPRAS APPROACH

The COPRAS (*CO*mplex*PR*oportional*As*sessment) method was first introduced by Zavadskas and Kaklauskas (1996). The COPRAS method determines a solution with the ratio to the best solution. This method assumes direct and proportional dependence of the significance and utility degree of investigated versions on a system of criteria adequately describing the alternatives and on values and weights of the criteria. COPRAS-F method was first introduced by Zavadskas and Antucheviciene (2007).

In conventional COPRAS, the weights of the criteria and the ratings of alternatives are taken into account as crisp numerical data. However, under many conditions crisp data are insufficient to handle real world decision problems andon the other hand perfect knowledge is not easily obtained. These make decision imprecise and inaccurate. Consequently, COPRAS-Fis proposedwhere criteria weights and alternative ratings are given by linguistic terms that are addressed using fuzzy numbers.

The mathematics concept of COPRAS-F can be described as follows:

Step 1: Choose the linguistic ratings for criteria and alternatives with respect to criteria.

In this step, the importance weights of evaluation criteria and the ratings of alternatives are considered as linguistic terms to assess risk under fuzzy environment. Linguistic values for importance weight of each criterionare shown in Table 1 and Fig. 3, andlinguisticvalues for preference rating of each alternative are presented in Table 2 and Fig. 4.

Table 1. Linguistic terms for criteria

Linguistic terms	Fuzzy number
Very low (VL)	(0.0,0.0,0.25)
Low (L)	(0.0,0.25,0.5)
Medium (M)	(0.25,0.5,0.75)
High (H)	(0.5,0.75,1.0)
Very High (VH)	(0.75,1.0,1.0)

Table 2. Linguistic rating for alternatives

Linguistic terms	Fuzzy rating
Very Poor (VP)	(0.0,0.0, 2.5)
Poor (P)	(0.0,2.5,5.0)
Fair (F)	(2.5,5.0,7.5)
Good (G)	(5.0,7.5,10.0)
Very Good (VG)	(7.5,10.0,10.0)

Figure 3.Linguistic values for importance weight of each criterion

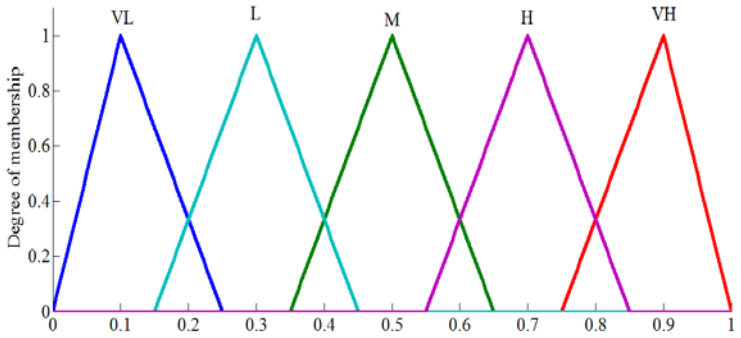
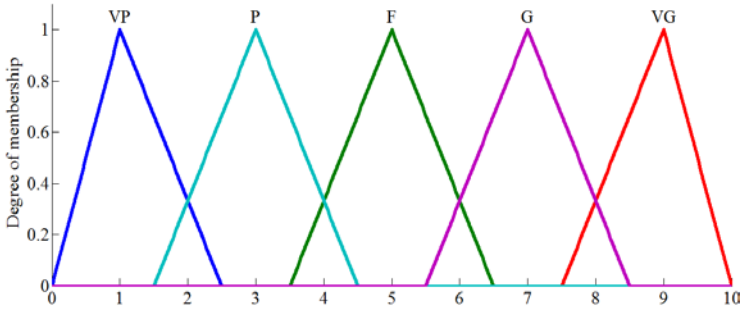


Figure 4. Linguistic values for preference rating of each alternative



Step 2. Construct the fuzzy decision matrix.

If assume that the number of criteria is *n* and the count of alternatives is *m*, fuzzy decision matrix will be obtained with *m* rows and *n* columns as following matrix:

(3)

$$\tilde{D} = \begin{array}{c} \begin{matrix} C_1 & C_2 & \cdots & C_n \end{matrix} \\ \begin{bmatrix} \tilde{x}_{11} & \tilde{x}_{12} & \cdots & \tilde{x}_{1n} \\ \tilde{x}_{21} & \tilde{x}_{22} & \cdots & \tilde{x}_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ \tilde{x}_{m1} & \tilde{x}_{m2} & & \tilde{x}_{mn} \end{bmatrix} \end{array} \begin{matrix} A_1 \\ A_2 \\ \vdots \\ A_m \end{matrix}$$

And criteria are constructed as follows:

(4)

$$\tilde{W} = (\tilde{w}_1, \tilde{w}_2, ..., \tilde{w}_n)$$

Defuzzify the fuzzy decision matrix and fuzzy weight of eachcriterion into crisp values. In order to deffuzzify fuzzy decision matrix and fuzzy weight of each criterioninto crisp values, the authorsusedthe centre of area (COA) method. This method is a simple and

practical without the need to bring in the preferences of any evaluators (Wu *et al*. 2009). The BNP value for the fuzzy number $\tilde{R}_i = (L\tilde{R}_i, M\tilde{R}_i, U\tilde{R}_i)$ can be found using the following equation:

$$BNP_i = [(U\tilde{R}_i - L\tilde{R}_i) + (M\tilde{R}_i - L\tilde{R}_i)]/3 + L\tilde{R}_i \tag{5}$$

4. Normalization of the defuzzieddecision-making matrix $\overline{X}$. The normalized values of this matrix are calculated as:

$$\overline{x}_{ij} = \frac{x_{ij}}{\sum_{j=1}^{n} x_{ij}};\ i = \overline{1,n}\ and\ j = \overline{1,m}\ . \tag{8}$$

After this step we have normalized decision-making matrix:

$$\overline{X} = \begin{bmatrix} \overline{x}_{11} & \overline{x}_{12} & \ldots & \overline{x}_{1m} \\ \overline{x}_{12} & \overline{x}_{22} & \ldots & \overline{x}_{2m} \\ \vdots & \vdots & \ldots & \vdots \\ \overline{x}_{n1} & \overline{x}_{n2} & \ldots & \overline{x}_{nm} \end{bmatrix}. \tag{9}$$

5. Calculation of the weighted normalized decision matrix $\hat{X}$. The weighted normalized values $\hat{x}_{ij}$ are calculated as:

$$\hat{x}_{ij} = \overline{x}_{ij} \cdot q_j;\ i = \overline{1,n}\ and\ j = \overline{1,m}. \tag{10}$$

In formula (10) q_j is weight of the $j-th$ attribute.

After this step we have weighted normalized decision-making matrix:

$$\hat{X} = \begin{bmatrix} \hat{x}_{11} & \hat{x}_{12} & \ldots & \hat{x}_{1m} \\ \hat{x}_{21} & \hat{x}_{22} & \ldots & \hat{x}_{2m} \\ \vdots & \vdots & \ldots & \vdots \\ \hat{x}_{n1} & \hat{x}_{n2} & \ldots & \hat{x}_{nm} \end{bmatrix}; i = \overline{1,n}\ and\ j = \overline{1,m}. \tag{11}$$

6. Sums P_j of attributes values which larger values are more preferable (optimization direction is maximization) calculation for each alternative (line of the decision-making matrix):

$$P_i = \sum_{j=1}^{k} \hat{x}_{ij} \cdot \tag{12}$$

In formula (6) *K* is number of attributes which must to be maximised (it is assumed that in the decision-making matrix columns first of all are placed attributes with optimization direction maximum and ones with optimization direction minimum are placed after).

7. Sums R_i of attributes values which smaller values are more preferable (optimization direction is minimization) calculation for each alternative (line of the decision-making matrix):

$$R_i = \sum_{j=k+1}^{m} \hat{x}_{ij}. \tag{13}$$

In formula (13) $(m-k)$ is number of attributes which must to be minimized.

8. Determining the minimal value of R_i:

$$R_{\min} = \min_i R_i;\ i = \overline{1,n}. \tag{14}$$

9. Calculation of the relative weight of each alternative Q_i:

$$Q_i = P_i + \frac{R_{\min} \sum_{i=1}^{n} R_i}{R_i \sum_{i=1}^{n} \frac{R_{\min}}{R_i}}. \tag{15*}$$

Formula (15) can to be written as follows:

$$Q_i = P_i + \frac{\sum_{i=1}^{n} R_i}{R_i \sum_{i=1}^{n} \cdot \frac{1}{R_i}}. \quad (15)$$

10. Determination of the optimality criterion K:

$$K = \max_i Q_i;\ i = \overline{1,n}. \quad (16)$$

11. Determination of the priority of the project. The greater weight (relative weight of alternative) Q_i, the higher is the priority (rank) of the project. In the case of $Q_{\max}$, the satisfaction degree is the highest.

12. Calculation of the utility degree of each alternative:

$$N_i = \frac{Q_i}{Q_{\max}} 100\%, \quad (17)$$

where Q_i and $Q_{\max}$ are the weight of projects obtained from Eq. (15).

5. THE PROPOSED FRAMEWORK

The proposed framework for ranking risk in critical infrastructures has followingthree phases:
1. Identify the existing risks.
2. Select the evaluation criteria.
3. Evaluate the identified risks using the COPRAS-F procedure.

5.1. RISKS IDENTIFICATION

In the risk identification phase, threats and hazards which could disrupt the critical services and products should be identified. One of the simplest method of identifying and analyzing the risks in a infrastructure is by asking questions such as which assets are most critical, which assets are more exposed to danger, and getting the right answers.

5.2. SELECTION OF CRITERIA

Selection of criteria is the first step for evaluating risk of critical infrastructures.The parameters of the RAMCAP methodology were identified as a part of evaluation criteria. Since these criteria are not enough to cover all aspects of risks; new criteria for a more precise, accurate, and sure risk analysis are developed. These criteria are presented in Table 3. As shown in Table 3, the first three criteria (i.e. C1, C2, and C3) are the cost type criteria (the lower, the better). The remaining criteriaare the benefit type criteria (the higher, the better).

Table 3. Evaluation criteria for analyze risk

Criteria	Definition	Type of criterion
Threat (C1)	Threat is defined as an event with an undesired impact	Cost
Vulnerability (C2)	Any weakness of an asset that can convert it into an event or disaster by one or more threats	Cost
Consequence (C3)	Consequence is defined as the effect of an event or incident	Cost
Detectability (C4)	The capability and potential for identification and elimination of the weakness	Benefit

Reaction against event (C5)	The capability of an appropriate response in order to reduce or limit the effect of an event after happening or prevent against the development of casualties, damage, and loss	Benefit

5.3. EVALUATING THE EXISTING RISKS USING THECOPRAS-F PROCEDURE

In the third phase, evaluating risks is determined by using theCOPRAS-F technique. Linguistic terms are utilized for evaluating the ratings and importance weights of alternatives and criteria.The definition of linguistic terms and triangular fuzzy numbers are presented in Tables (1) and (2).

6. CASE ANALYSIS

The proposed modelis utilized to rank the existing risk in a critical infrastructure in order to demonstrate the potential applications of the model. A rail transportation example is adopted from API & NPRA (2004). The example is of a fictitious hydrocarbon tank truck transportation system, which includes the tank truck, inventory of flammable liquids and the route specific variables such as the type of road, population centers and environmental receptors, and any stops.

6.1. RISKS IDENTIFICATION

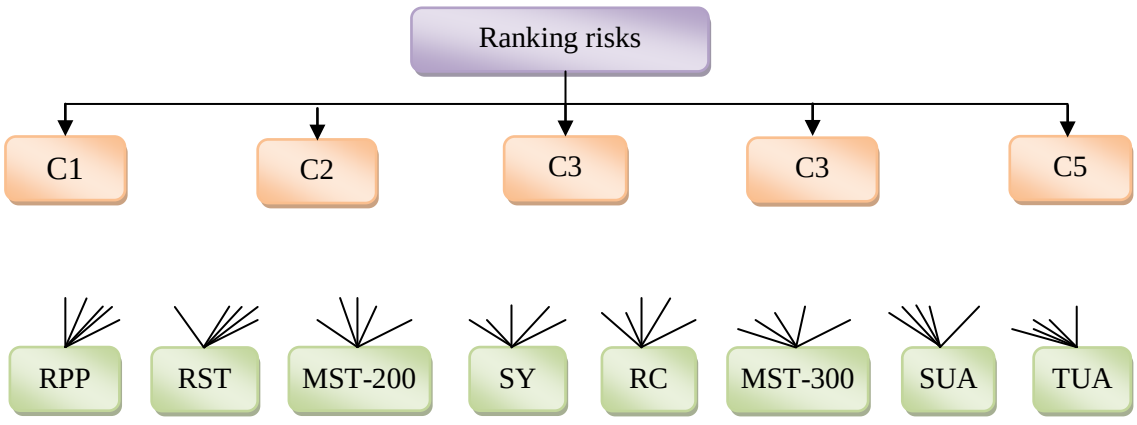
In our case, eight critical assets were identified as risky assets to be analyzed by the model. These assets include25 railcars of petroleum products (RPP), rural section of track to switch yard - 25 miles from shipper's site (RST), mainline section of track in rural area - 200 miles (MST-200), switch yard (SY), river crossing (RC), mainline section of track in urban area - 300 miles (MST-300), siding in Urban Area (SUA), and tunnel in Urban Area (TUA).

6.2. SELECTION OF CRITERIA

From above discussion, evaluation criteria to utilize in the proposed model comprise Threat (C1), Vulnerability (C2), Consequence (C3), Detectability (C4), andReaction against event (C5). Thus, the decision hierarchy is structuredas depicted in Fig. 5.

The decision problem consists of three levels: the objective of the problem is situated at the highest level, while in the second level, the criteria are presented, and the last level belongs to the alternatives.

Figure 5. The structure of decision



6.3. EVALUATING THE EXISTING RISKS USING FUZZY COPRAS PROCEDURE

Regarding the evaluation of the identified risks, 8 decision makers with minimum 5 years experience were invited to evaluate the weights of criteria and alternatives with respect to each criterion by using linguistic variables given in Table 1 and Table 2. For achieving the aim, two questionnaires are designed; one of them is to obtain the weights of criteria and other is to acquire the importance of alternatives with respect to criteria. To determine the fuzzy weight of each criterion, linguistic variables are converted into triangular fuzzy numbers as shown in the third column of Table 4. The crisp weights are calculated by Eq. (5) and are presented in the last column of Table 4.

Table 4. Fuzzy weights of criteria

Criteria	Linguistic term	Fuzzy weight	Crisp weight
C1	M	(0.25,0.5,0.75)	0.5
C2	H	(0.5,0.75,1.0)	0.75
C3	VH	(0.75,1.0,1.0)	0.916
C4	L	(0.0,0.25,0.5)	0.25
C5	M	(0.25,0.5,0.75)	0.5

Then, decision makers were asked to form fuzzy evaluation matrix by linguistic variables presented in Table 2. It is constructed by comparing eightpotential risks under five criteria separately. The fuzzy decision matrix is presented in Table 5. After constructing the fuzzy decision matrix, fuzzy values are converted into crisp values through Eq. (5).

Based on the fuzzy COPRAS procedure, the decision matrix formed in Table 5 needs to be normalized. Then, the weighted decision matrix for the existing alternatives is calculated by multiplying the weights of criteria with the normalized decision matrix as depicted in Table 6.

Table 5. Fuzzy decision matrix

	C1	C2	C3	C4	C5
RPP	G (5.0,7.5,10.0)	F (2.5,5.0,7.5)	G(5.0,7.5,10.0)	VG(7.5,10.0,10.0)	F (2.5,5.0,7.5)
RST	F (2.5,5.0,7.5)	G(5.0,7.5,10.0)	F (2.5,5.0,7.5)	P (0.0,2.5,5.0)	P (0.0,2.5,5.0)
MST -200	F (2.5,5.0,7.5)	F (2.5,5.0,7.5)	P (0.0,2.5,5.0)	VG(7.5,10.0,10.0)	G(5.0,7.5,10.0)
SY	G (5.0,7.5,10.0)	VP (0.0,0.0, 2.5)	P (0.0,2.5,5.0)	F (2.5,5.0,7.5)	VG(7.5,10.0,10.0)
RC	F (2.5,5.0,7.5)	G(5.0,7.5,10.0)	P (0.0,2.5,5.0)	F (2.5,5.0,7.5)	VG(7.5,10.0,10.0)
MST -300	VG(7.5,10.0,10.0)	F (2.5,5.0,7.5)	F (2.5,5.0,7.5)	P (0.0,2.5,5.0)	G(5.0,7.5,10.0)
SUA	VP (0.0,0.0, 2.5)	P (0.0,2.5,5.0)	G(5.0,7.5,10.0)	VG(7.5,10.0,10.0)	G(5.0,7.5,10.0)
TUA	G (5.0,7.5,10.0)	G(5.0,7.5,10.0)	F (2.5,5.0,7.5)	P (0.0,2.5,5.0)	F (2.5,5.0,7.5)

Table 6. Weighted normalized fuzzy decision matrix

	C1	C2	C3	C4	C5
RPP	0.078947	0.091837	0.183333	0.050926	0.046875
RST	0.052632	0.137755	0.122222	0.013889	0.234375
MST-200	0.052632	0.091837	0.061111	0.050926	0.351563
SY	0.078947	0.015306	0.061111	0.027778	1.289063
RC	0.052632	0.137755	0.061111	0.027778	1.575521
MST-300	0.096491	0.091837	0.122222	0.013889	1.289063
SUA	0.008772	0.045918	0.183333	0.050926	1.054688
TUA	0.078947	0.137755	0.122222	0.013889	0.703125

Then for the eight alternatives, the relative weight of each alternative is calculated. As mentioned above, C1, C2, and C3 are cost criteria whereas C4 and C5 are benefit criteria. Finally, the utility degree of each alternative is computed as presented in Table 7.

Table 7. Fuzzy COPRASoutput

	Q	***N***	Rank based on security
RPP	0.290986	52.52115	6
RST	0.256163	46.2358	8
MST-200	0.454007	81.94529	2
SY	0.554037	100	1
RC	0.385727	69.62121	4
MST-300	0.304489	54.95828	5
SUA	0.408648	73.75836	3
TUA	0.262609	47.39924	7

According to CC_i values, therisk rankingindescendingorder is SY, MST-200, SUA, RC, MST-300,RPP, TUA, and RST. Therefore, the riskiest asset is RST and the securest asset is SY.

7. COMPARE THE PROPOSED MODEL WITH THE CONVENTIONAL RAMCAP

In this subsection, in order to show the capability and suitability of the risk evaluation model proposed in this paper, a comparison of the model with conventional RAMCAP is presented. For this aim, we fulfill the risk analysis by using the conventional RAMCAP for previous case. Based on RAMCAP, risk is a function of only three components threat, vulnerability, and consequence magnitude.An evaluation scale withfive judgments {1, 2, 3,4, and 5} was applied, where 1 represents minimum judgment level and 5means the maximum as depicted in Table 8. The results of evaluator team for assets are presented in Table 9. For the aim of comparison, the output of fuzzy COPRAS is shown in the last column of Table 9.

Table 8. Definition of the RAMCAP components

	Components		
Rating	Threat (C1)	Vulnerability (C2)	Consequence (C3)
1	Very Poor (VP)	Very Poor (VP)	Very Poor (VP)
2	Poor (P)	Poor (P)	Poor (P)
3	Fair (F)	Fair (F)	Fair (F)
4	Good (G)	Good (G)	Good (G)
5	Very Good (VG)	Very Good (VG)	Very Good (VG)

Table 9. RAMCAP matrix

	C1	C2	C3	Risk value	Rank based on security	
					RAMCAP result	Fuzzy COPRAS result
RPP	4	3	4	48	7	6
RST	3	4	3	36	5	8
MST-200	3	3	2	18	3	2
SY	4	1	2	8	1	1
RC	3	4	2	24	4	4
MST-300	5	3	3	45	6	5
SUA	1	2	4	8	1	3
TUA	4	4	3	48	7	7

As can be easily seen, the final classification showssignificant differences between the results of RAMCAP and fuzzy COPRAS. According to the output of RAMCAP, the risk value belong to a limited set and never takes into account values such as 7, 11, 13, 14, 17, 19, 21. Furthermore, from a computational point of view, there is a reduction in the capability of the conventional RAMCAP methodology to define a precise and accurate rank, then grouping the critical assets into a fewcategories and allocating similar rank to different assets. This should be considered that organizations are forced with two main limitations finance and time. The allocation of resources for unnecessary activities leads to waste opportunities. Besides different sets of vulnerability, threat, and consequence may generate an identical value of risk; however, the risk implication may not necessarily be the same.For example, two assets RPP and TUA have values of 4, 3, 4 and 4, 4, 3 for C1, C2 and C3 respectively. Both these assets will have a risk value of 48; however, the risk implications of these two assets may be completely various. Other example is two assets SUA and SY, which have values of 1, 2, 4 and 4, 1, 2 for C1, C2 and C3 respectively, with similar risk value 8; nevertheless, the risk implications of these two assets may be entirely different. Finally, the relative importance among C1, C2 and C3 are not considered. This may not be accurate in real world problems. Therefore, the outputs of proposed model are more accurate. This may result a more precise, accurate and sure risk analysis for protection.

8. CONCLUSION

In response to the rapid growth of military industries and increasing the capability of terrorists to carry out destructive work, particularly for the critical infrastructures,the need for assets controls and risk measures has caught much time and attention of governments and

responsible sectors. On the other hand, the measurement of risk is difficult for decision makers to be precisely and accurately measured because of the intangible nature of dangerous and threats. Most previous studies only used the RAMCAP parameters to evaluate risk. In this paper, a new framework for evaluating risk in critical infrastructures is introduced and developed. The model proposed extends the conventional RAMCAPthrough introducing new parameters the effects on risk level to obtain a more precise classificationof the existing risks. According to the complexity of the proposed model due to exist different criteria, which are in conflicting with each other, a multi-criteriadecision makingmethod based on the fuzzy logic theory is described to also handle the uncertainty of decision making problem. This technique helps decision maker to specify relative importance of criteria and to determine judgments by means of linguistic variables.A case study is presented in order to demonstrate the potential applications of this methodology. Then a comparison between the proposed model and conventional RAMCAP is fulfilled. The results of the comparison show some shortages of the conventional RAMCAP as listed in the following:

(1) The values of risk evaluation belong to a limited set,
(2) Grouping the assets into a few categories,
(3) Allocating similar rank to different assets,
(4) Neglecting the relative importance of criteria.

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ANALIZA RIZIKA KRITIČNIH INFRASTRUKTURA POMOĆU NEIZRAZITE COPRAS

SAŽETAK

Kritične infrastrukture imaju važnu ulogu u zemljama radi same važnosti nacionalne sigurnosti, javne sigurnosti, društveno-ekonomske sigurnosti i načina života. S obzirom na važnost infrastruktura potrebno je analizirati potencijalne rizike kako se isti ne bi ostvarili. Svrha ovog rada je ponuditi razvijeni okvir u cilju prevladavanja ograničenja klasičnog pristupa izgradnji sigurnijih i izdržljivijih kritičnih infrastruktura s ciljem razvoja, primjene i kontrole. Predloženi okvir proširuje konvencionalni RAMCAP (Analiza i upravljanje rizikom za zaštitu ključnih faktora) uvođenjem novih parametara učinka na vrijednost rizika. S obzirom na složenost problema i inherentnu nesigurnost, istraživanje koristi neizrazitu (fuzzy) COPRAS (COPRAS-F) kao neizrazitu multi kriterijsku tehniku donošenja odluka kako bi se odredila težina svakog kriterija i važnost alternativa u odnosu na kriterije. Koristi se analiza slučajeva kako bi se prikazala sposobnost i efikasnost modela za rangiranje rizika kritičnih infrastruktura. Predloženi model prikazuje značajan napredak u usporedbi s konvencionalnim RAMCAP-om.

Ključne riječi: *Neizrazita (fuzzy) COPRAS, COPRAS-F, analiza rizika, kritične infrastrukture, RAMCAP*

JEL klasifikacija*: C53, C54, C61, C63.*

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MACROECONOMIC VARIABLES AND THE STOCK MARKET: THE CASE OF CROATIA

ABSTRACT

This paper examines the relationship between the Croatian stock market index and relevant macroeconomic variables. Applying the GARCH model, this paper finds that the Croatian stock market index is positively associated with real GDP, the M1/GDP ratio, the German stock market index and the euro area government bond yield and is negatively influenced by the ratio of the government deficit to GDP, the domestic real interest rate, the HRK/USD exchange rate, and the expected inflation rate. Hence, to promote a healthy stock market, the authorities are expected to pursue economic growth, fiscal discipline, moderate increase in the money supply, the appreciation of the kuna, and a relatively low interest rate or expected inflation rate.

Keywords: *CROBEX, government deficits, money supply, interest rates, exchange rates, world stock markets*

JEL Classification: E44, E52, E62, G15

1. INTRODUCTION

Like other transition economies suffering declining stock values due to the recent global financial crisis, the Croatian stock market index (CROBEX) had plunged 76.5% from October 2007 to March 2009, which was greater than the decline of 56.6% of the U.S. S&P 500 index. Although the index has shown an upward trend, as of June 20, 2011, it was still 58.6% below the all time high. The substantial decrease in stock prices would reduce consumption spending owing to the household wealth and liquidity effects and investment spending because of the balance sheet effect and Tobin's q theory.

This paper attempts to examine the behavior of the Croatian stock market index by specifying a model incorporating fiscal policy, monetary policy, the exchange rate, the world stock market index, the world interest rate and other related macroeconomic variables in order to estimate their respective impacts on the Croatian stock market index. Theoretical analysis of the sign of the partial derivative of the Croatian stock market index with respect to the money supply, the HRK/USD exchange rate or the world interest rate is presented. Advanced econometric techniques are employed in empirical work so that parameter estimates would be unbiased, consistent, and more efficient.

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Most previous studies of the relationship between the stock market performance and macroeconomic variables focus on the U.S. or other advanced countries (Fama, 1981, 1990; Campbell and Shiller, 1988; Fama and French, 1989; Chen, Roll and Ross, 1986; Bulmash and Trivoli, 1991; Abdullah and Hayworth, 1993; Dhakal, Kandil and Sharma, 1993; Mukherjee and Naka, 1995; Ajayi and Mougoue, 1996; Cheung and Ng, 1998; Nieh and Lee, 2001; Kim, 2003; Chaudhuri and Smiles, 2004; Ratanapakorn and Sharma, 2007; Humpe and Macmillan, 2009; and others). Among the macroeconomic variables used by these authors are industrial production or real GDP, the money supply, the consumer price index or the inflation rate, interest rates, exchange rates, foreign interest rates, and/or foreign stock market indexes. They find that these macroeconomic variables have significant impacts of on stock market indexes in the U.S. and other advanced countries to varying degrees.

Several recent studies examine the behavior of the stock markets for Croatian and other related countries. Erjavec and Cota (2007) find that returns on the DJIA and the NASDAQ have more impacts on the returns on the CROBEX index than the returns on the German DAX and the British FTSE, that the past return of the CROBEX index does not affect the current return, and that the lagged volume of trading reduces the returns on CROBEX. Ivanov and Lovrinović (2008) show that CROBEX is negatively affected by the money supply, the interest rate and the allocated required reserves and positively influenced by the household loans. Gklezakou and Mylonakis (2009) examine the correlation among seven stock markets in Southern Europe including Croatia and reveal that the correlation was weaker during 2000-2009 than that during the global financial crisis in 2007-2009. For example, the respective correlation coefficients between CROBEX and ATHEX and between CROBEX and DAX were 0.29 and 0.29 during 2000-2009 and were 0.44 and 0.62 during 2007-2009. Benaković and Posedel (2010) examine 14 major stocks in Croatia and indicate that CROBEX has the largest impact on individual stock prices and that stock prices are positively affected by industrial production, interest rates, and oil prices and negatively influenced by the inflation rate. They also show that CROBEX has a positive risk premium and that the inflation rate has a negative risk premium in 2004 and a positive risk premium in 2008. Morales and Andreosso-O'Callaghan (2010) study the contagion effect for many countries including Croatia and find that there is evidence of the contagion effect from the DJIA or the S&P500 index to the CORBEX index.

These previous studies have made significant contribution to the understanding of the behavior of the Croatian and other related stock markets. This paper attempts to formulate a comprehensive model examining the relationship between the Croatian stock market index and relevant macroeconomic variables.

2. THE MODEL

Extending previous studies, we can express the Croatian stock market index as:

$$S = f(Y, B, M, R, \varepsilon, \pi^e, S^*, R^*) \qquad (1)$$
$$+\ ?\ ?\ -\ ?\ -\ \ +\ ?$$

where

S = the Croatian stock market index,
Y = real output,
B = the government budget deficit,
M = the money supply,
R = the domestic real interest rate,
ε = the HRK/USD exchange rate (An increase means the depreciation of the kuna.),
π^e = the expected inflation rate,

S^* = the world stock market index, and

R^* = the world interest rate.

We expect that the Croatian stock market index is positively affected by real output and the world stock market index, is negatively influenced by the domestic real interest rate and the expected inflation rate, and may be positively or negatively impacted by the government deficit, the money supply, the exchange rate or the world interest rate.

In the short run, increased government deficit-financed spending would increase aggregate demand, business opportunities, the interest rate and the price level and crowd out some of private spending (Darrat, 1990a, 1990b; Ardagna, 2009). In the long run, deficit- or debt-financed government spending may have a neutral effect on the stock market index and real GDP due to the Ricardian equivalence theorem (Barro, 1974). Hence, its net impact is uncertain.

The effect of increased money supply on the stock market index is unclear because it is expected to increase the expected inflation rate (π^e) and real output (Y), reduce the interest rate (R), and increase the demand for stocks (D) and stock prices (S) due to the portfolio adjustment (Dhakal, Kandil and Sharma, 1993; Abdullah and Hayworth, 1993; Mukherjee and Naka, 1995; Cheung and Lai, 1999; Chaudhuri and Smiles, 2004; Ratanapakorn and Sharma, 2007; Humpe, 2009):

$$\frac{\partial S}{\partial M}=\left(\frac{\partial S}{\partial \pi^e}\times\frac{\partial \pi^e}{\partial M}\right)+\left(\frac{\partial S}{\partial Y}\times\frac{\partial Y}{\partial M}\right)+\left(\frac{\partial S}{\partial R}\times\frac{\partial R}{\partial M}\right)+\left(\frac{\partial S}{\partial D}\times\frac{\partial D}{\partial M}\right)>\text{ or }<0, \qquad (2)$$

where

$$\frac{\partial \pi^e}{\partial M}>0,\frac{\partial Y}{\partial M}>0,\frac{\partial R}{\partial M}<0,\frac{\partial D}{\partial M}>0.$$

The depreciation of the Croatian kuna is expected to reduce international capital inflows (F) because domestic assets are less attractive to international investors, help exports (X), and raise import costs (C) or domestic prices (P):

$$\frac{\partial S}{\partial \varepsilon}=\left(\frac{\partial S}{\partial F}\times\frac{\partial F}{\partial \varepsilon}\right)+\left(\frac{\partial S}{\partial X}\times\frac{\partial X}{\partial \varepsilon}\right)+\left(\frac{\partial S}{\partial C}\times\frac{\partial C}{\partial \varepsilon}\right)+\left(\frac{\partial S}{\partial P}\times\frac{\partial P}{\partial \varepsilon}\right)>\text{ or }<0, \qquad (3)$$

where

$$\frac{\partial F}{\partial \varepsilon}<0,\ \frac{\partial X}{\partial \varepsilon}>0,\ \frac{\partial C}{\partial \varepsilon}>0,\ \frac{\partial P}{\partial \varepsilon}>0\ .$$

Increased exports would help raise stock prices whereas increased import costs or domestic prices and decreased international capital inflows would reduce business profits or the demand for stocks and the price of stocks. Thus, its net impact is unclear **(**Choi, 1995; Abdalla and Murinde, 1997; Nieh and Lee, 2001; Ratanapakorn and Sharma, 2007)**.**

A higher world interest rate relative to the domestic interest rate would reduce international capital inflows and the demand for stocks but may cause the depreciation of the Croatian kuna and help net exports. Therefore, its net impact is ambiguous.

$$\frac{\partial S}{\partial R^*}=\left(\frac{\partial S}{\partial F}\times\frac{\partial F}{\partial R^*}\right)+\left(\frac{\partial S}{\partial \varepsilon}\times\frac{\partial \varepsilon}{\partial R^*}\right)>\text{ or }<0, \qquad (4)$$

where

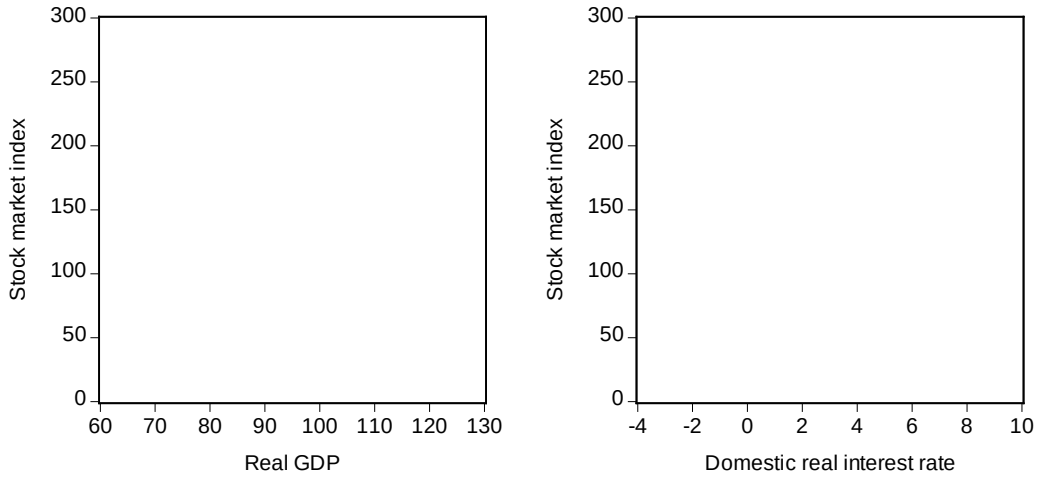
$$\frac{\partial F}{\partial R^*}<0,\frac{\partial \varepsilon}{\partial R^*}>0$$

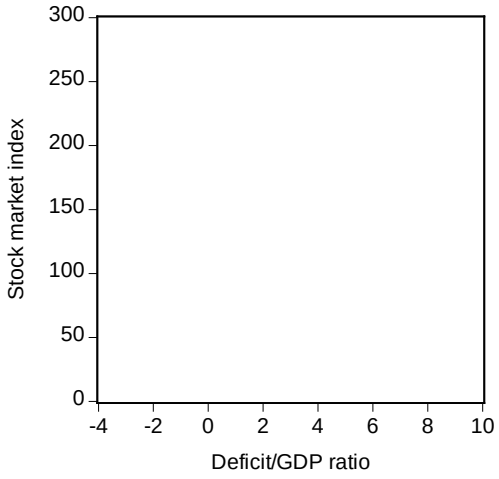
3. EMPIRICAL RESULTS

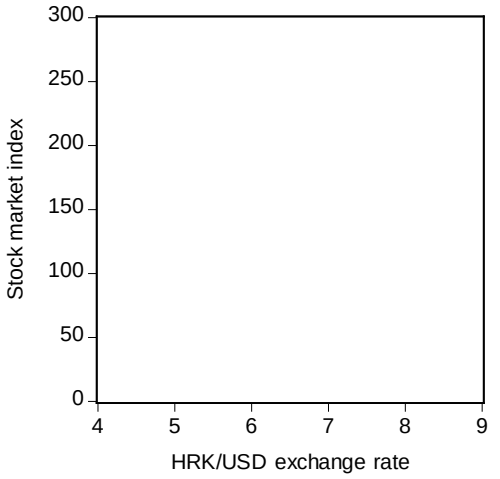
The source of the data came from the *International Financial Statistics*, which is published by the International Monetary Fund, and the Croatian National Bank. S is measured by the share price index with 2005 as the base year. Y is represented by the lagged real GDP index with 2005 as the base year. B is measured by the ratio of the government deficit to nominal GDP. M is measured by the ratio of M1 money supply to nominal GDP. The data for M2 are not published by the *International Financial Statistics*. R is measured by the money market rate minus the expected inflation rate, which is the average inflation rate of the past four quarters. ε is measured by the HRK/USD exchange rate. An increase in the HRK/USD exchange rate means the depreciation of the Croatian kuna. The choice of the HRK/USD exchange rate is because the absolute value of the correlation coefficient between the HRK/USD exchange rate and the Croatian stock market index is greater than the correlation coefficient between the nominal effective exchange rate and the Croatian stock market index. The German share price index with 2005 as the base year is selected to represent the world stock market index mainly because of the closer economic and financial ties between Croatia and Germany. The euro area government bond yield is chosen to represent the world interest rate because Croatia is a candidate for an EU member and is expected to follow the EU guidelines for the interest rate policy. Except for the expected inflation rate and the domestic real interest rate with negative values, other variables are measured in the logarithmic scale. Hence, for the variables measured in the logarithmic scale, the estimated coefficient is the elasticity or the percent change in the Croatian stock market index due to a 1% change in an explanatory variable. The quarterly sample ranges from 1997.Q3 to 2010.Q1 with 51 observations. The data for the share price index before 1997.Q3 are not available.

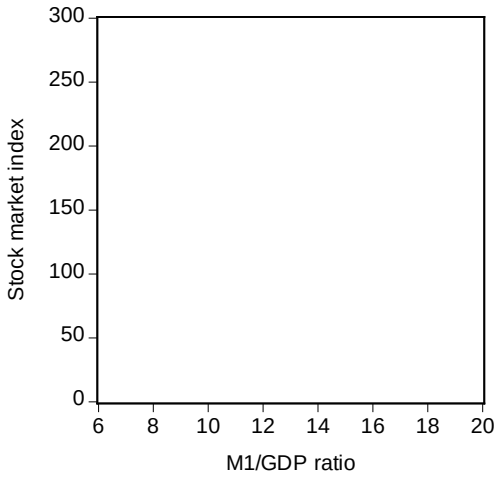
Graph 1 presents the scatter diagrams between the Croatian stock market index and the explanatory variables. Except for some outliers, the Croatian stock market index generally has a positive correlation with real GDP, the M1/GDP ratio, and the German stock market index and a negative correlation with the government deficit/GDP ratio, the domestic real interest rate, the HRK/USD exchange rate, and the expected inflation rate. Note that the flat portion in the scatter diagram between the Croatian stock market index and the German stock market index suggests that the linkage or co-movement between these two stock markets was not as strong as that in recent years.

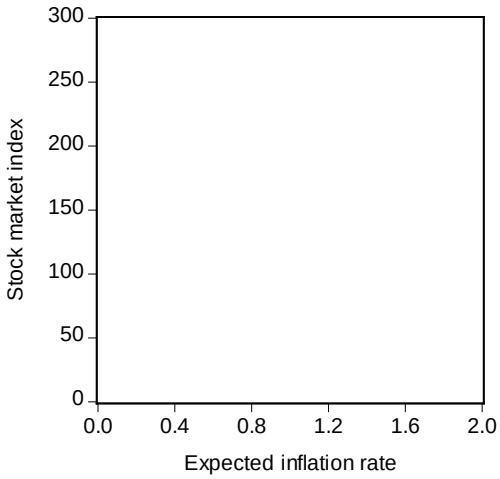
Graph 1. Scatter Diagrams

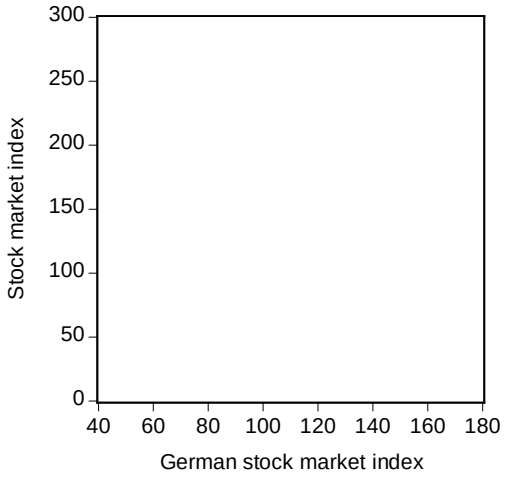



Stock market index
300
250
200
150
100
50
0
-4
-2
0
2
4
6
8
10
Deficit/GDP ratio


Stock market index
300
250
200
150
100
50
0
4
5
6
7
8
9
HRK/USD exchange rate


Stock market index
300
250
200
150
100
50
0
6
8
10
12
14
16
18
20
M1/GDP ratio


Stock market index
300
250
200
150
100
50
0
0.0
0.4
0.8
1.2
1.6
2.0
Expected inflation rate


Stock market index
300
250
200
150
100
50
0
40
60
80
100
120
140
160
180
German stock market index

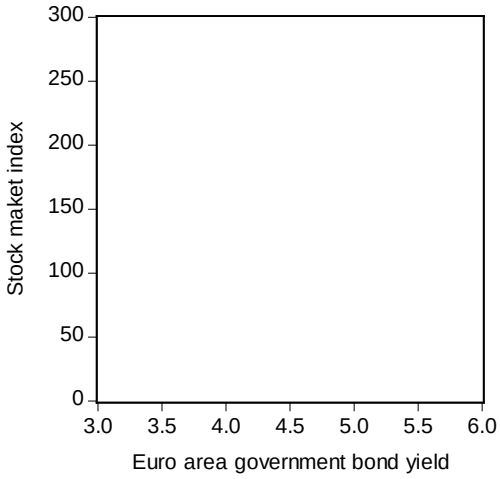

Stock maket index
300
250
200
150
100
50
0
3.0
3.5
4.0
4.5
5.0
5.5
6.0
Euro area government bond yield

Table 1. Estimated Regressions of the Croatian Stock Market Index: 1997.Q3-2010.Q1

	I	II	III	IV
Real GDP	0.629 (9.823)	0.729 (8.280)	0.640 (9.713)	0.758 (5.282)
Government deficit/GDP ratio	-0.007 (-2.188)	-0.008 (-4.079)	-0.008 (-2.712)	-0.011 (-3.411)
M1/GDP ratio	1.280 (18.539)	1.140 (17.175)	1.309 (14.929)	1.311 (12.632)
Domestic real interest rate	-0.009 (-3.274)	-0.012 (-4.193)	-0.016 (-5.864)	-0.017 (-5.160)
HRK/USD exchange rate	-1.208 (-12.797)		-1.224 (-17.371)	-1.089 (-9.027)
Nominal effective exchange rate		4.982 (77.592)		
Expected inflation rate	-0.203 (-10.971)	-0.212 (-15.805)	-0.188 (-8.240)	-0.070 (-1.991)
German stock market index	0.948 (34.474)	1.050 (51.392)	1.050 (17.905)	0.826 (12.522)
U.S. stock market index			-0.213 (-2.055)	
Euro area government bond yield	0.373 (7.276)	0.198 (5.346)	0.375 (7.448)	
U.S. government bond yield				0.308 (1.968)
Constant	-4.282 (-9.328)	-29.655 (-414.755)	-3.886 (-20.878)	-4.599 (-8.302)
Adjusted R-squared	0.902	0.910	0.906	0.905
AIC	-0.731	-0.802	-0.725	-0.682
SC	-0.238	-0.347	-0.195	-0.190
F-statistic	39.465	47.021	38.005	40.603
Estimation method	EGARCH	EGARCH	EGARCH	EGARCH

Notes: Figures in the parenthesis are z-statistics. AIC is Akaike information criterion. SC is Schwarz information criterion.

The correlation between the Croatian stock market index and the euro area government bond yield is not as clear as other correlations and will be determined by the hypothesis test.

Table 1 presents the estimated regressions and related statistics. Figures in the parenthesis are z-statistics. The EGARCH (Engle, 1982, 2001; Nelson, 1991) model is employed in empirical work as the error variance is a function of the lagged squared error and the lagged error variance. The base model is reported in Version I. Approximately 90.2% of the variation in the Croatian stock market index can be explained by the eight right-hand side variables. All the estimated coefficients are significant at the 1% or 5% level. The Croatian stock market index is positively impacted by real GDP, the M1/GDP ratio, the German stock market index and the euro area government bond yield and is negatively influenced by the government deficit/GDP ratio, the domestic real interest rate, the HRK/USD exchange rate, and the expected inflation rate.

According to estimated coefficients, the Croatian stock market index is more sensitive to a percent change in real GDP, the M1/GDP ratio, the exchange rate or the German stock market index than other variables. For example, a 1% change in real GDP, the M1/GDP ratio, the HRK/USD exchange rate, and the German stock market index would change the Croatian stock market index by +0.629%, +1.280%, -1.208%, and +0.948%, respectively.

To determine whether the above regression results may be spurious, the ADF test on the regression residuals is applied. Based on the Schwarz information criterion, a lag length of zero is selected. The value of the test statistic is estimated to be -5.840, which is greater than the critical value of -2.612 in absolute values at the 1% level. Hence, the regression outcomes are not spurious, and these time series variables have a long-term stable relationship.

Several different versions are estimated. When the HRK/USD exchange rate is substituted by the nominal effective exchange rate (Version II), its positive coefficient is significant at the 1% level, and other results are similar. If the U.S. stock market index is added to the estimated regression (Version III), its negative significant coefficient is inconsistent with the expected sign mainly due to a high degree of multicollinearity. If the U.S. government bond yield is in lieu of the euro area government bond yield (Version IV), its positive coefficient is significant at the 5% level. Therefore, the choice of the variables or measurements may affect the outcomes.

4. SUMMARY AND CONCLUSIONS

This paper has examined the relationship between the Croatian stock market index and selected macroeconomic variables based on a sample during 1997.Q3 – 2010.Q1. More real GDP, a lower government deficit/GDP ratio, a higher M1/GDP ratio, a lower real interest rate or expected inflation rate, a higher German stock market index, or a higher euro area government bond yield would increase the Croatian stock market index. If the nominal effective exchange rate, the U.S. stock market index or the U.S. government bond yield is used or included in the estimated regression, empirical outcomes may change.

There are several policy implications. To maintain a healthy stock market, the authorities would need to pursue economic growth, fiscal prudence, moderate increase in the money supply, a relatively low interest rate or inflation rate, and the appreciation of the Croatian kuna. While increased money supply to accommodate increased economic activities would be conducive to the stock market, too much money supply would cause inflation expectations to rise and be harmful to the stock market. Although the empirical finding shows that the appreciation of the Croatian kuna would help the stock market, it is possible that further appreciation of the Croatian kuna may hurt the Croatian stock market index because its negative impact on reduced exports may outweigh its positive impacts on increased

international capital inflows, lower import costs and lower prices. It appears that the German stock market index is more appropriate than the U.S. stock market index. Hence, any study which does not include the German stock market index would miss a key variable in regression analysis. The authorities need to monitor the external factors in order to forecast their potential impacts when any change occurs.

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MAKROEKONOMSKE VARIJABLE I TRŽIŠTE DIONICA: SLUČAJ HRVATSKE

SAŽETAK

Ovaj rad istražuje odnos između hrvatskog burzovnog indeksa i relevantnih makroekonomskih varijabli. Koristeći GARCH model, zaključujemo da je hrvatski burzovni indeks pozitivno povezan s realnim BDP-om, omjerom M1/BDP, njemačkim burzovnim indeksom i prinosom državnih obveznica euro zone, dok negativno na njega utječu omjer državnog deficita i BDP-a, domaća stvarna kamatna stopa, tečaj HRK/USD i očekivana stopa inflacije. Stoga, kako bi se promoviralo zdravo tržište dionica, vlada mora težiti ekonomskom rastu, fiskalnoj disciplini, blagom porastu opskrbe novcem, aprecijaciji kune i relativno niskoj kamatnoj stopi ili očekivanoj stopi inflacije.

***Ključne riječi**: CROBEX, vladin deficit, opskrba novcem, kamatne stope, tečaj, svjetska tržišta dionica*

JEL klasifikacija: E44, E52, E62, G15

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Preliminary paper
Prethodno priopćenje

VOLATILITY DYNAMICS IN AN EMERGING ECONOMY: CASE OF KARACHI STOCK EXCHANGE

ABSTRACT

The paper aims to model and forecast the volatility in the stocks traded at the Karachi Stock Exchange before and during the recent financial crisis using the GARCH, EGARCH and GJR-GARCH models. We find the stock return volatility to be characterized by clustering and displaying asymmetries. Results point to the capability of the EGARCH(1,1) model at forecasting for both periods lending support to the use of GARCH family of models for emerging markets during crisis. We find evidence for a synthetically constructed index based on trading volume capturing the volatility structure of the market as well as that based on market capitalization which has important implications for investors.

Keywords:*Karachi Stock Exchange, Trading Volume, Forecasting, Volatility Clustering*

JEL Classifications: *G12 G17*

1. INTRODUCTION

Financial markets play a dominant role in economic development by facilitating savings and promoting investments. Most of the developing economies experience slow and stagnant progression that emanates from their weak, fragile and highly volatile financial markets. Market panics and frictions are recurring characteristics that result from increased volatility making these markets vulnerable to crashes. Therefore, extreme volatility could ultimately distort financial system by negatively impacting the economic performance. The crashes in a highly volatile market could impair investors' confidence driving out consumer spending. Similarly, market makers with superior information can exploit volatility to yield abnormal returns on expense of small uninformed investors. Lastly, an increase in stock market volatility is interpreted as an increase in market risk resulting in an augmented cost of capital. This could impose severe capital constraints for small firms and affect financing policies. This makes analysis of volatility critical for investors, regulators and businesses.

The traditional measure of stock market volatility refers to the standard deviation of returns. The recent empirical evidences have reported some caveats for this estimate. Standard deviation is a valid estimate of volatility if the underlying returns or log prices are stationary and follow a Gaussian distribution. However, if these returns are not independent and identically distributed the standard deviation is not a convincing measure of volatility. This warrants for analysis of higher order moments in stock prices to capture the volatility and its variations over time. Mandelbrot (1963) [1] was the first to observe the incidence of volatility clustering in financial markets. The volatility clustering is the tendency that large variations

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will be followed by large variations and small variations are followed by small variations. This phenomenon is likely to be persistent, non stationary and volatility is expected to be mean reverting rather than remaining constant over time. Engle (1982) [2] and Bollerslev (1986) [3] proposed a new class of Autoregressive Conditional Heteroscedasticity (ARCH) models to explain the behavior of time varying volatility clustering. The empirical research on these models demonstrated superior results in favor of ARCH class models both for modeling historic volatility and forecasting (Taylor, 2004 [4]; Corradi and Awartani, 2005 [5]). The impact of volatility is even severe in emerging markets that lack structural and informational inefficiencies. The research on these markets has reported presence and persistence of volatility shocks contributing towards high risk for these economies. This makes variance or standard deviation a biased estimate of volatilities for these markets and warrants the use of ARCH class models for understanding volatility structure (Kim and Singal, 1997 [6]).

The infrequent trading a common trait of emerging markets, has severe implications for empirical estimations. The volatility behavior in a stock market is analyzed by the volatility patterns of stock indices; however, if these indices contain sleeping stocks and index values rely on few high volume stocks, the resulting estimates of volatility will be seriously biased. Therefore, unlike developed economies, use of stock indices from emerging markets with non synchronous trading could produce anomalous findings. This study aims to provide robust results by complimenting traditional market indices by a synthetic trading volume index.

Karachi Stock Exchange (KSE) is the leading and most liquid stock market of Pakistan that has witnessed severe volatility shocks in last five years. This has resulted in increased risk to market participants. The volatility could distort economic system and in economies like Pakistan, where stock market just began to develop in last decade, the consequences of volatility could be extreme. Therefore, it is vital to study the dynamics of volatility in KSE notably in last five years where market activity was substantially higher since the inception of the exchange. This study would attempt to model the higher order moments of volatility using the ARCH class models. More importantly, these models are also used for forecasting volatility; therefore, we will provide an insight about the prediction power of these models using an out of sample approach before and during the recent crisis.

This paper is expected to have multiple contributions towards existing academic literature. First, this would be the most comprehensive study of volatility dynamics in KSE as it compares the maximum number of ARCH class models for modeling historic volatility vis-à-vis previous researches on Pakistan. Secondly, we also provide evidence on forecasting ability of these models that has never been reported before for KSE. Thirdly, no prior study in Pakistan has incorporated the impact of trading volume on volatility and almost all studies have investigated the volatility using a market capitalization based index of KSE-100. Some of the companies in KSE-100 index are subject to non synchronous trading that could bias the estimates. Therefore, we construct a synthetic index based on trading volumes (top ten) to provide robust estimates for our research. Lastly, the sample period is unique as it incorporates both bullish and bearish trends with high level of trading volumes as compared to previous researches where trading activity was moderate to low.

The rest of the paper is as follows: Section II will present a brief review of literature; Section III will explain the data used, methodology of the research in section IV followed by results in section V and concluding comments in VI.

2. LITERATURE REVIEW

Most of the early research concentrated on developed countries stock markets. Research on the topic has now expanded to emerging markets where similar methodology is applied to model the volatility. However, the analysis at large has concentrated on the symmetric GARCH models. Non-constant volatility has been a common result in all studies while the evidence has been mixed once again with respect to the superiority of a specific model (see Gokcan, 2000 [7]; Shin, 2005 [8]).

Considerable work has been done to study the dynamics of the KSE since the 90s at large and to study the volatility displayed by the stock prices in particular. The authorities have made considerable efforts to regulate the market in order to control the pronounced volatility that is the characteristic of KSE. Uppal and Mangla (2006) [9] analyzed the impact of regulations and found that the difference in the volatility between the two periods is statistically insignificant pointing to the inability of the measures taken to curb the volatile trend of the market. They attributed the failure to the monopoly position of the KSE and the lack of accountability mechanism in the regulations pursued by the SECP.

Hameed and Ashraf (2006) [10] also find that the reforms of SECP have been relatively unsuccessful. Mubarik and Javaid (2009) [11] verifies empirically that there is significant interaction between trading volume and return volatility when volume is entered into variance equation of GARCH-M model (see also Mustafa and Nishat, 2008 [12]). All these studies provide evidence of volatility persistence and clustering to be present in the KSE. They also make attempts to factor into their modeling the non-constant nature of the volatility. While an attempt is made by Kiani (2006) [13] to factor in the presence of leverage effects in the stock return series in the Pakistani case, this has not been followed by application of any formal check to test for the presence of such effects. Hence, the efforts of modeling the volatility in the case of studies on Pakistan is limited to the use of symmetric GARCH models. Further, no attempt has been made to follow up the modeling stage with the forecasting of volatility. As has been detailed above, a reliable estimate of future volatility is of key importance to the development of sophisticated financial instruments in the country. It is at this end that this study attempts to make its greatest contribution to the existing literature.

3. DATA

The aim of the study is to evaluate the volatility patterns displayed by the daily stock returns in the KSE for 2004 to 2009 period. This sample period consists of 1439 daily observations for the 6 year trading period. The motivation is to evaluate the degree of persistence displayed by the returns over time. In order to adequately capture the volatility displayed by the market, there is a need for a representative index for the market. An obvious choice is the KSE-100 index which is a value weighted index of the stocks of 100 leading companies traded in the KSE based on their market capitalization and is a leading indicator of the Pakistan's equity market. Two series will be used[3] – one the adjusted closing prices (I_{ct}) and other constructed from the average of the highest and lowest value of the index for the day (I_{hlt}). In addition, to capture adequately the price movements in the market at large the KSE All Share Index[4] (I_{alt}) will also be employed.

Furthermore, an index will be constructed which will not be based on market capitalization unlike the other two but rather on trading volume. Ten companies with the

[3] Data Source: Yahoo Finance
[4] Data Source: KSE website

highest trading volume will be selected semi-annually for the sample period[5]. The daily stock prices of these companies will be used to construct an index weighted on the value of market capitalization of these ten companies. The purpose is to study the volatility patterns displayed by the most highly traded stocks at the KSE. This index will be re-balanced semi-annually to accommodate any changes in patterns of trading over time[6]. The base value of the index at 1st January 2004 is set at 1000 for ease of comparison so that all indices being used for analysis have a common basis. For each subsequent day the index is:

$$I_{ot} = \left(Total\ market\ Capitalization_t / Base\ period\ Value\right) * 1000$$

where t is the period from 2nd January 2004 to 31st December 2009 and Base period value is the total market capitalization of the 10 most highly traded companies for the period as on 1st January 2004.

Analysis across this wide range of indices will allow identification of the model that is best able to capture the impact of shocks on the market returns. The second part will be an evaluation of the predictive ability of the fitted models. This will be carried out by out of sample forecast evaluation. No study has been found that evaluates the predictive ability of the GARCH family of models for Pakistan. This exercise is particularly pertinent in the recessionary times we are in today as such periods are characterized by pronounced volatility.

The analysis will be first done over the entire sample period and then extended to a sub-period. Volatility will be modeled over the 2004-2008 period with the year 2009 used for out of sample forecast evaluation. Next the in-sample period extending from 1st January 2004 to 31st December 2007 which consists of 951 daily observations for the 3 year trading period with the year 2008 will be used for out of sample forecast. The sample period is chosen so that volatility during relatively stable period can be modeled and forecasting into a time frame that includes the impact of the world recession being felt on the KSE can be done. Trading showed such bullish trends that the index was fixed during parts of the last quarter of 2008.

The the daily stock index values of $I_t\{I_{ot}, I_{alt}, I_{hlt}, I_{act}\}$ series are non stationary; they shows no trend and does not revert back to their mean. There is consesus in finance literature on employing the Dickey Fuller (DF) test to ascertain the stationarity of the series to be studied[7]. This formally tests the presence of a unit root which is an indicator of non stationarity of the series being tested.Regressing the first difference of all four I_t series does not allow us to reject the null hypothesis at 1% levels of confidence which confirms that the series is non-stationary. Due to the non-stationary nature of the (I_t) series the daily stock returns[8] ($R_1 t$) will be used for analysis. Coverting the index value series yields stationary series as confirmed by the DF test and R_t $\{R_{ct}, R_{ot}, R_{alt}, R_{hlt}\}$ series can now be used for analysis (Results of Dickey Fuller tests in appendix 1).

The mean for all series is close to 0 and the return series are characterized by thicker tails than normal (summary statistics in Table 1 and series plots with normal curve imposed in appendix II). The normal curve is characterized by 0 skewness and kurtosis of 3. Our sample series have all a negative value for skewness and excess kurtosis (kurtosis value exceeding 3) pointing to their distrubutions being negatively skewed and more peaked than the normal

[5] Data Source: Business Recorder Online
[6] This is for consistency purposes as the KSE 100 index is also re-balanced semi-annually
[7] See Enders (2004),
[8] $R_t = \ln\left(\frac{I_t}{I_{t-1}}\right)$

curve[9]. Furthermore the series also demonstrates another common characteristic of financial time series - volatility clustering i.e. periods of well defined high and low volatility.

Table: 1 Summary statistics for R_t series

	Number of observations*	Mean	Std. Dev.	Min	Max	Skewness	Kurtosis
R_{hlt}	1387	0.0005	0.015	-0.084	0.120	-0.439	8.61
Rct	1387	0.0005	0.016	-0.086	0.090	-0.535	5.48
R_{alt}	1387	0.0006	0.016	-0.200	0.090	-0.658	7.39
R_{ot}	1376	0.0004	0.020	-0.070	0.070	-0.245	4.27

Note: Observations for the period in 2008 when KSE remained closed have been excluded
Source: Author's own calculations

4. METHODOLOGY

MODELING VOLATILITY

As first step the volatility of the four indices daily returns over the sample periods will be modeled in order to make predictions about future. As a second step, all fitted models will be employed to make forecasts into the future. All analysis has been done using Eviews Software. The first hypothesis of interest is to test whether the returns at KSE display time varying volatility returns.

To formally check for the presence of such ARCH effects the Lagrange Multiplier (LM) test of Engle (1982) [2] is applied. The expectation a-priori is that the errors will display non-constant variance and will hence render the commonly used Ordinary Least Squares technique as invalid. This will necessitate the use of a model which has been developed especially to take this non-constant variance into account. Such a model is the specification as proposed by Bollerslev (1986) [3] is:

$$h_t = \alpha_0 + \sum_{i=1}^{q} \alpha_i \varepsilon_{t-i}^2 + \sum_{i=1}^{p} \beta_i h_{t-i} \qquad (1)$$

Where there are p lags of conditional variance and q lags of squares of shocks in previous periods. The impact of volatility clustering is incorporated by including lags of the dependent variable. This allow for the values in previous periods to impact the value of volatility today. GARCH process does not differentiate between the impact of a positive and negative unexpected change in returns. It is therefore unable to capture asymmetric effect of good and bad news on the volatility of the financial time series – a phenomenon termed as "leverage effect".

Anderson et al. (2001) [14] present two explanations for leverage effect. One is that when there is a negative shock (i.e. a negative return) it increases financial and operating leverage which causes the volatility to rise. The second is that "if the market risk premium is an increasing function of volatility, large negative returns increase the future volatility by more than positive returns due to a volatility feedback effect". This means that the effect on

[9]The joint skewness/kurtosis test for normaility yields a p value of 0.00, allowing the null of normality to be rejected for all series.

volatility of unexpected bad news in the market would be higher than from that of unexpected good news of the same magnitude. To test for leverage effects, the sign bias test of Engle and Ng (1993) [15] is employed. The presence of asymmetry in financial time series necessitates the use of variants of GARCH which modifies the GARCH specification (1) to capture this phenomenon. The mixed response on the superiority of a particular kind of model does not allow the choice of one type of asymmetric model and so the popular EGARCH and GJR-GARCH are estimated. It is important to note here that the work done on modeling volatility in Pakistan has been limited to the use of symmetric models and even though presence of leverage effects was tested for by Kiani (2006) [13], asymmetric models have not been employed on Pakistan to formally account for it.

A form of the Threshold-GARCH model is the GRJ-GARCH model proposed by Golsten et.al (1993) [16]:

$$h_t = \alpha_0 + \sum_{i=1}^{q} \alpha_i \varepsilon_{t-i}^2 + \gamma_1 \varepsilon_{t-1}^2 I_t + \sum_{i=1}^{p} \beta_i h_{t-1} \qquad (2)$$

Where the leverage effect is captured by the use of the dummy variable I_t, such that I_t= 1 if ε_{t-1}<0 (bad news), I_t= 0 otherwise. The specification is exactly the same as the GARCH(p,q), augmented by the term with the dummy variable to capture the asymmetry.

EGARCH(p,q) proposed by Nelson (1991) [17] also captures the asymmetries by employing a logarithmic specification thereby ensuring that the conditional variance is positive and that there is no need to impose non-negativity constraints. It is different from GJR-GARCH since it makes use of standardized residuals and ensures that conditional variance is determined both by the sign and magnitude of these.

$$\log(h_t) = \alpha_0 + \sum_{i=1}^{p} \beta_i \log(h_{t-1}) + \sum_{i=1}^{q} [\![\alpha_i \left(\left| \frac{\varepsilon_{t-i}}{\sqrt{h_{t-i}}} \right| \right)]\!] + \sum_{i=1}^{q} [\![\gamma_i \left(\frac{\varepsilon_{t-i}}{\sqrt{h_{t-i}}} \right)]\!] \qquad (3)$$

If γ_i is significantly negative then there is asymmetric effect since the effect of negative shock ($\alpha_1 i - \gamma_1 i$) will be greater than that of a positive shock ($\alpha_1 i + \gamma_1 i$) of the same magnitude. Enders (2004) [18] note that EGARCH has the advantage that its coefficients can be negative as the h_t is obtained after taking anti-log and so can never be negative.

Equations (1) – (3) are first fitted in their most parsimonious form with lags p=q=1. Once the equations have been estimated, the next step would be to check if they adequately fit the data using the Portmanteau test to check for autocorrelation of errors. Autocorrelation in the errors from the estimated equations will indicate that the models have not fit the data thereby necessitating the inclusion of additional lags. Once we have an adequate fit as indicated by no autocorrelation in the errors, the next step is to forecast using the estimated models. In order to select the best model, forecasts from each model will be evaluated on the criterions detailed below. An alternative method to this would be to select the best model based on information criterions such as Akaike's and Bayesian which would indicate the best in-sample fit. However, the aim of this study is not to select the specification that best models the volatility in sample but rather to select the one which makes the best forecasts out of sample. Therefore concentration will be on the out of sample predicating capability of the models fitted and not on their in sample fit.

OUT OF SAMPLE FORECAST EVALUATION

For the purposes of forecast evaluation, one step ahead forecasts for the out of sample periods are made. Once the model has been estimated, in making each forecast the actual data available till that point is used as inputs into the equation estimated for conditional volatility by that model. The quality of these will be evaluated using standard forecast evaluation technique of employing loss based functions. In order to evaluate the quality, a measure for the actual realized volatility is needed. However, volatility is a latent variable that is unobserved and develops stochastically over time. Squared returns (r_t^2) are therefore commonly used as a proxy for the true volatility (the mean of the return series is 0). The simplest way to evaluate how different the conditional variance predictions made by the model are from the proxy being used for the true variance is to calculate the mean forecast error (ME):

$$ME = \left(\frac{1}{m}\right)\sum_{t=1}^{m}(\hat{y}_t - y_t) \quad (4)$$

Where m represents the number of forecasting observations and $\hat{y}_t$ is the predicted volatility while y_t. More sophisticated statistics have been developed like a common forecast evaluation statistic, the Mean square error (MSE):

$$MSE = \left(\frac{1}{m}\right)\left[\sum_{t=1}^{m}(\hat{y}_t - y_t)^2\right] \quad (5)$$

MSE squares the forecast errors ($\hat{y}_{t+h} - y_{t+h}$) and so penalizes larger errors more than smaller ones.

The DM test of Diebold and Mariano (1995) [19] is a test for comparing the forecasting ability of two models. This test will be employed to evaluate if there is any statistical difference between the forecasts from the models in the two sub period, before and after the crisis. To employ the test, var($\bar{d}$) is required. If d_i series is uncorrelated then var($\bar{d}$) is given by: $\frac{\gamma_0}{H-1}$ else specification given by Enders (2004) is followed: var($\bar{d}$) = $\frac{\gamma_0 + 2\gamma_1 + \cdots + 2\gamma_q}{H-1}$ where γ_i denotes the *i*-th auto-covariance of d_i, where first q values of γ_i are significant and H is the number of forecast errors.

5. EMPIRICAL RESULTS

MODELING THE CONDITIONAL VOLATILITY

Lagrange Multiplier (LM) Test allows us to conclude that there are ARCH disturbances in the all the returns series. Parameter estimates of equations (1) – (3) across all indices are reported in table 2[10]. Using the Portmanteau test on the errors from the models does not allow the null hypothesis of autocorrelations being insignificant to be rejected and the conclusion to be drawn that volatility has been correctly modeled. Results for GARCH(1,1) show that the coefficient of the lag of conditional variance β_1 is low which indicates that the effects of past is less persistent than for developed market. However, it is still high enough to indicate that the impact is more persistent than pronounced (since $\alpha_1 < \beta_1$).

[10]ARCH LM Test on squared residuals from the fitted models show that they are correctly specified and able to model the serial correlation structure

Employing formal tests, the series were found to be display pronounced conditional variance in the face of a negative shock. The next two models fitted formally account for this asymmetric effect in addition to the phenomena of volatility clustering and excess kurtosis. For the GJR-GARCH (1,1), the coefficient on the indicator function γ_1 is significant and positive for all series which shows that there are asymmetric effects. Also, for the EGARCH(1,1) model the γ_1 for all series turn to be negative and significant, once again verifying the presence of asymmetric effects.

FORECAST EVALUATION

For out of sample forecast evaluation, one-step ahead forecasts from each of the three models is made. Loss function evaluation technique is employed on these forecasts with the r_t^2 of each series acting as the benchmark (results in table 3). The lower the value of the criterions estimated using forecasts from a model, the better the forecasts from the model.

The low values for ME points to the supremacy of the asymmetric models in the case of all series. The MSE gives a mixed indication with EGARCH, the superior model in two out of the four series while the GARCH models do slightly better in the other two (R_{alt}, R_{act}.) at predicting volatility. A particularly interesting result is how well the synthetically constructed series of the top 10 traded stocks is able to model and forecast the volatility in the market. Both ME and MSE point towards the superiority of the EGARCH(1,1) model in predicting volatility of the R_{ot}. As a next step, it is worthwhile to check for the robustness of the constructed R_{ot} series on different time periods. As a point of comparison the R_{ht} series will be estimated using the EGARCH model as both ME and MSE point to its supremacy in this case.

Table: 2 Maximum Likelihood Estimates

	Ralt			Rhlt			Rct			Rot		
	GARCH(1,1)	EGARCH(1,1)	GJR-GARCH(1,1)	GARCH(1,1)	EGARCH(1,1)	GJR-GARCH(1,1)	GARCH(1,1)	EGARCH(1,1)	GJR-GARCH(1,1)	GARCH(1,1)	EGARCH(1,1)	GJR-GARCH(1,1)
α_0	0.000035 (5.14E-06)	0.815000 (0.098604)	6.95E-06 (6.95E-07)	0.000004 (7.91E-07)	-0.795774 (0.087281)	0.000006 (8.70E-07)	0.000025 (3.47E-06)	-1.660000 (0.199724)	0.000013 (1.38E-06)	0.000035 (4.10E-06)	-1.287924 (0.156258)	0.000027 (4.33E-06)
β_1	0.619000 (0.046414)	0.930000 (0.010393)	0.883933 (0.005191)	0.853873 (0.006059)	0.939739 (0.009636)	0.831000 (0.006726)	0.665000 (0.035972)	0.831000 (0.021758)	0.807000 (0.008599)	0.719000 (0.031352)	0.882420 (0.017188)	0.693627 (0.032989)
α_1	0.249000 (0.036020)	0.273000 (0.026344)	0.030775 (0.008065)	0.133112 (0.011890)	0.343436 (0.024777)	0.058904 (0.010705)	0.239000 (0.031530)	0.302000 (0.031174)	0.041000 (0.012797)	0.250000 (0.032244)	0.436487 (0.037485)	0.157226 (0.029726)
γ_1		-0.028572 (0.017380)	0.116775 (0.020155)		-0.087599 (0.017556)	0.170000 (0.025537)		-0.197403 (0.028349)	0.191442 (0.032920)		-0.116722 (0.023719)	0.173793 (0.051984)

Source: Author's own calculations, Standard errors in parenthesis, All coefficients are significant at 1% level

Table: 3 Loss function values for the one–step ahead predictions

	Ralt			Rhlt			Rct			Rot		
	GARCH(1,1)	EGARCH(1,1)	GJR-GARCH(1,1)	GARCH(1,1)	EGARCH(1,1)	GJR-GARCH(1,1)	GARCH(1,1)	EGARCH(1,1)	GJR-GARCH(1,1)	GARCH(1,1)	EGARCH(1,1)	GJR-GARCH(1,1)
ME	0.00002080	0.00002340	0.00000294	0.00000967	-0.00004100	-0.00002700	0.00001540	-0.00004400	-0.00003800	-0.00001900	-0.00004600	-0.00004000
MSE	0.00000012	0.00000014	0.00000015	0.00000077	0.00000071	0.00000075	0.00000015	0.00000017	0.00000018	0.00000048	0.00000048	0.00000048

Source: Author's own calculations

The purpose of this exercise is twofold. First is to test the model in different periods of relative tranquility and volatility in the stock market in order to evaluate is the predicting capability of the series is not hampered. Second, it is of interest to see if the R_{ot} series continues to be as good a representative of the actual market fluctuations as the R_{hlt}. This process will entail reducing the sample period from ending in December 2008 to ending in December 2007 and estimating the chosen model, the EGARCH on this sample with the year 2008 as the out of sample period.

One-step ahead forecasts for the year are made from this model so that comparisons can be made with the out of sample forecasts that were made for the entire period including the crisis that hit KSE. In this stable period the model when applied to both series yields quite similar results, lending support to the synthetically constructed index's ability to capture the volatility in the KSE (see table 4). The forecasting ability also indicates that the volatility is well predicted by the model.

Table: 4 Results from EGARCH(1,1) estimation for the 2004-07 sample period

	R_{ot}	R_{hlt}
α_0	-1.123	-0.883
	(0.133)	(0.173)
β_1	0.898	0.933
	(0.014)	(0.018)
α_1	0.394	0.367
	(0.035)	(0.048)
γ_1	-0.089	-0.102
	(0.025)	(0.027)

Source: Author's own calculations, Standard errors in parenthesis, All coefficients are significant at the 1% level

By mid 2008 the worldwide crisis had begun to show its impact in the stock market of the country with the KSE 100 index starting to decline. Hence, it is interesting to evaluate how the model is able to perform for the in the sample period from 2007 till 2008 with 2009 acting as out of sample period. As expected the forecast evaluation shows that the value for all evaluation criterions at all horizons have increased as compared to 2007 (results in table 5). This signals worsened forecasting, a result which is not surprising given that crisis periods are more volatile than usual and so predicting becomes more difficult. However, the DM test signals no statistical difference between the forecasting ability of the model - equally capable in making volatility predictions during crisis period as it is in making them during normal times. The increased volatility which is a characteristic of crisis period is adequately accounted for by the model. An important contribution is that the model fitted takes special account of the leverage

Table: 5 Results from EGARCH(1,1) forecast for 2008 period

	R_{ot}	R_{hlt}
ME	0.0003	0.0001
MSE	6.123E-06	5.487E-07

Source: Author's own calculations

6. CONCLUSION

These results have interesting implications for understanding the dynamics of volatility in an emerging stock market. Volatility of returns in financial markets is critical in attracting both local and foreign investments particularly in small economies with limited potential for diversification. Investors align their return expectations according to the risk preferences and this warrants precision in quantification of relevant risk. The traditional measure of risk using standard deviation of returns is flawed in small economies for at least two reasons. First, standard deviation could proxy risk if the distribution of returns is normal and second, if the volatility is constant over time.

The emerging markets have imperfections owing to weak regulatory framework, domination by few market makers, asymmetric information, speculative trading and volume concentration in few selected stocks. Therefore, the volatility is likely to cluster with skewed and extreme tail distribution of returns and this require analysis of higher moments. Our results demonstrate that in Pakistan, the volatility clustering is evident and risk can be adequately modeled using GARCH class of models. The results remained robust with out of sample forecast evaluation. The implications for financial decisions are immense. For capital budgeting purposes, if volatility clustering is ignored and reliance remains on standard deviation, the cost of capital will be imprecise with low estimates during periods of high volatility and high estimates in periods of low volatility. In valuation decisions, standard deviation will require a constant risk premium while in presence of volatility clustering, utility maximizing investors should demand a high premium in times of augmented risk level.

Another important finding is the ability of trading volume based synthetic index to capture and forecast volatility. This is consistent with the general notion of investment behavior in emerging markets. Investors in such markets have either low access to fundamental information or they do not have substantial capacity to properly analyze and interpret available information and therefore most of participants (even if they are speculators) would use trend of stock index as a critical base to their investing decisions. Our evidence suggests that trading volume index could better reveal the volatility dynamics in emerging markets.

The financial sector is even more sensitive to appropriate quantification of volatility to manage their exposures. The Basle II (2001) introduced measures of *value at risk* and *default likely indicator* based on information extracted from the stock market mainly volatility of asset returns. Therefore, if the volatility is modeled assuming a normal distribution where actual returns are fat tailed or skewed with persistent shocks, the estimation error of volatility could result in misleading exposures with dire consequences. Similarly, if policy makers are expected to introduce financial derivatives, the pricing of such instruments should incorporate the clustered volatility of underlying asset returns and not the Gaussian based standard deviation estimate.

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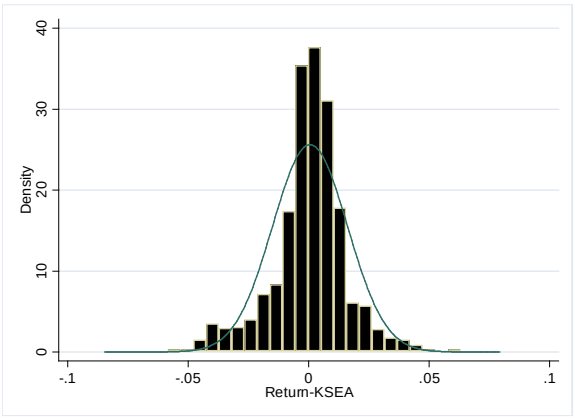
Appendix I: Dickey Fuller Test Results

	OT	ALT	CT	HLT
I_t	-1.561	-1.669	-1.664	-1.644
R_t	-33.779	-32.595	-32.596	-28.386

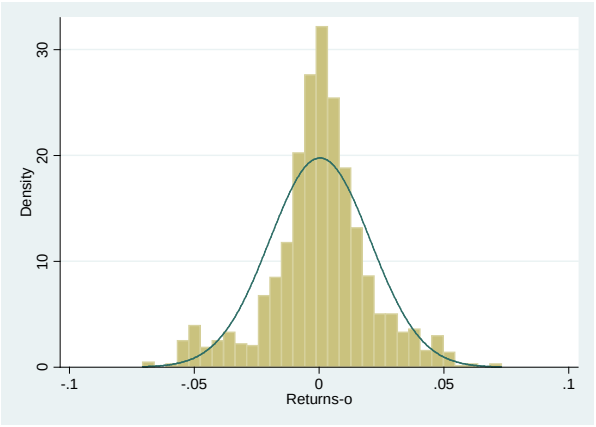
1% Critical Value = -3.430

Appendix II: Plot of R_t series

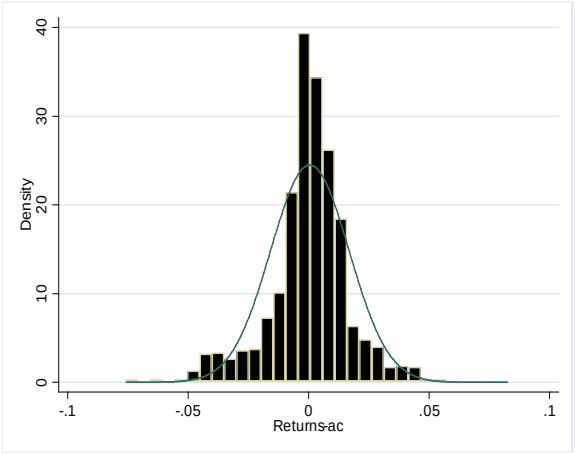
(a) R_{alt}



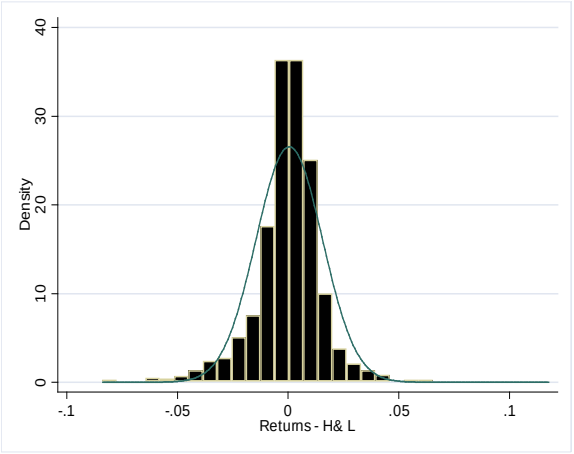
(b) R_{ot}



(c) R_{ct}



(d) R_{hlt}



DINAMIKA VOLATILNOSTI U NOVIJIM GOSPODARSTVIMA:

SLUČAJ BURZE U KARACHIJU

SAŽETAK

Rad ima za cilj stvoriti model i predvidjeti volatilnost dionica kojima se trgovalo na burzi u Karachiju prije i za vrijeme nedavne financijske krize koristeći GARCH, EGARCH i GJR-GARCH modele. Zaključujemo da je volatilnost zarade na burzi obilježena klasteringom te pokazuje asimetrije. Rezultati ukazuju na sposobnost EGARCH(1,1) modela da predviđa za oba perioda potvrđujući korisnost GARCH grupe modela za tržišta u nastajanju u vrijeme krize. Ima dokaza sintetički stvorenog indeksa na bazi volumena trgovine koji hvata volatilnost strukture tržišta, kao i onog baziranog na tržišnoj kapitalizaciji što ima važne implikacije za investitore.

***Ključne riječi**: burza u Karachiju, volumen trgovine, predviđanje, klastering volatilnosti*

***JEL klasifikacija**: G12 G17*

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UDK 336.761:330.35>(560)
336.71:330.35>(560)
Preliminary paper
Prethodno priopćenje

STOCK MARKET AND BANKING SECTOR DEVELOPMENT IN TURKEY: DO THEY HAVE THE SAME IMPACT ON ECONOMIC GROWTH?

ABSTRACT

This article investigates the impact of financial stock market development and banking sector development on economic growth in the case of Turkey using Johansen cointegration and Granger causality tests for the period between 01:1988 and 12:2004. The results suggest that banking sector development has positive impact on economic growth and vice versa. Hence, the results lend support to both demand following and supply leading hypotheses for banking sector development and economic growth relationship. However, the results fail to yield the same conclusion for the stock market-economic growth relationship.

Key words: *Granger-causality, banking sector, stock market*

JEL classification: F31, F37

1. INTRODUCTION

As discussed in Feridun et al. (2009), the liberalization of the Turkish economy which began with the implementation of an IMF-prompted structural adjustment program in 1980, led to the inauguration of the Istanbul Stock Exchange in 1986. The same period witnessed a marked improvement in the Turkish capital markets in terms of the legislative framework and the institutions. This paved the way to the liberalization of capital account in 1989, through which the Turkish financial markets began to attract inflows of hot money.

Since then, economists and practitioners have long debated over the effects of the Turkish financial liberalization on the economy. The removal of restrictions on international capital transactions has generally been welcome as a growth opportunity in the broad literature (see Feridun et al 2009). However, in the case of Turkey, financial liberalization has also been blamed for rendering the economy vulnerable to speculative attacks (see, for instance, Feridun 2008, 2009, 2011 and Katircioglu and Feridun, 2010).

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From a theoretical standpoint, different views exist regarding finance-growth nexus. Schumpeter (1911) argues that well performing banking system can contribute to economic growth by technological innovations which may occur as a result of efficient allocation of funds. In contrast, Robinson (1952) states that financial development is a result of improvements in economic performance.

Patrick (1966) suggests that there exists a bi-directional theoretical relationship between financial development and economic growth, namely *demand-following* and *supply-leading* relationships. In the former case the creation of financial intermediaries, their assets, liabilities and financial services is the result of demand for them. On the other hand, in the latter case, the creation of financial institutions, their financial assets and liabilities and financial services precedes the demand for them (Patrick, 1966).

In theory, stock market development may affect economic growth through various channels. For instance, stock markets may reduce risks for an investor who is reluctant to relinquish control of their savings for a long time. Liquidity enables investors to sell quickly and have easy access to their equities and by issuing equities enables firms to have a permanent access to capital. Also, long term and profitable projects will be easily financed, which, in turn, produce improvements in capital allocation and increase in economic growth.

Against this theoretical backdrop, this article aims to make a contribution to the existing literature by investigating the impact of financial development, as proxied by stock market development and banking sector development, on economic growth in Turkey using Johansen cointegration and Granger causality tests.

The rest of the study is structured as follows. Section II reviews the literature and Section III introduces the data and methodology. Section IV presents the empirical results, and Section V points out the conclusions that emerge from the study.

2. **LITERATURE REVIEW**

There exists a plethora of studies on the nexus between financial development and economic growth. Following work of Bagehot (1873), Schumpeter (1911), Gurley and Shaw (1955), Goldsmith (1969) and McKinnon (1973) researchers employed different econometric methodologies and data sets to investigate finance-growth relationship between different countries. As Levine (2003) explains, a growing body of empirical research, using different statistical procedures and data sets, produces remarkably consistent results showing that countries with developed financial systems tend to grow faster.

Studies such as Beck et al (2000), Levine et al (2000), King and Levine (1993), Bekaert et al (2003), Bhattacharya and Sivasubramanian (2003), Kar and Pentecost (2000), Cetintas and Barisik (2003), Levine and Zervos (1996), Calderon and Liu (2003), Khan and Senhadji (2003), Mazur and Alexander (2001), Christopoulos and Tsionas (2004), Soukhakian (2007a, 2007b), Ergungor (2008), and Jalil et al (2010) have generally found evidence that financial system development causes economic growth.

On the other hand, some studies have yielded contradicting findings. For instance, Demirguc-Kunt and Levine (1996) found empirical evidence that as countries become developed, their financial structure improves. Similarly, Boulila and Trabelsi (2002) found

that economic growth causes financial development. In addition, Rousseau and Vuthipadadorn (2005) obtained evidence of a bi-idirectional causal relationship between the two variables, whereas Chang (2002) found no evidence of a relationship between economic growth and financial development. The present study aims at making a contribution to the literature by studying the impact of stock market and banking sector development on economic growth in Turkey.

3. DATA AND METHODOLOGY

The data used in the present study is monthly, spans the period between 01:1988 and 12:2004, and have been obtained from the Central Bank of Turkish Republic of Turkey's web site. Economic growth is measured by real GDP per capita. The indicator of stock market development is value traded as the ratio of the total value of domestic shares traded on the stock market to GDP (VLTR). Value traded is the total value of domestic shares traded on the stock market and measures the trading volume of the stock markets as a share of GDP. It reflects the degree of liquidity that stock markets provide to economy (Beck et al, 2000). As the banking system development indicator, the ratio of liquid liabilities (currency plus demand and interest bearing liabilities of banks and non-bank financial intermediaries) of the financial system to GDP (FINDP) is used. Liquid liabilities are a typical measure of financial depth and are widely used as a measure of financial intermediation (see Beck et al, 2000). All variables are transformed into logarithmic returns.

In order to investigate the causal relationship between financial system development and economic growth, Johansen cointegration tests are applied. This methodology is extensively discussed in the literature and, therefore, has not been discussed here to preserve space. To implement the Johansen test we first examine the time series properties of the said variables. If variables are found to be integrated of same order, cointegration relationship can be investigated among them. If cointegration exists Granger causality is tested based on ECM, otherwise, simple Granger causality test is applied which is based on first difference bi-variate VAR between same order integrated variables.

Error correction mechanism[4] has been widely used in economics and carries the advantages of identifying the sources of Granger causation or disequilibrium adjustment. The simple idea behind ECM is that a proportion of the disequilibrium from one period is corrected in the next period (Engle and Granger, 1987).

The model can be expressed as follows:

$$\Delta \ln Y_t = \mu + \sum_{i=1}^{m} a_i \Delta \ln Y_{t-i} + \sum_{i=1}^{m} b_i \Delta \ln X_{t-i} + \beta_i ECT_{t-1} + u_t \quad (1)$$

$$\Delta \ln X_t = \mu + \sum_{i=1}^{m} c_i \Delta \ln X_{t-i} + \sum_{i=1}^{m} d_i \Delta \ln Y_{t-i} + \eta_i ECT_{t-1} + u_t \quad (2)$$

Where Y denotes Real GDP per capita and X denotes financial system development indicators which are found to have cointegration relationship with Real GDP per capita. a_i, b_i, c_i and d_i represents short run coefficients and β_i and η_i represents speed of adjustment

[4] For early versions see Sargan (1964) and Philips (1957)

coefficients. ECT_{t-1} is error correction term and contains r co-integrating terms, reflecting the long-run equilibrium relationship among variables. Also, measures the proportion by which the long term imbalance in dependent variable is corrected in each short run period. Δ indicates first difference operator.

If β_i and η_i are found as statistically significant, this means that deviation exists from long-run equilibrium. In order to correct this deviation, it is expected that values of β_i and η_i will be negative number which means variables are moving towards equilibrium.

In ECM, sources of causation can be exposed by applying three different tests. The first one is a joint test applied to the sum of the lags of each explanatory variable in turn using *F-test* which also represents existence of short run causality. Second one is a *t-test* on the lagged EC term which is in fact a weak exogeneity[5] test and represents the existence of long-run causality. The last one is the joint test applied to the sum of each explanatory variable and the lagged EC term which is a strong exogeneity[6] test (Charemza and Deadman, 1997).

The joint null hypothesis for equations 1 and 2 is that, X does not Granger causes Y and Y does not Granger causes X, in other words there is no Granger causality between X and Y, (b_i, d_i =0). H_o is rejected if sum of the lags of each explanatory variables and EC term is found statistically significant, using *F-test* and *t-test* respectively.

[5] A variable X_t is said to be weakly exogenous for estimating a set of parameters λ, if inference on λ conditional on X_t involves no loss of information. (Maddala, 1992, page 392)

[6] If X_t is weakly exogenous and X_t is not preceded by any of the endogenous variables in the system, X_t is defined to be strongly exogenous. (Maddala, 1992, page 393)

4. EMPIRICAL RESULTS

In order to investigate the stationarity properties of the variables, Augmented Dickey Fuller (ADF) and Zivot-Andrews (ZA) have been used. As can be seen from tables 1 and 2, all variables are integrated of order one, *I*(1).

Table 1. ADF Test for Unit Root

Statistics (Levels)	**LPRVT**	**Lag**	**LDMSTC**	**Lag**	**LFINDP**	**Lag**	**LCAP**	**Lag**	**LRGDP**	**Lag**	**LTRNV**	**lag**	**LVLTR**	**Lag**
τ_T (ADF)	-4.23*,**	(12)	-3.98*	(12)	-2.59	(12)	-3.16***	(0)	-2.86	(12)	-2.76	(0)	-1.92	(2)
τ_μ (ADF)	-3.44**	(12)	-3.20**	(12)	-0.70	(12)	-2.08	(2)	-1.37	(13)	-0.95	(0)	-1.87	(2)
τ (ADF)	-0.95	(12)	0.42	(12)	0.78	(12)	-2.20**	(2)	1.71***	(13)	3.25*,**	(0)	-1.83***	(2)
Statistics (First Difference)	**LPRVT**	**Lag**	**LDMSTC**	**Lag**	**LFINDP**	**Lag**	**LCAP**	**Lag**	**LRGDP**	**Lag**	**LTRNV**	**Lag**	**LVLTR**	**Lag**
τ_T (ADF)	-1.87*,***	(11)	-2.18	(11)	-3.13	(11)	-12.9*,***	(1)	-4.24**	(12)	-12.9*,***	(0)	-14.0*,***	(1)
τ_μ (ADF)	-1.85*,**	(11)	-2.14	(11)	-3.11**	(11)	-12.9*,***	(1)	-4.26*,**	(12)	-12.9*,**	(0)	-14.1*,**	(1)
τ (ADF)	-1.82*,**	(11)	-2.13**	(11)	-2.95*,**	(11)	-12.8*,***	(1)	-3.89*,**	(12)	-12.1*,**	(0)	-13.1*,**	(1)

Notes: *, ** and *** denote rejection of the null hypothesis at the 1%, 5% and 10% levels respectively. τ_T represents the most general model with a drift and trend; τ_μ is the model with a drift and without trend; τ is the most restricted model without drift and trend. Numbers in brackets are lag lengths used in ADF test (as determined by SIC set to maximum 14) to remove serial correlation in residuals. Tests for unit roots have been carried out in E-VIEWS 5.1.

Table 2. Zivot and Andrew unit root test for one break

Variable	***Model***	***k***	***Break***	***$t(\lambda_{inf})$***	***Inference***
LPRVT	A	13	2001 month 3	-6.21*,**,***	Statioanry
LDMSTC	A	13	2001 month 3	-5.45*,**,***	Statioanry
LCAP	B	12	1999 month 12	-4,78**,***	Stationary
LVLTR	B	6	1989 month 12	-3.19	Non-statioanry
LFINDP	C	12	1989 month 4	-3.35	Non-statioanry
LRGDP	C	12	2000 month 12	-5.07	Non-statioanry
LTRNV	C	12	2002 month 5	-5.44**,***	Statioanry

Notes: i) Model specification (i.e which model, A, B, or C is appropriate) is determined by first running each data series on Model C, with the possibility of both a slope and a level break. Model C is chosen if both dummy variables are significant. If only the slope dummy variable is significant, Model B is estimated. If only the level dummy is significant, Model A is estimated. ii) *, ** and *** denote rejection of the null hypothesis at the 1%, 5% and 10% levels respectively. Critical values are taken from Zivot and Andrew (1992). The 1%, 5% and 10% critical values are -5.34, -4.80 and -4.58,respectively, for model A. For model B, -4.93, -4.42 and -4.11,respectively, and -5.57, -5.08 and -4.82, respectively, for model C.

The results of Johansen cointegration test are reported in Table 3. Cheung and Lai (1993) suggest that the Trace test shows more robustness to both skewness and excess kurtosis in the residuals than maximum eigenvalue test. Hence, trace test statistics are used in the present study to determine the existence of co-integrating relationships.

Table 3. Cointegrtion tests based on the Johansen (1988) approach

Variables	Hypothesis	Trace Statistics	% 5 critical value	%1 critical value	Inference
LRGDP-LFINDP	H_o: r = 0 H_a : r = 1	19.726 0.522	15.41 3.76	20.04 6.65	Co-integrated at %5
LRGDP-LVLTR	H_o: r = 0 H_a : r = 1	15.62 2.62	15.41 3.76	20.04 6.65	Co-integrated at %5

Notes: r denotes the number of cointegrating vectors, SCI was used to select the number of lags required in cointegrating test, Critical values are taken from Osterwald-Lenum (1992)

Table 4. Granger causality tests based on Error Correction Models (ECM)

Null Hypothesis	***F*-stat**	***t*-stat**	***F*-stat**	***t*-stat**	***F*-stat**	***t*-stat**	***F*-stat**	***t*-stat**	***F*-stat**	***t*-stat**	***F*-stat**	***t*-stat**
	Lag	6	Lag	12	Lag	18	Lag	24	Lag	30	Lag	36
FINDP does not Granger cause RGDP	20.38*,**	2.66**	37.17*,**	2.68*,**	24.05*,**	2.30**	20.64*,**	2.49*,**	14.86*,**	2.37*,**	11.3*,**	2.03**
RGDP does not Granger cause FINDP	13.88*,**	2.73**	49.46*,**	3.28*,**	31.52*,**	3.29*,**	26.87*,**	2.97*,**	19.34*,**	1.80*,**	15.6*,**	2.44*,**
VLTR does not Granger cause RGDP	17.13*,**	1.22	28.78*,**	1.87**	19.01*,**	0.40	19.21*,**	0.77	14.77*,**	2.79*,**	10.3*,**	0.40
RGDP does not Granger cause VLTR	3.86*,**	2.81**	2.71*,**	3.68*,**	37.17*	4.26*,**	1.70*	2.73*,**	1.74*	0.51	1.95*	3.48*,**

Note: * and ** denote the rejection of the null hypothesis at 1% and 5% respectively. *t*-stat refers to t-statistics on ECM_{t-1}

Johansen test results suggest that there exists one cointegration vector between LRGDP-LFINDP and LRGDP-LVLTR. In other words, although series are non-stationary at their levels; they share common stochastic trends in the long-run.

The next step is to determine of the direction of Granger causality between co-integrated variables. In order to capture both long run and short run effects, Granger causality relationship is investigated using 6 month intervals till 36 month lag. While Table 4 reports the results of *F*-statistics and *t*-statistics of error correction term, Table 5 reports the coefficients of error correction terms for Granger causality test based on ECM. The coefficient of error correction term is found statistically significant and is negative, which shows that the variables in the system have a tendency to restore equilibrium.

For the case of financial depth and Real GDP per capita, both in the long-run and short-run, bi-directional Granger causality exists between variables. It can be said that while financial depth is a leading factor for RGDP per capita, at the same time RGDP per capita is leading factor for financial depth. In other words, improvements in real economy will produce consistent increases in the size of the banks and non-bank financial intermediaries. On the other hand, as financial sector develops and increases the amount of financial services and when size of sector increases this will create improvements in economic growth. Therefore, policymakers should take in to consideration of both sectors while they are designing policies for financial system and real economy.

On the other hand, when we evaluate the results for value traded and Real GDP per capita we see that there is no consistency in results and the direction of causality changes with

different lags. The reason behind instability in results may be weak correlation between stock market and real economy when value traded ratio is considered as an indicator for stock market development.

In general, for value traded and real GDP per capita, Granger causality relationship shows that, while in the short run bi-directional Granger causality exists, in the long run Granger causality is running from real GDP per capita to value traded ratio. Hence, it can be said that, in the short run, increased stock market liquidity creates more demand to investments, which in turn improves real GPD per capita.

If we compare the Granger causality test results of financial depth- real GDP per capita and value traded-real GDP per capita we see that Granger causality relationship between value traded ratio and RGDP per capita is not stronger as in relationship between financial depth and real GDP per capita.

5. CONCLUSION

This article has investigated the impact of financial development, as proxied by stock market development and banking sector development, on economic growth in Turkey using Johansen cointegration and Granger causality tests.

The results suggest that banking sector development has positive impact on economic growth and vice versa. Hence, the results lend support to both demand following and supply leading hypotheses for banking sector development and economic growth relationship. However, the results fail to yield the same conclusion for the stock market-economic growth relationship.

Thus, the results suggest that bank-based financial systems are more effective to promote long term growth than capital-market based one in the case of Turkey. This implies that, in order to promote economic growth, the policy-makers should increase the size of the financial sector and vice versa.

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RAZVOJ BURZE I BANKARSKOG SEKTORA U TURSKOJ: IMAJU LI JEDNAK UTJECAJ NA EKONOMSKI RAST?

SAŽETAK

Rad istražuje utjecaj razvoja financijskog tržišta dionica i bankarskog sektora na ekonomski rast u Turskoj koristeći Johansenov kointegracijski i Grangerov test kauzalnosti za period od siječnja 1988. do prosinca 2004. Rezultati ukazuju na to da razvoj bankarskog sektora ima pozitivni utjecaj na ekonomski rast i suprotno. Stoga, rezultati potkrepljuju obje hipoteze (demand following i supply leading) odnosa razvoja bankarskog sektora i ekonomskog rasta. Ipak, rezultati ne upućuju na jednak rezultat kad je u pitanju odnos burze i ekonomskog rasta.

***Ključne riječi**: Granger-kauzalnost, bankarski sektor, burza*

***JEL klasifikacija:** F31, F37*

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Preliminary paper
Prethodno priopćenje

THE ROLE OF REMITTANCES IN FINANCIAL CRISIS: EMPIRICAL EVIDENCE FROM MACEDONIA

ABSTRACT

The recent global financial crisis has heated the debate among economists on the role of migrant workers' remittances in times of financial crisis: Are they a shock absorber or a shock transmitter? The objective of this paper is to find out whether the remittances sent to Macedonia have a stabilizing or destabilizing effect. By specifying a vector error correction (VEC) model, we find evidence that real remittances have a destabilizing effect on the output both of the home country (Macedonia) and the host country (Germany). Consequently, they could not cushion large fluctuations in Macedonian output in stage of economic downturn.

Key words: *remittances, migration, cyclicality, financial crisis, vector error correction model (VEC)*

JEL classifications codes: C22, F29, J61, O11, O24

1. INTRODUCTION

Although at the beginning of the recent global financial and economic crisis, which started in summer 2007 when the first problems in US securities markets based on real estate loans occurred, it was thought that the current crisis will not affect Macedonia because it had no exposures to the US real estate market and because of the completely different structure of the Macedonian real estate market. Macedonia, like all other countries in Eastern and South Eastern Europe countries, has also been drawn in the severest crisis since the chronic days of the Great Depression via the trade and the capital flow channel. The global financial crisis started affecting the economy in the fourth quarter of 2008, led by a decline in the output of the metal and textile sectors. The macroeconomic situation deteriorated further in 2009 as industrial production contracted by 7.7 per cent compared with 2008, while foreign trade dropped sharply and foreign direct investment (FDI) declined by more than 66 per cent (National Bank of the Republic of Macedonia, 2011).

Unlike the FDI inflows, the migrant workers' remittances, which accounted for 4,5% of its GDP in 2009[2], have decreased by only 2% in 2009 compared with 2008 and in 2010 they reached a record level of 414 million US dollars (World Bank, 2011) which represents an increase of 3% compared with 2009. This is line with the data on remittances in other developing countries, which are estimated to reach the record level of 325 billion dollars in 2010, up from 307 billion dollars in 2009 (World Bank, 2011).

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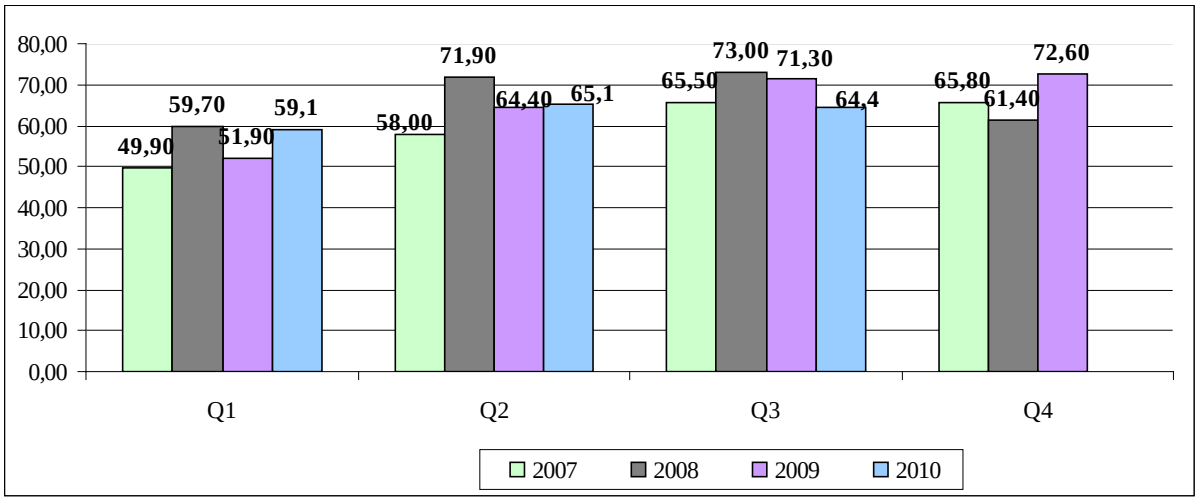
[2] Macedonia is among the leading 30 migration countries with 21.9 percent stock of emigrants as a percentage of population (World Bank, 2011).

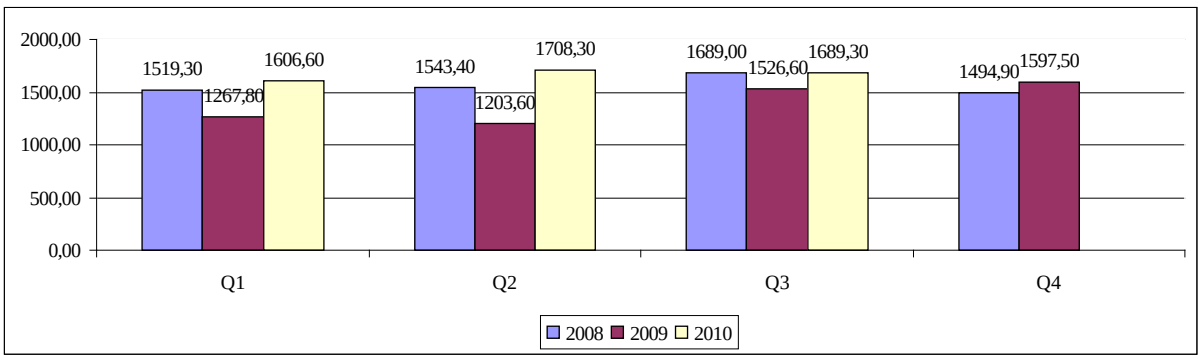
Figure 1: Quarterly remittance inflows to Macedonia in the period 2007-2010 in millions of US dollars



Source: National Bank of the Republic of Macedonia, Statistics, http://www.nbrm.mk/default en.asp?ItemID=16C5679A8986CE4391D1F76413410999, Assessed on 10th January 2011.

The rising trade deficit, on one hand and the sharp decline of FDI, on the other hand have pushed up the current account deficit. Not only the size of the current account deficit, but also the speed of its deterioration are of great concern. Indicators of external vulnerability, such as international reserve cover of imports, or of short-term foreign debt, have also worsened in 2009. Macedonia's international reserves declined sharply in the first two quarters of 2009 (see Figure 2), with exports decreasing faster than imports. The National Bank of the Republic of Macedonia responded to the sharp reserve outflows by tightening bank liquidity and reserve requirements and raising its policy rate from 7 percent to 9 percent. As a result of that policy, in the third quarter of 2009 the situation had stabilized and reserve losses from earlier in the year had been recouped. As a result of that, at the end of 2009 Macedonia recorded an increase of 7 percent in the foreign exchange reserves compared with 2008 (National Bank of the Republic of Macedonia, 2011) .

Figure 2: Quarterly gross foreign exchange reserves in 2008 and 2009 in millions of US dollars



Source: National Bank of the Republic of Macedonia, Statistics, http://www.nbrm.mk/default-en.asp?ItemID=16C5679A8986CE4391D1F76413410999, Assessed on 10th January 2011.

Given the persistent problems in the Macedonia's trade balance and balance of payment, on one hand and the important role that migrant remittances have been played in financing between 80-90 percent of the Macedonian trade deficit, it is of utmost importance to find out whether the remittances sent to Macedonia by Macedonian migrants working in Germany have a stabilizing or destabilizing effect on the output of the home country (Macedonia) and of the host country (Germany). We have chosen Germany due to the fact that Germany has been among the top ten destination countries for immigrants from Macedonia and the dominant EU receiving country of immigrants from Macedonia (in the period 2000-2009 the share of Macedonian immigrants working in Germany in the total number of Macedonian immigrants averaged 15 per cent), and as such it constitutes the largest source country of remittances to Macedonia.

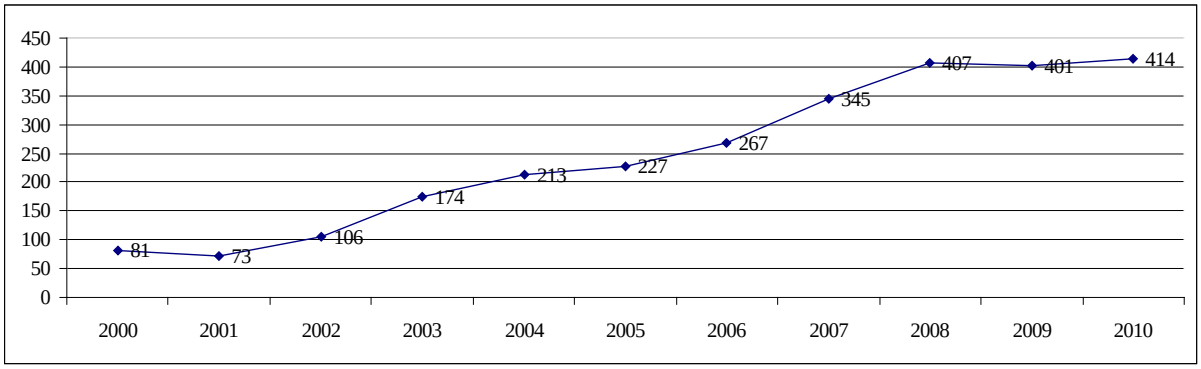
2. STYLIZED FACTS

The trend of migrant workers' remittance inflows to Macedonia is broadly in line with the trend observed in global remittance flows and the trend of remittance inflows to developing countries.

Migrant workers remittances[3] inflows to Macedonia have been constantly growing in the period 2000-2010 (Figure 3) averaging 246.18 million US dollars. It should be noted that these figures are official figures provided by the World Bank statistics division. However, the World Bank suggests that remittances sent through informal channels could add at least 50% to the official estimate (World Bank, 2006)

The annual rate of growth of workers' remittances to Macedonia in the period 2000-2010 have averaged 19.5 percent. In the same period the inward migrant workers remittances per capita also increased significantly at an average rate of 19.31 percent (Figure 4).

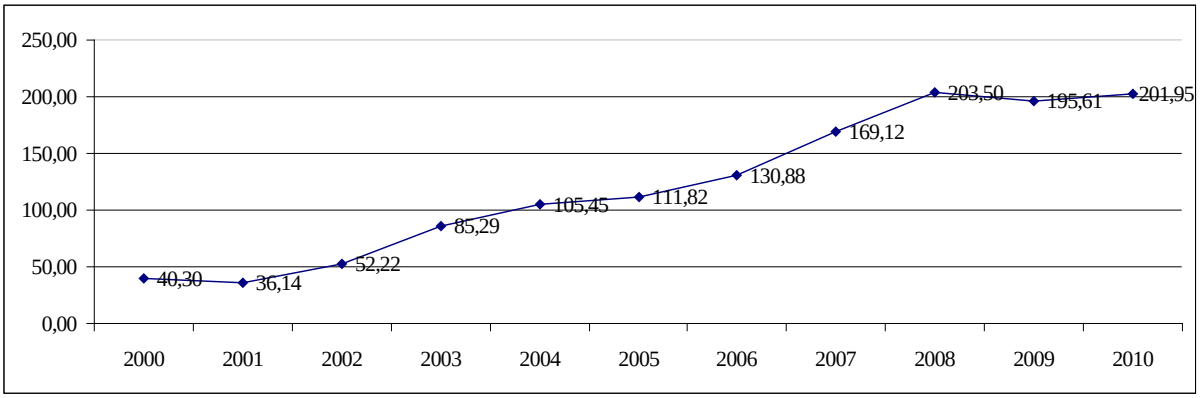
Figure 3: Inward migrant workers remittances in Macedonia in millions of US dollars, 2000-2010



Source: National Bank of the Republic of Macedonia, Statistics, http://www.nbrm.mk/default-en.asp?ItemID=16C5679A8986CE4391D1F76413410999, Assessed on 10th January 2011.

[3] The World Bank definition of remittances includes workers remittances, compensation of employees and migrant transfers. In case of Macedonia the migrant transfers are included in the cash exchange.

Figure 4: Per capita inward migrant workers remittances in Macedonia, 2000-2010



Source: National Bank of the Republic of Macedonia, Statistics, http://www.nbrm.mk/default-en.asp?ItemID=16C5679A8986CE4391D1F76413410999, Assessed on 10th January 2011.

Since 2002 workers' remittances have become the largest source of external financing for the Macedonian economy, by far exceeding other capital inflows, such as foreign direct investments (FDI), official development assistance and portfolio investment. Adding to the importance of remittances at a macro level, remittances are a significant source of external funding for many households, particularly in times of economic hardships.

In the economic literature as well as in the empirical research it is widely believed that workers' remittances are motivated by altruism (Rapoport and Docquier, 2005) and as such are expected to move countercyclical to the GDP in the recipient country. Ratha (2003) also corroborates the point that migrants may also increase remittances in times of economic hardship. However, since the decision to remit money is influenced not only by altruism, but by a number of determinants, it is conceivable that remittances may be procyclical or even acyclical with the GDP in some of the recipient countries (Sayan, 2006).

When they are countercyclical with the business cycle of the recipient country, they serve as a macroeconomic stabilizer. On the other hand when they are procyclical they may act as a destabilizing effect by amplifying cyclical fluctuations in GDP (Sayan and Tekin-Koru, 2007).

It is therefore important to find out if remittance inflows from Germany to Macedonia are countercyclycal, procyclical or even acyclical to the movements of Macedonian as well as German GDP over the different stages of the business cycle and to establish the main determinants of remittance inflows from Germany as the largest source country of remittances to Macedonia.

3. DATA, METHODOLOGY AND RESULTS

In order to investigate whether the workers' remittances sent to Macedonia by workers from Macedonia working in Germany are countercyclical or procyclical with macroeconomic conditions in the home country (Macedonia) and host country (Germany), we will estimate a vector error correction (VEC) model for Macedonia using quarterly data covering the period 2000-2009. The model is estimated and tested using the econometric software package EViews 6.

We decided to use the VEC model because: 1. most of the macroeconomic variables are endogenous, suggesting a multi-equation estimation; 2. many of the time series of the variables are non-stationary in their levels, but are in their differences and 3. there is a cointegrated relationship among the variables, suggesting the inclusion of the cointegrated relationship as an additional regressor. Our initial impressions are gained from looking at plots of the time series of the variables.

The dependent variable in our model is real migrant workers' remittances per capita sent by the Macedonian workers working in Germany to their families in Macedonia. Data on migrant workers' remittances to Macedonia in millions of US dollars are obtained from the National Bank of the Republic of Macedonia. We convert the quarterly remittances figures in nominal US Dollar terms into quarterly real values by dividing them by the GDP deflator. In order to determine the amount of worker remittances coming from Germany, we have calculated the share of workers from Macedonia working in Germany in the total number of migrant workers from Macedonia in the world as in Sayan and Tekin-Koru (2007) and after that we have used these weights for calculation the portion of remittances coming from Germany.

The selection of the explanatory variables is based on the previous empirical studies on the macroeconomic determinants of remittances listed in Table 1. These studies usually focus on the number of workers, wage rates and economic situation in host country, economic situation in country of origin, the exchange rates and relative interest rate between the sending and receiving country and political risk and facilities to transfer funds (i.e. institutions).

Table 1 gives a summary of the major empirical papers on the macroeconomic determinants of remittances. It is clear from this table that stock of migrants and the economic situation in the home and host country seem to be the most important factors for increased remittances.

In our model we use the following explanatory variables: the real gross domestic product (GDP) per capita in Macedonia as a proxy for the income level in the home country, the real gross national income (GNI) per capita in Germany as a proxy for the income level in the host country, the labour market situation in the home country proxied by the unemployment rate in Macedonia, the consumer price index (CPI) in Macedonia and the real effective exchange rate (REER) as proxies for macroeconomic stability in Macedonia and the interest rate difference (INTERESTDIF) between the short-term deposit interest rates in the home and host country (difference between the treasury bill rate in Macedonia and the treasury bill rate in Germany) as relative rate of return.

Table 1: Macroeconomic determinants of remittances

PAPER	NUMBER OF MIGRANT WORKERS	WAGE RATES	ECON.SITUATION IN HOST COUNTRY	POOR ECON.SITUATION IN HOME ECONOMY	EXCHANGE RATE (RESTRICTIONS)/DUAL EXCHANGE RATE	INTEREST RATE GAP BTW HOME AND HOST COUNTRY (BETTER INT. RATE IN HOST COUNTRY)	POLITICAL RISK	FINANCIAL SECTOR DEVELOPMENT	MACROECONOMIC INSTABILITY IN HOME COUNTRY
Akkoyunlu and Kholodilin (2006)			+	x					
Ayadas, Neyaptiand and Metin-Ozcan (2006)			+	+	-		-		-
Bouhga-Hegbe (2006)				+					
Buch, Kuchulenzandle and Manchec (2002,2004)	x	x	x	-	x	x		x	/-(1)
Jovicic and Dragutinovic (2006)	+	x		-				x	
Elbadawi and Rocha (1992)	+		+		-	-			-
Faini (1994)					(2)				
Freund and Spatafora (2005)	+		+		-			(3)	
Gupta (2005)	(4)	+	+	+	x	x	x		
IMF (2005)			+	+	-	x	x	x	-
Lianos (1997)	+	+	+	x	-	+			(1)
Luethand and Ruiz-Arranz (2006)			(5)						+
Luethand and Ruiz-Arranz (2007)		+	+	+	-				
Russell (1986)	+	+	*	*	*	*	-	+	
Sayan (2006)			x	-					
Schiopu (2006)			+	+		x			
Schrooten (2005)		+	+	+				x	
Schrooten (2006)	(4)		+					+	

+: positive effect; -: negative effect; x: included in regression but not significant

Source: Hagen-Zanker, J. and Siegel, M., 2007, p. 23.

According to the previous empirical studies mentioned in Table 1, home country income may affect migrant workers remittances either positively or negatively, depending on the motives to remit money (altruism or investment considerations). The income of the host country can be a significant factor of workers remittances due to better employment opportunities and higher wages offered to the migrant workers in the host country. We have chosen GDP as a measure of the income level of Macedonia (home country) and GNI as a proxy for host country income (Germany) on the basis of the national income conventions that define gross national product (GNP) as GDP plus net factor income from abroad (NFI). Since NFI includes net remittance receipts, home country's GDP and host country's GNP series leave out remittances sent home by migrant workers in the host country in question

(Sayan, 2004) Thus, GDP for Macedonia and GNI for Germany would be the more appropriate output measure to analyze the cyclical behaviour of real remittances sent home by migrant workers against the home and host country outputs. The quarterly data for GNI are obtained from the World Development Indicators 2010 of the World Bank and the quarterly data for GDP for Macedonia are obtained from the State Statistical Office and the National Bank of the Republic of Macedonia. Data on quarterly GDP deflator for Macedonia are obtained from Ministry of Finance of the Republic of Macedonia and data on GDP deflator for Germany are obtained from the World Development Indicators 2009 of the World Bank.

The higher unemployment rate in the home country can be expected to increase the incentives for migration which may consequently cause increase of remittances. While high unemployment may be a cause for migration, the household's community needs to have a certain level of development for investment by the household to be effective. Consequently it is possible fewer remittances are sent to developing countries (Hagen-Zanker and Siegel, 2007). The quarterly unemployment rates for Macedonia are obtained from the State Statistical Office of the Republic of Macedonia.

As far as causation between remittances receipts in home country and interest rate differential between the home and host country deposit interest rates is concerned, the directions may not be that clear-cut. While an increase in the interest rate differential would encourage migrant workers to channel their remittances to home country so as to earn interest income from the domestic banks, higher interest rate differential may also reflect higher macroeconomic instability and higher investment risks in the home country and as such could discourage migrant workers to invest their money in the domestic banks. The data on short-term interest rates (treasury bill rates) for Germany are taken from the United Nations Economic Commission for Europe, and for Macedonia from the National Bank of the Republic of Macedonia.

The impact of inflation (proxied by consumer price index) on migrant workers remittances is also ambiguous. Higher inflation rates would cause remittance inflows to decline suggesting that inflation acts as a proxy for macroeconomic instability and risks and therefore discourages the inflow of remittances or higher inflation in the home country is found to encourage more remittances flows to compensate for the loss of purchasing power. The quarterly data on consumer price index in Macedonia are taken from the United Nations Economic Commission for Europe.

The sign of the real effective exchange rate (REER) coefficient, as an important determinant of remittances, is a priori not clear. If families target a certain consumption level in domestic currency, depreciation would result in a negative sign through falling remittances. But, if the consumption basket also contains a considerable share of imported goods, a depreciation of domestic currency would be associated with an increase in remittances so as the preserve the family members purchasing power in the home country. The quarterly data on REER in Macedonia are taken from the National Bank of the Republic of Macedonia.

We first test for the presence of unit roots in the macroeconomic time series using the augmented Dickey-Fuller test and find that all series are integrated of order one. To determine the appropriate lag length we start with 9 lags and subsequently eliminate lags with insignificant coefficients. The choice of model, that is whether to include an intercept or time trend, is based on the approach of Doldado et.al., (1990). Under this approach, one starts with the least restrictive of plausible models (the test equation includes both the trend and

intercept) and then introduces restrictions until the null hypothesis of a unit root is rejected (if at all). As it can be seen from the results in Table 1, the null hypothesis of a unit root in the levels of data series is not rejected, therefore they are all a nonstationary (have unit roots). Next we proceed with testing for a second unit root, by testing for a unit root in the first differences of each if the series (∇).The results show that null hypothesis of the unit rot test in ∇ is not accepted, so we can conclude that all the series are integrated of first order I(1).

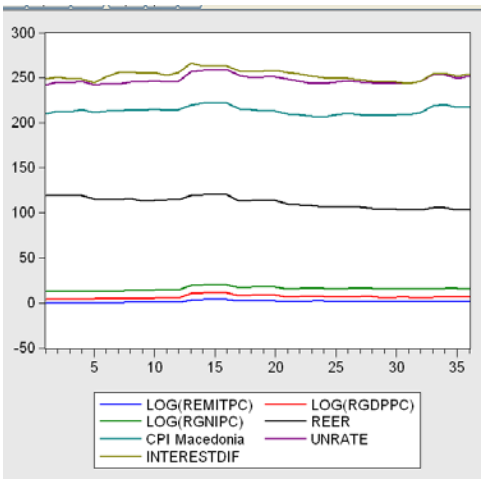
Table 2: Unit root test of the series

	LEVEL			FIRST DIFFERENCE		
	t-ADF	model *	lags	t-ADF	model	lags
REMITPC	-2.969302	2	1	-4.273018	2	0
RGDPPC	-2.154357	2	0	-5.702564	2	0
RGNIPC	-0.582429	2	0	-3.567557	3	0
REER	-1.281195	2	0	-6.230331	2	0
CPIM	0.907843	2	9	-4.730682	3	0
UNRATE	-1.430606	2	0	-5.823180	2	0
INTERESTDIF	-1.609364	2	0	-4.472809	3	0

* Model 2 includes intercept in test equation, but no trend, model 3 does not include any of them.

A graph of the series is shown in Figure 6. The series clearly move in a similar way in time.

Figure 5: Graph of the series



The next step is to test if there is a cointegration among the variables applying Johansen procedure. We use one lag to preserve sufficient degrees of freedom. Both the trace statistic and the maximum eigenvalue statistic confirm the existence of 2 cointegration relationships between log remittances per capita, log real GDP, log real GNI, real effective exchange rate, difference in interest rates, consumer price index in Macedonia and unemployment rate in Macedonia.

The estimated OLS regression equation is the following:

$$\ln REMITPC = -3{,}2336 + 1{,}081534 \ln RGDPPC + 1{,}32887 \ln RGNIPC - 0{,}04451 REER - 0{,}079804 CPIM - 0{,}007212 UNRATE - 0{,}03347 INTERESTDIF \quad (1)$$

(7,435833) (0,093128) (0,796765) (0,023397) (0,027209) (0,050788) (0,021468)

In order to see if this static relation is a long-run equilibrium relationship, and not just a spurious regression we have to test if the OLS residuals have a unit root, which implies that they are not stationary and the variables are not cointegrated, i.e. to implement the first phase of Engle-Granger procedure. The results of this test are given in Table 3.

Table 3: Dickey-Fuller t-test applied on the remittance residuals

Null Hypothesis: RESID02 has a unit root				
Exogenous: Constant				
Lag Length: 9 (Automatic based on SIC, MAXLAG=9)				
			t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic			-4.625207	0.0011
Test critical values:	1% level		-3.711457	
	5% level		-2.981038	
	10% level		-2.629906	
*MacKinnon (1996) one-sided p-values.				
Augmented Dickey-Fuller Test Equation				
Dependent Variable: D(RESID02)				
Method: Least Squares				
Date: 07/10/09 Time: 18:03				
Sample (adjusted): 11 36				
Included observations: 26 after adjustments				
	Coefficient	Std. Error	t-Statistic	Prob.
RESID02(-1)	-2.252427	0.486989	-4.625207	0.0003
D(RESID02(-1))	1.410548	0.395745	3.564282	0.0028
D(RESID02(-2))	0.930090	0.371914	2.500819	0.0245
D(RESID02(-3))	0.954700	0.313512	3.045182	0.0082
D(RESID02(-4))	1.076517	0.259401	4.150007	0.0009
D(RESID02(-5))	0.841375	0.228745	3.678226	0.0022
D(RESID02(-6))	0.603682	0.197654	3.054230	0.0080
D(RESID02(-7))	0.550644	0.150235	3.665208	0.0023
D(RESID02(-8))	0.353317	0.126901	2.784198	0.0139
D(RESID02(-9))	0.203369	0.092195	2.205854	0.0434
C	0.024082	0.024396	0.987143	0.3392

R-squared	0.862033	Mean dependent var	-0.024584
Adjusted R-squared	0.770055	S.D. dependent var	0.225080
S.E. of regression	0.107932	Akaike info criterion	-1.318526
Sum squared resid	0.174739	Schwarz criterion	-0.786254
Log likelihood	28.14083	Hannan-Quinn criter.	-1.165251
F-statistic	9.372163	Durbin-Watson stat	2.059456
Prob(F-statistic)	0.000086		

We can conclude that the null hypothesis of no cointegration can be rejected even at level of significance of 2.5%, meaning that the model (1) is a long-run equilibrium relationship.

Over the long run, remittance receipts increase as the Macedonian and German economy grows, and decline as the real effective exchange rate, unemployment rate, consumer price index in Macedonia and the difference between the short-term deposit interest rates in Macedonia and Germany increase.

The estimated short-run error correction model is given in the following figure:

Figure 6: The estimated error-correction model for ln(REMITPC)

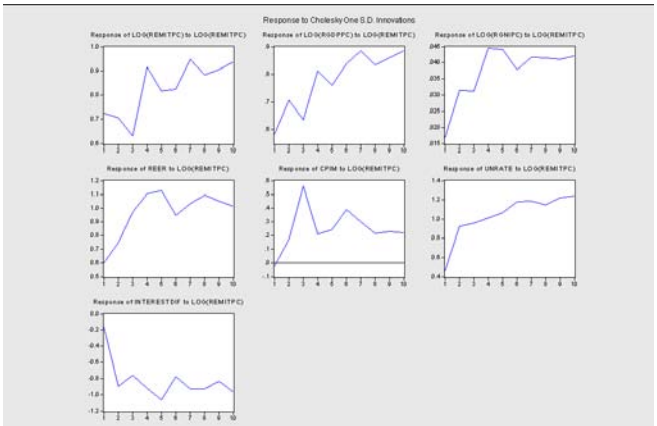
Dependent Variable: LOG(REMITPC)
Method: Least Squares
Date: 07/10/09 Time: 18:14
Sample (adjusted): 4 36
Included observations: 33 after adjustments

	Coefficient	Std. Error	t-Statistic	Prob.
C	1.695935	0.226963	7.472282	0.0000
D(LOG(RGDPPC))	0.210518	0.337374	0.623990	0.5388
D(LOG(RGNIPC))	3.584994	3.398540	1.054863	0.3024
D(REER)	0.064324	0.130333	0.493534	0.6263
D(CPIM)	-0.382674	0.147788	-2.589343	0.0164
D(UNRATE)	0.127891	0.175426	0.729032	0.4733
D(INTERESTDIF)	-0.235761	0.101403	-2.324985	0.0293
RESID02(-1)	-0.276619	0.750247	-0.368704	0.7157
D(LOG(REMITPC(-1)))	0.122308	0.291067	0.420205	0.6782
D(LOG(REMITPC(-2)))	0.494189	0.256486	1.926772	0.0665

R-squared	0.466831	Mean dependent var	1.521812
Adjusted R-squared	0.258200	S.D. dependent var	1.072231
S.E. of regression	0.923489	Akaike info criterion	2.923732
Sum squared resid	19.61513	Schwarz criterion	3.377219
Log likelihood	-38.24157	Hannan-Quinn criter.	3.076316
F-statistic	2.237591	Durbin-Watson stat	0.455310
Prob(F-statistic)	0.057601		

The estimation of of the VEC model is given in Table 4 in Appendix. Both Table 4 and Figure 7 show that remittances respond to shocks in real effective exchange rate and interest difference. The impulse response functions (Figure 7) illustrate how remittances react to one standard deviation shocks in Macedonian GDP and German GNI, real effective exchange rate, the price level and the unemployment rate in Macedonia and the difference in short-term interest rates before they are forced back onto their long-term path.

Figure 7: Cholesky impulse response functions



The obtained econometric findings can be summarized as follows:

1. *There is a positive significant relationship between remittances sent from Germany to Macedonia and Macedonian real GDP*. This relationship proved to be procyclical suggesting that real remittances per capita move in the same direction as the Macedonian real GDP per capita-they would increase when the Macedonia's real GDP would grow, possibly for investment purposes and would drop in times of recessions or economic downturns. Our econometric results suggest that, an increase in Macedonian real GDP per capita by 1 percent leads to an increase in real remittances per capita by 1,08 percent, all else remaining constant. The obtained econometric results are in compliance with the previous econometric research regarding middle-income countries to which Macedonia belongs (Jovicic and Dragutinovic-Mitrovic, 2006) The procyclicality of real remittances to Macedonian real GDP implies that remittances act as a boost to economic activity in times of economic upturns, and as a destabilizing factor to the economy in times of economic downturns with severe negative macroeconomic and microeconomic consequences.
2. *Remittances sent from Germany to Macedonia move procyclically with German real output (real GNI):* remittances increase during an up cycle in the German economy as a result of the increasing wages of the Macedonian workers and decrease when economic activity in Germany slows down and unemployment rates go up over the business cycle in Germany. In particular, an increase in German real GNI per capita by 1 percent leads to an increase in real remittances per capita by 1,33 percent ceteris paribus. This econometric result is also in line with previous econometric research. According to Sayan and Tekin-Koru (2007), even if remittances move countercyclically with the output in the home countries of migrant workers, the cycles in home and host country economies may concurrently move in the same direction, thereby preventing workers employed in an economy hit by crisis from helping out family members facing similar conditions back home. This is the case with the recent global economic crisis which stroke Germany and Macedonia simultaneously.
3. *Remittances fall when the unemployment rate in Macedonia increases:* a one percent increase of the Macedonian unemployment rate leads to 0,7 percent reduction in remittances. The sign of the estimated coefficient of unemployment rate in home country is unexpectedly negative, but not significant. This result can be explained with the previous findings that inward remittances coming from Macedonian workers in

Germany to Macedonia do decrease during period of recessions and economic downturns in Macedonia and in Germany.

4. *Remittances increase when the real exchange rate weakens:* a one percent depreciation of the denar leads to a 4,45 percent increase in remittances, ceteris paribus. Depreciation of the denar increases remittances due to the fact the Macedonian consumption basket contains a considerable share of imported goods. So in order to preserve the purchasing power of their family members in Macedonia, Macedonian migrant workers in Germany would transfer more money home.
5. *Remittances fall when the inflation rate increases:* a one percent increase of the inflation rate leads to a 7,98 percent reduction in remittances, assuming that all other variables are constant. Higher inflation rate is a signal of macroeconomic instability and would cause remittance inflows to decline.
6. *Remittances fall with the increase of interest rate differential.* An increase of the differential between home country and host country treasury bills interest rate by 1 percent, would lead to a decrease in remittances sent from Germany to Macedonia by 3,35 %, ceteris paribus. This result is in line with the previous conclusion that higher interest rate differential, as an indicator of higher macroeconomic instability, discourages migrant workers to invest their money in the domestic banks, and it is also in accordance with the relation to the inflation rate.

4. CONCLUSIONS AND POLICY IMPLICATIONS

Contrary to the theoretically plausible counter cyclical argument of remittance flows to emerging market economies, our econometric analysis has shown that real remittance inflows from Germany to Macedonia are positively and strongly correlated with Macedonian business cycle, suggesting that they are profit driven and governed by portfolio considerations, and not by altruism or insurance considerations The procyclicality of real remittances to Macedonian real GDP implies that remittances could not cushion large fluctuations in Macedonian output in times of recession or economic downturn. Moreover, the paper finds that real inward remittances receipts move also procyclically with German real output (real GNI).

The variable used to measure the impact of labor market on inward remittances (unemployment rate in home country) had the expected negative sign, but was not significant. Real exchange rate also proved to be an insignificant determinant of the level of per capita real remittances. Depreciation of the denar tends to increase remittances, implying that they may considerably provide insurance against balance of payment deficit since it is statistically significant at 10% level. The consumer price index is also statistically significant at 1% level of significance and it indicates that the inflation rate has a considerable negative impact to remittances. As far as the rate of return variable is concerned, results indicate that interest rate differential affected remittances negatively, but not significantly.

These findings have important policy implications. First, due to the procyclical behaviour, remittances can not be a substitute for good economic policies and structural reforms. Second, given the important economic benefits of remittances to Macedonia and the fact that they are far more stable source of external financing unlike FDI, Macedonian government should refocus from motivating the foreign investors to invest in Macedonia though very expensive and ineffective marketing campaigns to maximizing the developmental impact of remittances in Macedonia by offering more investment opportunities to Macedonian migrants, especially to those ones who wish to return to Macedonia.

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APPENDIX

Table 4: Vector error correction estimates

Vector Error Correction Estimates							
Date: 07/10/09 Time: 15:43							
Sample (adjusted): 4 36							
Included observations: 33 after adjustments							
Standard errors in ( ) & t-statistics in [ ]							
Cointegrating Eq:	CointEq1						
LOG (REMITPC(-1))	1.000000						
LOG (RGDPPC(-1))	2.307812						
	(0.23271)						
	[9.91704]						
LOG (RGNIPC(-1))	15.72516						
	(2.50051)						
	[6.28877]						
REER(-1)	-0.621153						
	(0.04028)						
	[-15.4203]						
CPIM(-1)	-0.874719						
	(0.08455)						
	[-10.3458]						
UNRATE(-1)	-1.996525						
	(0.16846)						
	[-11.8519]						
INTERESTDIF(-1)	0.307529						
	(0.04893)						
	[6.28466]						
C	61.68588						
Error Correction:	D(LOG(REMITPC))	D(LOG(RGDPPC))	D(LOG(RGNIPC))	D(REER)	D(CPIM)	D(UNRATE)	D(INTERESTDIF)
CointEq1	0.044679	-0.026848	0.005414	0.579551	0.005577	0.186553	-0.626185
	(0.09865)	(0.08446)	(0.00602)	(0.15982)	(0.16271)	(0.14528)	(0.17375)
	[0.45292]	[-0.31788]	[0.89869]	[3.62635]	[0.03427]	[1.28412]	[-3.60396]
D(LOG (REMITPC(-1)))	0.288026	0.752692	0.001573	-0.612655	-0.786767	0.261382	-0.706977
	(0.53977)	(0.46215)	(0.03296)	(0.87448)	(0.89031)	(0.79492)	(0.95071)
	[0.53361]	[1.62867]	[0.04771]	[-0.70059]	[-0.88370]	[0.32882]	[-0.74363]
D(LOG (REMITPC(-2)))	-0.258248	-0.180438	0.000401	-0.098818	0.197116	0.083792	1.729883
	(0.60189)	(0.51533)	(0.03676)	(0.97511)	(0.99275)	(0.88639)	(1.06011)
	[-0.42907]	[-0.35014]	[0.01091]	[-0.10134]	[0.19855]	[0.09453]	[1.63179]
D(LOG (RGDPPC(-1)))	-0.329921	-0.413030	-0.022419	-0.568755	1.333526	0.273779	1.469170

	(0.65484)	(0.56067)	(0.03999)	(1.06089)	(1.08009)	(0.96437)	(1.15338)
	[-0.50382]	[-0.73667]	[-0.56061]	[-0.53611]	[1.23464]	[0.28389]	[1.27380]
D(LOG (RGDPPC(-2)))	0.257962	0.395720	-0.014930	-0.194529	0.101964	-0.028746	-0.614903
	(0.68726)	(0.58843)	(0.04197)	(1.11341)	(1.13357)	(1.01212)	(1.21048)
	[0.37535]	[0.67251]	[-0.35573]	[-0.17471]	[0.08995]	[-0.02840]	[-0.50798]
D(LOG (RGNIPC(-1)))	-9.792375	-5.788950	-0.025403	-5.409892	2.077943	-4.658595	27.95346
	(4.48805)	(3.84265)	(0.27409)	(7.27101)	(7.40262)	(6.60950)	(7.90489)
	[-2.18188]	[-1.50650]	[-0.09268]	[-0.74404]	[0.28070]	[-0.70483]	[3.53622]
D(LOG (RGNIPC(-2)))	-0.537057	3.487960	-0.473854	-1.940851	5.478032	4.838455	12.26524
	(3.83386)	(3.28253)	(0.23413)	(6.21117)	(6.32360)	(5.64609)	(6.75266)
	[-0.14008]	[1.06258]	[-2.02386]	[-0.31248]	[0.86628]	[0.85696]	[1.81636]
D(REER(-1))	0.134106	0.033100	0.015000	-0.060398	0.017551	0.204712	-0.510940
	(0.11321)	(0.09693)	(0.00691)	(0.18341)	(0.18673)	(0.16672)	(0.19940)
	[1.18458]	[0.34148]	[2.16962]	[-0.32931]	[0.09399]	[1.22786]	[-2.56240]
D(REER(-2))	0.194521	0.115109	-0.003765	-0.352467	0.152173	0.059083	-0.732115
	(0.13513)	(0.11570)	(0.00825)	(0.21893)	(0.22289)	(0.19901)	(0.23801)
	[1.43946]	[0.99488]	[-0.45622]	[-1.60996]	[0.68272]	[0.29688]	[-3.07592]
D(CPIM(-1))	0.030090	0.053242	0.005657	0.067124	0.158748	-0.139902	-0.010392
	(0.15432)	(0.13213)	(0.00942)	(0.25002)	(0.25454)	(0.22727)	(0.27182)
	[0.19498]	[0.40294]	[0.60023]	[0.26848]	[0.62366]	[-0.61557]	[-0.03823]
D(CPIM(-2))	-0.057157	-0.150737	0.005940	0.591865	-0.010400	-0.259231	0.087397
	(0.13330)	(0.11413)	(0.00814)	(0.21596)	(0.21987)	(0.19631)	(0.23478)
	[-0.42878]	[-1.32074]	[0.72970]	[2.74066]	[-0.04730]	[-1.32052]	[0.37224]
D(UNRATE(-1))	0.078268	-0.117764	0.028395	0.977678	-0.226927	-0.193752	-1.214013
	(0.20361)	(0.17433)	(0.01243)	(0.32987)	(0.33584)	(0.29986)	(0.35863)
	[0.38439]	[-0.67551]	[2.28355]	[2.96380]	[-0.67569]	[-0.64614]	[-3.38513]
D(UNRATE(-2))	0.229066	-0.074764	0.010281	0.425900	-0.689128	0.217203	-0.432186
	(0.17443)	(0.14935)	(0.01065)	(0.28259)	(0.28771)	(0.25688)	(0.30723)
	[1.31322]	[-0.50061]	[0.96510]	[1.50712]	[-2.39525]	[0.84554]	[-1.40673]
D(INTERESTDIF (-1))	0.203990	0.132319	0.003395	-0.078784	-0.283233	0.198798	0.266145
	(0.11249)	(0.09631)	(0.00687)	(0.18224)	(0.18554)	(0.16566)	(0.19813)
	[1.81345]	[1.37387]	[0.49415]	[-0.43231]	[-1.52656]	[1.20005]	[1.34331]
D(INTERESTDIF (-2))	-0.117175	-0.119552	-0.015931	-0.242424	0.162403	-0.106950	0.228282
	(0.08856)	(0.07582)	(0.00541)	(0.14347)	(0.14607)	(0.13042)	(0.15598)
	[-1.32314]	[-1.57672]	[-2.94571]	[-1.68970]	[1.11183]	[-0.82005]	[1.46354]
C	0.458025	0.224285	0.026450	-1.113403	0.512902	0.437733	-1.622762
	(0.30840)	(0.26405)	(0.01883)	(0.49964)	(0.50868)	(0.45418)	(0.54320)
	[1.48515]	[0.84939]	[1.40436]	[-2.22842]	[1.00830]	[0.96378]	[-2.98743]

R-squared	0.439896	0.386452	0.609321	0.622711	0.514838	0.513515	0.763211
Adj. R-squared	-0.054313	-0.154914	0.264605	0.289809	0.086753	0.084264	0.554279
Sum sq. resids	8.963118	6.570598	0.033428	23.52521	24.38455	19.43934	27.80582
S.E. equation	0.726114	0.621696	0.044344	1.176366	1.197658	1.069341	1.278920
F-statistic	0.890102	0.713846	1.767600	1.870555	1.202655	1.196305	3.652920
Log likelihood	-25.31905	-20.19558	66.94020	-41.24080	-41.83277	-38.09303	-43.99915
Akaike AIC	2.504185	2.193671	-3.087285	3.469139	3.505016	3.278365	3.636312
Schwarz SC	3.229764	2.919251	-2.361705	4.194719	4.230596	4.003945	4.361891
Mean dependent	0.034061	0.039212	0.018197	-0.566667	0.657576	0.039394	-0.036364
S.D. dependent	0.707164	0.578500	0.051710	1.395902	1.253253	1.117458	1.915631
Determinant resid covariance (dof adj.)		1.40E-06					
Determinant resid covariance		1.35E-08					
Log likelihood		-28.78102					
Akaike information criterion		8.956426					
Schwarz criterion		14.35292					

ULOGA NOVČANIH POŠILJAKA U FINANCIJSKOJ KRIZI: EMPIRIJSKI DOKAZI IZ MAKEDONIJE

SAŽETAK

Nedavna globalna financijska kriza je ugrijala raspravu među ekonomistima u vezi uloge inozemnig doznaka radnika u vrijeme financijske krize: Jesu li oni amortizer ili odašiljač šoka? Cilj ovog rada je utvrditi da li doznake poslane u Makedoniju imaju stabilizirajući ili destabilizirajući učinak. Određivanjem vektorskog modela s korekcijom odstupanja (VEC), nalazimo dokaze da realne doznake imaju destabilizirajući učinak na ekonomije obe zemlje: zemlja porekla (Makedonija) i zemlja krajnjeg odredišta (Njemačka). Stoga, ni ne mogu ublažiti velike fluktuacije u makedonske proizvodnje u fazi gospodarske krize.

Ključne riječi: *doznake, migracija, cikličnost, financijska kriza, vektorski model s korekcijom odstupanja (VEC)*

JEL klasifikacija: *C22, F29, J61, O11, O24*

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Preliminary paper
Prethodno priopćenje

THE ROLE OF REMITTENCES IN THE EXPLANATION OF FELDSTEIN-HORIOKA PARADOX: EVIDENCE FROM TRANSITION ECONOMIES

ABSTRACT

We measure the level of capital mobility following Feldstein and Horioka (1980) who assume that measuring the extent to which national saving and investment rates are correlated indicate the degree of financial integration into the world economy. While they surprisingly found the high positive correlation between saving and investment in developed OECD economies, subsequent empirical studies on the sample of less developed economies found smaller saving-investment correlation. Concentrating on the determinants of investments in the transition economies that could explain now conventional, puzzling Feldstein-Horioka results for transition economies, we were the first who consider remittances as possible explanation. The results of panel analysis seem to support the hypothesis of capital mobility among the economies in transition for the period 1995-2007. Highly significant effect of remittances on investment supports our argument that a significant portion of received remittances is directed toward investment in transition economies.

Key words:*capital mobility, Feldstein-Horioka puzzle, remittances, transition economies*

1. INTRODUCTION

There is a common opinion that world's financial market is highly integrated, especially with rapid development of the new communication technologies and easily accessible information. Integration of the financial market is likely to be followed by capital mobility. The level of capital mobility can be measured in different ways and in our analyses we focused on the measure proposed by Feldstein and Horioka (1980). They assume that measuring the extent to which national saving and investment rates are correlated indicate the degree of financial integration into the world economy. While empirical work on this topic is extensive, it is mainly related to developed countries and in very limited number of cases the research is based on the sample of transition economies. More recent studies take into consideration that, apart from the savings, the other variables, such as aid or trade, have impact on investment and augmented the original FH model for these variables. Considering that remittances are one of the most important financial flows into transition group of economies, we primarily want to investigate their impact on the domestic investment-saving relation.

The structure of the paper is as follow: the next section presents the review of the most prominent empirical literature about Feldstein-Horiokapuzzleand considers the econometric methods and the results obtained in the analyses, with special emphasis on the analyses for the less developed and transition countries. The same section also provides a criticalassessment of

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the previous methods and the results and points to common weaknesses in original Feldstein-Horioka and the later analyses.The theoretical basis for the variables in our model is given in the third section. We further give more information about importance of our variable of interest, remittances, for transition economies. The choice of the model, estimation procedure and estimation results are presented in the fourth section. After the description of the data used, the econometric estimates are presented. The concluding comments are provided in the fifth section.

2. LITERATURE REVIEW

2.1. Felstein-Horioka model of saving-investment relation: results andinterpretation

When perfect capital mobility is present, it is generally assumed that flows of capital would be directed toward the location with the most productive investment. If this assumption holds, there should not be high correlation between domestic saving and domestic investment.Formalisation of saving-investment relation as an indication of capital mobility can be attached to work of Feldstein and Horioka(1980) (further FH). They assume that capital (im)mobility can be revealed by observing investment reaction on change in saving (measured by β) from simple cross-section regression(1), also referred as FH model in the literature:

$$(I/Y)_i = \alpha + \beta(S/Y)_i + u_i \qquad i = 1, 2, 3,. ..N \qquad (1)$$

where $(I/Y)_i$is gross national investment to GDP ratio and $(S/Y)_i$is gross national savings to GDP ratio, α is intercept, β is saving retention coefficient and $u_i$is the error term.

. As developed countries are characterized by the absence of widespread capital controls, the dominance of easily available information and deregulated financial markets, Feldstein-Horioka hypothesized that β (in literature referred as saving retention coefficient) should not be statistically different from zero for OECD countries. However, the estimated coefficient for developed countries was surprisingly high (0.89), which Feldstein and Horioka (1980) interpreted as a signal of low capital mobility among the countries in the sample. Since FH results do not comply with theoretical expectation, results are often referred as "FH or globalization puzzle" and according to Obstfeld and Rogoff's (2000) classification,it is one of the six key puzzles in international economics. Au contraire to the conventionally accepted view that the global financial market is significantly integrated, the FH results raise doubts on the existence of financial globalization.

Official restrictions on the export of capital, possible institutional rigidities, currency and political risk and uncertainty, international differences of taxation and the interaction of foreign and domestic taxation (Feldstein and Horioka, 1980; Isaksson, 2001) have been recognized as possible explanations for retention of domestic savings within domestic territory. FH results became a conventional wisdom and any rejection of the FH puzzle has being considered as an exception rather than empirical regularity.

2.2. Weaknesses of Feldstein-Horioka results

Most authors have accepted the close correlation between savings and investment rates as a robust empirical regularity but deny that it is evidence for less than perfect capital mobility.

Further academic discussions about the FH puzzle suggest that concept of capital mobility is not a clear-cut analytical issue and often argue about the problem of identification of true

meaning of FH retention coefficient. It is pointed out that a high saving-investment correlation does not necessarily reflect less than perfect capital mobility and low capital market integration. Literature suggests thatthe integration of global capital markets is a necessary but not sufficient condition for a net capital in/out-flow and this depends on a whole range of exogenous factors suchas the presence of the non-tradable goods (Wong, 1990), current account targeting by government expenditure (Bayoumi,1990), economic or population growth (Obstfeld, 1986),the dependency ratio (Herwartz and Xu, 2009) and productivity shocks such as technological change (Obstfeld, 1986; Stockman and Tesar, 1995). The saving-investment relation could also be attributed to a "large country effect" i.e. an endogenous domestic interest rate defined through influences that large country has on world interest rate(Baxter &Crucini, 1993; Dooley et al., 1987,Herwartz and Xu, 2009).Another group of factors, referred as the "policy reaction" argument, is attributed to government actions and rests on assumption that government targets the current account balance and varies its economic policies to offset private net capital flows (Tobin, 1983). All those factors are considered to simultaneously affect saving and investment and omitting them from analyses is likely to cause misspecification in the cross-section estimation of the FH model.

There is an argument in theory that the interest sensitivity of saving and the covariance between savings and the error terms are not zero. According to discussion in the literature, the other factors, besides savings, could produce a correlation between saving and investment. If they are omitted from the model, they would go in error term and results in non-zero covariance between savings and error term. It implies possible endogeneity of savings and simultaneity bias attached to estimates of the FH coefficient.The problem of potential endogeneity has been considered in various analyses with different researchers using range of instruments (example of instruments are the ratio of military expenses to GNP and the dependency ratio used by Feldstein and Horioka (1980) or past savingsusedby Kasuga(2004)). However, it has often been found that the use of instrumental variable estimation does not change empirical results qualitatively.

2.3. Estimation results for the less developed countries (LDC)

Most of the empirical results suggest that, when LDCs are included in the sample, the high positive correlation between saving and investment does not exist. Since transition countries, the group of countries that we are primarily interested in, is considered to be subgroup of LDCs, we dedicate more attention to empirical findings for LDCs. If we consider a lower saving-investment correlation to be an indication of greater capital mobility, the results for LDCs seems to be less plausible due to the longer persistence of tight financial constraints in LDCs compared to OECD countries. Different studies (Dooley et al., 1987; Wong, 1990; Issakson, 2001; Kasuga,2004; Payne and Kumazawa, 2006) have found support for several possible explanationsof the LDCs' results: heterogeneity of financial characteristics and factor endowment; the size of the non-traded sector; the low correlation of returns between developing countries' market and easier access to foreign capital (mainly in form of cheap government debt and foreign aid). The lower saving retention coefficient for LDCs relative to developed countries has also been attributed to the "country size" factor which implies that in relatively small developing countries the world interest rate is taken as given (Dooley et al., 1987).Thus low saving-investment correlation in LDC, in light of afore mentioned factors, does not inevitably infer high capital market integration, as capital flows are mainly result of official transactions, while private investors still face controls and obstacles (Vamvakidis and Wacziarg , 1998). The results for LDC should also be interpreted

with caution as there are possible inaccuracies that could affect the results' validity. Although estimation for the developed countries is not without problem, fragile results are more likely to be observed for developing than developed countries. It is argued that the results for LDCs are downward biased, largely due to errors in data measurement. This error could arise as a result of neglecting the significant level of the "shadow" economy, capital inflows in form of aid and remittances and capital outflows in form of debt repayments. Biased estimation of the FH retention coefficient for LDC sample is likely to be caused by omitting such factorsfrom analyses.

Transition countries have not largely been covered in literature and empirical work on the savings-investment relationship in transition economies is rather limited.Payne and Mohammadi (2006) analyse original FH estimation and suggest that the findings on the relation between savings and investment in transition economies are similar to those for developing countries, suggesting a low coefficient on savings and hence fairly high capital mobility between countries.

3. THEORETICAL FRAMEWORK FOR EMPIRICAL ANALYSIS

3.1. Theoretical justification for independent variable selection

Two approaches for testing capital mobility arise in the literature: the first is the structural model that requires testing interest rate differentials on capital across countries and the second is Feldstein and Horioka's proposition which measures the extent to which national saving and investment rates are correlated in order to determine the degree of financial integration in the world economy. Referring back to previous discussion, we adopted the Feldstein and Horioka(1980) proposition and use model (1) as a starting point for our analyses. Feldstein and Horioka's (FH's) puzzling results and their interpretation have provoked a dynamic discussion in both the theoretical and empirical literature. Following this model, the central variables in our analysesare the gross savings-GDP ratio and the gross investment- GDP ratio. Feldstein and Horioka suggest two arguments why gross and not net saving flows between countries are appropriate to be used in analyses. Firstly, the gross measure would give more consistency because differences in accounting definitions of depreciation across countries that could invalidate the measurement of net saving, especially in the presence of high inflation. Secondly, the gross measure of fixed capital formation is appropriate to be used since it excludes the procyclical inventories component that may lead to spurious correlations with savings (Bayoumi, 1990; Sinha and Sinha, 2004).However, the relationship with net data has been estimated and similar, but slightly higher coefficient obtained, possibly reflecting errors in measuring depreciation (Feldstein and Horioka, 1980).

The FH model provides very little interpretation of the relationship over time, but lots of studies (Isaksson, 2001;Georgopoulos and Hejazi, 2005; Younas, 2007) augmented the traditional saving-investment modelwith a time dummy (T) interacted with saving rates. The interaction variableaims to capture the change in the savings rate over time period and serves to evaluate the effectiveness of policy and institutional changes aimed to improve capital mobility. Further variables to be included in our model are also in line with previous studies. Empirical evidence shows that among many measures of openness, the flow of trade (imports and exports) appears to have the most consistent relationship with investment, indicating positive relationship between investment and trade (a review of studies given in Ndikumana, 2000).

Feldstein and Horioka(1980) argue that the estimates for developing countries need further investigation because of possible endogeneity. They rely on Bhagwati's (1978) discussion, that the additional flow of foreign capital (government aid or private capital) into LDCs may give a negative bias in the saving-investment correlation. The same proposition is made by the other authors such as Montiel (1994) and Vamvakidis and Wacziarg (1998), who argue that foreign aid might largely drive the empirical findings of correlations for developing countries. Montiel discussed two possibilities: when all aid is directed toward investment activities and when only part of foreign aid is used for investment and the rest is used for consumption. In the former case, foreign aid and domestic savings are independent variables and the coefficient of the variables will correctly capture the independent effect of variables on domestic investment. Hence, neglect of aid in the FHmodel would be the source of regression misspecification. If the later situation prevails and the aid affects not just investment, the saving retention coefficient will pick up some of the effect of aid on investment and the omission of the foreign aid from regression would bias estimation of the saving retention coefficient.[2] Since foreign aid is significant part of investment financing in developing countries, the empirical investigations of SI relation on LDCs samples includethe level of foreign aid in the investigation of the saving-investment relation.

3.2. Adding new variables in the FH model: input from transition economies

Along with a foreign aid, remittances are an important source of financing in transition economies. They constitute an increasingly important mechanism for the transfer of resources to developing countries in general and transition in particular.With remittances, an economy can spend more than it produces, import more than it exports or invest more than it saves. However, there is danger that remittances could create an economic dependency that undermines prospect of development.Remittances might behave in a similar manner as aid and are expected to be positively correlated with official capital flows (Buch and Kuckulenz, 2004).A significant, though generally small, part of remittances does go into uses that can be classifieddirectly as investment. [3]However, remittances can be transferred for investment purposes indirectly. Although those flows could be significant, usually are not officially recorded in the balance of payments.

On the same basis as the argument considered above for foreign aid, we extended FH model to include remittances. We also control for the fact that transition countries from the sample joined the EU during the observed period and include an EU dummy (EU)[4]to capture possible differences in the level of domestic investment that those countries may have after they join EU. It is the first time in the theory and empirical investigation of the FH puzzle that remittances are included in analyses and our prime interest is to observe whether remittances are part of the explanation of the FH results for transition economies, which will be discussed further in the text

[2]In the former case the measured savings rate would decline and estimated savings retention coefficient would be downward biased as a measure of the independent effect of saving on investment. Hence, the omission of foreign aid in that case would weakens savings-investment correlation i.e. indicate more capital mobility than is actually present.

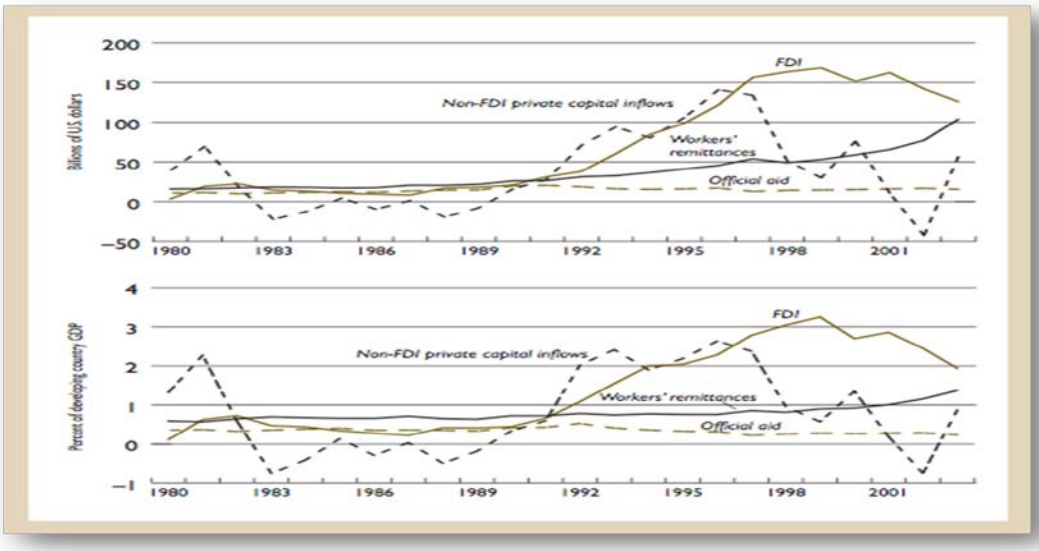
[3] Several studies found that remittances are transferred in different type of domestic investment such as investment in land or buildings (Alderman ,1996 and Adams ,1998 cited in Chami, 2008).

[4]We assign value of one to EU dummy for the period of EU membership and zero otherwise. We also consider Croatia as EU member along with the later group of countries, because Croatia fulfill economic condition to join EU in the same year as Bulgaria and Romania.

3.2.1. Importance of remittances for transition economies

Workers' remittances to developing countries have been steadily increasing in the past decades (see Figure 1). In the mid-1990s they overtook the total of private portfolio flows,thereby becoming the second most important source of foreign exchange for the developing countries and the second to foreign direct investment (FDI).

Figure 1. Workers' Remittances and other inflows to Developing Countries



Source: Chami (2008)

The rising trend of world's remittance has continued in the first decade of the second millennium. From 2001 to 2007, remittance receipts measured as global receipts of "workers' remittances" and "compensation of employees" more than doubled to US$336 billion (Table 1.).

Table 1. Compensation of Employees and Workers' Remittances, 2001 to 2007

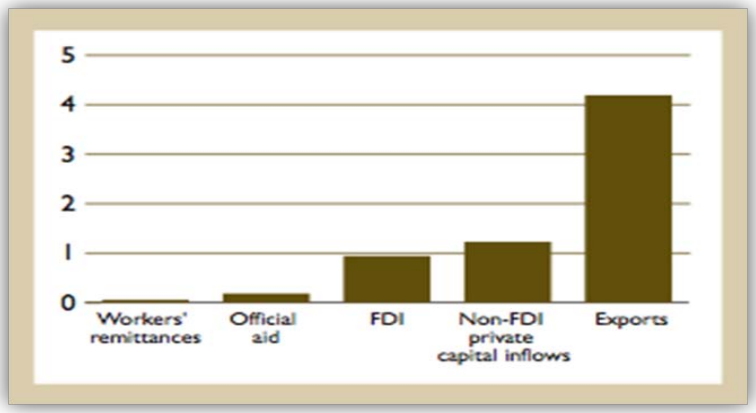
(In millions of US dollars)	2001	2002	2003	2004	2005	2006	2007
Compensation of employees							
Credit	43,517	49,475	60,096	70,714	76,460	82,602	98,934
Debit	51,030	57,312	67,926	76,463	84,883	95,144	113,975
Global discrepancy	7,513	7,837	7,830	5,749	8,423	12,542	15,041
Workers' remittances							
Credit	81,168	93,410	112,693	126,007	153,009	180,715	237,396
Debit	67,612	77,829	81,465	91,780	99,853	117,259	135,748
Global discrepancy	–13,557	–15,582	–31,228	–34,228	–53,156	–63,457	–101,648
Sum of compensation of employees and workers' remittances							
Credit	124,686	142,885	172,789	196,721	229,469	263,318	336,330
Debit	118,642	135,141	149,391	168,242	184,736	212,403	249,72
Global discrepancy	–6,043	–7,745	–23,398	–28,479	–44,733	–50,915	–86,608

Source: IMF's Balance of Payments Statistics Yearbook 2008

According to Buch and Kuckulenz (2004), remittances provide a stable inflow of money to the receiving country, compared to other private capital inflows and official assistance (Figure 2). Chami(2008) presented the World Bank and IMF's data on volatility of

inflows for developing countries in period 1980-2003, which reveals that volatility of official aid was as three times as volatility of workers' remittances during observed period (Figure 2).

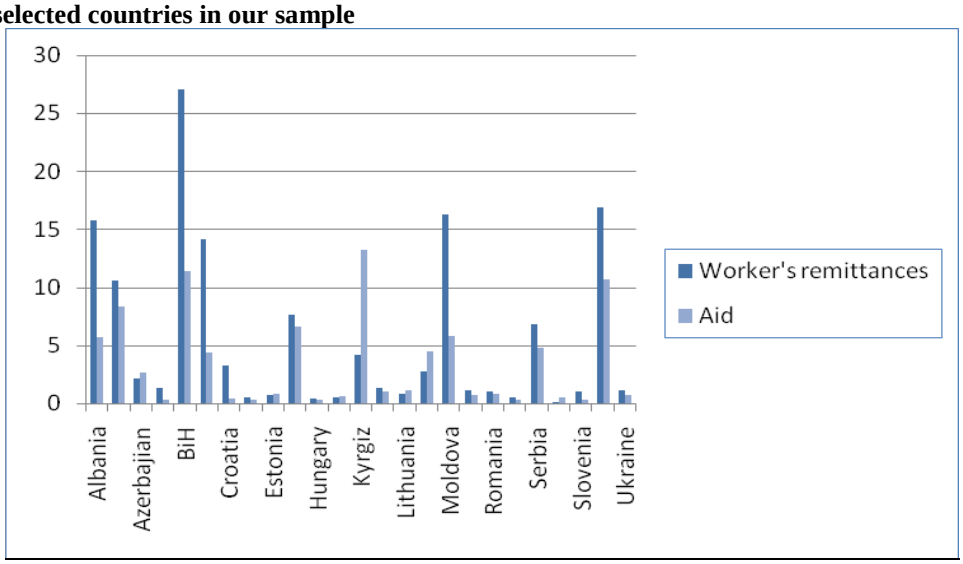
Figure 2. Volatility of inflows to developing countries , 1980-2003



Sources: World Bank (2006) and IMF(2005)
Notes: Volatility is defined as the standard deviation of the detrended ratio of each variable to GDP

The same trend regarding importance of remittances is observed in our sample. On average, in the period 1995-2007, the remittances were far more important than aid in the most of the countries in our sample (Figure 3).

Figure 3. Average value of worker's remittances and aid expressed as % of GDP for 1995-2007 for selected countries in our sample



Source: World Bank Development Indicator (WDI) database (2008) and author's calculation

There is considerable variation in the measure of remittances among the countries in our sample for observed period. For the entire study period from 1995 to 2007, the standard deviationof the average worker's remittances and employee's compensation across countries in sample ranged from 0.44 in Slovak Republic up to 12.72 in Tajikistan.

Overall, examination of the magnitude of the ratio of remittances to GDP in transition countries reveals their importance for economies. Although remittances have not been equally important for all countries, they help stabilizationof a number of transition economies and

positively affect countries' macroeconomic performance in general and domestic investment in particular. Hence, inclusion of the remittances in our model is logical step in the analyses.

4. MODEL ESTIMATION AND THE MAIN FINDINGS

4.1. The model

Following previous discussion, model (2) is a model to be estimated: [5]

$$\left(\frac{I}{Y}\right) = \alpha + \beta_1\left(\frac{S}{Y}\right) + \beta_2 T + \beta_3 T\left(\frac{S}{Y}\right) + \beta_4\left(\frac{EX+M}{Y}\right) + \beta_5\left(\frac{A}{Y}\right) + \beta_6\left(\frac{R}{Y}\right) + \beta_7 EU + u \qquad (2)$$

where I/Y is gross national investment to GDP ratio, S/Y represent gross national savings to GDP ratio, (EX+M)/Y is sum of export and import to GDP ratio, A/Y is aid to GDP ratio, R/Y is remittances to GDP ratio, T is time dummy and EU is EU dummy accounted for the countries join EU.

It is a priori expected that the coefficient on the savings rate will be positive, but declining through time, which should be reflected in a negative coefficient on the interaction between the time dummy-savings rategiven the common view that capital mobility has been increasing. This is in line with a recent comprehensive survey of the vast empirical literature on FH puzzle by Apergis and Tsoumas (2009) who conclude that the majority of the empirical studies indicate a declining savings coefficient that opposes the original strong FH results but found that the correlation still exists in a weaker form.The ability of capital to move is greater in more open economies and hence coefficient on openness proxy is expected to be positive.Feldsten and Horioka (1980) also argue that it is likely that small economies which engage in substantial international trade have a much weaker link between domestic saving and domestic investment than the large ones, but they do not test for this proposition. Stockman and Tesar (1995) note that countries with greater ability to trade internationally have less strong relation between production and consumption and greater response of investment to change in rate of return. Foreign aid and similarly remittances are also expected to have a positive impact on investment rates. Membership in EU is expected to have positive effect on investment as well.

4.2. Data description

We use the a data set for 27 transition economies in Europe and Central Asia extracted from the World Bank Development Indicator (WDI) database(2008). Variables Y, S, I, EX and IM are provided directly in WDI. We used net official development assistance and official aid as a proxy for a variable aid in our model, while the series remittance is obtained from workers' remittance and employees' compensation. Since the availability and quality of economic data for transition economies from local sources is problematic, the consistency of the data in WDI was a prime reason for choosing this international database rather than national statistics to be the main data source. For 25 countriesanalysed, the longest period of consistent data with annual frequency is 1995-2007.Although the rest of the countries do not have data for the whole period in a consistent form, we usethese data as well yielding

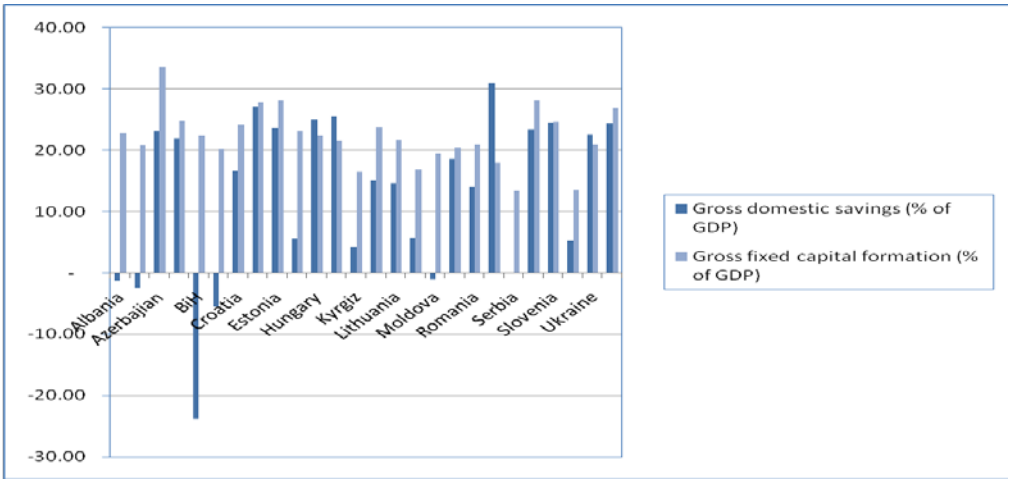
[5]Empirical estimation of the model will be provided in the next section

unbalanced panel, with limitedyears for the following countries: Czech Republic, Estonia, Kyrgiz and Latvia from 1995 to 2006 and Serbia from 1997 to 2007.

The capacities to save and invest (along with other factors such as the efficiency of investment) are broad indicators of the success of economic policies. By these measures, the majority of the EU members since 2004 (primarily Czech Republic, Estonia and Slovenia) and some of the Commonwealth of Independent States (CIS) countries such as Azerbaijan and Armenia, have been the most successful of the transition economies in our data set.Armeniarecorded remarkable success in this regard, boosting its savings/GDP ratio from -19.8 % in 1995 to 19.2% in 2007 and its investment/GDP ratio from only 16.2 % in 1995 to 33.3 % in 2007, i.e. changes of 38.58 and 17.1 percentage points.

The data on savings and investment reflects the unstable conditions on the transition markets and the external shocks affecting some countries, such as war in former Yugoslavia. It is expected and often confirmed that investments are higher than saving rates for individual countries and it is likely that this could be due to foreign aid or remittances (McKinley, 2004). Investment is higher than the saving rate on average for most countries (20 countries out of 25) in our sample.One of the recipients of substantial foreign aid and remittances, Bosnia and Herzegovina (B&H), the country with the most damaged economy after the war in former Yugoslavia, has far the highest negative rate of savings among countries in the sample, indicating that total spending is more than the total income. While the level of national income in B&H is moderate and highly vulnerable to external shocks, at the same time B&H has the highest ratio of foreign aid and remittances to GDP.

Figure 5. Average value of gross domestic saving and gross domestic investment to GDP ratio for 1995-2007 for selected countries



Source: World Bank Development Indicator (WDI) database (2008) and author's calculation

Data on remittances, like other components of the balance of payments statements, arecompiled by relevant statistical authorities in member countries (typically the central bank ornational statistical office). In order to be consistent in data sources, we use WB categories,data on worker's remittancesand compensation of employees, as a proxy for remittances in our model. The WB measures only workers' remittances and compensation of employees, which comprise the current transfers by migrant workers and salaries earned by nonresident workers and are drawn mainly from IMF resources, complemented by WB staff estimates.Reinke (2007) explained that many weaknesses of existing data on remittances primarily arise as a result of the incomplete coverage of transactions, variation of reporting

practice (such as the difference in the time of recording transactions) and the different interpretation of definition between countries. Since large numbers of remittances are not transferred through the formal banking system, especially in less developed countries such as transition countries, it is likely that the data are underestimated. Some transactions, such as financial assistance provided from migrants during their visits to their home country, are not sufficiently covered by customs data and they could be substantial where large migrant flows occur.Data could also be overestimated when imports and the amount temporary employees spend in their countries of employment are misidentified as a remittances. Balance of payment statistics show, under the compensation of employees, the remuneration paid by resident companies to nonresident employees and remuneration received by residents from nonresident employers. However, a part of these earnings is likely to be spent in the host economy and will therefore not accrue to the home economy as net income. Hence, at best the figures can only be regarded as estimates.

4.3. Estimation of the model

A priori, since a pooling model cannot control for unobserved country-specific heterogeneity, it seems appropriate to use a panel data estimation technique. Theory argues that since panel estimation techniques incorporate both time-series and cross-section dimensions of the data and increase the degrees of freedom of the estimator, collinearity among regressors is decreasedand coefficient estimates are more reliable in a panel context (Hsiao, 2003). The formal test explained further in Section 4.3.1 supports the view that panel estimation is more appropriate for our model.

4.3.1. Static estimation

We apply OLS and static panel estimation technique, fixed effects (FE) and random effects (RE) models. The model to be estimated is:

OLS (Without Group Dummy Variables)

$$\left(\frac{I}{Y}\right)_{it} = \alpha + \beta_1\left(\frac{S}{Y}\right)_{it} + \beta_2 T + \beta_3 T\left(\frac{S}{Y}\right)_{it} + \beta_4\left(\frac{EX+M}{Y}\right)_{it} + \beta_5\left(\frac{A}{Y}\right)_{it} + \beta_6\left(\frac{R}{Y}\right)_{it} + \beta_7 EU_{it} + u_{it}$$

One-way FE model:

$$\left(\frac{I}{Y}\right)_{it} = \alpha_i + \beta_1\left(\frac{S}{Y}\right)_{it} + \beta_2 T + \beta_3 T\left(\frac{S}{Y}\right)_{it} + \beta_4\left(\frac{EX+M}{Y}\right)_{it} + \beta_5\left(\frac{A}{Y}\right)_{it} + \beta_6\left(\frac{R}{Y}\right)_{it} + \beta_7 EU_{it} + u_{it}$$

One-way RE model :

$$\left(\frac{I}{Y}\right)_{it} = \alpha + \beta_1\left(\frac{S}{Y}\right)_{it} + \beta_2 T + \beta_3 T\left(\frac{S}{Y}\right)_{it} + \beta_4\left(\frac{EX+M}{Y}\right)_{it} + \beta_5\left(\frac{A}{Y}\right)_{it} + \beta_6\left(\frac{R}{Y}\right)_{it} + \beta_7 EU_{it} + (\varepsilon_{it} + u_i$$

It is expected to observe country-specific and time-invariant fixed factors and if those factors are correlated with domestic saving rates, the use of pooled data could provide a biased estimation of the retention coefficient. In the case of a fixed effect included in regression, any remaining unobserved heterogeneity that OLS does not control for will be captured within the panel framework (Younas, 2007). While FEmodels capture country-specific effects with α_i, that do not change over time, REincorporates heterogeneity among the countries by including

a specific non-observable effect (ε_{it}) in the error term. Specification testing for effects versus OLS (LM and Likelihood ratio test) indicates that the effect models, fixed(FE) and random effects(RE) are preferable to OLS with probability of 0.000 of making type I error if we reject the H_0 that group effect is constant with no variance between groups. The result of the Hausman test indicates that regressors are uncorrelated with random errorand that not just FE, but also RE, is consistent and could be used for estimation(Table 2.).

Table 2. LM, LR and Hausmantest for model (2)

Specification tests	Theoretical distribution	Computed value	p- value	H_0 of the test
LM	$\chi^2_{1\ d.f}$	272.64	0.000	The group variance is zero
Likelihood	$\chi^2_{13\ d.f}$	18.12	0.000	The group effects is constant
Hausman	$\chi^2_{8\ d.f}$	7.37	0.497	Random effects u_i and regressors are uncorrelated

Since theHausmantests do not explicitly suggest which effects model, FE or RE, is preferred, our choice of FE model has several rationales. While RE properties are asymptotic, FE is preferred for small and moderate sized samples, which applies in our case. An emphasized disadvantage of the FE estimates, that inference is restrictedtothe set of cross-section units included in the estimation (Maddala, 2001), is not of concern as we are not interested in making inference for the countries outside our sample. Hence, our further inference relies on the results of the FE estimation.

4.3.2. Estimation procedure and the main findings

Firstly we estimate FE model with default standard errors. Although the results of the Wald test of joint significance of independent variables indicate that all independent variables, except the EU dummy and the saving-interaction term, have explanatory power with t-statistics showing individual significance at the conventional 1% and 5% level of significance, the result of the diagnostic tests raises doubts about coefficient validity. Serial correlation and heteroskedasticity of any kind would make standard errors biased and FE estimation inefficient and hence, we must consider estimation that takes those characteristics into account.

Hence, we estimate model with robust standard error in order to correct the standard errors for this heteroscedasticity. The revised estimates change the significance for aid, trade and trend (shaded area in Table 3), indicating the existence of heteroscedasticity within the cross-sectional units in our model. Heteroscedasticity in panel data could arise from unequal variance of error term across cross-sectional units, which is known as groupwiseheteroscedasticity(Baum, 2001). The highly significant result of test for groupwiseheteroscedasticityinfers that the variance of the error term differs across cross-section units given the p-value of 0.000. The autocorrelation coefficient (ρ) of 0.44 is larger than 0.3, Gujarati's(2003) suggested "rule of thumb" value above which there is an indication of the problem of serial autocorrelation. That there is such a problem is supported by the Wooldridge test of autocorrelation which gives a 0.000 % probability of make Type I error if we reject the hypothesis of no autocorrelation. In macroeconomic relations such as investment-savings, it is likely that unobserved shock in current period will affect the relationship for at least the next few periods (Baltagi, 2008). Kezdi(2003) notes that practitioners have been ignored serial correlation consistent standard error estimators for panel models, although they were developed for FE models by Kiefer (1980), Bhargava et al.

(1982), and Arellano (1987). He further argues that lack of use is likely to be attributed to possible finite-sample bias of the robust estimators. However, assuming no serial correlation when it is present results in a larger bias than the finite-sample bias of the robust estimators at any sample size.

Kezdi(2003), Wooldridge(2003, 2006) and Stock and Watson (2008) argues that the "clustered" estimator in fixed effect estimation accounts for within-panel correlation and is robust to heteroscedasticity. Nichols and Schaffer (2007) explain that FE, cluster-robust estimation firstly partial-out thefixed effects and then use the cluster-robust estimators to account for any remaining within-groupcorrelation. Studies indicate consistency and good finite sample properties of estimation. Possible problems of cluster robust errors are mainly related to the number of clusters needed for reliable inference. Monte-Carlo simulation provided by Kezdi (2003) shows that "cluster" estimates have less power in a smaller sample, but are not weaken with an increase in the time-span of the data. On the other handRogers (1993) infers that if clusters have equal sizeand the largest cluster is 5% or less of the sample, cluster-robust estimates with a moderate number of clusters, such as 20, would suffer from a very small bias. Since we have moderately number of clusters (25), with very similar cluster size, we use the FE cluster-robust model, as a model for our further inference, but we report the estimated coefficient of all techniques utilized to indicate changes in standard errors and hence in the significance of variables (Table 3.).

Table 3. Comparison of p-values estimated by robust and non-robust one-way FE model

Dependent variable: INVEST						
Independent variables	Non-robust one-way RE		Robust one-way FE		Cluster robust one-way FE	
	Coefficent	P-value	CoefficentP-value		Coefficent	P-value
CONSTANT***	11.732	0.000	11.732	0.000	11.732	0.008
SAVINGS**	0.201	0.000	0.201	0.000	0.213	0.000
TRADE*	0.063	0.003	0.063	0.169	0.063	0.169
TREND**	0.226	0.056	0.226	0.090	0.226	0.158
SAVTREND**	-0.006	0.120	-0.006	0.274	-0.006	0.380
EU	-1.046	0.120	-1.046	0.244	-1.046	0.332
AID	-0.202	0.044	-0.202	0.068	-0.202	0.134
WBREMIT	0.317	0.000	0.317	0.001	0.317	0.001

Goodness-of-fit in panel models is uncommon and is not appropriate to use as criteria for the choice between estimators (Verbeek, 2008). The estimate of autocorrelation coefficient (0.54) suggests that slightly more than a half variation in investment is related to intercountry differences in investment rates. The F test following the regression indicates that there are significant individual (country level) effects, implying that pooled OLS would be inappropriate.The correlation matrix (Table 4.) does not indicate with problems of highly correlated regressorsas the correlation coefficients on the variables are not higher than tolerance value of 0.8.

Table 4.Correlation matrix of coefficients of the model

e(V)	savings	trend	savtrend	aid	wbremit	trade	eu	_cons
savings	1.0000							
trend	0.1421	1.0000						
savtrend	-0.2019	-0.7102	1.0000					
aid	0.4904	-0.0040	-0.0608	1.0000				
wbremit	0.2830	-0.1477	-0.2125	0.3326	1.0000			
trade	-0.2234	0.1514	-0.5684	-0.0192	0.1570	1.0000		
eu	0.0585	-0.1456	0.2404	0.1962	0.0747	-0.2840	1.0000	
_cons	0.0276	-0.2763	0.6281	-0.1712	-0.2543	-0.9623	0.2296	1.0000

The independent variables joint have explanatory power in explaining investment, but not all are individually significant. Saving and remittances are highly significant at 1% level and have the expecteda priori positive effect on the investment rate (Table 3).The size of the retention coefficient is smaller compared to the original FH results and in line with previous findings for less developed countries. Our variable of interest, remittances, has highly significant impact on investment in all models, which supports our argument that a significant portion of received remittances is directed toward investment in transition economies. All the other variables, aid, trade, trend, savtrendand the EU dummy, are insignificant.The negative sign of savings-trend interaction term indicate increasing capital mobility over time, which was also confirmed in previous studies. An EU dummy has not been introduced in previous literature, as since the EU members are more developed, it was expected that the membership in EU would bring more investment. The actual estimation has the opposite sing but is insignificant.

5. CONCLUSION

The Feldstein-Horioka puzzling results that indicate immobility of capital in developed OECD economies has not been confirmed in the majority of studies for less developed countries. Our investigation was primarily concentrated on the determinants of investments in the transition economies that could explain now conventional, puzzling Feldstein-Horioka results for transition economies. More recent studies recognized aid to be a factor and included it as an independent variable in the model. Observing the categories of the balance of payment in transition economies, remittances are a more important financial flow than aid. Hence, on the same basis as aid, we also included remittances in the model and our prime goal was to investigate its impact on investment and capital mobility in general.

Following the literature, we investigate our hypothesis by applying static panel estimation technique. Specification tests for the static panel models and the characteristics of our variables indicate fixed effect model to be preferred. However, the results of investigation for autocorrelation and heteroscedasticity indicate the problems and give rise doubts to the validity of the results. Following Kezdi(2003), Wooldridge (2006) and Stock and Watson's

(2008) proposition that fixed effect estimation with "cluster" standard errors is robust for these problems, we reported t-test based on these standard errors. We find a highly significant, positive effect of domestic savings and remittances on domestic investment.

The results seem to support the hypothesis of capital mobility among the economies in transition for the period 1995-2007. The evidence of high capital mobility among the countries in our sample (indicated by smaller absolute value of the savings coefficientcompared to the original FH results) seems to be consistent with the previous empirical findings for less developed countries. Including remittances in the model, gives an insignificant aid coefficient and a highly significant effect of remittances on investment, which supports our argument that a significant portion of received remittances is directed toward investment in transition economies.

Undoubtedly more research is necessary to examine level of capital mobility and its determinants for transition economies.We conducted our analyses using the best possible data on remittances available at this moment, but we acknowledge that there are some doubts on its quality.Due to acknowledge drawbacks in data on remittances, international organisations, such as IMF, have agreed on revision of the data. Hence, in the near future, it would be possible to obtain more quality analyses with the new, revised data. Generally for transition economies, the limited possible cross section and a short time span of data gives a relatively small sample and revision of the data and greater coverage of countries could result in better estimates in the future.Short span of data in transition economies limits application of time-series methods. However, time-series estimation seems to be appropriate in the context of the model estimated as macroeconomic variables, such as savings and investment, are usually random walk-like variables. Hence, estimation method, such as group mean panel dynamic OLS (DOLS) suggested by Pedroni (2001), seems to provide more robust results and it should be included in a future research, when more data for transition will be available.

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LOG NOVČANIH POŠILJAKA U OBJAŠNJENJU FELDSTEIN-HORIOKA PARADOKSA: DOKAZI IZ ZEMALJA U TRANZICIJI

SAŽETAK

Razinu mobilnosti kapitala mjerimo slijedeći Feldsteinai Horioku (1980) koji kažu da mjerenje razmjera do kojeg su državne stope štednje i ulaganja korelirane, ukazuje na stupanj financijske integracije u svjetsku ekonomiju. I dok su neočekivano zaključili da postoji visok stupanj pozitivne korelacije između štednje i ulaganja u razvijenim OECD ekonomijama, kasnija empirijska istraživanja na uzorku manje razvijenih zemalja, pokazala su manju korelaciju štednje i ulaganja. Koncentrirajući se na odrednice ulaganja u tranzicijska gospodarstva koje bi mogle objasniti sada konvencionalne, zbunjujuće Feldstein-Horioka rezultate za tranzicijska gospodarstva, bili smo prvi koji su razmotrili novčane pošiljke kao moguće objašnjenje. Rezultati panelne analize idu u prilog hipotezi o mobilnosti kapitala u tranzicijskim gospodarstvima za period od 1995-2007. Vrlo značajan učinak novčanih pošiljaka na ulaganja podržava našu tvrdnju da je značajan udio primljenih novčanih pošiljaka usmjeren ka ulaganju u tranzicijska gospodarstva.

***Ključne riječi**: mobilnost kapitala, Feldstein-Horiokazagonetka, novčane pošiljke, tranzicijska gospodarstva*

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OVERVIEW AND ESTIMATION OF THE 2008 FINANCIAL AND ECONOMIC CRISIS 'EFFECT SIZE' ON SME CAPITAL STRUCTURES: CASE OF SLOVENIA

ABSTRACT

Myriad factors have been identified to impact a company's capital structure. However, the majority of academic interest is focused on the internal (company) determinants of capital structure, and much less on external environment determinants, such as restricted access to financial resources; especially for micro, small and medium-sized companies (SMEs). As a small country, and member of the EU and Eurozone, Slovenia provides an ideal setting for the study of the impact of the 2008 financial and economic crisis on the capital structures of SMEs; especially given the dominance of the banking sector, as the prime financing vehicle for companies. In this context we employ a novel power analysis estimation approach in the literature, employing Cohen's d and McGraw-Wong's common language (CL) effect size statistics. We analyzed the capital structures of Slovenian SMEs between 2006 and 2009. Our study shows that SMEs were unable to tap into "soft budget constraints" made available by the banking sector to large companies, and have been correspondingly harder hit by the crisis.

Keywords: *SMEs, Capital structures, 2008 crisis, Power analysis, Cohen's d statistic, CL effect size statistic, Slovenia.*

JEL keywords: *G01, G21, G32, O16, C18.*

1. INTRODUCTION

The question of optimal company capital structure – not just a mixture of equity and debt, but also their types used to finance company assets – has been at the forefront of academic interest for over 50 years. So far, myriad factors have been identified, including (but not limited to): *company size*, *profitability*, *liquidity*, *asset structure* and *growth opportunities*. In this context, the majority of academic interest is focused on the internal (company) determinants of a company's capital structure, and much less on external environment determinants (constraints), such as restricted access to financial resources; especially for micro, small and medium-sized companies (now on denoted as SMEs) (Rouse & Jayawarna, 2006). In this regard, some describe SMEs as the *"disadvantaged real sector"* (Rouse & Jayawarna, 2006, p. 389), while others believe them to be *"financially frustrated"* (Vos et al., 2007, p. 2649). In addition, there is many anecdotal evidence that SMEs are the prime victims

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of the so called *"credit crunch"*, especially in times of financial crises (European Commission, 2009). However, despite a plethora of such anecdotal evidence, systematic and detailed empirical studies of this problem are extremely rare; especially in transition countries.

Both institutional policy makers (e.g. European Investment Fund, European Investment Bank, World Bank, International Monetary Fund, OECD etc.) and the scientific literature (e.g. Storey, 1994; Berger & Udell, 1998; Gregory et al., 2005; Beck & Demirgüç-Kunt, 2006; Vos et al., 2007; Beck, Demirgüç-Kunt & Maksimovic, 2008 etc.) recognize a mismatch between the supply of quality-at-affordable-price financing, and the need (demand) for such financing among companies in the market. This discrepancy, often referred to as the *financing gap*, is thought to be most prevalent among SMEs, which correspondingly tend to display most sub-optimal capital structures (Ang, 1992; Avery, Bostic & Samolyk, 1998; Berger & Udell, 1998; Rouse & Jayawarna, 2006; Claessens & Tzioumis, 2006). The emergence of these financing imperfections is thought to be particularly prevalent in developing and transitional countries with poor legal environment, higher levels of corruption and lower level of financial development (La Porta et al., 1997; Demirgüç-Kunt & Maksimovic, 1998; Rajan & Zingales, 1998); particularly in Central and Eastern Europe (Pissarides, 1999; Nivorozhkin, 2005).

Haas, Ferreira & Taci (2010; *cf.* Berger & Udell, 2002; Petersen & Rajan, 2002) also emphasize the issue of *bank ownership* in transition environments, where foreign ownership is frequently prevalent. Namely, according to Haas, Ferreira & Taci (2010); Berger, Klapper & Udell (2001), and Berger et al. (2008) compared to foreign banks *"domestic banks tend to have a deeper understanding of local businesses and base their decisions on the 'soft' qualitative information that is available on local and smaller firms with whom they develop long-term relationships"* (Haas, Ferreira & Taci, 2010, p. 389). Also importantly, foreign-owned banks, even smaller ones, usually rely on more standardized and formal client evaluation procedures, taking into account "harder", rather than "softer" client information; particularly related to SMEs (Hass, Ferreira & Taci, 2010). Furthermore, Haas, Ferreira & Taci (2010) point to very *"heterogeneous levels of legal creditor protection"* in transition environments, which coupled with a less efficient legal environment (La Porta et al., 1998) influence the *"lending composition"* in these countries (Haas, Ferreira & Taci, 2010, p. 390). All these issues in turn aggravate the issue of SME financing in transition and developing countries, relative to other developed countries, and imply even larger policy challenges.

Interestingly enough, a study of company's capital structures across 39 countries by Fan, Titman & Twite (2003) has shown institutional 'endowments' to be a significantly higher predictor of company's capital structure, relative to other factors, even industry affiliation (Beck, Demirgüç-Kunt & Maksimovic, 2008). This link has not only been established on the micro level, in terms of capital structures (Berger & Udell, 2006), but also on the mezzo level, in terms of the development of various industries (Carlin & Mayer, 2003), and macro level, in terms of investments (Wurgler, 2000; Love, 2003) and economic growth (King & Levine, 1993; Levine & Zervos, 1998; Beck, Levine & Loayza, 2000). This makes the financial gap *"an important policy challenge"* (OECD, 2006, p. 10).

The primary goal of the paper is to analyze how micro, small, medium sized and large companies have been able to 'cope' and 'adjust' their capital structures to worsened financial conditions (credit crunch, and related impaired access to finance), and economic conditions (pressures related to inventory, liabilities and net working capital) in the period between 2006 (pre-crisis) and 2009 (during crisis). In this regard, we use a novel power analysis methodological approach, to estimate the "effect sizes" of the crisis.

This paper addresses not only a growing interest in SME financing (gaps), and SME capital structures (Parker, 2002; Cressy, 2002), but also responds to the call of the European Investment Fund (2008) and OECD (2006) to develop a *'practically-oriented'* assessment approaches in these areas, despite the illusiveness of estimating such a gap (Vasilescu, 2010). The paper narrows an empirical gap in the literature related to SME financing, and SME financing in transition countries. In doing so, it introduces a novel *power analysis* methodology (Breaugh, 2003; Cohen, 1992) to estimate the *effect size* of the current financial and economic crisis on (particularly) the SME financing and capital structures. To the best of our knowledge, such a methodological approach, with its origin in psychometry, and marked by a recent emergence in the management literature (Breaugh, 2003), has never been employed in this area of the financial and economic literature.

2. THE SLOVENIAN FINANCIAL SYSTEM AND SME CAPITAL STRUCTURES

As a small, developed new EU member state, and member of the Eurozone and OECD, Slovenia provides an ideal setting for the study of the impact of the 2008 financial and economic crisis on the capital structures of SMEs; especially given the dominance of the banking sector, as the primary financial vehicle for SME financing. Furthermore, *access to finance* is the most problematic impediment to doing business in Slovenia (World Economic Forum, 2010). At the same time Slovenia is among the countries with one of the highest required level of collateral for a bank loan, where an average loan has to be secured with appropriate collateral of over 145 per cent (World Bank, 2007). The World Bank's *Doing Business Survey* (2010) ranks Slovenia in 116th place out of 183 countries in terms of the *"ease of getting a business loan"*. According to the company-level data and analyses conducted by Beck, Demirgüç-Kunt & Maksimovic (2008)[3] Slovenia's share of external financing is only 38.55 per cent (compared to e.g. Estonia: 60.14 per cent; Italy: 77.71 per cent and Poland: 58.60 per cent). All these international benchmarks indicate a highly impaired access to financial resources in Slovenia, with profound implications for the competitiveness of the Slovenian economy. This is in our opinion further complemented by Slovenia's high level of uncertaincy avoidance within the Hofstede (2001) typology, providing a strong support also for the prevalence of the *pecking order theory* in SME financing.

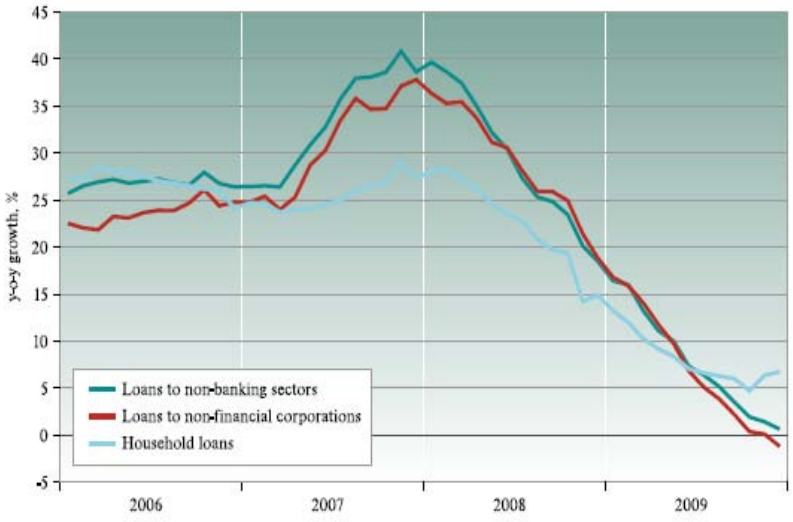
Following the German-based financial system the banking sector in Slovenia is the main financial vehicle for all companies. According to the Bank of Slovenia (2009) the

[3] Data taken from the World Business Environment Survey (WBES); 80 per cent of respondent companies were SMEs. See Beck, Demirgüç-Kunt & Maksimovic (2008) for more details.

banking sector had a 99.3 per cent share in the Slovenian financial market at the end of 2008. In 2009 the total assets of the banking sector represented 147 per cent of Slovenia's GDP (Bank of Slovenia, 2010a). The market share of top five banks in 2009 was little over 60 per cent, with the main state-owned bank (NLB bank) having the biggest (30.2 per cent) market share; although steadily falling each year. Total bank loans to non-banking sector in 2009 amounted to 65.6 billion EUR (or 85.5 per cent of all loan activity). Total loans to the business sector amounted to 38.9 billion EUR or about 59.3 per cent of all loans by Slovene banks to non-banking sector (Bank of Slovenia, 2010b). In terms of the situation in the Slovene banking sector by the end of 2009 Figure 1 best displays the impact of the 2008 global financial crisis on the Slovene banking, and its lending to non-financial institutions.

As depicted in Figure 1 the credit crunch in the Slovene banking sector manifested itself in a severe downturn of loans to the private sector, as well as to households and non-financial institutions. In 2009 the growth in bank loans to non-financial corporations completely ceased. According to the Bank of Slovenia (2009) decline in lending growth was more pronounced in foreign-owned banks and large domestic banks, which controlled a good third of the market in Slovenia (Feldin et al., 2009). This provides an alternative perspective to the evidence from Yilmaz & Koyuncu's (2010) fixed effect multivariate panel logit econometric model for transitional economies in the period 1990-2006, where the authors have shown that the rate of foreign bank participation decreases the occurrence of banking crises in transition economies; which seems to hold only for "local" banking crises.

Figure 1: Yearly growth in bank loans to non-financial institutions in Slovenia



Source: Bank of Slovenia: Annual Report 2009.

Demirgüç-Kunt & Maksimovic (2002) performed an extensive 40-country study, and showed that a bank-dominated financial system is more prone towards short-term financing, while the market-based financial system is more inclined towards longer-term financing. However, the authors concluded that the empirical data in their study does not directly show the level of access to external financing significantly varying between the two systems, but rather impacts the capital structures of companies; particularly SMEs. In Slovenia, however,

both the European Investment Fund (2008), as well as the SID export and development bank (2009) generally identified a strong prevalence of the financing gap, and its widening under the current financial conditions. Also, the existence of sub-optimal financing structures of SMEs in Slovenia has been previously empirical established by Berk-Skok & Lončarski (2008).

Other studies of dyadic bank-SME financing relationships have shown that these relationships are characterized by profound rigidities and very high levels of standardization, rather than flexibility, not tailored to the specifics of individual SMEs (Silver & Vegholm, 2009). This clearly shows that the banking sector is not servicing the SME sector in the most optimal and marketing-oriented way, which may in turn impede access to finance for certain segments of SMEs. Other authors have made a clearer evaluation of the insufficiency of lending to SMEs (Bartels, 2002), which may be *"leading to sectoral competitive disadvantage"* (Carey & Flynn, 2005, p. 713).

3. HYPOTHESES DEVELOPMENT

Despite the acknowledgement and importance of the SME financing gap, many believe this gap to be *"immeasurable"* (JEREMIE, 2007; Vasilescu, 2010). While Claessens & Tzioumis (2006, p. 8) stress *"the absence of a unified conceptual framework for data collection"*, with most collected data being of *"ad hoc nature, with varying definitions over time,"* the European Investment Fund and its JEREMIE program believe *"the primary challenges are in the form of data availability and the feasibility of measuring the gap between current supply and potential demand"* (JEREMIE, 2007, p. 25). Further elaborating on this, Vasilescu (2010, p. 58-59) also points out that: *"In fact, one fundamental problem in dealing with the SME financing gap is lack of basic information about just how big such a gap may be. Often the only evidence is in the form of complaints from SMEs themselves, and this is difficult for analysis or comparison."* Despite this issue, there is still a need to develop *"proactively-oriented"* estimation approaches (JEREMIE, 2007, p. 25). This paper contributes to the existing literature by providing a practically-oriented approach to SME financing gap effect (size) estimation, with a specific focus on the current financial and economic crisis, and its impact on SME capital structures.

3.1 COMPANY SIZE AS A KEY FACTOR AFFECTING CAPITAL STRUCTURES

Sub-optimal capital structures are thought to be most apparent among SMEs for a number of reasons. On the supply-of-funds side, the reasons for this lie first-and-foremost in information asymmetry (Vos et al., 2007), due to low (financial) transparency of SMEs, their lack of credit history and track records (Fraser, 2004; Claessens & Tzioumis, 2006). In addition, agency cost issues, harder assessment of risk and costly monitoring, parallel with higher volatility and lower survival rates of SMEs (Storey, 1994) also affect the supply of funds. As we already emphasized, the legal and institutional frameworks have an important role (Beck, Demirgüç-Kunt & Maksimovic, 2008), accompanied also by the structure of the financial system, i.e. bank and/or market-based financing (Beck, Demirgüç-Kunt & Maksimovic, 2008). These latter issues are particularly important in transition countries.

Storey (1994) also points to the (limited) level of competition among banks in a market, as a possible source for the supply side of the SME financing gap, while Berger & Udell (2006) point to the level of so called *"transaction technologies"* in banking, which influence transaction costs of lending to SMEs. Koutsomanoli-Filippaki, Margaritis & Staikouras (2009) further point to the ratio between foreign-owned and domestic banks (where foreign-owned banks tend to be more efficient), while Feldin et al. (2009) have also shown foreign-owned banks to be more flexible in terms of their banking strategies, in order to attract new clientele, including SMEs.

On the demand-for-funds side the following factors are thought to influence capital structures of SMEs: lack of economies of scale in SMEs' operations (Tether, 1998); lack of collateral (Fraser, 2004); inseparability of the owner's and company's financial position (Berger & Udell, 2006); lack of experience and know-how (Berger & Udell, 1998); limited human resources (Rašković et al., 2011); higher personal involvement and desire for control (Cosh & Hughes, 1994; Hamelin, 2011); pecking order theory (Hussain, Millman & Matlay, 2006; Beck, Demirgüç-Kunt & Maksimovic, 2008); lack of information and knowledge about existing financing sources (Fraser, 2004); lower involvement in various social networks (Vos et al., 2007); and different business objectives, compared to large profit and growth-driven companies (Vos et al., 2007; Curran, 1986; Hakim, 1989). As pointed out by Park, Lim & Koo (2008) there are conflicting views on the main reason for the existence of the SME sub-optimal capital structures, with some emphasizing more the supply-of-funds side and others more the issues on the demand-for-funds side. However, one thing is for sure: SMEs' capital structures are different compared to capital structures of large companies.

3.2 CAPITAL STRUCTURES IN THE CONTEXT OF A FINANCIAL AND ECONOMIC CRISIS

In times of a financial crisis the supply-of-funds side conditions worsen, leading to decreased bank lending (Brunnermeier & Pedersen, 2005), emergence of a "credit crunch" (Berger & Udell, 1998; Peek & Rosengren, 1995; Berger & Udell, 2006; Blalock, Gertler & Levine, 2008), and fueled by higher levels of perceived risks and volatility of the market. As outlined by Goodhart (2005) cyclical bank loan supply goes hand-in-hand with the cyclicality of economic growth, mainly due to risk-based capital requirements (Nier & Zicchino, 2006). Furthermore, Diamond and Rajan (2005) also confirm that the level of increased borrower default impacts bank loan supply in worsened economic conditions. On the other hand the prolongation of outstanding payables and soft budget constraints (Blalock, Gertler & Levine, 2008; Koutsomanoli-Filippaki, Margaritis & Staikouras, 2009), as well as payer default actually increases the importance of working capital in times of economic downturn, further increasing the demand. Therefore, our study tests the following two hypotheses:

H1: The current financial and economic crisis has lead to a greater mismatch between supply-of-funds and demand-for-funds (financing gap), affecting capital structures of all companies in Slovenia.[4]

H2: With the onset of the current financial and economic crisis the SMEs ' capital structures have been notably more affected by the widening of the financing gap, since they could not adequately increase their bank financing and/or secure favorable trade credit, compared to large companies.

While Blome & Schoenherr (2011) have shown the emergence of increased supply chain pressures, and the emergence of supply chain risks in a time of economic crisis, Love, Preve & Sarrina-Allende (2007) have shown companies increasing pressures for trade credit in a credit-crunched economic crisis after math (Petersen & Rajan, 1997; Fisman & Love, 2003). However, contrary to an idealized redistribution belief how such financing externalities are passed on from "stronger" (e.g. large) companies to "weaker" (e.g. SMEs) companies (Meltzer, 1960), we believe companies to be disproportionately affected by such shifts from credit to trade financing, where large companies utilize their considerable market power over SMEs.

4. DATA SET AND RESEARCH METHODOLOGY

Each Slovenian company, regardless of its size, has to file an annual financial statement to the Agency of the Republic of Slovenia for Public Legal Records and Related Services (AJPES), in order to meet the legal requirement of a public presentation of their business performance, as well as for tax and statistical purposes. As the nature of non-profit organizations and financial companies significantly differs from the rest of the companies, we excluded them from our analysis. Our sample, obtained from the AJPES, therefore consist of all non-financial, profit oriented companies registered in Slovenia to conduct business between 2006 and 2009. In our effect size estimations insolvent companies (companies with negative equity) were additionally omitted from our analyses.

The paper employs a novel *power analysis* approach to the estimation of the so called *effect size* of the current financial and economic crisis (credit crunch) on the capital structures of Slovenian companies. While traditional significance testing from the beginning of the 20th century has been employed as the 'gold standard' for assessing "*weather the findings are important"* (Breaugh, 2003, p. 79), Kaufman (1998) points to the overreliance of significance *"as a major methodological issue of our generation"* (DeVaney, 2001, p. 310). Namely, statistical significance testing is strongly influenced by sample size, since large sample sizes a priori produce significant effects (DeVaney, 2001. A solution to this problem is the use of the so called *effect size* statistics, since according to Ziliak & McCloskey (2008) the primary interest of scientific comparison should be in the estimation of causal effect sizes, explaining

[4] Here we apply an indirect differential approach to the testing of this hypothesis, by comparing capital structure changes between 2006 and 2009.

both the amount and nature of the differences (Cohen, 1994). Cohen (1988, p. 9-10) describes effect size as *"the degree to which the phenomenon is present in the population."* This has lead to the emergence of the so called *power analysis* (Cohen, 1992), which has been gaining increasing employment in the scientific community (Rosenthal, Rosnow & Rubin, 2000; Breaugh, 2003).

A plethora of effect size statistics exist today (see Kirk, 1996), however they are most often divided into three groups: (1) based on standardized differences between group means, (2) based on measures of explained variance (Richardson, 1996), as well as (3) based on measures of association (Thompson, 1999).

In our power analyses we employed Cohen's *d* statistic (Cohen, 1988), as one of the most widely used and useful effect size measures in power analysis (Breaugh, 2003); since it allows for comparison across samples and variables with different variance, and tackling the issue of heteroscadasticity (Cohen, 1988). Therefore, the use of Cohen's *d* effect size statistic is superior to simple t-test significance testing, as it explains both the amount and nature of the difference, and is unbiased by sample size and differences in variance. Table 1 provides an overview of the formulas for Cohen's *d* and McGraw & Wong's CL effect size statistics.

Table 1: Cohen's *d* and McGraw & Wong's CL "effect size" statistics

Effect size statistic	Formula	Reference
Cohen's *d*	$d=(M_1 - M_2)/\sigma_{pooled}$ $\sigma_{pooled} = \sqrt{\frac{1}{2}(\sigma_1 + \sigma_2)}$	Cohen (1988); Cohen (1992); Cohen (1994)
McGraw & Wong's CL	Z score translated to a probability distribution: $Z_{CL} = \frac{M_1 - M_2}{\sqrt{Var_1 + Var_2}}$	McGraw & Wong (1992); Breaugh (2003)

Where noticeable (*d>0.2*) effect sizes have been detected[5], the paper also employs the *common language (CL) effect size statistics* by McGraw & Wong (1992), which is especially useful for interpretation of results, since it converts the effect size into a probability *"that a score randomly sampled from one distribution will be larger than a score sampled from a second distribution"* (McGraw & Wong, 1992, p. 361).

5. RESULTS

Table 2 shows that almost all (98.6 per cent) of Slovenian companies were SMEs at the end of 2009. Slovenian SMEs owned 42.8 per cent of total assets owned by companies in Slovenia, yet those assets are rarely financed by bank debt, particularly in micro Slovenian companies (92.5 per cent of the population), where only 29.08 per cent of them have some form of bank financing. Also, the share of bank debt financing, as percentage of total assets, for a median micro company, which was able to get some form of bank financing, is with 19.42 per cent about 1.5 times lower compared to the median for large companies (29.53 per

[5] According to Cohen's (1988) recommendations *d* values of 0.2 correspond to small effect sizes, 0.5 to medium effect sizes, and 0.8 to large effect sizes. Furthermore, the complexity of the observed phenomena should also be considered, when making final estimations of effect sizes.

cent). On the other hand, the majority of small, medium and large companies in Slovenia rely on bank debt financing, ranging from 72.48 per cent for small to 75.69 per cent for large companies.

Table 2: Slovenian SME demographics and financing patterns at the end of 2009

Size[6]	Number of companies	Number of employees	Total assets (in mn EUR)	Turnover (in mn EUR)	Percentage of companies with bank debt	Percentage of total assets financed with bank debt for a median company with bank debt
Micro	49,875	130,068	20,297.4	11,709.7	29.08%	19.42%
Small	2,475	75,141	12,823.2	9,219.3	72.48%	23.10%
Medium	790	76,768	11,534.8	10,112.4	72.78%	24.85%
Large	757	197,917	59,651.6	36,790.2	75.69%	29.53%
Total	53,897	479,894	104,307.0	67,831.6	32,37%	N/A

Source: authors' calculations, based on AJPES database, 2010.

This data is comparable with secondary data from Eurobarometer (SME access to finance in the new member states, 2006), which indicates that about 80 per cent of small and medium companies rely on bank debt financing in Slovenia.

5.1. EFFECT OF THE FINANCIAL AND ECONOMIC CRISIS ON LIABILITIES TO BANKS (SUPPLY-OF-FUNDS)

Table 3 displays a summary of long-term and short-term liabilities to banks, relative to all liabilities, for the period between 2006 and 2009. As can be seen from the data in Table 3 the share of companies using bank debt financing (regardless of the amount) decreased from 2006 to 2009 for all size categories, except small companies. The share of long-term and short-term bank debt financing (relative to total liabilities) remained fairly constant for micro companies, and increased mainly in the area of short-term financing for small, medium size and large companies. However, most obvious is the increase in long-term financing for large companies: from 5.85 per cent in 2006 to 9.82 per cent in 2009. Adding to this, Table 7 further on in the paper also displays, how large and medium companies were the only ones able to tap more heavily into bank financing in the face of worsened economic (and financial) conditions, particularly in the 2008-2009 period.

[6] Classification is based on the Slovenian Companies' Act. Micro companies meet at least two of these criteria: average number of employees does not exceed 10, revenue does not exceed 2 mn EUR, and value of assets does not exceed 2 mn EUR, followed by: small companies (employees < 50; revenues < 8.8 mn EUR; assets < 4.4 mn EUR); medium companies (employees < 250; revenues < 35 mn EUR; assets < 17.5 mn EUR); large companies (all other).

Table 3: Long-term and short-term liabilities to banks, relative to all liabilities, between 2006 and 2009 (median values)

Company size	2006			2007			2008			2009		
	All Slovenian companies											
	n	LT	ST	n	LT	ST	n	LT	ST	n	LT	ST
Micro	41407	0	0	44595	0	0	47488	0	0	49875	0	0
Small	1784	0.08%	3.49%	1980	0.33%	4.03%	2396	0.70%	4.47%	2475	1.35%	4.34%
Medium	745	0.64%	4.87%	803	0.79%	5.33%	768	0.61%	6.22%	790	0.85%	5.75%
Large	755	1.77%	6.91%	786	1.67%	7.36%	779	1.99%	8.83%	757	3.88%	8.68%
Company size	**Only Slovenian companies with bank debt**											
Micro	12149 (29.34%)	0	6.33%	13148 (29.48%)	0.32%	6.31%	14023 (29.53%)	0.03%	6.79%	14503 (29.08%)	0	6.83%
Small	1255 (70.35%)	6.92%	7.99%	1435 (72.47%)	5.96%	8.63%	1756 (73.29%)	6.32%	9.28%	1794 (72.48%)	8.06%	9.02%
Medium	546 (73.29%)	5.40%	9.18%	576 (71.73%)	6.09%	10.69%	561 (73.05%)	5.77%	11.12%	575 (72.78%)	7.67%	10.60%
Large	583 (77.22%)	5.85%	10.77%	593 (75.45%)	6.12%	11.84%	592 (75.99%)	6.05%	14.15%	573 (75.69%)	9.82%	13.65%

Notes: n = number of companies; LT = long-term liabilities to banks; ST = short-term liabilities to banks; number in brackets = percentage of companies that are using bank debt financing out of the whole population of sample companies in a given reference year.
Source: authors' calculations, based on AJPES database, 2010.

The results from Table 4 clearly show that all apart from micro companies increased their share of liabilities to banks (relative to their total liabilities) from 2008 to 2009. However, large companies secured considerably higher increases, compared to either medium or small companies.

Table 4: Total liabilities to banks, relative to all liabilities for companies, which have bank debt financing, between 2006 and 2009 (median values)

Year	2006		2007		2008		2009	
Size	**%**	**STLB**	**%**	**STLB**	**%**	**STLB**	**%**	**STLB**
Micro	29.34%	17.17%	29.51%	18.64%	29.55%	19.82%	29.08%	19.42%
Small	70.35%	20.36%	72.63%	21.22%	73.29%	22.28%	72.84%	23.10%
Medium	73.29%	18.37%	72.35%	21.90%	73.70%	23.20%	72.78%	24.85%
Large	77.22%	22.19%	75.95%	24.44%	76.25%	27.97%	75.69%	29.53%

Notes: % = percentage of companies that are using bank debt financing out of the whole population of sample companies in a given reference year; STBL= share of total liabilities to banks, relative to total liabilities.
Source: authors' calculations, based on AJPES database, 2010.

Particularly important, only the increase among medium and large companies (relative to other company sizes) in terms of the share of total liabilities to banks (relative to total company liabilities) is significant enough to be "captured" by Cohen's *d* effect size statistic (*d*

> 0.2) as shown in Table 5. All other changes, including decreasing shares for micro and small companies were not sufficiently large to be either statistically significant, or "captured" by the effect size statistics.

Table 5: Cohen's *d* and *CL* (in brackets) effect size statistics, based on median values, for share of total liabilities to banks, relative to total company liabilities of solvent companies, which have bank financing

Time period / Size	2006-2007	2007-2008	2008-2009	2006-2009
Micro	0.057	0.046	-0.014	0.091
Small	0.041	0.047	0.042	0.129
Medium	0.223	0.076	0.110	**0.397*** (57.9%**)
Large	0.122	0.179	**0.239*** (54%**)	**0.392*** (57.9%**)

Notes: Only companies with positive capital in a given reference year. * Noticeable effect size, with common language effect size statistics in brackets. **Where Cohen's *d* > 0.2 CL effect size statistics (in brackets) were calculated for interpretative purposes. Source: authors' calculations, based on AJPES database, 2010.

Looking overall at the increase of liabilities to banks (either long-term or short-term), relative to total liabilities for companies with bank financing, we can see even clearer that with the emergence of the 2008 financial and economic crisis, only large companies were able to significantly increase their shares of such liabilities to banks. Furthermore, in the whole 2006-2009 period only medium sized and large companies were able to considerably increase the share of liabilities to banks in their total liabilities, while micro and small companies were not able to do so. However, only large companies were able to considerably increase both the share of long-term and short-term liabilities to banks, as confirmed by Cohen's d effect size statistics in Table 6.

Table 6: Cohen's *d* and *CL* (in brackets) effect size statistics, based on median values, for long-term and short-term liabilities to banks, relative to all liabilities, only for solvent companies, which have bank debt financing

Time period	2007-2006		2008-2007		2009-2008		2009-2006	
Size	**LT**	**ST**	**LT**	**ST**	**LT**	**ST**	**LT**	**ST**
Micro	0.048	-0.001	-0.018	0.029	-0.003	0.008	0.027	0.037
Small	-0.068	0.050	0.021	0.050	0.106	-0.017	0.064	0.083
Medium	0.062	0.138	-0.063	0.053	0.189	-0.047	0.194	0.131
Large	0.026	0.076	0.006	0.155	**0.241*** (54%**)	-0.033	**0.274*** (54%**)	**0.209*** (54%**)

Notes: Only companies with positive capital in a given reference year; n = number of companies; LT= long-term; ST= short-term. * Noticeable effect size, with common language effect size statistics in brackets. **Where Cohen's *d* > 0.2 CL effect size statistics (in brackets) were calculated for interpretative purposes. Source: authors' calculations, based on AJPES database, 2010.

Looking only at companies with bank debt, large companies were the only ones which managed to considerably increase the share of long-term liabilities to banks in their total liabilities with the outbreak of the financial crisis (period 2008-2009). Furthermore, with the outbreak of the financial crisis the share of long-term liabilities to banks relative to total

liabilities increased/decreased proportionally with company size. Thus, this share actually decreased for micro companies, slightly increased for small companies, while medium sized and large companies managed to increase their share of long-term liabilities to banks moderately (medium size) and significantly (large). This indicates that on average Slovenian SMEs did not acquire higher shares of either long-term or short-term financing from banks from 2006 to 2009. On the other hand, large companies were able to utilize bank financing in worsened financial and economic conditions.

5.2. EFFECT OF THE FINANCIAL CRISIS ON DEMAND FOR FUNDS

Table 7 displays median values of selected asset and liability components according to company size categories. The most rapid decline in the share of inventories in total assets is visible among large companies, falling from 8.75 per cent in 2006 to 6.09 per cent by 2009. This clearly indicates the impact of the worsened economic conditions, to which large companies responded by cutting down inventories. While net working capital, as a share of total assets, slowly increased among SMEs, it decreased from 8.97 per cent to 7.59 per cent among large companies. This indicates an increased pressure for financing among Slovenian SMEs compared to large companies.

Table 7: Shares of selected asset and liability components in total assets for companies, which have bank debt financing, between 2006 and 2009 (median values)

Year	**2006**		**2007**		**2008**		**2009**	
Size	**INV**	**NWC**	**INV**	**NWC**	**INV**	**NWC**	**INV**	**NWC**
Micro	2.72%	10.64%	2.32%	10.67%	1.97%	11.22%	1.90%	12.07%
Small	12.15%	14.35%	11.40%	15.49%	10.70%	15.71%	10.51%	16.47%
Medium	13.49%	14.90%	14.67%	16.73%	14.12%	17.08%	12.51%	17.11%
Large	8.75%	8.97%	8.01%	8.44%	8.53%	8.86%	6.09%	7.59%
Size	**STL**	**LTL**	**STL**	**LTL**	**STL**	**LTL**	**STL**	**LTL**
Micro	50.25%	10.59%	49.56%	12.12%	49.77%	12.46%	50.56%	11.72%
Small	47.50%	15.54%	47.68%	15.07%	46.94%	15.91%	43.84%	17.54%
Medium	43.43%	11.55%	46.21%	13.37%	45.68%	13.42%	43.42%	14.38%
Large	38.45%	11.10%	39.62%	10.83%	42.82%	11.24%	39.00%	15.39%

Notes: INV= share of inventories in total assets; NWC = share of net working capital in total assets (net working capital = accounts receivable + inventories - accounts payable); STL= share of short-term liabilities in total liabilities; LTL= share of long-term liabilities in total liabilities. Source: authors' calculations, based on AJPES database, 2010.

The share of debt financing (short-term and long-term liabilities as a share of total liabilities) remained almost comparable in the year 2009 to the share of debt financing in 2006 for micro companies. The share of short-term liabilities in the total liabilities has stayed approximately the same for large companies too, however the share of long-term liabilities increased by almost 40 per cent (not percentage points!) among large companies. This significant increase is confirmed by Cohen's d effect size statistic, shown in Table 8.

Table 8: Cohen's *d* and *CL* (in brackets) effect size statistic, based on median values, for selected asset and liability categories, for solvent companies with bank financing

Time period	**2006-2007**		**2007-2008**		**2008-2009**		**2006-2009**	
Size	**INV**	**NWC**	**INV**	**NWC**	**INV**	**NWC**	**INV**	**NWC**
Micro	-0.017	0.004	-0.017	0.039	0.003	0.042	-0.031	0.086
Small	-0.051	0.064	-0.024	0.030	-0.018	0.031	-0.091	0.124
Medium	0.088	0.067	0.007	0.045	-0.145	-0.024	-0.053	0.088
Large	-0.060	-0.039	0.019	0.010	-0.178	-0.075	**-0.230*** (54%**)	-0.105
Size	**STL**	**LTL**	**STL**	**LTL**	**STL**	**LTL**	**STL**	**LTL**
Micro	-0.018	0.053	-0.002	0.011	-0.011	-0.024	-0.031	0.041
Small	-0.016	-0.019	0.005	0.030	-0.166	0.074	-0.178	0.086
Medium	0.136	0.083	-0.000	0.022	-0.160	0.058	-0.023	0.161
Large	0.084	-0.014	0.128	0.031	-0.173	**0.223*** (54%**)	0.045	**0.242*** (54%**)

Notes: INV= share of inventories in total assets; NWC = share of net working capital in total assets (net working capital = accounts receivable + inventories - accounts payable); STL= share of short-term liabilities in total liabilities; LTL= share of long-term liabilities in total liabilities; * Noticeable effect size, with common language effect size statistics in brackets. **Where Cohen's $d > 0.2$ CL effect size statistics (in brackets) were calculated for interpretative purposes. Source: authors' calculations, based on AJPES database, 2010.

Looking at the specific asset and liability categories of companies which had bank financing we can see that in the 2006-2009 period only large companies were able to substantially decrease their inventories. On the liabilities side, only large companies were able to substantially increase their total long-term liabilities, which include long-term bank debt. Both effects combined, this led to reduced pressure, compared to SMEs, which could not cut their inventories or secure additional financing.

5. POLICY IMPLICATIONS

The results of our analysis point to a clear lack of micro loans to SMEs. It is evident, loans should be more available to SMEs, and therefore lending to SMEs should not require high collateral. The state could play an important facilitator in this area, by creating a special insurance trust, acting as a guarantor to SMEs in need of micro loans. While the issue of micro loan SME financing has been discussed back and forth for close to a decade in Slovenia, so far no in-roads have been made in this area, and status quo seems to be eminent for the near future.

In addition to short-term working capital financing, a greater need for long-term SME financing should be met as well; either by the state institutions (e.g. already established SID export and development bank) and/or by commercial banking sector. Namely, long-term financing represents a foundation for SMEs future growth. In general, the Slovenian banking sector could offer a broader array of loans, tailored to SMEs needs; as well as further differentiate this portfolio of loans according to different SME segments (e.g. high- vs. low-tech SMEs; export- vs. domestically-oriented SMEs; SMEs at various stages of their life-cycles etc.). Obviously, this requires sophisticated risk estimation by the banks, which would

enable such differentiation of their financing options. It is our assumption this is currently not the case; either to their inability, or unwillingness.

But not all problems are related to bank loan supply; demand management should also be taken into strong consideration (Rašković and Durukan, 2010). Besides the reluctance to get a bank loan (outlined by pecking order theory), SMEs often lack extensive knowledge about all possible financing options. Some information could be obtained through different information systems, however these are highly fragmented. In this regard, the various institutions, forming SMEs' support environment, ought to collaborate more closely with banks, since they are the main sources of external financing in Slovenia. Thus, a standardized informational platform, where SMEs could get information and directly compare different financing options, offered either by the state (e.g. repayable and non-repayable grants), or through various commercial banks could greatly improve SME's ability to get an appropriate and affordable financing. Lastly, the reluctance to get a bank loan or an external investor (pecking order theory perspective) could perhaps be further reduced by various tax incentives to SMEs.

6. CONCLUSION

The goal of this paper was to analyze how micro, small, medium sized and large companies in Slovenia have been able to 'cope' and 'adjust' their capital structures to worsened financial and economic conditions, in the face of the recent financial and economic crisis. In this regard, we used a novel power analysis methodological approach. Complementing and extending the work by Vasilescu (2010) on the SME financing gap publish recently in *Ekonomska istraživanja* we have employed a differential approach, and further estimated the effect size changes in company capital structures in Slovenia.

A clear picture emerges; large companies did not only manage to secure additional financing sources from banks, but have also been able to decrease their inventories, measured as a share of total assets. On the other hand SMEs, and especially small companies, were unable to tap into 'soft budget constraints' made available by the commercial banking sector to large companies, and were virtually cut off in terms of financing. It seems that with limited access to finance by the banking sector, large companies were too big to perish, and SMEs become the "simplest" collateral damage. Furthermore, SMEs were in most cases suppliers and contractors to large and high export-oriented Slovenian companies, however they did not reap the alleged redistribution effects proposed by Meltzer (1960), which could manifest in favorable trade credit terms to SMEs, passed on from large companies.

With regards to our two hypotheses we can conclude that the existing mismatch between supply-for-funds and demand-for-funds (the proverbial SME financing gap) tested in hypothesis 1 has increased with the advent of the 2008 financial and economic crisis. While we could not in absolute evaluate either the supply of or demand for such funds, due to issues discussed by Vasilescu (2010), our analyses have shown significant 'pressures' on the demand side, which were not followed by proportional increases or adjustments on the supply side, leading to the widening of the mismatch (gap). In terms of hypothesis 2, the results of our power analyses and the corresponding effect sizes have clearly shown that large

companies were able to secure higher levels of additional financing, decreasing inventories and adjusting their net working capital.

The goal of our analyses was also to offer interpretable effect size estimations of these changes. Using the interpretive power of McGraw's and Wong's (1992) *CL* effect size statistic for noticeable effect sizes, we observed the following key changes:

- In the 2006-2009 period the probability of both a median medium sized and large company (with bank debt) obtaining additional financing (either short- or long-term financing) increased by almost 8 percentage points (see Table 5), while there was no such increase for a median small company.
- In the 2006-2009 period the probability of a median large company (with bank debt) to obtain additional short-term financing increased by 4 percentage points, as well as 4 percentage points for long-term financing (see Table 6).
- In the 2006-2009 period the probability of a median large company to significantly decrease its inventory (measured as a share of all assets) increased by 4 percentage points, while the share of increasing long-term liabilities increased by 4 percentage points (see Table 8). No such changes could be noticed for either medium sized, small or micro companies.

While these changes may at first sight not seem very big, they are quite important given the complex nature of the studied phenomena, and the fact they are based on median company estimations of the whole company populations in each size segment. Where relevant, they clearly show noticeable changes in capital structures, however underlined by myriad and complex forces. This adds to the complexity of the studied phenomena, and results in interpreting the obtained results as proxies of relative changes, further signaling both a general widening of the gap, as well as different consequences of this widening for different company size segments.

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PREGLED I PROCJENA VELIČINE UČINKA FINANCIJSKE I EKONOMSKE KRIZE IZ 2008. NA STRUKTURU KAPITALA MALIH I SREDNJIH PODUZEĆA: SLUČAJ SLOVENIJE

SAŽETAK

Nebrojeni faktori utječu na strukturu kapitala poduzeća. Ipak, najveći dio akademskog interesa usredotočen je na unutarnje odrednice strukture kapitala poduzeća, a puno manje na vanjske odrednice kao što je ograničeni pristup izvorima financiranja; to je pogotovo tako za mikro, mala i srednja poduzeća. Kao mala zemlja i članica EU i Eurozone, Slovenija pruža idealno okružje za proučavanje učinka financijske i ekonomske krize iz 2008. na strukturu kapitala malih i srednjih poduzeća; posebno s obzirom na dominaciju bankarskog sektora kao primarnog izvora financiranja za poduzeća. U tom kontekstu koristimo u literaturi novi pristup procjeni power analize, uz pomoć Cohenove d i McGraw-Wong common language (CL) statistike veličine učinka. Analizirali smo strukturu kapitala slovenskih malih i srednjih poduzeća od 2006 do 2009. Naše istraživanje pokazuje da mala i srednja poduzeća nisu bila u stanju u potpunosti iskoristiti „blaga budžetna ograničenja" koja je velikim tvrtkama omogućio bankarski sektor, te su stoga utoliko jače pogođena krizom.

Ključne riječi: *SME – mala i srednja poduzeća, struktura kapitala, kriza 2008., power analiza, Cohenova d statistika, CL statistika veličine učinka, Slovenija*

JEL: *G01, G21, G32, O16, C18.*

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RE.THINKING THE CORPORATE SOCIAL RESPONSIBILITY IN SLOVENIA: EMPIRICAL EVIDENCE

ABSTRACT

The paper identifies positive and educational effects of implementation of corporate social responsibility (CSR) through the project "Re.think", as a result of collaboration between Slovenian academic institution, Faculty of Economics University of Ljubljana, and international mobile company Si.mobil. CSR has gained importance throughout the last decades in both, academic community as well as among practitioners in business environment. The paper provides the appropriate combination of relevant factors, methods and techniques for greater awareness of CSR. Qualitative and quantitative methods were used in order to triangulate the findings of the research. Through the principal axis factoring and multiple regression techniques seven identified factors have been interpreted as a group of indicators fostering the development of CSR in Slovenia. The results indicate that the implementation of CSR activities is strengthening the creation of socially responsible organizational reputation.

***Keywords**: corporate social responsibility, job characteristics model, factor analysis, multiple regression, Slovenia*

JEL:M14

1. INTRODUCTION

Corporate social responsibility (CSR) is nowadays gathering exceptional significance (Guadamillas-Gómez et al, 2010). In order to create a good reputation and stakeholders' trust (McWilliams et al, 2006; Mitchell et al, 1997; Nicolau, 2008) organizations must demonstrate genuine concern and evidence of long-term enhancement of CSR. This paper deals with a project named "Re.think", which is a joint corporate social responsibility (CSR) project between the Faculty of Economics of the University of Ljubljana (FELU) and the second largest Slovenian mobile operator – Si.mobil.

The research seeks to define the factors of the CSR in Slovenia and evaluate the change in brand perception and consuming behaviour of the students at the FELU. The aim is to fill

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this research gap by developing the conceptual model of CSR and testing the factors that govern the foundation of CSR in Slovenia. The main research goal is to identify the effects and underlying factors that contribute to the fostering of CSR reputation. The main research question posed is weather students perceive FELU and Si.mobil as socially responsible organizations which is researched through measuring the perceptions of students at FELU. The main theses are 1) the project "Re.think" is strengthening the social responsibility awareness of the students at the FELU; 2) the employees of Si.mobil find it empowering to be able to cooperate on the CSR projects, conceptualized by the Si.mobil's Eco team; and 3) the project "Re.think" influences the behaviour of students as consumers of the Si.mobil products and services.

The main analytical methods used in the paper are theoretical narrative and gathering of the empirical data of the project "Re.think" at the FELU, analyzed through principal axis factoring, using varimax rotation on the explanatory variables with primary goal of data reduction and testing the relationship between CSR reputation and preference of ecological suppliers, such as Si.mobil through multiple regression technique. Respectively, a questionnaire was distributed among the FELU students, asking them how they perceive the activities of the "Re.think" project, performed at FELU.

The paper is structured as follows: First part of the paper presents the theoretical narrative, review of CSR in theory and practice and conceptual model of the CSR. The second part refers to the findings of qualitative research methods, such as focus group, observation, interviews with in-depth questions, secondary data analysis and to the findings of quantitative research methods, such as the principal axis factoring technique, using varimax rotation of the explanatory variables with primary goal of data reduction and multiple regression technique. Last part presents general conclusions.

2. REVIEW OF CORPORATE SOCIAL RESPONSIBILITY IN THEORY AND PRACTICE

The paper intends to highlight internal and external effects of the "Re.think" project and identify underlying factors that foster CSR in Slovenia; therefore theoretical constructs of CSR and job characteristics model of work motivation are presented. Almost half a century ago Milton Friedman (1962) wrote that business corporations, along with businesses in general, have only one social responsibility and that is to increase their profits. Today, organizations around the world, and their stakeholders, are becoming increasingly aware of the need for and the benefits of socially responsible behaviour. An organization's performance in relation to the society in which it operates and to its impact on the environment has become a critical part of measuring its overall performance and its ability to continue operating effectively. Globalization, greater ease of mobility and accessibility, and the availability of instant communications mean that individuals and organizations around the world are finding it easier to know about the activities of organizations in both nearby and distant locations. These factors provide the opportunity for organizations to benefit from learning new ways of doing things and solving problems. They also mean that organizations' activities are subject to increased scrutiny by a wide variety of groups and individuals. With the International Standard ISO 26000 providing guidelines for social responsibility, the public pressure on the organizations to bear their fair share of social responsibility will increase.

The term social responsibility came into widespread use in the early 1970s, although various aspects of social responsibility were the subject of action by organizations and

governments as far back as the late 19th century. An early notion of social responsibility centred on philanthropic activities such as giving to charity. Subjects such as labour practices and fair operating practices emerged a century ago. Other subjects, such as human rights, the environment, countering corruption and consumer protection, were added over time, as these subjects received greater attention.

Corporate social responsibility (CSR; Blowfield and Murray, 2008; Bowen, 1953; Drašček, 2006; Kotler and Lee, 2004; Littrell and Dickson, 1999; Margolis and Walsh, 2001; Willmott, 2001) is regarded as »voluntary corporate commitment to exceed the explicit and implicit obligations imposed on a company by society's expectations of conventional corporate behavior« (Falck and Heblich, 2007) and has been of scientific concern in connection with profitability ever since 1970s in United States of America. The European interest in CSR is, however, a relatively recent trend (Falck and Heblich, 2007) and mostly seen as organizational competitive advantage (Lahovnik, 2004) if implemented in order with the preferences of key stakeholders (Freeman, 1984). According to the World Bank definition (in Nicolau, 2008) CSR are company's obligations to be accountable to all of its stakeholders in all its activities. Nowadays, the Draft International Standard ISO 26000 (2009) states that to define the scope of CSR (Table 1), identify relevant issues and to set its priorities, an organization should address the following seven core subjects: organizational governance, environment, fair operating practices, consumer issues, community development, human rights and labour practices. Literature (Hall, 2001; Margolis and Walsh, 2001; Orlitzky et al, 2003) shows that market rewards CSR activities; therefore according to previous research (Falck and Heblich, 2007) correlation between CSR and profitability is proven.

Table 1 Illustrative Examples of Corporate Social Responsibility in the International Business Environment

Socially Responsible Organization	**Practice and Activities**
Nike	Two main CSR initiatives: (1) Considered Ethos combines sophisticated design with sustainable construction and recycled materials; (2) Let Me Play initiative improves access to sport through partnerships like Nike-Changemakers Sport for a Better World Competition.
GE	Ecoimagination Initiative is in charge of the reduction of greenhouse gas emissions of all its company's sectors. Promotion of clean research and design, in this way improving sales of environmentally friendly products and informing customers and the public about its progress.
Mountain Equipment Co-op	A Canadian consumers' cooperative, which sells outdoor gear and clothing emphasizes long-wearing, high quality products (consumers are encouraged to return old items for recycling), ethical sourcing and charitable donation (1% of profits goes to good causes).
Starbucks	CSR is present in all aspects of their business operations: sustaining coffee quality, creating a sustainable approach, respect for workers' human rights, supporting local communities and economic

	development, climate change mitigation strategy, greening the cup initiative, nutrition information on Starbucks beverages and fresh food, long-term approach to health and wellness.
Google	Investment of 1% of Google's annual profits – as well as employee time – into businesses and charities that tackle poverty, disease and global warming. Google.org has five major initiatives: (1) develop renewable energy cheaper than coal; (2) accelerate the commercialization of plug-in vehicles (RechargeIT); (3) predict and prevent infectious diseases and climate risks; (4) inform and empower to improve public services; (5) fuel the growth of small and medium-sized enterprises.

Source: Adjusted after Edelman Goodpurpose Community, 2011; Starbucks Coffee, 2011; Google.org: Searching for Solutions, 2011.

In order to motivate employees to work well, jobs need to be enriched which means that employers and employees need to incorporate CSR activities into the work environment. Hackman and Oldham (1976, 255-259) propose a model that specifies the conditions under which individuals become internally motivated to perform effectively on their jobs. The model focuses on the interaction among three classes of variables: 1) the psychological states of employees that must be present for internally motivated work behavior to develop; 2) the characteristics of jobs that can create these psychological states; and 3) the attributes of individuals that determine how positively a person will respond to a complex and challenging job. The model is an attempt to extend, refine, and systematize the relationships between job characteristics and individual responses to the work. At the most general level, five main job dimensions are seen as prompting three psychological states which, in turn, lead to a number of beneficial personal and work outcomes. The three psychological states (experienced meaningfulness of the work, experienced responsibility for the outcomes of the work and knowledge of the results of the work activities) are the causal core of the model. The model postulates that an individual experiences positive affect to the extent that he learns (knowledge of results) that he personally (experienced responsibility) has performed well on a task that he cares about (experienced meaningfulness). This positive affect is reinforcing to the individual, and serves as an incentive for him to continue to try to perform well in the future (Hackman & Oldham 1976, 255-256).

It is important that employees share the dedication to CSR that the organization is committed to. Job Characteristics Theory (Hackman and Oldham, 1976; Oldham and Hackman, 2010) states that the presence of certain characteristics of jobs increases the probability that individuals will regard the work meaningful, experience responsibility for work outcomes, and will have trustworthy knowledge of the results of their work, therefore CSR can be seen as a useful tool for work motivation.

3. RESEARCH DESCRIPTION AND FRAMEWORK

"Re.think" project brings together environmental values of FELU and company Si.mobil: recycle, reuse, reduce and above all rethink what you use and where you use it. It is based on the "Re.think" concept (Reduce, Reuse and Recycle), which has been widely accepted and epitomizes environmental awareness and responsibility of individuals and organizations. FELU has a long tradition in research and education as it was founded in 1946. Today, it is the largest faculty of the University of Ljubljana with around 6000 full-time and

part-time undergraduate and graduate students. FELU has previously concentrated on the social component of the CSR, but has recently started also its path to the socially responsible organization in the environmental sense of the word. The first activity in this direction has been the setting up of the separate waste collection system and the second one is the "Re.think" project in cooperation with Si.mobil.

Si.mobil is the second largest Slovenian mobile operator and is a part of international telecommunication group Telekom Austria Group. Strategic partnership with the world`s leading mobile operator Vodafone enables Si.mobil's customers to experience global products and services. Its main competitor in the mobile industry in Slovenia is Mobitel that also carries out various CSR activities in the field of education (sponsoring books for Golden readers contest in elementary schools etc.), humanitarian aid (sponsoring vacation for disadvantaged children etc.) culture (main sponsor of film festival LIFFe etc.) and sports (sponsoring skiers, hockey players, chess players etc.), however so far it has not developed a holistic sustainable CSR partnership with tertiary educational institution. At the end of 2010, Si.mobil had 352 employees who worked on providing services for 605.300 users and achieved a 28,8% market share (Si.mobil, 2011). One of the pillars of Si.mobil's operations is the realization of social responsibility, which is captured under the name "Re.think", and includes: care for the employees, care for the environment, "Si.water" fund and care for users. "Re.think" joint project between FELU and Si.mobil is, therefore, only one of many CSR projects of Si.mobil.

At Si.mobil, they are aware of the significance of responsible and environmentally friendly operation, so they have included environmental care into their long-term business strategy and business processes. Employees often craft their work (Oldham and Hackman, 2010) and in company Si.mobil the initiative for project "Re.think" came from employees themselves and the company supported the idea in the organizational setting and incorporated it into strategic practice of CSR (Falck and Heblich, 2007). In order to involve their employees in environmental activities as much as possible, the management founded an in-company Eco team, where 15 percent of their employees are active on a voluntary basis. Si.mobil contacted FELU in 2008 and came out with the proposal to involve employees and students of the FELU in environmental activities as much as possible. The FELU is the first outside organization to have started the "Re.think" philosophy, initiated by Si.mobil. In May 2009, the Chairman of Si.mobil's Management Board, Dejan Turk, and the dean of the FELU, Dušan Mramor, signed an agreement, under which both organizations fostered the implementation of CSR activities in order to strengthen the creation of socially responsible organizational reputation. Additionally, FELU began following Si.mobil's good practice in the direction of introducing environmentally-friendly measures and the manner of motivating and raising the CSR awareness of everyone at FELU. The faculty established its own Eco team, furnished its premises with stickers and motivators, and pledged to seek opportunities to make suitable changes within their own operations.

FELU is aware of the tendency that is given to environmental issues and intertwined social responsibility. Eco team is trying to implement small but important changes at the Faculty. Specifically, Eco team activities at FELU are : 1) placement of the stickers with ecological contents in the lavatories with the intention to reduce the usage of water, paper and electricity; 2) yearly inventory of the water, paper and electricity consumption; 3) promotion of the environmentally friendly separate waste collection; 4) promotion of usage of bicycles, which are an ideal environmental transportation for short distance, like the drive to the

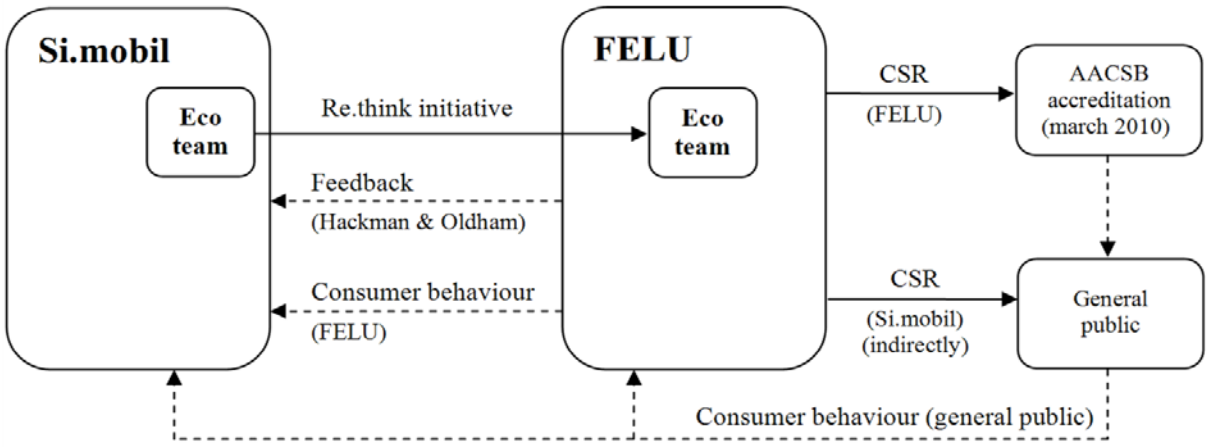
University of Ljubljana; 5) CO2 footprint calculation for the faculty; and 6) organization of movie nights, where ecological topics are presented.

Environmental issues are being promoted by organizations, such as FELU and Si.mobil as a win-win situation of strategic philanthropy (Porter and Kramer, 2002) as both organizations seek »to do well by doing good« (Falck and Heblich, 2007). A CSR reputation is essential to attract, retain and motivate (Oldham and Hackman, 2010) employees and to increase the value of the brand. Ninety percent of the Fortune 500 companies have evident CSR activities (Kotler and Lee, 2004); therefore, active involvement in responsibilities outside of the business arena has a positive effect on organization's outcome (Nicolau, 2008). CSR can be seen as an efficient management strategy (Baron, 2003) but organizations are also in a need of efficient management of CSR which needs to focus on (1) strategic planning of activities, (2) organization, (3) leading efforts and (4) evaluation of effects which are usually long-term intended.

4. CONCEPTUALIZATION OF THE RESEARCH MODEL

Paper is focused on the effects of the "Re.think" project in three areas of interest, as presented in the Figure 1, below: 1) the strengthening of the social responsibility awareness of the students at FELU, 2) brand perception and consumer behaviour of the FELU students, and 3) work motivation of the Si.mobil employees. In order to investigate the first two areas of interest – the factors that govern the foundation of social responsibility of FELU students - the questionnaires were divided among FELU students. The questions applied were those that, according to expert judgment, best describe CSR characteristics. The study tested whether students at FELU notice and are aware of the "Re.think" project and if they perceive FELU and Si.mobil as socially responsible organizations and how this perception influences their buying intention/behaviour. The effects of CSR on work motivation in Si.mobil were investigated through secondary data analysis (Si.mobil, Annual Report 2009, 2010; Si.mobil, Annual Reports Archive, 2010; Si.mobil, Social Responsibility; Si.mobil, "Re.think" Project, 2011).

Figure 1*The Conceptualization of the Research Model: Re.thinking the Corporate Social Responsibility in Slovenia*



Source: Authours' own conceptualization.

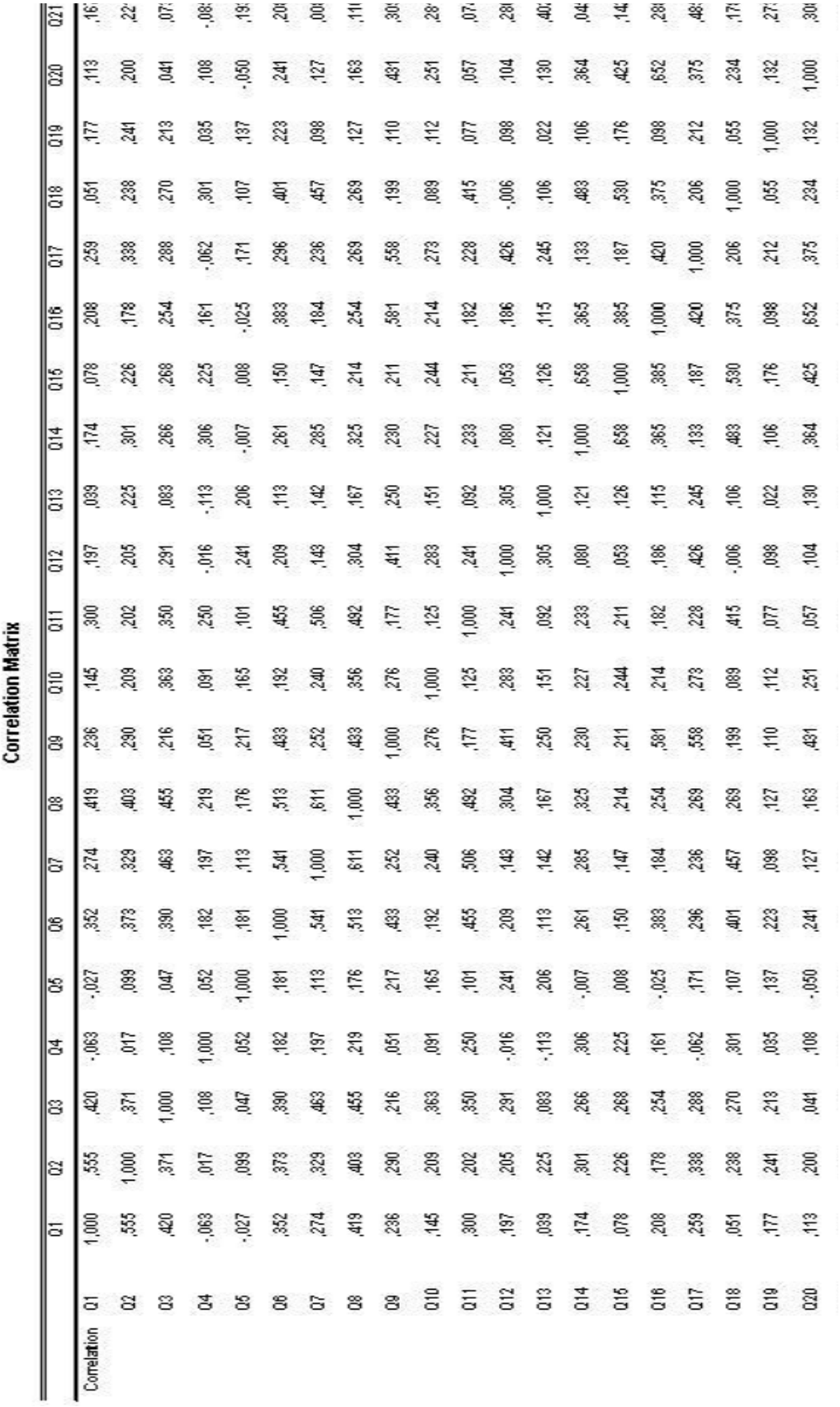
5. RESEARCH METHODOLOGY

Qualitative and quantitative methods were used in order to triangulate the findings of the research. Through the method of observation and interviews with in-depth questions the internal effects of the project "Re.think" at FELU were explored. The internal effects of the project "Re.think" in Si.mobil were researched by secondary data analysis according to the extension of Job Characteristics Model of Work Motivation (Hackman & Oldham, 1976) with CSR component. External effects of the project "Re.think" were measured with factor analysis and multiple regression technique.

CSR was measured by interviewing 120 students at FELU in summer semester 2009/2010. The convenience sampling was used for this purpose as, this being the first research on CSR in collaboration with profit company Si.mobil and Slovenian higher educational institution. Students were anonymously interviewed using paper questionnaires. The questionnaires took about 5 minutes to complete. This is significant since longer questionnaires may be less reliable due to responded fatigue (Malhotra, 2010). The questionnaire consisted of 21 variables, describing interviewees' attitude towards social responsibility. The five point Likert scale was used to characterize the level of agreement, ranging from: (1) disagree strongly, (2) disagree, (3) neutral, (4) agree, and (5) agree strongly. A total sum of 120 questionnaires were completed and returned immediately during the class. This represented a basis for factor analysis, where as a rough guideline there should be at least four to five times as many observations as there are variables (Neal, 2010).

Data were analyzed using the Statistical Package for the Social Sciences (SPSS 18.0). An alpha level of 0,05 was used as margin of statistical significance (Malhotra, 2010). The factor analysis using the Principal Axis Factoring method and varimax rotation was employed to extract social responsibility factors. Extracted factors were then employed in the multiple regression analysis that is a statistical technique, used to analyze the relationship between a single dependent (criterion) variable and several independent (predictor) variables. Common factor analysis (Neal, 2010) is the technique, where the factors are estimated based only on the common variance. Communalities are inserted in the diagonal of the correlation matrix. Factor analysis is a generic term for a family of statistical techniques concerned with the reduction of a set of observable variables in terms of a small number of latent factors. The principal axis factoring method is appropriate when the primary concern is to identify the underlying dimensions and the common variance is of interest (Malhotra, 2010). An examination of the correlation matrix indicates that a considerable number of correlations exceeded 0.30, and thus the matrix is suitable for factoring (Figure 2).

Figure 2 Correlation Matrix



Correlation Matrix

		Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12	Q13	Q14	Q15	Q16	Q17	Q18	Q19	Q20	Q21
Correlation	Q1	1,000	,555	,420	-,063	-,027	,352	,274	,419	,236	,145	,300	,197	,039	,174	,078	,208	,259	,051	,177	,113	,16
	Q2	,555	1,000	,371	,017	,099	,373	,329	,403	,290	,209	,202	,205	,225	,301	,226	,178	,338	,238	,241	,200	,22
	Q3	,420	,371	1,000	,108	,047	,390	,463	,455	,216	,363	,350	,291	,083	,266	,268	,254	,288	,270	,223	,041	,07
	Q4	-,063	,017	,108	1,000	,052	,182	,197	,219	,051	,091	,250	-,016	-,113	,306	,225	,161	-,062	,301	,035	,108	-,08
	Q5	-,027	,099	,047	,052	1,000	,181	,113	,176	,217	,165	,101	,241	,206	-,007	,008	-,025	,171	,107	,137	-,050	,19
	Q6	,352	,373	,390	,182	,181	1,000	,541	,513	,433	,192	,455	,209	,113	,261	,150	,383	,296	,401	,223	,241	,20
	Q7	,274	,329	,463	,197	,113	,541	1,000	,611	,252	,240	,506	,143	,142	,285	,147	,184	,236	,457	,098	,127	,00
	Q8	,419	,403	,455	,219	,176	,513	,611	1,000	,433	,356	,492	,304	,167	,325	,214	,254	,269	,269	,127	,163	,11
	Q9	,236	,290	,216	,051	,217	,433	,252	,433	1,000	,276	,177	,411	,250	,230	,211	,581	,558	,199	,110	,431	,30
	Q10	,145	,209	,363	,091	,165	,192	,240	,356	,276	1,000	,125	,283	,151	,227	,244	,214	,273	,089	,112	,251	,28
	Q11	,300	,202	,350	,250	,101	,455	,506	,492	,177	,125	1,000	,241	,092	,233	,211	,182	,228	,415	,077	,057	,07
	Q12	,197	,205	,291	-,016	,241	,209	,143	,304	,411	,283	,241	1,000	,305	,080	,053	,186	,426	-,006	,098	,104	,28
	Q13	,039	,225	,083	-,113	,206	,113	,142	,167	,250	,151	,092	,305	1,000	,121	,126	,115	,245	,106	,022	,130	,40
	Q14	,174	,301	,266	,306	-,007	,261	,285	,325	,230	,227	,233	,080	,121	1,000	,658	,365	,133	,483	,106	,364	,04
	Q15	,078	,226	,268	,225	,008	,150	,147	,214	,211	,244	,211	,053	,126	,658	1,000	,385	,187	,530	,176	,425	,14
	Q16	,208	,178	,254	,161	-,025	,383	,184	,254	,581	,214	,182	,186	,115	,365	,385	1,000	,420	,375	,098	,652	,28
	Q17	,259	,338	,288	-,062	,171	,296	,236	,269	,558	,273	,228	,426	,245	,133	,187	,420	1,000	,206	,212	,375	,48
	Q18	,051	,238	,270	,301	,107	,401	,457	,269	,199	,089	,415	-,006	,106	,483	,530	,375	,206	1,000	,055	,234	,17
	Q19	,177	,241	,213	,035	,137	,223	,098	,127	,110	,112	,077	,098	,022	,106	,176	,098	,212	,055	1,000	,132	,27
	Q20	,113	,200	,041	,108	-,050	,241	,127	,163	,431	,251	,057	,104	,130	,364	,425	,652	,375	,234	,132	1,000	,30

6. QUANTITATIVE DATA ANALYSIS

For testing the appropriateness of the factor model Bartlett's Test of Sphericity (χ^2 test) was used to test the null hypothesis that the variables are uncorrelated in the population. The observed significance level is .0000 (Neal, 2010). In the study, the null hypothesis, that the population matrix is an identity test, is rejected by Bartlett's Test of Sphericity. The approximate chi-square is 929,731 with 210 degrees of freedom, which is significant at 0.05 level (Figure 3). It is concluded that the strength of the relationship among variables is strong. The applicability of factor analysis was tested also using Kaiser-Meyer-Olkin Measure of Sampling Adequacy (KMO measure). The KMO measures the sampling adequacy which should be greater than 0.5 for a satisfactory factor analysis to proceed (Neal, 2010). In the study the value of KMO statistic (0,795) is also large (>0.5). Thus, factor analysis may be considered for analyzing the correlation matrix. In order to assess the reliability of compound scales (the extracted factors) the Cronbach Alpha Coefficient was calculated for all factors (Figure 4). The reliability coefficient α of 0,7 or higher is considered acceptable in most social science research situations (Malhotra, 2010). As indicated the results of analysis are satisfactory, where factors have common Cronbach Alpha value 0,850. These results indicate that the extracted factors appropriately characterize the dimensionality of the data.

Figure 3 Measures of Applicabillity

KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		,795
Bartlett's Test of Sphericity	Approx. Chi-Square	929,731
	df	210
	Sig.	,000

Figure 4 Reliability Statistics: Cronbach's Alpha

Reliability Statistics

Cronbach's Alpha	N of Items
,850	21

For the purpose of interpretation of results, each factor was composed of variables that loaded 0.30 or higher on the factor. The total variance explained statistics (Figure 5) displays the initial eigenvalues, extraction sums of squared loadings, and varimax rotation sums of squared loadings. The seven factors explained 53,666 percent of the total variance. According to eigenvalues rule ("greater-than-one rule", Neal, 2010) and scree plot (Figure 6) seven factors were extracted and labeled as: 1) FELU's social responsibility (best explaining six variables); 2) preference of ecologically responsible supplier (best explaining three variables); 3) Si.mobil's social responsibility (best explaining three variables); 4) individual proactivity towards social responsibility (best explaining five variables); 5) public awareness (best

explaining two variables); 6) daily ecological action (strong variable forming its own factor); 7) All-Slovenian cleaning initiative (strong variable forming its own factor); (Figure 5).

Figure 5 Total Variance Explained Statistics

Total Variance Explained

	Factor	Initial Eigenvalues[a]			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
		Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
Raw	1	6,302	26,042	26,042	5,818	24,042	24,042	2,566	10,603	10,603
	2	2,624	10,845	36,887	1,976	8,165	32,207	2,359	9,748	20,351
	3	2,123	8,775	45,661	1,684	6,959	39,166	2,234	9,233	29,585
	4	1,951	8,061	53,722	1,072	4,432	43,598	1,754	7,250	36,835
	5	1,678	6,935	60,657	,922	3,809	47,407	1,777	7,344	44,179
	6	1,273	5,262	65,919	,632	2,610	50,017	,963	3,981	48,160
	7	1,227	5,069	70,988	,556	2,299	52,316	1,006	4,156	52,316
	8	,940	3,886	74,874						
	9	,920	3,803	78,677						
	10	,761	3,146	81,823						
	11	,715	2,953	84,776						
	12	,613	2,532	87,308						
	13	,548	2,264	89,572						
	14	,433	1,788	91,359						
	15	,404	1,668	93,028						
	16	,385	1,592	94,619						
	17	,334	1,381	96,001						
	18	,298	1,233	97,233						
	19	,267	1,102	98,335						
	20	,212	,877	99,213						
	21	,191	,787	100,000						
Rescaled	1	6,302	26,042	26,042	5,391	25,671	25,671	2,734	13,020	13,020
	2	2,624	10,845	36,887	1,653	7,873	33,545	2,116	10,074	23,094
	3	2,123	8,775	45,661	1,610	7,669	41,214	1,882	8,961	32,056
	4	1,951	8,061	53,722	,843	4,013	45,227	1,586	7,552	39,608
	5	1,678	6,935	60,657	,731	3,481	48,708	1,417	6,750	46,357
	6	1,273	5,262	65,919	,531	2,528	51,236	,870	4,143	50,500
	7	1,227	5,069	70,988	,510	2,430	53,666	,665	3,166	53,666
	8	,940	3,886	74,874						
	9	,920	3,803	78,677						
	10	,761	3,146	81,823						
	11	,715	2,953	84,776						
	12	,613	2,532	87,308						
	13	,548	2,264	89,572						
	14	,433	1,788	91,359						
	15	,404	1,668	93,028						
	16	,385	1,592	94,619						
	17	,334	1,381	96,001						
	18	,298	1,233	97,233						
	19	,267	1,102	98,335						
	20	,212	,877	99,213						
	21	,191	,787	100,000						

Extraction Method: Principal Axis Factoring.

a. When analyzing a covariance matrix, the initial eigenvalues are the same across the raw and rescaled solution.

The rotated factor matrix contains the rotated factor loadings, which are the correlations between the variable and the factor. From output of our study it is seen that rotated solutions resulted in extraction of seven distinct factors, as they are explained (Figure 6 and Figure 7).

Figure 6 Scree Plot

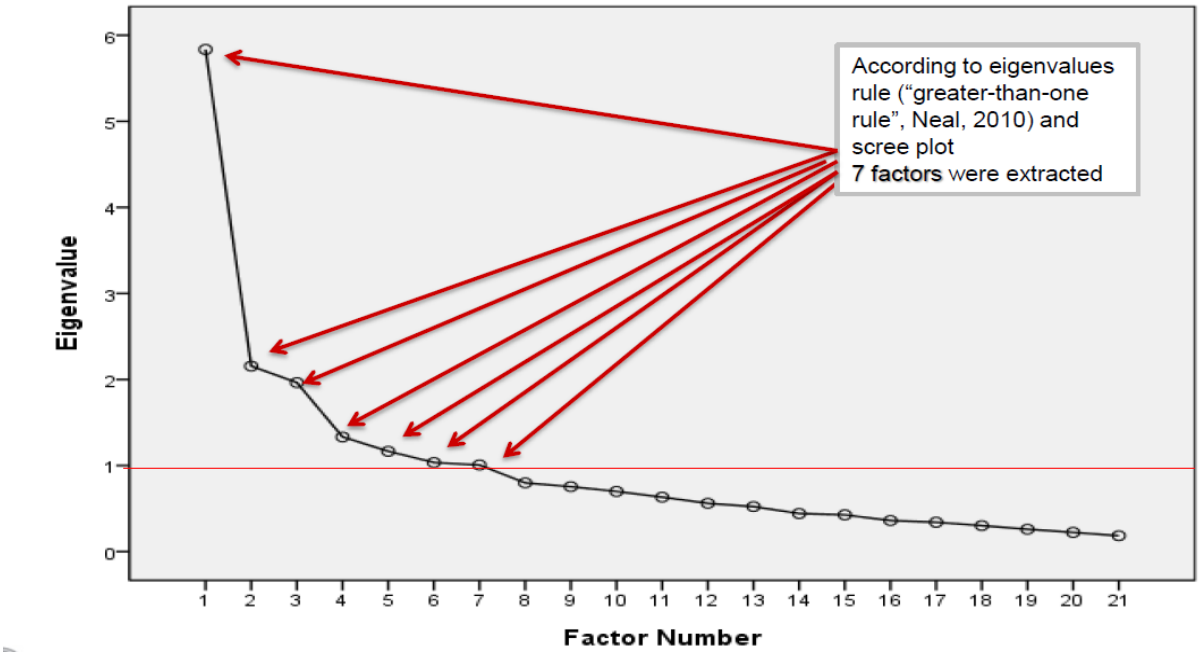


Figure 7 Rotated Factor Matrix

Rotated Factor Matrix[a]

	Raw Factor							Rescaled Factor						
	1	2	3	4	5	6	7	1	2	3	4	5	6	7
Q7	,669							,721						
Q6	,563							,653						
Q8	,638					,392		,633					,389	
Q11	,479							,630						
Q3	,445				,401	,333		,411				,371	,307	
Q4	,437							,333						
Q16		,915							,826					
Q20		,714	,332						,695	,323				
Q9		,581		,333					,601		,344			
Q15			,932							,814				
Q14			,763							,714				
Q18	,536		,538			-,321		,553		,555			-,381	
Q13				,589							,602			
Q21		,314		,605					,306		,589			
Q17		,523		,529					,455		,460			
Q12				,389		,342					,438		,385	
Q5				,481							,365			
Q1					,930							,780		
Q2					,584							,565		
Q10						,542							,458	
Q19							,839							,635

Extraction Method: Principal Axis Factoring.
Rotation Method: Varimax with Kaiser Normalization.

a. Rotation converged in 10 iterations.

After conducting factor analysis, multiple regression technique was implemented by extracting seven factors: 1) FELU's social responsibility; 2) preference of ecologically

responsible supplier; 3) Si.mobil's social responsibility; 4) individual proactivity towards social responsibility;5) public awareness; 6) daily ecological action; 7) All-Slovenian cleaning initiative. The focus was on researching how factors 1, 3, 4, 5, 6, and 7 (explanatory variables) influence factor 2 (preference of ecologically responsible supplier; dependent variable), by testing the research thesis: There is a positive relationship between attitude towards social responsibility of respondents and actual buying intention/behaviour of an ecological supplier.

Table 2 Multiple Regression Results for Preference of Ecologically Responsible Supplier as the Dependent Variable

	Model 1	**Model 2**
Constant	-0.116	-0.091
FELU's social responsibility	0.236**	0.237**
Si.mobil's social responsibility	0.328***	0.329 ***
Individual proactivity towards social responsibility	0.135	0.141
Public awareness	0.127	0.132
Daily ecological action	0.145	0.145
All-Slovenian cleaning initiative	0.034	
R2	0.458	0.457
Adjusted R2	0.430	0.433
Number of observations	120	

*** indicates significance at 99% level; ** indicates significance at 95% level; * indicates significance at 90% level

Statistical power was estimated through the programme GPower 3.0.10 and is 1. It is at the maximum level. Since the interviewer-analyist of the data was present at the gathering of the data in class, all the necessary instructions were given in order to avoid missing data. Due to the higher R2 adjusted in the Model 2, the model 2 was used. (without Factor 7: All Slovenian cleaning initiative). Standardized β reports the effect of the independent variable on the dependent variable: Factor 3 – Si.mobil's social responsibility influences on the preference of ecological responsible supplier the most with the value β=0.329. The second biggest influence on the dependent variable is of the Factor 1 - FELU's social responsibility with the value β=0.237.

7. DISCUSSION

The main findings of the analysis of the Slovene consumers' attitude and behaviour regarding CSR (Prešern 2009, 67) support the thesis that the brand perception and consumer behaviour of the Slovene consumers are positively correlated with the CSR activities of the organizations and that Si.mobil is on the right track with its CSR orientation which we have also confirmed for FELU's social responsibility activities. Research has shown that students respond positively to socially responsible activities which were demonstrated by clear extraction of factors and multiple regression analysis. Our research has demonstrated that students at FELU prefer services and products from socially responsible suppliers, such as

Si.mobil (Table 3). Multiple regression technique was used in order to test the relationship between buying intention (dependent metric variable) and attitude towards social responsibility (independent metric variables). Practical significance of the results is in the stated influence between attitude towards social responsibility and buying intentions of ecologically responsible supplier. Therefore, it is stated that ecologically responsible suppliers can target in their marketing efforts people who are inclined toward socially responsible campaigns. It can also be concluded that advertising at ecological institutions (such as FELU is perceived by the students) and events is beneficial for ecological suppliers. Company Si.mobil is by taking care of wider environment in collaboration with employees and students at FELU also taking care for future business as socially responsible people prefer buying from ecologically responsible suplier(s).

In order to understand the full range of the project "Re.think" impact besides raising awareness of FELU students for socially responsible activities investigation into social responsibility as the promoter of work motivation at Si.mobil has been done. Individuals of the Eco team experience positive effect, which is reinforcing to them, and serves as an incentive for them to continue to try to perform well in the future (Hackman & Oldham 1976, 255-256; Kruhar, 2010; Waring and Lewer, 2004).

Table 3 Overall Impact of the project "Re.think" in the Educational Environment of the FELU and in Business Environment of the Company Si.mobil

Triangulation of Research Findings	**FELU**	**Si.mobil**
Internal effects (qualitative research approach):	**Focus Group**: Students at the FELU perceive FELU as socially responsible organization that dedicates a special dedication to environmental issues (taking care for the wider environment) and advances comprehensive knowledge of its students. **Interviews with in-depth questions:** (1)Professors and assistants at the FELU became more aware of saving resources and are extensively starting with e-assignments in order to safe paper. (2) CSR activities are an integral part of Academic Assembly of FELU and monthly informal gatherings of Department of Management and Organization. (3) CSR theme is incorporated into syllabuses and final works of students. (4) Students and employees develop multiple intelligences and are able to implement them through practical outcomes.	**Secondary data analysis**: CSR as a useful tool for employee work motivation: • *Experienced meaningfulness of work:* (1) skill variety: various work tasks at Eco team; (2) task identity: voluntary work due to the concern for environment; (3) task significance: brainstorming becomes implemented in real life. • *Knowledge of actual results of work activities*: (1) feedback: CEO is acknowledging the efforts of Eco team on overall performance of Si.mobil. • *Experienced responsibility for the outcomes of the work:* (1) autonomy: Eco team plans and executes eco activities itself.

External effects (qualitative and quantitative research approach):	**Observation with participation:** (1) Students and employees at FELU as well as employees at Si.mobil are in constant contact with socially responsible contents in the form of messages in the toilettes, on the stairs, in the hallways, in front of the classrooms – raising social and environmental awareness together with marketing logo of Si.mobil. (2) Employees of Si.mobil and FELU together with students have supported the All-Slovenian Cleaning Initiative by cleaning Slovenia in one day. **Quantitative research approach** has proved a positive inclination of FELU students towards ecologically responsible suppliers as one component of CSR. Students who perceive Si.mobil as socially responsible company also prefer ecologically responsible suppliers. Students who perceive FELU as socially responsible organization are more inclined towards buying from ecologically responsible suppliers.

The collaborative CSR partnership has two main strategic benefits: 1) Incorporation of CSR into education at FELU and everyday practice of staff and students is valuable in strengthening their multiple intelligences (Chen & Gardner, 2009): logical-mathematical; musical; bodily-kinesthetic; linguistic; spatial; interpersonal; intrapersonal; naturalist; and existential intelligence (Gardner, 2006) as the members of the Eco team are free to demonstrate their social responsibility in any way they see appropriate. Theory of multiple intelligences (Gardner, 1983) states that human beings possess many potentials that an educational institution, such as FELU needs to nurture as its main social responsibility towards its stakeholders. Project "Re.think" evokes and employs multiple intelligences of students and employees at the activities that are important to them and society as a whole. They can organize music nights, concerts, workshops, leaflets or hold seminars on CSR themes in collaboration with the leadership of FELU and Si.mobil. Strengthening the multiple intelligences is not the final goal, however using these intelligences (Chen & Gardner, 2009) for a socially desirable outcome, is. 2) Si.mobil benefits from CSR reputation in educational and business environment and by gaining the marketing position at FELU.

Our analysis confirmed that FELU and Si.mobil are perceived as socially responsible organizations through clear extraction of factors. Therefore, four perspectives can be gathered, as follows: 1) conceptual perspective of social responsibility (concept of ecology and corporate social responsibility is worth investing in as it has impact on employee work satisfaction and customer loyalty); 2) individual perspective of social responsibility (students were shown to be capable of proactive actions and producing actions that encourage social responsibility); 3) institutional perspective of social responsibility (both Si.mobil and FELU are perceived by students as socially responsible institutions); 4) state perspective of social responsibility (elements of ecology and social responsibility are widely appreciated and should therefore be incorporated in state's politics agenda).

8. CONCLUSION

In order to create a CSR reputation and stakeholders' trust (Nicolau, 2008) organizations must demonstrate genuine concern and evidence of long-term enhancement of CSR and also inform the stakeholders about social influence of their every day's operations on environment which project "Re.think" has implemented in the shape of encouraging social responsibility of students at FELU. Eco-directed student-employee team projects, such as "Re.think" offer different educational experiences and possibilities to learn from business

community, promote mutual understanding and transfer of knowledge through experiential learning (Krbec and Currie, 2010) by designing the educational environment according to the theory of multiple intelligences (Gardner, 2006) and building personalities of students by promoting their different interests and potentials, therefore, incorporating social responsibility in the everyday educational activities at FELU.

All of the three theses of research have proven to be positively correlated with the activities of the "Re.think" project. In general, our research shows valuable, positive and educational effects of implementation of CSR activities for all partners in the joint project: FELU as academic institution, company Si.mobil, students as consumers and/or future employees, investors, and wider community. The "Re.think" project does not only strengthen CSR reputation of both organizations and foster social responsibility awareness of the students at FELU, but also influences students' behaviour as potential consumers of the Si.mobil products and services. The employees of Si.mobil at the same time find it empowering to be able to cooperate on the CSR projects, conceptualized by the Si.mobil's Eco team. It can, therefore, be concluded that Si.mobil's business success of the past few years is in great part based on the recently started CSR activities, including the "Re.think" project. Contrary to the belief of Milton Friedman, research results in this paper show that investments in CSR do pay off in the long run and are, therefore, a reasonable investment into the long-term existence of organizations in general.

The limitation of our study is that the data was only focused on project "Re.think" and limited to a total sum of 120 surveys. Another limitation has to be stressed here, long-term issues must be taken into future research consideration (Indihar-Štemberger et al, 2009); therefore, analysis of the effects of the "Re.think" project at the FELU and Si.mobil needs to be repeated over time.

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PROMIŠLJANJE O KORPORATIVNOJ DRUŠTVENOJ ODGOVORNOSTI U SLOVENIJI: EMPIRIJSKI DOKAZI

SAŽETAK

Rad identificira pozitivne i obrazovne efekte na implementaciju korporativne društvene odgovornosti (CSR) kroz project "Re.think", kao rezultata suradnje između slovenske akademske institucije, Ekonomskog fakulteta Sveučilišta u Ljubljani i međunarodne kompanije mobilne komunikacije Si.mobil. CSR je dobio na značaju kroz posljednje desetljeće kako unutar akademske zajednice tako i među stručnjacima poslovnog okruženja. Ovaj rad pruža prikladnu kombinaciju značajnih faktora, metoda i tehnika za jačanje svijesti o CSR-u. Korištene su kvalitativne i kvantitativne metode u triangulaciji rezultata istraživanja Faktorskom analizom glavne osi i tehnikama višestruke regresije interpretirano je sedam identificiranih faktora kao grupe indikatora koji potiču razvoj CSR-a u Sloveniji. Rezultati ukazuju da implementacija CSR aktivnosti pojačava kreiranje imidža društveno odgovorne organizacije.

***Ključne riječi**: korporativna društvena odgovornost, model poslovnih karakteristika, faktorska analiza, višestruka regresija, Slovenija*

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RELATIONS AMONG GOVERNMENT REVENUES AND GROSS DOMESTIC PRODUCT (GDP) OF THE REPUBLIC OF CROATIA

A B S T R A C T

The aim of this paper is to analyse the relations between the gross domestic product (GDP) and budget revenues of the Republic of Croatia in the period from the first quarter of 2000 to the first quarter of 2010.

Vector autoregressive model is used for the analysis. The interdependence between selected macroeconomic values was examined using cointegration analysis, which has proved that there is statistically significant, long-run stable relationship between the GDP and budget revenues.

Granger Causality Test has proved that GDP in the Granger sense has a significant impact on changes in state revenues.

JEL: E00, E01
Keywords: *cointegration analysis, Granger causality, GDP, budget revenues.*

1. INTRODUCTION

Numerous papers are dealing with the fiscal policy and are focused on current macroeconomic issues such as budget deficits, public debt and reduction of budget expenditures.

This paper analyzes the relationship between budget revenues of the Republic of Croatia and its GDP in the period from the first quarter of 2000 to the first quarter of 2010. For the purpose of this analysis, we used current revenues, because tax revenues are the most important source of state revenues and GDP. Both indicators are expressed in the actual values to avoid the impact of inflation on the survey results. The interdependence between macroeconomic values of gross domestic product and budget revenues is being investigated through cointegration analysis to determine whether there is a long-run linear relationship between these variables and their speed of adjustment towards that long-run linear combination. In order to confirm the results obtained from the cointegration analysis, we performed Granger Causality Test between the variables.

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2. OVERVIEW OF CURRENT EMPIRICAL RESEARCH

Many papers have been written in Croatia and abroad on the connection between the indicators of economic activity and budget variables. M. Benazic (2006) researched the impact of fiscal policy on economic activity. The author of the analysis used monthly data expressed in real values for the period from the January 1995 to the April 2004. In the analysis he used the following variables: budget revenues, budget expenditures and GDP. The analysis was performed using cointegration analysis and vector error correction model. The results show the possibility that an increase in government revenues will have a negative impact on real economic activity while government expenditures will have a positive impact on real economic activity. The importance of the effects of budget revenues was also established, which influence in the long-run declines. S. Svaljek, M. Vizek, A. Mervar (2009) calculated the cyclically adjusted budget balance in order to obtain a clearer picture of the fiscal trends and analysis of fiscal policy in Croatia. For this analysis, the authors identified cyclically sensitive budget revenues and expenditures and then calculated the trend values of macroeconomic base using Hodrick-Prescott filter techniques. The elasticity of cyclically sensitive budget components, with respect to their macroeconomic bases, is calculated with an error-correction model. The analysis covered the period from the first quarter of 1995 to the third quarter of 2008. The results of the exercise indicated that both periods of pro- and anticyclical fiscal policies have been present in the analyzed period with the restrictive and procyclical policy prevailing in the recent years. H. Simunic analyzed the interdependence between the taxation and the economic growth (2008). The analysis was performed on monthly data for the period from July 2004 to the June 2008. The analysis used two variables, budget revenues and the index of industrial production. In the econometric analysis the author used the regression analysis to confirm the significant taxation-economic growth relation, and the vector auto-regression (VAR) model to explore the interaction of taxation and economic growth in Croatia. In the analysis of VAR model he used Granger Causality Test, an orthogonal decomposition of the variance and impulse response analysis. With this econometric analysis the author proved the correlation between the taxation and the economic growth in Croatia. He also proved that there is mutual influence between taxation and economic growth, but that taxation has more significant affect on the economic growth. M. Tkalec and M. Vizek analyzed the impact of macroeconomic policies on manufacturing production in Croatia (2009.). The analysis was conducted for the period from the first quarter of 1998 to the third quarter of 2008. They used multiple regressions model. Chosen independent variables were personal consumption, investments, interest rates, the real effective exchange rate, government consumption, fiscal deficit and foreign demand, while the manufacture of the specific manufacturing sector was the dependant variable (they analyzed the total of 22 manufacturing sectors). The results suggest that changes in fiscal conditions, the real effective exchange rate and personal consumption mostly affect low technological intensity industries. Changes in investments, foreign demand and fiscal policy strongly affect the production in high technological intensity industries. It was concluded that fiscal policy is particularly important for manufacturing industry due to two reasons, the fiscal elasticity and shorter time lags for the impact of fiscal policy. D. Rukelj (2009) used structural vector error correction model to explore the interactions of fiscal and monetary policy, and economic activity in Croatia. He analyzed monthly data for the period from the January 1997 to the December 2008. The variables used in the analysis are expressed in real values. They are government expenditures, monetary aggregates M1 and the index of economic activity. The conclusion of this paper is that the monetary and fiscal policy affect economic activity, but are often used as substitutes and move in the opposite direction. The author also

concluded that an aggregate supply shock has a statistically significant permanent effect on all three observed variables in the long-run.

C. Gray, T. Lane, A. Varoudakis conducted the research for the World Bank on the topic of fiscal policy and economic growth (2007). The research was conducted on the basis of regression analysis on panel data of 57 developed and developing countries (countries of Central and Eastern Europe and Central Asia), which are grouped into three groups depending on the level of national income. One of the results of this analysis is that the higher GDP/ per capita is associated with the higher tax rates. It has been noted that countries with higher national income had a statistically significant higher taxes than other countries involved in the analysis. Research of the European Central Bank (2003) on the impact of fiscal policy on long-run economic growth in the EU was based on the analysis of panel data for all EU countries, for the period from 1961 to 2001. The analysis used data on government revenues and expenditures, and GDP of all EU member states. The aim was to empirically prove the extent to which fiscal policy reform in the EU affects the economic growth. The main conclusion is that government expenditures have impact on long-run growth during the business cycle. Cointegration analysis proved a strong correlation between budgetary revenues and expenditures. It was proved that government spending and government transfers have a negative impact on economic growth, while state investments have a positive impact on economic growth. The impact of taxes on economic growth was not clearly proven, but based on the available data it was concluded that direct taxes have a negative impact on the accumulation of capital. G. Karras and D. Furceri (2009.) also investigated the effects of changes in taxes on economic growth in EU. The authors used panel data from 1965 to 2003 for a panel of nineteen European economies. Used variables were the total tax rate, corporate tax, income tax and capital gains, social security contributions, property taxes, taxes on goods and services and GDP / per capita. The results show that an increase in the tax has a negative impact on long-run growth in the EU. According to this research, an increase in the total tax rate by 1% of GP will have a long-run effect on GDP per capita of 0,5% and 1%. The European Central Bank (2008) analysed the effects of size and volatility of government revenue and spending on growth in OECD and EU 15 countries. The research was based on the analysis combined cross-section time-series regressions for seven five-year periods from 1970 to 2004. The results show that both variables are determinal to growth. According to this research a percentage point increase in the share of total revenue in GDP would decrease output growth by 0.12 percentage points both for the OECD and the EU countries, but revenue volatility does not significantly affect growth. The main conclusion is that effect of government revenues ratios squared does not depend on the relative size of government. Barro and Redlick (2009) analysed macroeconomic effects from government purchases and taxes in USA. They described their empirical framework (time series from 1912 to 2006) for assessing effects on real GDP from changes in government purchases, taxes and other variables. Samples since 1950 indicate substantial and significantly negative effects from changes in average marginal income-tax rates on real GDP growth.

3. RESEARCH METHODOLOGY

Statistical relationship between the variables of government revenue and gross domestic product is analyzed using cointegration analysis and Granger causality test.

Both methods use vector autoregression (VAR) environment. *K*-dimensional reduced vector autoregressive model of order *p* looks like:

$$z_t = v + A_1 z_{t-1} + \cdots + A_p z_{t-p} + u_t \qquad (1)$$

where $z_t = \left(z_{1t}, \cdots, z_{Kt}\right)'$ is *K*-dimensional vector of random variables, A_i are matrices of fixed coefficients $(K \times K)$, $v = \left(v_{1,} \cdots, v_K\right)'$ is *K*-dimensional vector of constants, u_t is *K*-dimensional process with white noise for which $E\left(u_t\right) = 0$, $E\left(u_t u_t'\right) = \Sigma_u$, $E\left(u_t u_s^{'}\right) = 0$ for $s \neq t$.

VAR order i.e. the number of lags crucial for its dynamics, is tested with Akaika (AIC), Hannan and Quinna and Schwartz (SC) criterion and (HQ) criterion, by minimizing their values.

The quality of vector autoregression model is verified by testing the normality of distribution and residual autocorrelation. Normality of distribution of residuals is tested with the multivariate version of Shenton-Bowman test offered by Doornika and Hansen[1].

Residual autocorrelation is tested with Ljung-Box test of autocorrelation developed by Godfrey[2]. Heteroskedasticity of residuals are tested by ARCH tests.

If we assume that elements of vector z_t from (1) integrates variables of order *I*(1):

$z_t = v + A_1 z_{t-1} + \cdots + A_p z_{t-p} + u_t$,

and if we subtract from both sides of the equation z_{t-1}, after sorting we get:

$$\Delta z_t = v + \Pi z_{t-1} + \Gamma_1 \Delta z_{t-1} + \cdots + \Gamma_{p-1} \Delta z_{t-p+1} + u_t \qquad (2)$$

where $\Pi = \alpha\beta'$. β' is cointegration matrix or matrix of cointegration vectors and α is so-called loading matrix whose parameters indicate the speed of adjustment of the variables to long-run equilibrium shown with cointegration vectors.

If variables are cointegrated, it means that there is a long-run linear relationship between them. It is apparent that cointegration vectors are not unique. Namely, if $\beta = \left(\beta_1, \beta_2, \ldots, \beta_K\right)'$ is cointegration vector, then for each $\lambda \neq 0$ exists cointegration vector $\left(\lambda\beta_1, \lambda\beta_2, ..., \lambda\beta_K\right)'$. This means that all dependent vectors of cointegration vector β are also cointegration vectors themselves. Therefore, the cointegration vector can be normalized by some variable.

Since the values α and β in the matrix Π must be simultaneously determined, then ordinary least square (OLS) method is not suitable for evaluation of model parameters (2). Therefore, the evaluation of parameters is based on the method of maximum likelihood developed by Johansen and Juselius[3] and Johansen[4]. Johansen likelihood ratio test is used to test cointegration rang λ_{trace}:

$$\lambda_{\text{trace}}(r) = -T \sum_{i=r+1}^{p} \ln\left(1 - \hat{\lambda}_i\right).$$

λ_{trace} statistics tests the null hypothesis that the number of different cointegration vectors is less than or equal to *r* against the alternative hypothesis that it is higher.

Since the processes in equation (2) are stationary in first difference if the processes, which enter the analysis, are I (1) processes, i.e. processes of the first order of integration, testing whether this is deterministic or stochastic trend is done with the augmented Dickey-Fuller (ADF) test and Phillips-Perron test.

[1] Doornik, J. A., Hansen, H., An Omnibus Test for Univariate and Multivariate Normality, Working Paper, Nuffield College, Oxford, 2005.
[2] Godfrey, L. G., Misspecification Tests in Econometrics; the Lagrange Multiplier and other Approaches, Cambridge University Press, 1988.
[3] Johansen S., K. Juselius, Maximum Likelihood Estimation and Inference on Cointegration with Application to the Demand for Money, Oxford Bulettin of Economics and Statistics 52, 1990., str. 169-209.
[4] Johansen S., Likelihood-Based Inference in Cointegrated Vector Auto-Regression Models, Oxford Univerity Press, 1995.

In 1969 Granger[5] defined the concept of causality, which can easily be tested in the autoregressive VAR structure. Granger causality is based on the idea that an effect can not precede its cause. Therefore, if the variable *x* causes variable *y*, the variable *x* should contribute to the forecast of the variable *y* since the variable *x* with lags contains additional information on variable *y*. Conversely, we can test whether there exists a feedback impact of the variable *y* on variable *x*.

In the VAR structure we can easily test whether, in Granger sense, variable *x* causes variable *y* by simply testing VAR coefficients in a way that all coefficients associated with the variable *x*, in the equation of the variable *y* of reduced VAR are equated to zero. If this constraint is not statistically significant, it is said that the variable *x* does not cause, in the Granger sense, the variable *y*. As all equations in reduced VAR are evaluated independently from each other, we can test the common parameters of a single VAR equation with a simple F-test. It is clear that one can test the effect of the variable *y* on variable *x* in a similar way.

4. RESEARCH RESULTS

DATA

Data on real GDP in Croatia in prices in year 2005 are taken from IFS (International Financial Statistics), a database of the International Monetary Fund. Information about current government revenues are taken from the Ministry of Finance and are reduced to a real category in prices in 2005. In this way, we can compare the absolute changes in variables, both expressed in the prices in 2005. Since Croatian government revenues as well as Croatian GDP show significant seasonal variations, we used X11 ARIMA methodology to create seasonal adjustments of the variables. In other words, the further analysis was entered with the seasonally adjusted quarterly data, with the real size of the variables expressed in the prices for 2005, for the period from the first quarter of 2000 to the first quarter of 2010.

Stationarity of the data included in the cointegration analysis was tested using the ADF and PP tests. SBIC (Schwartz Bayesian Information Criterion) criterion is used to select the length of the autoregressive components.

Table 1.: Testing the unit eigenvalues of the process

	At level			In first difference		
	det. components: *c*, *t*			det. comp..: *c*		
Variable	lag	ADF	PP	lag	ADF	PP
REVENUES	0	-1.91	-5.97	1	-5.97**	-84.05**
GDP	0	-0.64	-1.98	0	-5.36**	-35.27**

* statistically significant at the significance level of 5%
** statistically significant at the significance level of 1%

Table 1 shows the results of testing stationarity of the processes that are included in the analysis. As the processes at level show trends, we approached the testing with the trend and constant as deterministic components. In this way, we tested whether the trend in variables is of a deterministic or stochastic nature. From Table 1, it is evident that for the variable Revenues and the variable GDP we can not reject the hypothesis about the unit root in the presence of a deterministic trend. Therefore, it can be concluded that their visible trends are of stochastic nature, and that these variables can be stationed so that they can be

[5] C.W.J.Granger,"Investigating Causal Relations by Econometric Models and Cross Spectral Methods", Econometrica, 37, 1969., str. 424-438

differentiated. When variables are differentiated from Table 1 it is evident from the augmented Dickey-Fuller test with a constant deterministic component that both variables are stationary in the first difference. This suggests that the variables GDP and Revenues are processes of the first order of integration I (1), which are suitable for cointegration analysis.

COINTEGRATION ANALYSIS

Quality cointegration analysis is based on the quality VAR model. Important decision about VAR model shown in equation (1) is his order, i.e. the number of lags to be included in the model. The decision on the number of lags was made on the basis of three criteria: the Akaike, Hannan-Quinn and Schwartz criterion. The test results are shown in Table 2.

Table 2.: Lag selection criteria for VAR model

	Lag	AIC	HQ	SC
1	27.26444		27.32550	**27.43333**
2	**27.12074**		**27.24317**	27.46198
3	27.13911		27.32311	27.65625
4	27.16439		27.40998	27.86100
5	27.38387		27.69092	28.26360

Based on Table 2 it is apparent that AIC and HQ suggest two lags while the SC criterion indicates one time lag. In the event of disagreement in criteria about the optimal lag Reimers[6] concludes that HQ is superior information criterion relative to other criteria and that the Schwartz criterion is biased towards one lag. One can therefore conclude that the optimal number of lags for the VAR on which to base the cointegration analysis is 2, or second-order VAR.

Table 3 shows the results of testing the VAR model residuals. Residuals are not autocorrelated, as evidenced in the Ljung-Box test, they are normally distributed (Shenton-Bowman test) and there is no trace of heteroskedasticity (ARCH tests). In other words, the VAR model is correctly specified and therefore the conclusions derived from this model are statistically significant and valid.

Table 3.: Diagnostics for VAR model

Tests for Autocorrelation
Ljung-Box(9): ChiSqr(30) = 39.624 [0.112]
LM(1): ChiSqr(4) = 6.321 [0.176]
LM(2): ChiSqr(4) = 7.171 [0.127]
Test for Normality: ChiSqr(4) = 0.915 [0.922]
Test for ARCH:
LM(1): ChiSqr(9) = 3.953 [0.914]
LM(2): ChiSqr(18) = 7.911 [0.980]

[6] Reimers H. E., Lag order determination in cointegrated VAR systems with application to small German Macro-Models, WP, ESEM, UPPSALA, 1993.

Table 4 shows Johansen's likelihood ratio test λ_{trace}. The first column shows the (*K-r* or the number of endogenous variables minus the rank of matrix Π), which indicates the number of common trends among the variables, the second column shows the rank of matrix Π, the third column shows the value of the eigenvalues ordered from larger to smaller, the fourth column shows λ_{trace} statistics, the fifth column shows the critical values for the 95% reliability and the last column shows the level of test significance. Based on the test with 95% of reliability, we can reject the hypothesis that the intrinsic value (0.440) of matrix Π is equal to zero, while for the intrinsic value of 0.179 we can not reject the hypothesis that it is zero. Since the rank of certain matrix is equal to the number of eigenvalues of matrix which are different from zero, it can be concluded that there exists an inherent value statistically significantly different from zero and that rank (Π)=1, the matrix in equation (2). In other words, it can be concluded that there is a long-run stationary relationship between the variable Revenues and GDP.

Table 4.: Johansen's likelihood ratio test

λ_{trace} test ranga matrice Π					
K-r	r	Eig.Value	Trace	Frac95	P-Value
2	0	0.440	30.294	20.164	0.001
1	**1**	**0.179**	7.711	**9.142**	**0.095**

Table 5 shows the decomposition of the matrix Π in equation (14) on cointegration vector β (normalized by variable Revenues) and loading matrix α that indicates the speed of adjustment of the variables to a long-run equilibrium. In parentheses are given *t* values that are used to test the significance of the parameters.

Table 5: The decomposition of the matrix Π

β'			
	PRIHOD	BDP	CONSTANT
$\beta(1)$	1.000	−0.394	4440.025
		[−30.669]	[4.772]

α	
	$\alpha(1)$
ΔPRIHOD	−0.614
	[−3.154]
ΔBDP	0.490
	[1.772]

From Table 5, it is apparent that the GDP and the constant component belong to the cointegration space (significant *t* values). Reverse signs between α and β coefficients indicate that the variables are returning to long-run equilibrium after leaving it, i.e. that we do not have so-called overshooting effect. Regarding the speed of adjustment, it can be concluded that the Revenues adjust to long-run equilibrium in little less than 2 quarters (-0614), while the GDP does not return to equilibrium after the model comes out of the long-run equilibrium (t=1.772 (p<0.05)); in other words, we can say that the GDP is a weakly exogenous variable, which does not adjust to a long-run equilibrium identified between these two variables. It follows that within the two quarters only Revenues adjust to a long-run equilibrium identified between these two variables.

Cointegration vector in Table 5 can be written in the form of equation:

$$\underset{}{\text{Prihodi}} = \underset{(-4.772)}{-4440.025} + \underset{(30.669)}{0.394}\,\text{BDP}$$

with t values in brackets. Based on t values, for which applies that their level of test significance p<0.05, in both cases it can be concluded that we can reject the hypothesis that the upper parameters are equal to zero. In other words, the GDP variable is statistically significant in explaining the trends of the variable Revenues, and the constant component is statistically significantly different from zero.

The above equation states that if, for example, GDP increases by one million HRK in prices in 2005, government revenues would increase by 394 000 HRK in prices in 2005, while if the GDP is zero (there are no taxes or contributions from which it could be financed) then the government budget would have a deficit of 4.440 billion HRK.

GRANGER CAUSALITY

Granger causality can be easily tested in a VAR setting. As Table 2 revealed that the optimal number of lags is 2, then in this case, the VAR model is reduced to:

$$(\text{Prihodi})_t = v_1 + a_{11}(\text{Prihodi})_{t-1} + a_{12}(\text{Prihodi})_{t-2} + a_{13}(BDP)_{t-1} + a_{14}(BDP)_{t-2} + u_1$$

$$(BDP)_t = v_2 + a_{21}(\text{Prihodi})_{t-1} + a_{22}(\text{Prihodi})_{t-2} + a_{23}(BDP)_{t-1} + a_{24}(BDP)_{t-2} + u_2$$

To test whether the GDP has an impact on the revenues, in Granger sense, means simply to test the hypothesis $H_0 : a_{13} = a_{14} = 0$ on the VAR model parameters; while to test whether the revenues have an impact on GDP means to test the hypothesis $H_0 : a_{21} = a_{22} = 0$. Hypothesis $H_0 : a_{13} = a_{14} = 0$ can be rejected at a significance level of 5% as the result of testing is F= 13.4981 (p=0.00004<0.05); while hypothesis $H_0 : a_{21} = a_{22} = 0$ cannot be rejected at a significance level of 5% as the result of testing is F=0.8131 (p=0.4519>0.05). In other words, we can say that GDP, in Granger sense, statistically significantly causes revenues, while revenues do not, in Granger sense, cause the GDP.

Therefore, the direction of activity between the variables is from the GDP towards the revenues. This result additionally confirms the result obtained by the cointegration analysis where it was found that GDP is weakly exogenous variable, i.e. that it does not adjust to a long-run stable relationship between revenues and GDP, but that a long-run cointegration relationship between GDP and revenues exists because the revenues adjust to that relationship within two quarters.

5. CONCLUSION

This paper analyzed the relationship between government revenues in the Republic of Croatia and its GDP from the first quarter of 2000 until the first quarter of 2010. Values required for the analysis have been derived using cointegration analysis. All variables (GDP and budget revenues) that entered into the VAR model are reduced to real size (in prices in 2005) and seasonally adjusted. Using the augmented Dickey-Fuller test it has been concluded that they are I (1) processes that can be stationed if they are differentiated. Therefore, such processes are suitable for use in cointegration analysis. Cointegration analysis using Johansen's methodology indicated the existence of a statistically significant stable long-run relationship between GDP and the government budget revenues, which when normalized by the revenues variable looks like $\begin{bmatrix} \text{Pr}\,ihodi & BDP & Kons\tan ta \\ 1 & -0.394 & 4.440 \end{bmatrix}$. It says that if the GDP increases, for example, by one billion of HRK, government budget revenues will adjust with the increase of 394 million HRK. If there would be no GDP, then the long-run relationship between the variables shows that the government budget would have the deficit of 4:44 billion HRK. Furthermore, it has been discovered that the government budget revenues adjust to the above mentioned long-run equilibrium within the two quarters, while the GDP is weakly exogenous variable that does not adjust to the long-run stable equilibrium. Further confirmation of these discoveries was obtained when testing Granger causality, i.e. that GDP has a significant impact on the government revenue trends, while budget revenues do not have impact, in Granger sense, on the GDP trends.

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ODNOS PRIHODA DRŽAVNOG PRORAČUNA I BRUTO DOMAĆEG PROIZVODA (BDP-a) U REPUBLICI HRVATSKOJ

S A Ž E T A K

Cilj ovoga rada je analizirati odnose između bruto domaćeg proizvoda (BDP-a) i prihoda državnog proračuna Republike Hrvatske za razdoblje od prvog kvartala 2000. do prvog kvartala 2010. godine.

Za analizu je korišten vektorski autoregresijski model. Međuovisnost između odabranih makroekonomskih veličina ispitivana je kointegracijskom analizom, kojom se dokazalo da postoji statistički značajna, dugoročna veza između bruto domaćeg proizvoda i prihoda državnog proračuna.

Testom Grangerove uzročnosti se dokazalo da bruto domaći proizvod ima značajan utjecaj, u Grangerovom smislu, na prihode državnog proračuna.

JEL: E00, E01

Ključne riječi: *kointegracijska analiza, Grangerova uzročnost, BDP, prihodi državnog proračuna*

Anton Jamnik.[1]

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Review
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BUSINESS ETHICS IN FINANCIAL SECTOR

ABSTRACT

Proponents of the financial theory of the firm generally argue that other constituencies should either protect themselves (workers can bargain for safer working conditions, for example) or seek regulatory protection by means of occupational safety and health laws. On the financial theory of the firm, the responsibility for upholding ethical standards, forcing the internalization of costs, and so on, belong ultimately to government, not to corporate managers. The main argument for this position is that corporate managers have neither the right nor the ability to pursue multiple, nonfinancial goals.By contrast, stakeholder theory contends that the list of corporate constituencies includes all those who have a legitimate interest in the activities of a firm, regardless of any interest that the firm takes in them. Furthermore, the interests of these stakeholder groups merit consideration for their own sake, not because of their usefulness to the firm. Stakeholder theory has not been developed as a full-fledged alternative to the financial theory, and it is questionable whether it is necessarily incompatible with it. SWM is justified on the financial theory for its benefits to the whole of society, which includes all stakeholder groups. Corporate managers need not consider the interests of all stakeholders as long as these interests are adequately protected by some means, such as government regulation. In addition, managing a corporation with attention to stakeholder interests may be an effective means for maximizing shareholder value. Some very successful companies are driven by philosophies that put employees or customers first.

Key words*: ethics, business, financial theory, manager, market. Ethical code, dignity of person,*

Although many business ethics problems are common to every functional area, finance involves some distinctive ethical issues that require separate treatment. Because financial activity is closely regulated, these issues are often addressed as matters of law rather than ethics, but the basis of regulation in finance includes some fundamental ethical precepts, such as fairness in financial markets and the duties of fiduciaries. The law is an uncertain regulator, though, and much financial activity presupposes unwritten rules of ethical behavior. People trained in finance enter many different lines of work, and so finance ethics is necessarily diverse; ethical conduct is not the same for bond traders, mutual fund managers, and corporate financial officers, for example. Moreover, finance ethics is concerned not only with individual conduct but also with the operation of financial markets and financial institutions. Finally, the financial management of corporations, with its objective of maximizing shareholder wealth, raises yet different ethical issues. Despite this complexity, the field of financial ethics can be organized under the three major headings of financial markets, financial services, and financial management.

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• *Financial markets* are vulnerable to unfair trading practices (fraud and manipulation), unfair conditions (an unlevel playing field), and contractual difficulties (forming, interpreting, and enforcing contracts). The main aim of federal securities laws and the self-regulation of exchanges is expressed in the phrase "fair and orderly" markets, which reflects the need in financial markets to balance the twin goals of fairness and efficiency.

• Many individuals and institutions serve as financial intermediaries, providing *financial services* on behalf of others. Financial intermediaries commonly make decisions as agents for principals in an agency relation, and they often become fiduciaries with fiduciary duties. Agents and fiduciaries have an obligation to act solely in the interests of other parties and, especially, to avoid conflicts of interest. Although financial services providers are often merely sellers in a buyer-seller relation, they still have the obligations of any seller to avoid deceptive and abusive sales practices.

• *Financial Management:* Business firms are legally structured as the financial instruments of shareholders, and officers and directors are agents of firms, and have a fiduciary duty to manage the firms with the objective of maximizing shareholder wealth. Ethical issues in financial management concern the actions that violate the duties of financial managers and the discretion of financial managers to serve the interests of nonshareholder groups, commonly called "stakeholders."

All financial activity takes place in a larger economic, political, and social setting, and so ethical issues arise about the overall impact of financial activity. Although financial decision making is generally limited to the financial factors of risk and return over time, ethics includes a consideration of the ethical treatment of everyone affected by a decision, and the consequences for the whole of society.

1. FINANCIAL MARKETS

The fundamental ethical requirement of financial markets is that they be *fair*. Fairness may be defined either *substantively* (when the price of a security reflects the actual value) or *procedurally* (when buyers are enabled to determine the actual value of a security). In the USA, some state securities laws aim at substantive fairness by requiring expert evaluation of new securities (so-called "blue-sky" laws), but the federal Securities Act of 1933 and the Securities Exchange Act of 1934 attempt to secure fairness procedurally by requiring adequate disclosure. The rationale for mandatory disclosure is that securities transactions are more likely to be fair when material information must be disclosed, and investors have easy access to information.

1.1. UNFAIR TRADING PRACTICES

Fraud, manipulation, and other unfair trading practices lead not only to unfair treatment in securities transactions but to a loss of investor confidence in the integrity of financial markets. Speculative activity also produces excess volatility, which was blamed for the stock market crashes of 1929 and October 1987.

Both fraud and manipulation are defined broadly. Section 17(a) of the 1933 Securities Act and Section 10(b) of the 1934 Securities Exchange Act prohibit anyone involved in the issue or exchange of securities to make a false statement of a material fact, to omit a fact that makes a statement of material facts misleading, or to engage in any practice or scheme that would serve to defraud. Whereas fraud generally involves the disclosure or concealment of information that bears on the value of a security,

manipulation consists of trading for the purpose of creating a misleading impression about a security's value.

Fraud is obviously committed by an initial stock offering that inflates the assets of a firm or fails to disclose some of its liabilities. Insider trading has been prosecuted as a fraud on the grounds that nonpublic material information ought to be disclosed before trading. In the 1920s, the stock market was manipulated by traders who bid up the price of stock in order to sell at the peak to unwary investors. In recent years, concern has been expressed about a form of program trading known as index arbitrage, in which traders are able to create volatility in different markets, solely for the purpose of trading on the resulting price differences.

1.2. FAIR CONDITIONS

Fairness in financial markets is often expressed by the concept of a level playing field. A playing field may be unlevel because of inequalities in information, bargaining power, resources, processing ability, and special vulnerabilities.

Unequal information, or *information asymmetry,* may refer either to the fact that the parties to a transaction do not possess the same information or that they do not have the same *access* to information. The possession of different information is a pervasive feature of markets that is not always ethically objectionable. Indeed, investors who invest resources in acquiring superior information are entitled to exploit this advantage, and they perform a service by making markets more efficient. The unequal possession of information is unfair only when the information has not been legitimately acquired or when its use violates some right or obligation. Other arguments against insider trading, for example, are that the information has not been acquired legitimately but has been misappropriated from the rightful owner (the "misappropriation theory") and that an insider who trades on information that has been acquired in a fiduciary relation violates a fiduciary duty. Equal access to information is problematical because accessibility is not a feature of information itself but a function of the investment that is required to obtain information. To the objection that an inside trader is using information that is inherently inaccessible, some reply that anyone can become an insider by devoting enough resources.

Similarly, inequalities in bargaining power, resources, and processing ability - which are pervasive in financial markets - are ethically objectionable only when they are used in violation of some right or obligation and especially when they are used coer-cively. The main ethical requirement is that people not use any advantage unfairly. For example, American stock markets permit relatively unsophisticated investors with modest resources and processing ability to buy stocks on fair terms, and some changes, such as increased use of program trading or private placements, are criticized for increasing the advantages of institutional investors. (The growth of mutual funds has served to reduce the adverse consequences of inequalities among investors.) Vulnerabilities, such as impulsiveness or overconfidence, create opportunities for exploitation that can be countered by such measures as a "cooling off" period on purchases and loans, and the warning to request and read a prospectus before investing.

1.3. FINANCIAL CONTRACTING

Some financial instruments, such as home mortgages and futures options, are contracts which commit the parties to a certain course of action, and many financial relations, such as being a trustee or corporate officer, are contractual in nature. Contracts

are often vague, ambiguous, or incomplete, with the result that disagreements arise about what is ethically and legally required.

First, beyond the written words of *express contracts* lie innumerable tacit understandings that constitute *implied contracts.* Financial affairs would be impossible if every detail had to be made explicit. However, whatever is left implicit is subject to differing interpretations, and insofar as implied contracts are not legally enforceable, they may be breached with impunity. Not only financial instruments but the relations of corporations with employees, customers, suppliers, and other stakeholders consist of implied contracts, from which each party receives some value. One objection to hostile takeovers is that raiders are able to finance such deals by capturing the value of the implied contracts that the target firm has made with its stakeholders.

Second, contracts are sometimes imperfect because of limitations in our cognitive ability, especially incomplete knowledge, bounded rationality, and future contingencies.

In addition, some situations may be too complex and uncertain to permit careful planning. As a result, the parties may fail to negotiate contracts that produce the maximum benefit for themselves. Disputes in contractual relations also arise over what constitutes a breach of contract and what is an appropriate remedy.

Agency and fiduciary relations are one solution for the problems of imperfect contracting because they replace specific obligations with a general duty to act in another's interests. In particular, the fiduciary relations of managers to shareholders has arisen because of the difficulties of writing contracts for this particular relation. Similarly, supplier relations are not easily reduced to contractual terms. The term *relational contracting* has been coined to describe the building of working relations as an alternative to rigid contracts.

2. FINANCIAL SERVICES

The financial services industry - which includes commercial banks, securities and investment firms, mutual and pension funds, insurance companies, and financial planners - provides a vast array of financial services to individuals, businesses, and governments. Financial services firms act primarily as financial *intermediaries,* which is to say that they use their capital to provide services rather than to trade on their own behalf. In providing financial services, these firms sometimes act as agents or fiduciaries with respect to clients; at other times, they act as sellers in a typical buyer-seller relation. Thus, a broker who is authorized to trade for a client's account is an agent, but a broker who makes a cold call to a prospect is merely a salesperson. Many ethical disputes result from misunderstandings about the nature of a financial service provider's role.

2.1.FIDUCIARIES AND AGENTS

A fiduciary is a person who is entrusted to act in the interests of another. Fiduciary duties are the duties of a fiduciary to act in that other person's interest without gaining any material benefit except with the knowledge and consent of that person. Similar to the fiduciary relation is the relation *of agent* and *principal,* in which one person (the agent) is engaged to act on behalf of another (the principal). Whereas fiduciary relations arise when something of value is entrusted to another person, agency relations are due to the need to rely on others for their specialized knowledge and skill. In both relations, the specific acts to be performed are not fully specified in advance and fiduciaries and agents have wide latitude.

A major source of unethical conduct by fiduciaries and agents is conflict of interest,

in which a personal interest of the fiduciary or agent interferes with the ability of the person to act in the interest of the other person. Fiduciaries and agents are called upon to exercise judgment on behalf of others, and their judgment can be compromised if they stand to gain personally by a decision. For example, a conflict of interest is created when a brokerage firm offers a higher commission for selling in-house mutual funds. The conflict arises because the broker has an incentive to sell funds that may not be in a client's best interests. Whether mutual fund managers should be permitted to trade for their own account is a controversial question because of the perceived conflict of interest. Fiduciaries and agents also have duties to preserve the confidentiality of information and not to use the information for their own benefit. Thus, "piggyback" trading, in which a broker copies the trades of a savvy client, is a breach of confidentiality.

Agency relations are subject to some well-known difficulties that arise from the inability of principals to monitor agents closely. These difficulties are opportunism, moral hazard, and adverse selection. Opportunism, or shirking, occurs because of the tendency of agents to advance their own interests despite the commitment to act on behalf of another. In agency theory, which is the study of agency relations, whatever a principal loses from opportunism is known as agency loss. The total of the agency loss and expenditures to reduce it are called agency costs. Moral hazard arises when the cost (or risk) of an activity is borne by others, as when a person seeks more medical care because of insurance. Moral hazard can be reduced in insurance by requiring deductibles and copayments, which provide an insured person with an incentive to lower costs. Insurance companies can also seek out better insurance prospects, but this leads to the problem of adverse selection. Adverse selection is the tendency, in insurance, of less suitable prospects to seek more insurance, which increases the risk for insurers who cannot easily identify good and bad insurance prospects. More generally, principals are not always able to judge the suitability of agents, and agents have an incentive to misrepresent themselves.

Many ethical problems, ranging from churning of client accounts by stockbrokers to the empire-building tendencies of CEOs, result from the difficulties inherent in agency relations. These problems can be addressed by closer monitoring and by changes in the structure of the relation. For example, the incentive for brokers to churn could be reduced by basing compensation more on the performance of clients' portfolios and less on the volume of trades. In addition, compensating executives with stock options aligns their interests more closely with those of the shareholders and thus prevents empire building. The most effective solutions for ethical problems in agency relations are twofold: first, there must be a strong sense of professionalism accompanied by professional organizations with codes of ethics; second, a high degree of trust must be present. Trust is essential in the financial services industry, and companies generally pay a heavy price for violating the public's confidence.

2.2. SALES PRACTICES

In the selling of financial products, such as mutual funds, insurance policies, and loans, the ordinary standards for ethical sales practices apply. Thus, the financial services industry, like any business, has an obligation to refrain from deception and to make adequate disclosure of material information. A mutual fund prospectus, for example, is screened by regulatory authorities, but personal sales pitches and mass-media advertising sometimes contain false and misleading claims. For example, figures in an advertisement may exaggerate the fund's past performance or omit sales charges. Whether an advertisement is deceptive is often a matter of dispute. The generally accepted standard for disclosure is materiality, which refers to information about which an average prudent

investor ought to be informed or to which a reasonable person would attach importance in making a decision.

For many financial products, the degree of risk is material information that ought to be disclosed. Thus, some clients of investment firms have attributed large losses in derivatives to inadequate disclosure of the risks involved. Brokers and insurance agents have an obligation to recommend only products that are *suitable.* Risk and suitability are closely related because whether an investment is suitable generally depends on the level of risk that is appropriate for an investor. Suitability is often difficult to determine, and investments may be unsuitable for many different reasons. Thus, a security might be unsuitable because it does not offer sufficient diversification or it is not sufficiently liquid, or because it involves inappropriate trading techniques, such as the use of margin.

Financial products are susceptible to abusive sales practices, such as "twisting," in which an insurance agent persuades a client to replace an existing policy merely for the commission, and "flipping," which is the practice of replacing one loan with another in order to generate additional fees. The poor are frequent targets of abuses by loan providers who offer high-interest loans and add on various "options" of little value. Finally, financial products should meet certain standards of integrity, just as automobiles and houses can be shoddily made, so too are there shoddy financial products. The sale of limited partnerships, for example, has been criticized in recent years for dubious valuation of assets and questionable practices by developers.

Victims of fraud or abuse by financial services firms generally have recourse to the courts, but the securities industry in the USA requires most customers (and employees) to sign a predispute arbitration agreement (PDAA) that commits them to binding arbitration of disputes. Mandatory arbitration is spreading to the holders of credit cards, insurance policies, and other financial products. Although arbitration has many advantages over litigation, critics charge that the process is often unfair and denies investors adequate protection. The controversy over compulsory arbitration in the securities industry focuses on three issues: the requirement that investors sign a PDAA as a condition of opening an account, the alleged industry bias of arbitration panels, and the permissibility of punitive damages. In addition, the requirement that employees submit complaints about such matters as discrimination and harassment to arbitration denies them of the right to sue in court, a right that employees outside the securities industry take for granted.

2.3. FINANCIAL SERVICES FIRMS

Financial services firms are themselves businesses, and the management of such a business raises some ethical issues, especially in the treatment of institutional clients. For example, underwriters of municipal bonds have been criticized for making political contributions in city elections in order to gain access. Firms as well as individuals encounter conflicts of interest, such as the reluctance of brokerage firms to issue a negative analysis of a client company's stock. In recent years, rogue traders have caused great losses at some firms, including the collapse of a major bank.

The managers of large investment portfolios for mutual funds, insurance companies, pension funds, and private endowments face two important ethical questions.

1 Should they consider social factors in making decisions, such as how a corporation treats its employees or its record on the environment?

2 Should they vote the stock that they hold, and if so, what criteria should they use to evaluate the issues that are submitted to a vote?

Some large institutional investors take a hands-off approach, while others are

becoming actively involved as shareholders in a movement known as relationship investing.

3. FINANCIAL MANAGEMENT

Financial managers have the task of actively deploying assets rather than investing them. Unlike a portfolio manager who merely buys stocks of corporations for a client, a corporate financial manager is involved in the running of a corporation. Investment decisions in a corporation are concerned not with which securities to hold but with what business opportunities to pursue. These decisions are still made using standard financial criteria, however. Finance theory can be applied to the operation of a corporation by viewing the various components of a business as a portfolio with assets that can be bought and sold. Option pricing theory, in particular, suggests that all of the possibilities for a firm can be regarded options to buy and sell assets. Bankruptcy, for example, is exercising an option to "sell" the corporation to the debtholders. (However, one critic has called this a "thoroughly immoral view of finance.") The ethical issues in financial management are twofold.

- Financial managers, as agents and fiduciaries, have an obligation to manage assets prudently and especially to avoid the use of assets for personal benefit. Thus, managers, who have preferential access to information, should not engage in insider trading or self-dealing. For example, management buyouts, in which a group of managers take a public corporation private, raise the question whether people who are paid to mind the store should seek to buy it.
- Financial managers are called upon to make decisions that impact many different groups, and they have an obligation in their decision making to balance some competing interests. For example, should the decision to close a plant be made solely with the shareholders' interests in mind or should the interests of the employees and the local community be taken into account?

3.1.BALANCING COMPETING INTERESTS

In finance theory, the objective of the firm is shareholder wealth maximization (SWM). This objective is reflected in corporate law, according to which officers and directors of corporations are agents of the corporation and have a fiduciary duty to operate the corporation in the interests of the shareholders. Despite the seemingly unequivocal guide of SWM, financial managers still face the need, in some situations, to balance competing interests. In particular, decisions about levels of risk and hostile takeovers reveal some difficulties in the pursuit of SWM.

The level of risk Maximizing shareholder wealth cannot be done without assuming some risk. A critical, often overlooked, task of financial management is determining the appropriate level of risk. Leveraging, for example, increases the riskiness of a firm. The capital asset pricing model suggests that, for properly diversified shareholders, the level of risk for any given firm, called *unique* risk, is irrelevant and that only market or *systemic* risk is important. Finance theory treats bankruptcy as merely an event risk that is worth courting if the returns are high enough. If a firm is in distress, then a high risk, "bet-the-farm" strategy is especially beneficial to shareholders, because they will reap all the gains of success, while everyone will share the losses of failure (the moral hazard problem). Consequently, a financial manager should seek the highest return adjusted for risk, no matter the actual consequences.

However, a high-risk strategy poses dangers for bondholders, employees, suppliers,

and managers themselves, all of whom place a high value on the continued operation of the firm. Employees, in particular, are more vulnerable than shareholders to unique, as opposed to systemic, risk because of their inability to diversify. Is it ethical for financial managers to increase risk in a firm so as to benefit shareholders, at the expense of other corporate constituencies? Does the firm, as an ongoing entity, have value that should be considered in financial decision making? Some have argued that managing purely by financial criteria, without regard for the level of risk, is immoral.

Hostile takeovers Hostile takeovers are often epic battles with winners and losers. For this reason, the rules for acquiring controlling interest should be fair to all parties involved. Managers of target companies feel entitled to a fair chance to defend their jobs; shareholders who sell their shares, and those who do not, have a right to make a decision in a fair and orderly manner; bondholders often lose in takeovers because of the increased debt; and employees and residents of local communities, who usually have no say in the decision, are generally the groups most harmed.

Insofar as a takeover is conducted in a market through the buying and selling of shares, there exists a "market for corporate control." Critics of hostile takeovers question whether such an important decision should be made in the marketplace. Does a market for corporate control provide adequate protection for all of the parties whose interests are affected? Incumbent managers have many defenses. Collectively called "shark repellents," these include poison pills, white knights, lockups, crown jewel options, the Pac-Man defense, golden parachutes, and greenmail. These are frequently criticized for being self-serving and for giving management an undue advantage in thwarting shareholder desires for change.

The directors of a target company, whose approval is often necessary for a successful takeover, have a fiduciary duty to act in the best interests of the firm itself, which may not be identical with the interests of either the preexisting shareholders or those who seek control. A majority of states have adopted so-called "other constituency statutes" that permit boards of directors to consider other constituencies, such as employees, suppliers, customers, and local communities, in evaluating a takeover bid. Many other laws govern the conduct of raiders and defenders alike, so that the market for corporate control is scarcely a pure market. In general, courts and legislatures have created rules for takeovers that seek both fairness and efficiency.

3.2. THE FINANCIAL THEORY OF THE FIRM

The financial argument for SWM, and the legal argument for the fiduciary duties of corporate officers and directors, are each built upon a conception of the business firm as a nexus of contracts between a firm and its constituencies, including shareholders, debtholders, employees, suppliers, and customers. This nexus-of-contracts view of the firm is employed in law and finance as a descriptive model for explaining the legal and financial structure of firms as well as a normative model for justifying fiduciary duties and SWM. The normative adequacy of the nexus-of-contracts view has been challenged, especially by those who contend that corporations have ethical obligations to various nonshareholder constituencies which are not accounted for in the model. Stakeholder theory is offered by some as a more adequate descriptive and normative model of the modern corporation.

Fiduciary duties in corporate law were originally founded on the role of shareholders as the owners of the corporation who had entrusted their assets to management. With the separation of ownership and control in the modern corporation, shareholders ceased to be owners in any meaningful sense, and the fiduciary duties of corporate managers to shareholders are now based on the premise that serving the shareholders' interests

maximizes total wealth creation. The aim of corporate governance structures is to restrain managers, who have *de facto* control, from using corporate assets for their own benefit and to give them incentives to apply these assets to their most productive uses. In terms of agency theory, this end can be achieved at the lowest agency cost by imposing a fiduciary duty on managers to maximize shareholder wealth.

In finance theory, shareholders are residual risk bearers, which is to say that they are entitled only to the earnings that remain (the residue) after all other obligations (such as wages to employees and payments to suppliers) are met. The argument, then, is that people with capital would agree to become residual risk bearers only if a firm is operated in their interests. Without this protection, investors would seek other contractual arrangements, such as the guaranteed returns of a bondholder. In the nexus-of-contracts firm, bondholders' returns, employees' wages, and suppliers' payments are assured by fixed-term contracts, but the interests of shareholders can be protected only if management agrees to serve their interests. Furthermore, residual risk bearers have the greatest incentives to ensure that the firm is operated so as to create the maximum amount of wealth. The primacy of shareholder interests thus benefits society as a whole.

3.3.STOCKHOLDERS VS STAKEHOLDERS

The shareholder-centered financial theory of the firm is criticized for giving inadequate recognition to the rights and interests of nonshareholder constituencies. Critics make four related points concerning ethical standards, externalities, abuses in contracting, and distribution.

Ethical standards Corporations ought to treat all corporate constituencies or stakeholder groups according to certain minimal ethical standards. Agents and fiduciaries do not have a right to advance the interests that they are pledged to serve in ways that violate fundamental rights or inflict wrongful harm. Thus, to expose workers and consumers to hazardous substances, or to exploit labor in lesser-developed countries, is unjustified.

Externalities Business activity imposes great social costs in the form of externalities or spillover effects. When pollution or urban blight, for example, is a direct result of corporate investment decisions, then critics contend that they have an obligation to address these problems.

Abuses in contracting Contracting provides an opportunity for one party to take unfair advantage of the other party. Such advantage-taking occurs in many forms. For example, downsizing may involve breaking an implicit understanding of job security for loyal employees. Some solvent corporations have sought bankruptcy protection so as to avoid paying product liability claims to injured consumers or to renege on collective bargaining agreements. In agency theory, principals are assumed to be vulnerable to shirking by agents, but agents can abuse principals by predatory behavior that has been called "sharking."

Distribution The financial theory of the firm takes no account of the inequalities that result from contracting in the nexus-of-contracts firm. In the USA, the widening gulf between low- and high-wage employees, and the high levels of executive compensation are causes for concern. In general, markets achieve efficiency, not equity; hence the need to attend to the equity/efficiency trade-off.

3.4. STAKEHOLDER THEORY

These four sources of ethical problems are acknowledged in the finance literature, and disagreements occur primarily over their solution. Proponents of the financial theory of the firm generally argue that other constituencies should either protect themselves (workers can bargain for safer working conditions, for example) or seek regulatory protection by means of occupational safety and health laws. On the financial theory of the firm, the responsibility for upholding ethical standards, forcing the internalization of costs, and so on, belong ultimately to government, not to corporate managers. The main argument for this position is that corporate managers have neither the right nor the ability to pursue multiple, nonfinancial goals.

By contrast, stakeholder theory contends that the list of corporate constituencies includes all those who have a legitimate interest in the activities of a firm, regardless of any interest that the firm takes in them. Furthermore, the interests of these stakeholder groups merit consideration for their own sake, not because of their usefulness to the firm. Stakeholder theory has not been developed as a full-fledged alternative to the financial theory, and it is questionable whether it is necessarily incompatible with it. SWM is justified on the financial theory for its benefits to the whole of society, which includes all stakeholder groups. Corporate managers need not consider the interests of all stakeholders as long as these interests are adequately protected by some means, such as government regulation. In addition, managing a corporation with attention to stakeholder interests may be an effective means for maximizing shareholder value. Some very successful companies are driven by philosophies that put employees or customers first.

Finally, the concept of shareholder wealth is problematical. The existence of different kinds of securities blurs the distinction between equity and debt, and creates multiple classes of shareholders with divergent interests. Even holders of ordinary common stock may differ in their risk preferences or time horizons. Some finance research indicates that managing to maximize short-term stock price may not result in maximum shareholder value in the long run. Thus, SWM is not a wholly objective guide for financial managers, and the decisions about the shareholders' interest may themselves involve some value judgments.

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POSLOVNA ETIKA U FINANCIJSKOM SEKTORU

Sažetak

Predlagatelji financijske teorije poduzeća uglavnom su stava da se drugi sudionici trebaju sami zaštititi (na primjer, radnici se mogu izboriti za sigurnije uvjete rada) ili zatražiti regulatornu zaštitu putem zakona o radu, sigurnosti i zaštiti zdravlja. Po financijskoj teoriji poduzeća, odgovornost za održavanje etičkih standarda, provođenje internalizacije troškova i slično, u konačnici snosi vlada, a ne korporativni menadžeri. Glavni argument za takav stav je da korporativni menadžeri nemaju ni pravo ni sposobnost postavljati si višestruke nefinancijske ciljeve. Suprotno tome, teorija dionika tvrdi da su sudionici korporacije i svi oni koji imaju zakoniti interes u aktivnosti tvrtke, neovisno o eventualnom interesu kojeg tvrtka ima prema njima. Nadalje, interesi tih grupa dionika trebaju biti uzeti u obzir zbog njih samih a ne radi njihove koristi za tvrtku. Teorija dionika nije razvijena kao punopravna alternativa financijskoj teoriji, te je upitno je li nužno s njom nekompatibilna. SWM je opravdan u financijskoj teoriji radi dobrobiti koju donosi cjelokupnom društvu, što uključuje sve grupe dionika. Korporativni menadžeri ne moraju uzimati u obzir interese svih dionika sve dok su ti interesi na neki način adekvatno zaštićeni, kao na primjer vladinim regulativama. Osim toga, upravljanje korporacijom na način da se posvećuje pažnja interesima dionika može biti efikasan način maksimiziranja vrijednosti dioničara. Neke vrlo uspješne tvrtke imaju filozofiju koja zaposlenike i klijente stavlja na prvo mjesto.

Ključne riječi: *etika, posao, financijska teorija, menadžer, tržište, etički kodeks, dostojanstvo osobe*

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Review
Pregledni rad

CAUSES OF AUDITOR MISTAKES IN PUBLISHED AUDIT REPORTS IN BOSNIA AND HERZEGOVINA

Abstract

The authors carried out research in which they identified errors in published audit reports carried out by some independent auditors from Bosnia and Herzegovina. They also carried out the analysis on causes for the identified errors. Through the analysis of the collected audit reports it has been established the existence of numerous deviations comparing to the requirements of the International Standards on Auditing (ISA) 700 and 701, with aspect of the formal contents of the reports as well as the essence of the reports. The research established that the causes of the identified errors are: inadequate legislature in Bosnia and Herzegovina, inadequate continuous education of the auditors, insufficiently developed auditing practice, absence or inadequate internal control of quality in most audit firms, and absence of public supervision on the state level. The recently passed law which refers to accounting and auditing opens some more space for certain improvements, especially through establishing the Audit Chamber and the Public Supervision Board.

Key words: *International auditing standards, audit reports, errors of auditor.*

1. INTRODUCTION

In auditing, there is always a risk that an auditor will unintentionally express a positive opinion on financial reports which contain considerable erroneous information. Provided that an auditor, with no exceptions stuck to the procedures regulated by the International auditing standards, he cannot be considered responsible for the unintentionally expressed the opinion which is apparently erroneous. The law on accounting and auditing of Federation of Bosnia and Herzegovina regulates application of International Standards on Auditing (ISA). These standards strictly regulate the content and the formal frame of audit reports. Consequently, the auditor which stipulates in his report that his auditing was conducted according to the ISA, is obliged to apply the legal content and formal frame in the report. By all the means of communication we have a chance to see various types and forms of audit reports. That gives us a chance to notice that those reports express reference to various audit standards, the content frames of the reports are different in respect to their scope and structure. These deviations confuse their users and consequently they often have no idea what the legal and proper audit reports should look like. In accordance to that, the research goals are defined:
Are the published audit reports in accordance with ISA, and are there any discrepancies? What are the causes of deviations found in published audit reports comparing to ISA,, are they the consequential result of the subjective weaknesses of the auditors or there are some other causes which originate from the environment? Is it possible that the deviations found in published audit reports because certain consequences related to the auditor, the users of audit reports, or the audit profession itself? The initial goal of the research was to classify

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deviations that are recognized in the audit reports, comparing to the audit reports regulated by ISA,. The explanation goals of the research are as follows:

- ☑ To analyze if the legislature in B&H could be the cause of deviations in audit reports, comparing to ISA,.
- ☑ Examine if the auditors in B&H get appropriate education prior to the promotion to professional auditors, if they get appropriate continuous education, and if the educational anomalies could be the cause of the subjective weaknesses of the auditors, recognized through their erroneous audit reports.
- ☑ Compare the number of the conducted audits to the total number of companies in B&H, and analyze if the auditors in B&H have the opportunity to get enough appropriate practice.
- ☑ Analyze quality control of audit business and public supervision over the audit activities in Bosnia and Herzegovina and determine if inadequate quality control and insufficiency of public supervision could be causes for errors in audit reports in Bosnia and Herzegovina comparing to ISA,.

The research started from the assumption that the main causes for deviations found in published audit reports comparing to ISA, are: inadequate legislature related to auditing business, inadequate education of auditors, inactivity of the field experts associations, absence of public supervision over auditors as well as absence of the auditing business quality control.
The multilevel empirical research was conducted by means of:

- ☑ Analysis of audit reports of commercial auditors, published in press and e-media.
- ☑ Gathering and analysis the data published in audit reports in Federation of B&H.
- ☑ Analysis of the structure of education for certified auditors, published on the field experts associations official web pages.
- ☑ Analysis of continuous education agenda structure, published by officials in charge of continuous education.

2. CLASSIFICATION OF TYPES OF COMMERCIAL AUDITOR AUDIT REPORT DEVIATIONS

The law on accounting and auditing of Federation of Bosnia and Herzegovina assumes application of ISA,. Those standards clearly explain what the formal frame and the content should look like. Consequently, the auditor who stipulates in his report that the auditing was conducted in accordance to ISA, is legally obliged to apply the ISA, regulated formal frame as well as the content. Despite of that obligation we recognize various different formal frames and text bodies of audit reports through media and other means of public communication. Analyzing the commercial auditor audit reports published by printing media (“Dnevni avaz”, “Oslobođenje”, “San” – all from Sarajevo) and e-media in 2009, certain deviations in audit reports compared to ISA, are noticed. It has been gathered and analyzed 48 samples of auditor positions which were analyzed from the point of view concerning their accordance with ISA, 700 and ISA, 701.

2.1. ERRORS OF FORMAL NATURE

Analyzing the gathered audit reports it was found that there is a number of deviations relating to ISA, 700 and 701 bearing the nature of formal frame and the content. Those deviations are related as follows:

a) Incompletely or incorrectly defined the subject of the auditing: In the initial part of the report it is not clearly listed the complete set of the financial statements that was the

subject of the auditing. The most frequently, auditors fail to stipulate "Notes to the Financial Statements" as a component of a legally regulated set of a financial statement.

b) Incompletely or irregularly defined the responsibility of the Bureau for financial reports: In the chapter *Management's Responsibility for the Financial Statements,* in accordance with ISA 700, an auditor is supposed to use the expression: "Management is responsible for the preparation and fair presentation of these financial statements in accordance with International Financial Reporting Standards, and for such internal control as management determines is necessary to enable the preparation of financial statements that are free from material misstatement, whether due to fraud or error."

On the contrary, the analysis proved that auditors do not use the full section of ISA 700, but most frequently use the two sentences: „For these financial reports, the Company management takes the responsibility. Our responsibility is to express opinion on the financial reports, based on the conducted auditing. "

c) Incorrectly stipulated auditing standards: A significant number of audit reports stipulate that „The auditing was conducted in accordance with the Auditing standards of Federation B&H and those are in accordance with the International standards on auditing." The Auditing standards of Federation B&H were put out of effect by passing the Law on accounting and auditing 2005, which regulates ISA, legal usage. Besides, the fact is that the Auditing standards of Federation B&H used to be in accordance with ISA until 2005. Since then, ISA has been significantly changed.

d) Incomplete description of the audit process: According to ISA 700 an audit should be described as it follows: "An audit involves performing procedures to obtain audit evidence about the amounts and disclosures in the financial statements. The procedures selected depend on the auditor's judgment, including the assessment of the risks of material misstatement of the financial statements, whether due to fraud or error. In making those risk assessments, the auditor considers internal control relevant to the entity's preparation and fair presentation of the financial statements in order to design audit procedures that are appropriate in the circumstances, but not for the purpose of expressing an opinion on the effectiveness of the entity's internal control. An audit also includes evaluating the appropriateness of accounting policies used and the reasonableness of accounting estimates made by management, as well as evaluating the overall presentation of the financial statements. We believe that the audit evidence we have obtained is sufficient and appropriate to provide a basis for our audit opinion.". However, most of the audit firms use an incomplete description as follows: "An audit involves performing procedures to obtain audit evidence about the amounts and disclosures in the financial statements. An audit also includes evaluating the appropriateness of accounting policies used and the reasonableness of accounting estimates made by management, as well as evaluating the overall presentation of the financial statements. We believe that the audit evidence we have obtained is sufficient and appropriate to provide a basis for our audit opinion."

2.2. ERRORS OF SUBSTANCE NATURE

Analyzing the gathered audit reports it was established that there is a number of deviations comparing to the standards ISA 700 and 701 with aspect of the substance itself. Those deviations are related to the matter as it follows:

a) Auditor inserts his own remarks into "Notes to the Financial Statements": Obviously, a number of auditors do not understand purpose and substance of Notes attached to financial reports. Frequently, auditors describe and insert spotted irregularities into Notes attached to financial reports. Attached notes pose a part of the mandatory set of financial reports and they are supposed to be the statement given by managements, not the statement given by an auditor. An auditor is only supposed to enclose all the financial report

components together with his own audit report as well as the Notes. An auditor is not supposed to make any changes to the text that has been presented by the management. If an auditor does any corrections to the Notes it means that he presents his opinion about his own statements, not about management statements.

b) Misunderstanding of audit scope limitations: In a number of audit reports it is stated that „the previous year audit did another auditor"or „the auditor was not present to the process of inventory", and a positive audit evaluation is stated. Consequently, potential limitations of the audit scope are unnecessary to state, and the auditor did not have scope limitations since he was in position to express his opinion.

c) Missing quantitative description of financial consequences caused by spotted irregularities: In some of the analyzed audit reports the auditor expresses his opinion with a reservation, because of irregularities in some part of a balance sheet, but does not give any quantitative description of its influence on the financial reports. According to ISA 701 "Whenever the auditor expresses an opinion that is other than unqualified, a clear description of all the substantive reasons should be included in the report and, unless impracticable, a quantification of the possible effect(s) on the financial statements. Ordinarily, this information would be set out in a separate paragraph preceding the opinion or disclaimer of opinion on the financial statements and may include a reference to a more extensive discussion, if any, in a note to the financial statements. [3]

d) Emphasizing the facts that are not to be emphasized: According to ISA 701 "The auditor should modify the auditor's report by adding a paragraph to "highlight a material matter regarding a going concern problem."[4]. Furthermore:"The auditor should consider modifying the auditor's report by adding a paragraph if there is a significant uncertainty (other than a going concern problem), the resolution of which is dependent upon future events and which may affect the financial statements. An uncertainty is a matter whose outcome depends on future actions or events not under the direct control of the entity but that may affect the financial statements." [5] However, in some of the analyzed audit reports, it is obvious that an auditor emphasizes the facts that can be related neither to any concern nor to uncertainty.

There are some cases of emphasizing the facts that a company has not brought its documents into accord with The Law on Public Enterprises in Federation of Bosnia and Herzegovina, or the internal control system is inadequate.

e) Incorrect qualification of business continuation principles: According to ISA 701, part 6. "The auditor should modify the auditor's report by adding a paragraph to "highlight a material matter regarding a going concern problem." However, the analysis proves that the doubting any concern is handled as an issue that influences auditor opinion and consequently the auditor restrains from expressing his opinion.

The table that follows is a review of the identified deviations:

[3]International standard on auditing 701, &15
[4] Ibidem, & 6.
[5] Ibidem, & 7.

Table 1: Type of deviations classification

Reports with no deviations	5	10,42%
Reports with deviations	43	89,58%
TOTAL	**48**	**100,00%**
TYPE OF DEVIATION	**Number of deviations**	**Structure**
Incomplete or incorrectly defined the audit focus	32	15,46%
Incomplete or incorrectly defined the management responsibilities for Financial Reports	36	17,39%
Incorrectly stated audit standards	18	8,70%
Incomplete description of audit process	38	18,36%
Auditor inserts his own remarks into Remarks to the financial report	27	13,04%
Misunderstanding of audit scope limitations	17	8,21%
Missing quantitative description of financial consequences caused by spotted irregularities	15	7,25%
Emphasizing the facts that are not to be emphasized	21	10,14%
Incorrect qualification of going concern problem	3	1,45%
TOTAL NUMBER OF DEVIATIONS	**207**	**100,00%**

3. LEGISLATURE IN BOSNIA AND HERZEGOVINA AS THE CAUSE FOR DEVIANT AUDIT REPORTS

Legislature in B&H from 1998 to 2004 was significantly harmonized with ISA. The laws on accounting and audit on Entity level were passed in 2005. The principal characteristic of those laws is their incompatibility with the state law decrees and consequently their own mutual incompatibility. Besides, the Law on accounting and audit in Federation of B&H passed in 2005 poorly refers to the field of audit. Despite the fact that audit was a legal obligation for large turnover legal entities, it occurred that the legislator failed to define legal sanctions related to the legal obligation. There are efforts to overcome this shortage by passing some new Laws on accounting and audit on the Entity level. Until now in Bosnia and Herzegovina has not been published the translation of ISA and consequently auditors find it difficult to apply it. They are even excused from applying ISA since ISA has not been translated and officially published. The translation of the standards is supposed to be assigned to the Committee for accounting and audit as the legal obligation. In banking and insurance sector in FB&H there are regulations that put an auditor in a position which makes him deviate from ISA. The Banking agency requires an auditor to provide additional reports. The additional requirements defined by the agency are listed in the Decree on minimal programme scope, form and content frame and the report on economy-financial audit of banking[6] which was issued by the Banking Agency of Federation of B&H. Accounting reform based on the unified Law on accounting and audit on the state B&H has not produced positive results in the audit field. Before the Law was passed on the state level auditors had had the Audit standards of FB&H issued by the Federal bureau for accounting and audit at disposal to use, but nowadays the standards do not exist anymore and ISA has not been translated. From the

[6] Official Gazette FBiH , 3/03

previously offered analysis we can conclude that the B&H legislature considerably puts auditors in the position to deviate from ISA.

4. EDUCATION OF AUDITORS IN B&H AND ITS INFLUENCE ON QUALITY OF AUDIT REPORTS

The analysis of quality of education of auditors was conducted in two ways:

- ☑ The analysis of education required for accountants and auditors to qualify for the profession
- ☑ The analysis of continuous accountants and auditors education

In accordance with the Law on accounting and audit on B&H state level it has been formed the Commission for accounting and audit. The commission is authorized for translation and publishing standards, and in certain circumstances it can give directives and explanations for the directives. The commission is in charge of conducting the uniform education program for qualification to accounting business), coordinating with professional bodies and educational services it publishes the required instructions which are necessary for the appropriate and uniform application of the program in the whole territory of B&H. In practice, getting a professional title in B&H is rather undefined. The comity for accounting and audit is only formally in charge of the matter, in a way that it transferred the mission to the entity accountant and auditor associations. The analysis of education required to qualify for an accounting or auditing vocation was conducted through analysis of the required answers to the quizzes given to the professional auditor nominees in the period of November 2007, May 2008, May 2009, and November 2009 downloaded from the web page owned by the Accountants, auditors and financial branch association of FB&H (SRRF B&H). The analysis of the required answers for the time periods proved that there are certain deviations if we compare them to the International standards on auditing (ISA). The analysis proved that the auditor candidate testing process itself is faulty because in many cases wrong answers are rated correct even though they are not in accordance with auditing standards. The goal that we defined when started the analysis of the continuous education was to establish if auditors get appropriate continues education, in other words get the answer if the education content declared by the official entities in charge of conducting the education may be the cause of subjective weaknesses of auditors which show up though the creating deviant audit reports. Until now, four consulting firms from Federation of Bosnia and Herzegovina, authorized by the experts in the field association, have taken part in conducting the education program. The research and the analysis was conducted by gathering information regarding the topic contents and lectures given through certain forms of education in 2009 and also by classifying according to areas: Accounting standards, annual and semi-annual balances, tax issues, budget accounting, finances, audit and other topics. Analyzing the structure of seminars, which have the status of confirmed and continuous education in 2009 and in the first four months in 2010 it was confirmed that all in all 168 seminars which were organized by 4 consulting firms (142 seminars in 2009 and 26 seminars in the first 4 months in 2010) discussed none of audit topics. Analyzing the special field topics of education it was established the structure of education as it follows:

Table 2: Education topics structure

TYPE	Seminars	Structure
Budget	6	4,23%
Finances	2	1,41%
IAS and IFRS	25	17,61%
Balance	17	11,97%
Other	13	9,15%
Tax	79	55,63%
TOTAL	**142**	**100,00%**

The table clearly shows that the majority of the topics are related to the tax issues (55%) while audit topics were not discussed at all. Three of the education sessions organizers organized international symposiums. Those symposiums treated the topics as it follows.

Table 3.: Audit field topics – International symposium 2009 listed by performers

SYMPOSIUM		TOPIC
REVICON	1	Audit and analysis of financial reports
	2	Audit of efficiency and measuring success in public services
	3	Most frequent deviations and remarks of audit institutions of B&H
	4	Tendencies in public services audit
	5	Most common irregularities and remarks in audit findings in FB&H institutions
FEB	6	Audit of business operating in unstable circumstances
	7	Accounting and audit of bankruptcy
	8	International framework of internal auditor professional performance
	9	Current changes in international audit standards
FIRCON	10	Auditor performance quality control- theory and practice
	11	INTOSAI audit standards and application in public services audit
	12	Public supervision committee and auditor performance quality control
	13	Financial report audit quality control according to ISA 220
	14	ISA 240 – framework for defining of the auditor role in uncovering of fraud

From the topic titles it is obvious that half of the topics are related to audit of public services and those only 7 topics are related to the external commercial audit field. It is important to mention that the seminar presentations for each topic lasted for up to 15 minutes. On that base we can make a conclusion that less than two school periods were spent on the discussion related to external commercial audit. Because of the law definitions currently in effect auditors are not in position to influence directly on the education structure. Despite the fact that the Accounting and auditing commission is authorized for education and certification, it authorized the Accounting, audit and financial field experts of FB&H association to perform instead. However, auditors have no influence o on the association because of the reasons as it follows:

☑ Auditors are not present to the Association meetings since the meetings are not held publicly and transparently. Not all the members are invited to the meetings but only the

representatives of the associations that established the Association and who are controlled by the consulting firms "Revicon", "FEB" and "Fircon."

- ☑ The Association bylaw has never been published and consequently the members, especially auditors do not know their rights and obligations.

Regarding the education auditors are the same way as the other members of the Association put in the same position despite the fact that other members are far less educated (the majority of other members have only a high school diploma). The research clearly indicated that the auditors in B&H do not get proper education while attending the course to get the title, and also the continuous audit field education almost does not exist.

5. TOTAL NUMBER OF PUBLISHED AUDITS AND ITS INFLUENCE ON THE AUDIT REPORTS QUALITY

One of the research goals was to quantify the total number of audits in relation to the total number of legal entities in FB&H, find the answer to the question if B&H auditors have a chance to get appropriate practice and if the insufficiently developed audit practice could be the cause of deviations in audit reports comparing to ISA. The quantification of the number of audits carried out comparing to the total number of legal entities in FB&H in 2009 was carried out on the sample that consists of: processing industries, (sample-57 legal entities), banks and insurance companies. It was established and confirmed that 3816 processing industry subjects turned in their financial reports for 2009 to AFIP in appropriate legal forms. The analysis was conducted on the sample of 57 legal entities which turned in their reports to the Securities commission for the time period of the year 2009. The analysis established that 27 legal entities did audit which presents 47% of the total number of the analyzed legal entities. It was established that 4 of the legal entities had the audit in progress which presents 7% of the total number. The other 26 legal entities which present 46% of the total number had not audit done yet. It is necessary to emphasize that most of the legal entities in processing industry in FB&H are registered as companies with limited liability. Consequently, they are not legally obliged to turn in to the Commission neither financial nor audit reports. It is obvious that those companies with limited liability show poor transparency
in their financial reporting. The research establishes the fact that banks and insurance companies do financial report audits, especially because audit liability is imposed by the special regulations issued by supervision agencies. However, in 90% of the cases, banks and insurance companies look for internationally licensed audit firm's services, and consequently most of the FB&H audit firms have no opportunity to audit in this business field. The analysis also proved that B&H auditors have no opportunity to get the proper practice since very few audits are done in FB&H. Audit is conducted in share holding companies as well as the companies that are required to do so according to some other requirements. Those companies are subjected to be supervised by some special standards (banks, insurance companies, investment fund organizations, public enterprises). However, most of companies with limited liability evade audits (even big companies) taking advantage of the previous Law on accounting and auditing (2005) shortages. Insufficiently developed audit practice with no doubt is a significant cause for erroneous audit reports.

6. QUALITY CONTROL OF AUDIT, PUBIC SUPERVISION OF AUDITORS IN B&H AND THE REFLECTION IN THE AUDIT REPORT QUALITY

The analysis confirmed that the number and the structure of the employees in audit firms, in any case, poses a key factor for the quality control policies, demanded by the international standards, to be put in practice. The research on the number and the structure of employees in audit firms in B&H was conducted on sample basis, through the questionnaire which included 32 audit firms in its scope. The questionnaire required information as it follows: total number of employed certified auditors, official book of regulations at disposal.

It is necessary to emphasize that the audit firms, the branch offices of big international audit firms were excluded from the analysis of application of the audit quality control principle. Anyway, these audit firms are obliged to conduct the quality policy established by their mother organizations.

The questioner analysis results are as it follows:

Table 4: Number and structure of employees in audit firms in FB&H

	1 - 2	**3 - 5**	**6 - 10**	**11 - 15**	**over 15**	**YES**	**NO**	**TOTAL**
NUMBER OF EMPLOYEES	**18**	**9**	**2**	**2**	**1**			**32**
NUMBER OF CERTIFIED AUDITORS	**31**	**1**						**32**
BOOK OF REGULATIONS AT DISPOSAL						**2**	**30**	**32**

The analysis indicates that more than a half of the total number of audit firms has one or two employees, almost all of the firms have one or two certified auditors, and only two firms have a quality control rule book. Having in mind the circumstances, it is obvious that at least a part of the standard quality control elements is not possible to be applied in practice in audit firms in FB&H, especially the components as it follows: task distribution, authorization, advising and observation.

Since the Law on accounting and audit in FB&H (2005) was passed, the role of public supervision is practically held by the Ministry of finance B&H. However, the research proves that the Ministry has not published a single report on public supervision conducted. None of the audit firms of an auditor has been decertified (except the cases of reregistration). None of the audit firms or auditors was officially denounced.

These arguments prove that the Ministry has not put in operational practice public supervision role. Besides, it has not taken any measures in this field. That is, by all means, a significant cause for poor quality of the published audits reports.

7. CONCLUSION

The analysis of the gathered audit reports proved that there is a number of deviations if Compared to ISA 700 and 701, from the formal text content aspect as well as the essence aspect, taking in consideration both commercial auditors and government auditors in B&H.

Analyzing the Legislative regulations in the audit field in B&H and its influence on audit report quality, it has been proved that in a part of the legislature in B&H there are some regulations that have negative influence on audit quality. The analysis of education required to qualify and acquire the certification in accounting and audit profession, and also the analysis of continuous education of accountants and auditors, conducted by the experts in the field association, indicated that the auditors in FB&H have no opportunity to get the proper education to ensure their performance in accordance with ISA. The analysis of the total number of audits and its influence on the audit reports quality indicated that most of B&H auditors have no opportunity to get enough practice, and insufficiently developed audit practice presents a significant cause for creating erroneous audit reports. The analysis of audit quality control and public supervision control in FB&H it was proved that the quality control rendered by audit firms in most cases is not credible because of the small number of employees in audit firms, and the external quality control and public supervision in than last 5 years existed only formally. They have been put in practice by the ministry in charge. In order to overcome the current situation in audit field it is necessary to adapt the legal regulations in the audit field to the real requirements of the audit business, and also publish the translation of ISA to the local languages as soon as possible. The audit firms should establish the Audit Chamber and eliminate the problem of the audit field disunity and the problem of not making difference between auditors and accountants and sometimes between auditors and high school educated accountant technicians, regarding the education. It is also necessary to adapt the Education program for auditors according to the real requirements on the market that the auditors encounter, in a way that the education topics the related to the audit issues take more places in the education program initiated by the experts in field associations in charge of conducting the seminars and education. In order to improve the audit quality control
it is essential to establish an appropriate regulatory body to control the audit associations performance and also control the certified auditors performance. It is also supposed to establish public supervision over the regulatory body in charge of the quality control, over the audit organizations and certified auditors, in order to contribute to the harmonization of operating the mentioned business subject in business.

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RAZLOZI REVIZORSKIH GREŠAKA U OBJAVLJENIM REVIZORSKIM IZVJEŠTAJIMA U BOSNI I HERCEGOVINI

SAŽETAK

Autori su realizirali istraživanje u okviru kojeg su identificirane greške u objavljenim revizorskim izvještajima bosanskohercegovačkih nezavisnih revizora, te analizirani uzroci uočenih grešaka. Analizom prikupljenih revizorskih izvještaja utvrđeno je da postoje brojne devijacije u odnosu na zahtjeve Međunarodnih revizijskih standarda 700 i 701, kako sa aspekta formalnog sadržaja teksta izvještaja, tako i sa suštinskog aspekta. Istraživanjem je utvrđeno da su uzroci identificiranih grešaka: neadekvatna zakonska regulativa u BiH, neodgovarajuća kontinuirana edukacija revizora, nedovoljna razvijena revizorska praksa, nedostatak interne kontrole kvaliteta u većini revizorskih firmi te nedostatak javnog nadzora na nivou države. Novi Zakon o računovodstvu i reviziji otvara prostor za određena poboljšanja, a naročito kroz osnivanje Revizorske komore i Odbora za javni nadzor.

Ključne riječi: *Međunarodni revizijski standardi, revizijski izvještaji, greške revizora*

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REFLECTIONS ON THE SECURITIES HOLDING SYSTEM IN CROATIA IN LIGHT OF THE UNIDROIT's CONVENTION ON INTERMEDIATED SECURITIES

ABSTRACT

Securities holding systems are vital for the effective functioning of capital markets. They reduce the risks associated with transfer of securities between market participants; their smooth functioning depends from certainty as to the rights and obligations of different subjects. If there is no such certainty, the system is prone to legal risk and – in time of financial duress – to systemic risk as well. The purpose of this paper is twofold: first, to analyse the difference between various systems of holding securities and second (section 1 and 2), to assess the Croatian securities holding system (section 3). Our attention is especially focused on Croatian legislation governing securities, with emphasis on the national Central Clearing and Depository Agency. In section 4 we discuss the UNIDROIT's Convention on Intermediated Securities. Finally, section 5 discusses recent EU regulatory initiatives which are part of an overarching post-crisis reform agenda in the financial markets.

Key-words: *intermediated securities, securities holding system, Geneva Convention, central securities depository, Securities Law Directive*

1. INTRODUCTION

The purpose of this paper is twofold. First, we discuss the difference between various systems of holding securities and their development. We also point to the different legal options encompassed within the term of "book-entry securities". Then our attention focuses on the efforts of the International Institute for the Unification of Private Law (hereinafter the UNIDROIT) with respect to changes in securities markets that have occurred over the last three decades – specifically the dematerialisation of securities and consequently their intermediated holding. We do this by discussing the result of such efforts, namely the UNIDROIT Convention on Intermediated Securities (hereinafter the Geneva Convention). Second, against this background we discuss the securities holding system in Croatia and we analyse how beneficial can the UNIDROIT's work in this area be for its future development. Regardless of the fact that the intermediary holding of securities is an accepted practice in Croatia, the issue received little attention by experts in the field; as a result relevant literature is almost non-existent. Thus, our goal is to assess the state of Croatian legislation governing securities holding system, with special consideration of the position of the Croatian Central Clearing and Depository Agency. In addition, we assess Croatia's preparedness to follow recent regulatory trends in this area, in order to enhance the stability of the national securities market and its cross-border compatibility (particularly important from the aspect of the EU accession).

2. DISTINGUISHING BETWEEN SECURITIES HOLDING SYSTEMS

In this section we discuss the difference between direct and indirect holding systems of securities. It is very difficult to divide national systems into these clear-cut categories. The reality is heterogeneous, with the two categories encompassing a wide range of legal options each of them with its own peculiarities. We begin our analysis with a historical background to the development of securities holding systems and the evolution of the form of securities.

One of the crucial innovations of securities markets was the incorporation of investors' intangible rights into certificates which represented negotiable instruments that could easily be transferred between subjects. By transforming intangible rights into a tangible property, investors were able to prove their ownership by holding certificates and to dispose their investment by delivering them to purchasers or lenders in a securities lending transaction (*e.g.* repurchase agreements). The sale and purchase or lending of securities could be carried out in a manner similar for any other moveable; one party delivered the certificate representing the underlying security to the other. The delivery also transferred the title in securities, thus constituting a settlement[1]. Through the circulation of certificated securities, capital flows between investors. By mid-20th century the volume, number of issues, and turnover speed made the delivery of certificated securities impractical and costly. In addition, the level of operational risk connected with the physical handling of certificates was not acceptable anymore[2]. These events induced a growing number of countries to transition from direct holdings of certificated securities to indirect holdings of uncertificated securities through one or more custodians, such as banks or other specialised financial institutions. *Dematerialisation* and *immobilisation* of securities were the innovative solutions. Physical securities that were certified became unnecessary, and thus replaced by an "issue account" against which dematerialised securities were credited (that is to accounts of market participants) and transferred by means of "book-entry". Dematerialised securities take the form of a book-entry on a securities account which are opened either with an intermediary responsible to open accounts for its clients' final investors or directly in the books of the issuer. Immobilisation means that securities are held in custody of reliable depositories and represented by entries in securities accounts which were maintained by financial intermediaries for the investors[3]. [4]We also point that these intermediaries are usually investment firms or credit institutions whose operations and obligations are governed by specific legislation[5].

Nowadays, in almost all regulated markets worldwide, the securities issued and listed by different companies are dematerialised[6]. Furthermore, the relation existing between the substantial owner of securities to these securities and the issue of directness of this relation and of its interruption by the imposition of an intermediary determines the type of securities holding system in practice. There are two basic types of securities holding systems: direct and indirect. In this analysis we depart from a basic presumption; that all book-entry securities

[1] Kronke, H., (2008): "The Draft Unidroit Convention in Intermediated Securities: Transactional Certainty and Market Stability", Current Developments in Monetary and Financial Law, 5: 619-643.
[2] See Thèvenoz, L., (2007): "Intermediated Securities, Legal Risk, and the International Harmonization of Commercial Law", Duke Law School Legal Studies Research Paper No. 170; available at: www.ssrn.com
[3] See Garcimartín Alférez, F. J., (2006): "The UNIDROIT Project on Intermediated Securities: Direct and Indirect Holding Systems", Revista para el análisis del derecho, 324: 3.
[4]
[5] In the EU these are the Markets in Financial Instruments Directive and the Second Banking Directive.
[6] Diathesopoulos (2010) notes that in the UK and USA paper securities still constitute an important ratio of overall traded securities. The rationale for this may be found in their legal tradition, and their long-standing trading infrastructure concerning paper securities. See Diathesopoulos, M. D., (2010): "Interests in Securities Under a Comparative Law Approach", PFESR Annual Review; available at: www.ssrn.com

systems are *de facto* intermediated and in this sense indirectly held[7]. In other words, a third party that exerts control over the books or the registry comes between the issuer and the holder of the security. However, one must be careful in distinguishing between securities holding systems upon this presumption; the difference between direct and indirect holding systems is not practical and does not depend on whether the investor physically possesses the security, but rather it is legal and it depends on the way in which a legal system prevents custody risk and facilitates the exercise of investors' corporate rights in the case of intermediated securities. Does the intermediary act as a mere agent or a facilitator for the investor or does the intermediary appear as the owner of the securities in the issuer's registry?

In direct holding systems intermediaries only have the function of a book-keeper and have no legal interest in the underlying securities, while in indirect holding systems a number of intermediaries comes between the end-investor and the issuer of securities. In discussing direct holding systems one has to keep in mind that there is a difference between their earlier versions[8] and the "modern direct holding system". We will focus solely on the latter type. In a modern direct holding system investors maintain a direct legal relationship with the security's issuer. As investors are direct owners of all the rights incorporated in the security, their interests in the intermediary is limited to the exercise of these rights. The central securities depository (hereinafter the CSD) operates thousands of investors' accounts. These accounts are opened directly with the investor and as such are known as "owner accounts". In a modern direct holding system the legal framework ensures that account holders at the CSD are the owners of shareholder rights against the issuer of securities. To this aim, the intermediary – or the CSD – holds the accounts without having any right to the securities. The CSDs have the ability to access the identity of investors in real time irrespective of the complexity of the mediation chain. Furthermore, all positions of beneficial owners are registered, meaning that their identity is known to the issuer or the central securities depository. These systems are considered to be transparent, "direct holding" systems[9].

Certain jurisdictions (most notably the US) consider that the process of intermediation requires creation of new legal concepts: *an entitlement over the securities different from the underlying securities and derived from the position of the intermediary*[10]. In this way, they create a new form of proprietary rights better suited for investor protection with respect to intermediated securities. The term "indirectly held securities" has lately been described as referring to securities held on account by an intermediary, therefore differentiating them from securities held by owners in paper form. The existence of an account being administered by someone with whom the holder has an agreement – following certain regulation – is the fact that necessitates special attention. If the person, responsible in relation to the account holder for the administration of the account, is called an intermediary then all intermediaries are CSDs and all securities held on CSD accounts are indirectly held. This system is also known as a "multi-tired holding system" as it usually consists of one or more tiers of intermediaries between the issuer and investor. In this case, the interests of investors are recorded in the files of the intermediary, who in turn records these securities in the files of another intermediary, and so on until an intermediary appears as the owner of the securities in the issuer's registry.

[7] See Garcimartín Alférez, F. J., (2006): "The UNIDROIT Project on Intermediated Securities: Direct and Indirect Holding Systems", Revista para el análisis del derecho, 324: 3.

[8] An early direct securities holding system is associated with paper securities, and was exercised before the era of immobilization and dematerialisation. In this system transfer of the interest in securities (ownership) was executed through physical delivery of certificates from the seller to the buyer.

[9] According to the Report of the UNIDROIT, transparent systems are divided into three categories. In the first there is no mediation chain and intermediaries settle their transactions directly through the management of their accounts by the CSD. In the second category, on upper level of chain in CSD accounts are maintained in the name of the intermediary, but are divided into several sub-accounts for each account-holder client of the intermediary reflecting the number of shares that each client owns. The third category covers systems where there is an account at the level of CSD in the name of the intermediary reflecting the total amount of securities held by the intermediary on behalf of its clients. See UNIDROIT Committee of Governmental Experts of a Draft Convention on Substantive rules regarding intermediated securities, *Report of the Transparent Systems Working Group – Study LXXVIII*, Doc. 88 (Rome: 2007); available at: www.unidroit.org

[10] Ibidem.

Schwarcz (2001) describes indirect holding systems as those where investors generally record ownership of their securities as belonging to one or more depositories. Although securities held with a depository are often evidenced by physical certificates these certificates remain in the possession of the depository and are never delivered to third parties. The depositories in turn, record the identities of other intermediaries, such as brokers or banks that purchase interests in these securities. And those other intermediaries record the identities of investors that purchase interests in the intermediaries' interests[11]. In short, the indirect holding system functions as a chain where various intermediaries are the links between the issuer and the original investor. The transfer of interests in securities is performed through book-entries and no physical delivery of securities is required.

In order to perform a credit or a debit (depending whether there is a purchase or sale of securities) on the individual securities account the end-investor must hold a securities account with a custodian in the system, which is usually kept in the form of Collective Securities Accounts. This is in fact a chain of sub-custodians, starting from the CSD authorized with respect to the place of the transaction to the end-investor's custodian, who has their individual securities and monetary account (either themselves or through a credit institution) and a dematerialised movement of securities with entries in accounts kept in more tiers (Diathesopoulos, 2010, 24). In the first tier the CSD registered in the books of the issuing company keeps securities accounts for its members (*e.g.* brokers, custodians) to whom it is contractually bind. Typically the CSD has to provide a final file with information related to people who act as owners of securities kept and that are entitled to securities rights. In the next tier members either hold accounts for other intermediaries or individual accounts for their customers' end-investor. Therefore, unlike in direct holding systems, the end-investor may exercise their rights deriving from securities (and against the issuer) either through their custodian (who may exercise such rights either directly or by authorising another intermediary in case there is more than one intermediary in the system) and they cannot directly claim securities entered in a Collective Securities Account kept by an intermediary of a next tier[12]. Therefore, end-investors may exercise their rights only indirectly.

The two securities holding systems are obviously very different from a legal aspect, but how does their nature relate to an economic context? Diathesopoulos (2010) argues that one of the main advantages of an indirect holding system is the reduction of the investors' total cost, which is not required to open individual securities accounts in each clearance and settlement system operating in every market he invests in. More specifically, this type of system organisation is appropriate for well developed securities markets opened to international activities. In fact, it allows international and institutional investors a certain relation to a custodian, typically an international one, who undertakes to further organise the investor's equity participations in each country and their custody, through local custodians (usually brokers, credit institutions, Units for Collective investments in Transferable Securities or mutual funds, acting on behalf of end-investors and not as end-investors themselves[13]). Furthermore, the indirect holding system reduces the risks associated with transfer of securities as it allows rapid disposition of the interests nationally and internationally through the system of book-entries by one or more intermediaries[14].

[11] See Schwarcz, S. L., (2001): "Intermediary Risk in a Global Economy", Duke Law Journal, 50(6): 6.
[12] See *supra* note 5, p. 24.
[13] More on the legal nature and economic strategies of these investors can be found at: http://ec.europa.eu/internal_market/investment/index_en.htm
[14] Nevertheless, it cannot be argued that the indirect holding system is completely immune from certain vulnerabilities. An obvious one is that in such a system the issuers do not know the identity of their securities' beneficial owners; they typically know only the identity of the intermediary.

3. SECURITIES REGULATION AND THE SECURITIES HOLDING SYSTEM IN CROATIA

Although Croatian securities regulation follows the European and thus, international regulatory trends and specifications (and in doing this Croatia is very well prepared) what is striking is that there is virtually no information or relevant studies regarding the type of the securities holding system exercised or adopted regulation. Hence, an analysis of this issue is long overdue, especially when considering its evidenced economic impact. Before entering the merit of the discussion in this section let us first briefly explain the economic nature of securities. Securities are a type of financial assets. They are created through the interaction of two persons, which are bound together either by statutory provisions or contract, from which the asset derives its value. Securities are intangible assets whose financial value is dependent from the future business performance of its issuer[15]. From the investor's point of view securities operate in two capacities: (i) they constitute personal rights against the issuer, and (ii) they represent an asset. The interest of the *issuer* is to follow clear and transparent rules regarding in favour of whom it must fulfil the obligations incorporated in the security. The interest of the *investor* is to have a sound protection of his property against the issuer (issuer risk) but also, in the case of intermediated securities, against other creditors of the intermediary (custody risk)[16]. The way in which the latter risk is mitigated depends on the way the security is represented within a legal system (whether it is a direct or indirect holding system).

Regulation of securities in Croatia owes its speedy development to the harmonisation requirements with the European *acquis*. Croatia's political choice to become an EU Member State and its negotiation toward accession has greatly contributed to the development of capital market regulation, and as such to securities law. A textbook example of this development is the Capital Markets Act, which came in force in January 2009 (*Zakon o tržištu kapitala*, OG No. 88/2008, 146/08, 74/2009) and replaced both the Act on Issuance and Transactions with Securities and the Securities Market Act (*Zakon o izdavanju i prometu vrijednosnim papirima*, OG 107/95, 142/98, 87/00; *Zakon o tržištu vrijednosnih papira*, OG No. 84/02 and 138/06). The Capital Markets Act (hereinafter the CMA) incorporates the EU directives and regulations thus fully aligning Croatian legislation in this area with the EU regulatory requirements[17].

According to Croatian law[18], securities can be represented in two forms: as a physical document (certificated securities) or as an electronic entry. In the first case, the contractual claim with respect to the issuer of the security cannot be separated from the material certificate, meaning that from the actual physical transfer of the certificate (or the endorsement of a registered security) follows the transfer of the entitlement to the rights incorporated in the security. In the second case, and according to s. 490(1) of the CMA, the security is represented by electronic information recorded in a registry. Thus according to the law, the creation, the transfer and the exercise of rights can only take place as a consequence of entries in an electronic registry. In addition, securities may be issued as registered or bearer securities. Although in principle issuers of securities are free to determine the manner of representation of their securities, s. 490(2) and (3) of the CMA in line with the general

[15] See Moloney, N., (2008): EC Securities Regulation, 2nd edition, (Oxford: Oxford University Press), p. 53.
[16] See *supra* note 6.
[17] It is the author's opinion that the Capital Markets Act is of somewhat poor legal quality, in the sense that it lacks a more streamlined approach to its regulatory objectives and instruments used. When reading the legislative text one comes to a conclusion that Croatian legislators wished for the remainder of EU law to be incorporated as soon as possible in Croatian legislation. The result is a non-coherent legislative text with some hastily found nomenclatures and provisions, which is detached from the Croatian legislative tradition in the area of securities and company law. In general, the Capital Markets Act concurs fully to the impression of EU decision-makers which seldom pointed to Croatia's *ad hoc* approach to measures of economic and financial policy. However, it has to be noted that the mere existence of this legislative text provides a starting point for further sophistication in the capital markets regulation.
[18] See s. 1135 of the Civil Obligations Act, Official Gazette No. 35/2005.

provision mandated by s. 1135(2) of the Civil Obligations Act, provide that the book-entry form of representation (*i.e.* the issuance of dematerialised securities) is obligatory for all issuers registered within Croatian territory and who want to offer their securities by means of public offering, as well as all credit institutions, investment firms established as joint stock companies, insurance undertakings and close-end investment funds. For these types of securities, Croatia – similar to other European countries – has opted for a fully dematerialised scheme and immobilisation (see s. 490(1) of the CMA).

Irrespective of the argument put forward by Goode (1996, 167) and which states that, unlike full dematerialisation, immobilisation affects the direct relationship between investors and issuers, we argue that Croatia follows a "modern" direct holding system. In this system the majority of the securities are now intermediated, and *de facto* held indirectly. This is partly the result of the assumption made by Croatian legislators that dematerialised securities don't call for a radical change in the regulatory and conceptual framework traditionally applied to securities. Naturally, Croatian securities and company law had to be modified in order for them to be adapted to the technical and operational peculiarities of book-entry securities. The majority of adaptations regarded investor protection, where physical possession of the certificate as a form of protection, had to be replaced by an electronic registry that could fulfil the function equivalent to physical possession[19].

The Croatian securities holding system is based on the idea of a single registry where entries of securities traded on regulated and unregulated markets take place. The central depository in Croatia is the Central Clearing and Depository Agency (*Središnje Klirinško Depozitarno Društvo*; hereinafter the CCDA). The CCDA was established in April 1997 as a joint stock company (*dioničko društvo*) under a somewhat different name but encompassing the same activities that it carries on at present. As for its ownership structure, the Republic of Croatia is a majority shareholder (it holds 62.30% of ordinary shares), followed by other participants in the capital market (such as banks, brokers, and exchanges) and the Croatian Financial Agency (*Financijska agencija*). In line with the provisions of the Capital Markets Act, as well as the Regulations and Guidelines[20], some of the most important activities of the CCDA are:

(i) management of the central depository of dematerialised securities;

(ii) management of the clearing and settlement system for securities transactions concluded on regulated and over-the-counter markets (OTC), as well as on multilateral trading facilities (MTFs)[21];

(iii) determining unique identification numbers for dematerialised securities[22].

In our analysis of the securities holding system exercised in Croatia and our argument in favour of a modern direct holding system, we rely heavily on these CCDA's legal documents.

In Croatia, investors often hold their securities on accounts opened directly with the CCDA (the so called "owner accounts" or "*osnovni račun*"[23]). Therefore the Croatian securities holding system can be described as direct at first glance. However, the owner can

[19] To this end the obligation of custody of materialized documents was replaced by the obligation of keeping a book-entry registry, the principle of good faith acquisition based on the appearance of physical possession was replaced by the acquisition based on the appearance of the electronic registry, the transmission by physical delivery was replaced by entries in the registry, and so on.

[20] *Pravila Središnjeg klirinškog depozitarnog društva d.d.*, Zagreb 7.05.2009; and *Uputa Središnjeg klirinškog depozitarnog društva d.d.*, Zagreb 7.05.2009. The Regulations and Guidelines are available in Croatian language from: www.skdd.hr

[21] OTC markets are markets organized for trading securities that are not listed on an organized stock exchange (*i.e.* regulated market). A MTF is a multilateral system, operated by an investment firm or market operator, which brings together multiple third-party buying and selling interests in financial instruments – in the system and in accordance with non-discretionary rules – in a way that results in a contract in accordance with the provisions of Title II of the Markets in Financial Instruments Directive. See Fitch, T. (1990): "*Dictionary of Banking Terms*", (New York Hauppauge: Barron's), and Directive 2004/39/EC, available at: http://eur-lex.europa.eu

[22] These are the International Securities Identification Number (ISIN) and the Classification of Financial Instruments code (CFI).

[23] See s. 104 of the *Uputa Središnjeg klirinškog depozitarnog društva*, Zagreb 7 May 2009, available in Croatian from: www.skdd.hr

assign another person to "hold" the securities, therefore a "nominee account"[24] ("*zastupnički račun*" and "*skrbnički račun*"[25]) is also allowed. On these accounts it is noted that the account holder is holding the securities for the benefit of one or more investors. Thus, this type of holding does not interfere with the exercise of investors' rights, which is also concurrent with our categorization of the Croatian securities holding system as direct. Furthermore, we support our argument of a direct holding system with the provision of s. 103 of the CCDA's Guidelines which states:

"*Every entity registered in the depository is registered as an investor or as an owner/nominee of an account, regardless of the fact whether the investor is the actual holder of the security, or one of the co-owners, legal or other representative, or a proxy authorized to exercise voting rights or whether he/she holds securities for a third party*."

We have already stated that in a modern direct holding system, the issuer of securities knows the end-investor, his/hers identity is disclosed. The provisions of s. 286 of the CCDA's Guidelines regulate access to information related to accounts holders:

"*Issuers of dematerialised securities have the right to access information regarding the type, class, quantity, proprietary rights and the persons entitled to these rights, as well as on the restrictions imposed on proprietary rights associated to dematerialised securities and the registration history of dematerialised securities and which regard the issuer's accounts of dematerialised securities, as well as to information regarding the type, class, quantity, proprietary rights and the persons entitled to these rights, as well as on the restrictions imposed on proprietary rights of other holders of dematerialised securities issued by the same issuer*."

This model of central record-keeping of dematerialised securities established under Croatian law permits to maintain the conceptual framework of direct holding. The name of the owners of the securities appears in the detailed registries of the CCDA, and those owners, *i.e.* investors have direct rights in relation to the issuer and third parties, including the right to receive and enjoy the fruits of ownership of the securities, the right to dispose of the securities, and so on. The intermediary holds the accounts without having any right on the shares. Naturally, in order to exercise the rights arising from securities the owner may require the assistance of the intermediary, but nevertheless these are still rights of the investor whilst the intermediary acts in the capacity of an agent or an authorized person.

4. THE UNIDROIT CONVENTION ON INTERMEDIATED SECURITIES

The UNIDROIT Convention on Substantive Rules for Intermediated Securities[26] (the Geneva Convention) was adopted on a diplomatic convention held in Geneva in October 2009. The Geneva Convention represents the culmination of regulatory efforts made through an extensive negotiation process which started in 2002. As such, it is a major breakthrough in global harmonisation in what is probably one of the most complex and economically significant areas of financial regulation, which is securities law. The scope of the Geneva Convention is to improve the regulatory framework for securities holding, transfer and collateralisation, in order to enhance the internal stability of national financial markets and their cross-border compatibility (Estrella Faria, 2010, 196). The UNIDROIT intends to continue its research within projects relating to transactions on transnational and connected capital markets and considers the Geneva Convention to be one of the first instruments developed as part of its research.

[24] In such an account the nominee is permitted to do only acts that are strictly necessary to maintain the client's holding of securities. In addition there are several other accounts that entities may hold at the CCDA ("*trezorski račun*", "*račun portfelja*" and so on). In all of these accounts the end-investor is disclosed and as such known to the issuer.
[25] Ibidem.
[26] Available at: http://www.unidroit.org/english/conventions/2009intermediatedsecurities/main.htm

The transformation of market practice of holding and disposition of securities which we have discussed in previous sections of this paper meant that many countries have revised their legal framework applicable to the holding of securities in order to better suit market trends. However, in many countries, the legal framework which underlined the securities holding system was built on traditional legal concepts which were first developed for the traditional method of holding and the disposition of certificated securities. As a result, considerable legal uncertainty is caused by the fact that securities are widely transferred across borders whilst the applicable law remains uncertain, and thus the legal risk connected with these transaction increases. Henceforth, legal risk can in time of financial duress even trigger systemic risk (as was also demonstrated by events during the last economic and financial crisis) which in this way originates from capital markets; and from the aspect of financial stability it is very important to have effective capital markets. Several international initiatives addressed this issue, for instance the 2001 Recommendations issued by the International Organisation of Securities Commission, the 2003 G30 Plan of Action, and the 2006 Report on cross-border collateral arrangements of the Bank for International Settlement[27]. On an EU level, the Report of the Giovannini group is the cornerstone for every analysis in this area[28]. The wider community recognized the need for a reliable regulatory framework adapted to the modern securities holding system as a crucial element for efficient capital markets, and the protection of all participants – first of all investors, but also issuers of securities, clearing and settlement organizations and parties to collateral arrangements involving dematerialised securities. Private international law also addressed this subject by adopting the Hague Convention on the Law applicable to Certain Rights in respect of Securities held with an Intermediary in December 2002[29]. However, its legal nature and orientation toward conflict-of-law rules means that the Convention does not address issues of substantive law.

During its negotiation the drafting of the Geneva Convention was guided by several policy goals (Estrella Faria, 2010):
(1) to secure *internal soundness of systems* with respect to investor protection;
(2) to ensure *compatibility of different legal systems* that should converge with respect to company law and financial supervision to some extent, when regulating cross-border securities transactions;
(3) to ensure *validity of book entry accounts* which would dismiss any doubts regarding the effectiveness and finality of an interest represented by a book entry debit or credit;
(4) to follow a *neutral and functional approach*, as the convention tries to accommodate different legal systems and traditions;
(5) to use a "*minimalist" approach to regulatory intervention* only in those issues which clearly lack uniformity and from which systemic risk may arise, as well as to secure *compatibility with other policy instruments* (such as EU law or international regulations).

Let us now discuss the sphere of application of the Geneva Convention. A general observation is that the sphere of application of international conventions and other forms of international *soft law* in the field of financial regulation is often defined by a general description of the subject covered and a reference to some element of internationality. However, this is not the case with the Geneva Convention. As the high level of interdependency in contemporary financial markets makes the distinction between "national" and "international" obsolete, the Geneva Convention opted for the possibility to become part

[27] See Committee on Payment and Settlement Systems and the Technical Committee of the international Organization of Securities Commissions, *Recommendations for Securities Settlement Systems*, (Basel, BIS, January 2001), available at: www.bis.org; The Group of Thirty, *Global Clearing and Settlement – A plan of Action*, (Washington, D.C, 2003);available at: www.group30.org ; Committee on Payment and Settlement Systems, *Report on cross-border collateral arrangements*, (Basel, BIS, January 2006), available at: www.bis.org
[28] The Giovannini Group, *Second Report on EU Clearing and Settlement*, (Brussels, 04/2003), available at: www.ec.europa.eu
[29] Convention on the Law Applicable to Certain Rights in respect of Securities Held with an Intermediary, adopted under the auspices of The Hague Convention on Private International Law, (The Hague, 12/2002), available at: www.hcch.net

of the substantive law of a Contracting State. Therefore, whenever the law of a Contracting State is the applicable law for matters covered by the Convention, the provisions of the Geneva Convention apply (rather than the State's law).

The key elements regulated by the Geneva Convention are the following three terms: *"intermediated securities"*, *"intermediary"* and *"securities account"*. According to s. 1(a), (b) an "intermediated security" refers to any share, bond or other financial instrument or financial asset, capable of being credited to a securities account and of being acquired and disposed of in accordance with the provisions of the Convention and which have in fact been credited to a securities account or rights or interests in securities resulting from the credit of securities to a securities account. Following the provisions of s. 1(c), (d) we can define a "securities account" as an account to which securities may be credited or debited and which is maintained by an "intermediary", that is, a person who in the course of a business or other regular activity maintains securities accounts for other or both for others and for its own account and is acting in that capacity. Among central banks, credit institutions and brokers, that can be considered as intermediaries by deduction the Geneva Convention expressly includes Central Securities Depositories (CSDs). As for the types of securities regulated, the Geneva Convention mandates two characteristics:
(1) they must be capable to be credited to securities accounts held by an intermediary and
(2) they must be capable of being acquired or disposed of in accordance with the Convention's provisions[30].
The Geneva Convention does not provide an exhaustive list of securities included under its framework, but we can conclude that the Convention's provisions apply to bearer and registered securities, securities represented by individual certificates, those represented by a global certificate as well as purely dematerialised securities. Thus, the Geneva Convention excludes certificated securities held physically and directly by an investor as well as securities registered directly with an issuer in the name of investors.

An interesting observation has to be made at the end of this discussion regarding the limitations of the sphere of the Convention's application. The Geneva Convention doesn't define the term "issuer". The interpretation of this term is not problematic with respect to issuers of "traditional" securities such as shares and bonds, but in structured financial products, such as asset-backed securities for instance, it is more complicated to determine the issuer. Such issues, which are not addressed by the Convention, will be the subject of UNIDROIT's further efforts; the UNIDROIT will surely compose a document which will serve as a guideline in relation to these issues, or it will allow Contracting States to provide otherwise[31].

5. EU REGULATORY INITIATIVES WITH RESPECT TO SECURITIES HOLDING SYSTEMS

Looking at the various securities holding systems currently exercised across EU Member States, at first glance we will note a somewhat irreconcilable difference between the "direct ownership-book entry intermediation" approach of most civil law countries, and the "derivative property" approach of common law countries. It must be noted however, that EU legislation does not regulate the prerequisites neither for book-entry keeping nor for custodian services provision. The perspective under which the majority of EU Member States developed ruled regarding securities holding systems was driven by practices of local stock exchanges and referred mostly to domestic issuers. The reason for this is the lack of links between

[30] See s. 12 of the Geneva Convention which deals with acquisitions and dispositions of intermediated securities by three additional methods (other than credits or debits).
[31] To this end the UNIDROIT Secretariat has started to prepare an Accession Kit to the Convention that will provide advice for countries that ratify the Convention on how to incorporate its provisions and integrate the Convention into their national legal systems.

issuers and the CSDs governed by different legislations, due to the fact that the Member States company legislation governing the issuer, in the absence of harmonization, cannot establish rights and obligations regarding book-entries kept by foreign intermediaries[32]. As a result, the regulatory framework in force across Member States governing holding and transactions of securities through securities accounts differs considerably. Additionally, national rules often prohibit the depositing of securities issues in a Member State different from the one in which the issuer is registered. In December 2008 the European Commission affirmed that legislative intervention in this area, at a supranational level, would provide for a more harmonised legal framework for intermediated securities and a better protection of investors' rights. On top of legal uncertainties caused by the current situation in this area, some costly operational consequences emerged as well – holding chains of securities are more complicated than necessary and restrictions hamper competition as well as operational efficiency. Thus, it is a common stance that EU law should regulate the legal framework governing the holding and disposition of securities held through securities accounts and the processing of rights flowing from these securities. Although the issue and its possible solutions are legal in nature the underlying problems have a significant economic impact.

Against this background, the Commission is preparing a draft Directive on legal certainty of securities holding and transactions (hereinafter the Securities Law Directive or SLD)[33]. This draft Directive is a result of policy efforts made in consultations with the Legal Certainty Group – a group of legal experts that advises the Commission on legislation that should be adopted in the field of securities holding. The Directive is expected to address three issues:

(i) the legal framework of holding and disposition of securities held in securities accounts;
(ii) the legal framework governing the exercise of investor's rights flowing from securities through a "chain" of intermediaries, in particular in cross-border situations;
(iii) the submission of any activity of safekeeping and administration of securities under an appropriate supervisory regime[34].

The SLD comes as part of an extensive regulatory reform package that will shape the post-crisis market environment in which investors will operate. The Directive's aim is to dismantle some of the so called Giovannini Barriers to safe and effective cross-border clearing and settlement of securities in the EU[35]. It is important to note that the Directive does not seek to harmonize whom the issuer of the securities has to recognize as the legal holder of its securities. To harmonize the national laws of legal ownership of shares between Member States would be highly impractical and unnecessary. In fact, this would require intervention into core legal areas and concepts (such as property law, company law, etc.) which vary greatly across EU countries, and not all Member States would be ready to accept such supranational intervention.

The envisaged European approach is completely compatible with the Geneva Convention as a global instrument for the substantive law of holding and disposition of securities. This is a certainly a complicated area of law and the scope of the SLD seems wide enough to cover the majority of issues. At the same time this "broad coverage" may cause some problems as the Directives brings into its remit some unconventional securities such as derivatives and fund units. Similarly, the term "account provider" includes custodians, nominees, UCITS and other potential depositories. One of the cornerstones of the SLD is to ensure that the ultimate account holder enjoys equal rights with the registered shareholder.

[32] Tsibanoulis, D.: Scope, Legal Certainty Project, Brussels 26.03.2006, available at: www.ec.europa.eu, p. 2.
[33] This piece of EU legislation should be finalised by mid-2011 and transposed at national level by mid-2012.
[34] See: http://ec.europa.eu/internal_market/financial-markets/securities-law/index_en.htm

[35] For more information on these barriers and other findings related to the EU securities clearing and settlement systems see the report of the Giovannini Group.
Available at: http://ec.europa.eu/internal_market/financial-markets/clearing/communication_en.htm

Moreover, the Directive's "value added" contribution is to convert account-provision into a fully fledged investment service for the purposes of the Markets in Financial Instruments Directive[36]. This is because the objective of European policymakers is to ensure that persons providing accounts are duly regulated in the same way as investment firms.

6. CONCLUSION

Even though the regulation of intermediated securities takes place in a global and competitive marketplace, the existing legal regimes are notable for their stark national differences in the regulation of intermediaries and secured transactions. This paper has discussed recent regulatory developments in this area, focusing primarily on the functionalist approach of the Geneva Convention. Its flexible approach accommodates both types of securities holding systems. This is a result of the UNIDROIT's regulatory intention – namely the drafting of functional rules and the setting out of certain legal features of intermediated securities without prejudice to the fundamental characterisation of the interests which account holders derive from credits to their securities account. Croatia was quick in adopting EU legislation in the area of securities markets; this also included the manner in which securities are represented (*i.e.* mainly dematerialised) and held – indirectly with a central securities depository. But the true effects of this regulation on the market have yet to emerge. For the time being, the Croatian system of modern direct holding of securities is adequate to the modest needs of the national capital market. As the EU trend of more market-oriented economies has come to a halt, and at time when policy confusion is cleared with new regulatory interventions, unhurried thinking is a highly praised virtue. In the end, why should Croatia develop its securities market more aggressively? It is our opinion that a market-oriented economy is not equally beneficial for all countries. What Croatia needs is a more studious approach to securities markets – about its functions, the regulatory environment it is based upon, and about the direction that the EU law and international regulations will lead.

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PROMIŠLJANJE O SUSTAVU DRŽANJA VRIJEDNOSNICA U HRVATSKOJ U VEZI S UNIDROIT KONVENCIJOM O POSREDOVANIM VRIJEDNOSNIM PAPIRIMA

SAŽETAK

Sustavi držanja vrijednosnih papira su od vitalne važnosti za efikasno funkcioniranje tržišta kapitala. Oni umanjuju rizike povezane s transferom vrijednosnica između sudionika na tržištu; njihovo glatko funkcioniranje ovisi o sigurnosti u prava i obveze raznih subjekata. ukoliko takva sigurnost ne postoji, sustav je podložan pravnom riziku a, u vremenu financijskih prisila, i sustavnom riziku. Cilj ovog rada je dvostruk: prvo, analizirati razliku između raznih sustava držanja vrijednosnih papira, drugo (1. i 2. dio), procijeniti hrvatski sustav držanja vrijednosnih papira (3. dio). Posebnu pažnju pridajemo hrvatskom zakonodavstvu na polju vrijednosnica, s naglaskom na državnu Centralnu depozitarnu agenciju. U 4. dijelu raspravljamo o UNIDROIT Konvenciji o međunarodnim vrijednosnim papirima. Na kraju, u 5. dijelu se govori o novijim regulatornim inicijativama u EU koje su dijelom plana reformi financijskih tržišta poslije krize.

Ključne riječi: *posredovani vrijednosni papiri, sustav držanja vrijednosnih papira, Ženevska konvencija, centralni depozitar vrijednosnih papira, direktiva o zakonu koji regulira vrijednosnice*