ECONOMIC GROWTH AND ELECTRICITY CONSUMPTION IN EMERGING COUNTRIES OF EUROPA: AN ARDL ANALYSIS

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Abstract

The structure of energy intensity is not only important for the economists but also for the policymakers since it contributes to the policy debate on the link between energy use and economic growth and co-movement of the energy supply and growth policies. This study estimates the causal relationship between energy consumption and economic growth at per capita and aggregate levels for some transition countries in Europe; Albania, Belarus, Bulgaria, Czech Republic, Hungary, Lithuania, Poland, Romania and Slovakia.. The study also presents the income elasticities of total energy demand by using the ARDL (Auto Regressive Distributed Lag) method.

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1   Introduction

Importance of energy for economic growth and social welfare is a well known subject. However, economists could not agree upon the degree of this importance and interrelationship between the energy use and economic growth. Energy consumption may accelerate, impede or sluggish to the growth. Furthermore, as it is in the argument of Gales, Kander, Malanima and Rubio (2007), energy intensity shows an inverted U-curve pattern with a relative increase in the beginning of development and subsequent decline in the later phases of industrialization. The structure of energy intensity is not only important for the economists but also for the policymakers since it contributes to the policy debate on the link between energy use and economic growth and co-movement of the energy supply and growth policies. (Nepal, 2011).

Countries in Central and Eastern Europe are not very efficient in energy intensity, in which the ratio of energy demand to Gross Domestic Product (GDP) is much higher than the European Union (EU) average. According to Dobozi (1991), central planning that estimates energy demand with upward biased, a large reliance on heavy industries and energy resources in some countries, low energy prices, the lack of incentives and mechanisms to save energy and deceleration of technological progress have been the main reasons for this inefficiency. Cornillie and Fankhauser (2004) argue that the decline in the total use of energy in the transition period of these countries can be attributed to the decline in general economic activity since energy intensity has increased.

United Nations Development Programme (UNDP) report (Jochem, 2004) reveals that ratios of primary energy use to GDP have gone through new phases in the transition countries of Europe. In the early 1990s economic reforms began to restructure production and consumption patterns. In the Baltics, the Czech Republic, Hungary, and Poland this led to real declines in the ratios of primary energy to GDP as efficiency increased and the structure of manufacturing changed. Remarkable contraction in energy use by industry in transition economies were often not related to efficiency, mostly because of structural changes. However, structural changes in industry, integration with global markets, and investments in new processes, buildings, and infrastructure are expected to improve energy efficiency considerably over the next 20 years. Hence, this makes the knowledge about the relationship between energy consumption and economic growth more

significant for these countries.

The aim of this study is to estimate the relationship between energy consumption and economic growth by ARDL method in some developing countries of Eastern Europe. Finding whether there are differences or not in the energy demand elasticities and the direction of causality relations among analyzed countries are the other analyzed points. In the next section of the study, the survey of the elasticity, demand forecasting and causality literatures will be presented. Econometric theory and methodology are identified in the third section. Fourth section consists of from the empirical results while the last section includes conclusions and policy implications.

2   *Literature Review*

The causality studies were started at the extent of energy consumption then were disintegrated into sub-components like electricity and oil consumption and their relations with GDP and/or economic growth was investigated. Examinations on the relationship between electricity and growth were accelerated in the last decade. Rasche and Tatom's (1977) study was different from the other studies in the previous literature about the causality of electricity consumption and economic growth because they specified a production function for the United States. Kraft and Kraft (1978) found that the relationship between energy consumption and GNP for the 1947-1974 period could be approached with a Sims causality analysis.

Markandya, Pedroso and Streimikiene (2006) investigated the relationship between energy intensity in the 12 countries of Eastern Europe. Results show that the energy intensities of transition countries converge to EU levels significantly. The countries with the fastest convergence rates given these parameters are the Czech Republic, Bulgaria, Croatia and Turkey. Nepal's (2011) econometric results from the bias corrected fixed-effect analysis suggest that both large and small scale privatization process has been the sole driver of energy efficiency in transition countries. Cornilie and Frankhauser (2004) study the evolution of energy intensities in the transition countries by decomposing the energy data and using panel data model based on random effects to identify the main factors driving improvements in energy intensity. The study concludes that energy prices

and progress in enterprise restructuring are the two most significant drivers for efficient energy use. Polimeni and Polimeni (2007) argue that improved energy efficiency leads to increased consumption of energy for the transitional economies of Romania, Bulgaria, Poland, and Hungary. Analysis of this kind is vital because it could enable policy makers to develop national energy strategies that would account for the stages of economic development that their countries reached. Differences in the causality results allows for four hypotheses: 1) the "neutrality hypothesis" (if no causality exists between GDP and energy consumption; 2) the "conservation hypothesis" (the unidirectional causal relationship moves from GDP to energy consumption); 3) the "growth hypothesis" (the unidirectional causal relationship moves from energy consumption to GDP); and 4) the "feedback hypothesis" (if there is a bi-directional causal relationship between GDP and energy consumption). According to the results of our survey about East European countries, 31.8% of them supported the neutrality hypothesis, 13.6% of them supported the conservation hypothesis, 31.8% of them supported the growth hypothesis, and 22.7% of them supported the feedback hypothesis. Causality studies about the East European Countries are presented in table 1 where EC is the energy consumption and Y is GDP.

TABLE 1 - Causality Literature

Author(s)	Country	Period	Methodology	Main Variables	causality
Conservation hypothesis					
Narayan and Prasad (2008)	Hungary	1960-2002	Granger causality	GDP, Electricity consumption	$Y \rightarrow EC$
Chontanawat and Hunt (2006)	Albania, Bulgaria	1971-2000	Granger causality	GDP, Energy consumption	$Y \rightarrow EC$
Growth Hypothesis					
Kayhan, Adıgüzel, Bayat and Lebe (2010)	Romania	2001-2010	Granger causality (Toda Yamamoto)	GDP, Electricity consumption	$EC \rightarrow Y$
Chontanawat and Hunt (2006)	Poland	1960-2000	Granger causality	GDP, Energy consumption	$EC \rightarrow Y$
Chontanawat and Hunt (2006)	Czech Republic	1971-2000	Granger causality	GDP, Energy consumption	$EC \rightarrow Y$
Narayan and Prasad (2008)	Czech Republic, Slovak Republic	1960-2002	Granger causality	GDP, Electricity consumption	$EC \rightarrow Y$
Bohm (2008)	Czech Republic, Slovak Republic	1960-2002	Granger causality	GDP, Electricity consumption	$EC \rightarrow Y$

End of Table 1.

Feedback hypothesis					
Öztürk and Acaravcı (2010)	Hungary	1980-2006	Bound test (ARDL)	GDP, Electricity consumption	
Chontanawat and Hunt (2006)	Slovakia, Romania	1971-2000	Granger causality	GDP, Energy consumption	
Chontanawat and Hunt (2006)	Hungary	1965-2000	Granger causality	GDP, Energy consumption	
Mutascu, Shahbaz and Tiwari (2011)	Romania	1980-2008	Bound test (Toda Yamamoto)	GDP, Electricity consumption	
Neutrality hypothesis					
Narayan and Prasad (2008)	Poland	1960-2002	Granger causality	GDP, Electricity consumption	none
Öztürk and Acaravcı (2010)	Albania, Bulgaria, Romania	1980-2006	Bound test (ARDL)	GDP, Electricity consumption	none
Öztürk and Acaravcı (2009)	15 East European and Eurasian Countries	1990-2006	Pedroni cointegation	GDP, Electricity consumption	none
Yu and Choi (1985)	Poland	1950-1976	Sims, Granger causality	GDP, Electricity consumption	none
Soytaş and Sarı (2003)	Poland	1965-1994	Cointegration, ECM	GDP, Electricity consumption	none

Source: Authors calculation

3   Data and Methodology

3.1   Data

Data consists of from the per capita Gross Domestic Product (PCY), total energy consumption (EC) and Gross Domestic Product (Y) for some Emerging European countries: Albania (1980–2009), Belarus (1971–2009), Bulgaria (1971–2009), Czech Republic (1971–2009), Hungary (1971-2009), Lithuania (1990–2010), Poland (1970–2009), Romania (1980–2009) and Slovakia (1982-2009). In order to gain from the largest number of observations, Y was used for Belarus, Bulgaria, Czech Republic, Hungary, Lithuania and Poland whereas PCY was used for Albania, Romania and Slovakia. Y (PCY) is $\log(Y/Y_{t-1})$ $(\log(PCY/PCY_{t-1})$. EC is taken as $\log(EC/EC_{t-1})$. Data periods seem to be short. However, ARDL method is suitable for especially shorter time periods. Data are obtained annually and were taken from International Energy Agency, gapminder and Worldbank.

3.2   Methodology

3.2.1   Cointegration Analysis

In this paper, the ARDL approach to cointegration involves two steps for estimating a long-run relationship. The first step is to investigate the existence of a long-run relationship among all variables. If there is a long-run relationship (cointegration) among variables, the second step is to estimate the following long-run and short-run models. Panel data method is not used since the aim of this paper is to see the differences in the energy consumption behaviors of the countries in the sample. The ARDL model for the standard log-linear functional specification with an OLS estimation technique is as follows:

$$\Delta Y = \alpha_0 + \sum_{i=1}^{m} \beta_i \Delta Y_{t-i} + \sum_{i=1}^{m} \phi_i \Delta EC_{t-i} + \delta_1 Y_{t-1} + \delta_2 EC_{t-1} + \varepsilon_t \qquad (1)$$

$$\Delta EC = \alpha_0 + \sum_{i=1}^{m} \beta_i \Delta EC_{t-i} + \sum_{i=1}^{m} \phi_i \Delta Y_{t-i} + \phi_1 EC_{t-1} + \phi_2 Y_{t-1} + \varepsilon_t \qquad (2)$$

where Δ and ε_t are the first difference operator and the white noise term, respectively. An appropriate lag selection is based on the Akaike Information Criterion (AIC). The bounds testing procedure is based on the joint F-statistic or Wald

statistic that tests the null hypothesis of no cointegration. That is; $H_0 : \delta_1 = \delta_2 = 0$ against the alternative hypothesis $H_1 : \delta_1 \neq \delta_2 \neq 0$ for equation 1 and $H_0 : \phi_1 = \phi_2 = 0$ against the alternative hypothesis $H_1 : \phi_1 \neq \phi_2 \neq 0$ for equation 2. The distribution of the test statistics under the null is non-standard, in which critical values depend on the order of integration of the variables involved. Thus, rather than using standard critical F statistic values, the upper (for I(1)) and lower (for I(0)) bounds of the F statistics presented by Pesaran et al. (2001) are used.[1]

3.2.2 *Granger Causality*

Vector Error Correction model that was used to analyze the short run relationships between the variables were constructed as follows:

$$\Delta Y = \alpha_0 + \sum_{i=1}^{m} \beta_i \Delta Y_{t-i} + \sum_{i=0}^{n} \phi_i \Delta EC_{t-i} + \varphi_1 ECT_{t-1} + e_t \tag{3}$$

$$\Delta EC = \alpha_0 + \sum_{i=1}^{m} \theta_i \Delta EC_{t-i} + \sum_{i=0}^{n} \vartheta_i \Delta Y_{t-i} + \varphi_2 ECT_{t-1} + e_t \tag{4}$$

where residuals, e_t are independently and normally distributed (i.i.d.) with zero mean and constant variance and ECT_{t-1} is the error correction term resulting from the long-un equilibrium relationship and β, ϕ, θ and ϑ are parameters to be estimated. φ is a parameter indicating the speed of adjustment to the equilibrium level after a shock. The F statistics on the lagged explanatory variables of the ECT indicates the significance of the short-run causal effects.

As can be seen from table 1, the Granger causality test was widely used to analyze the causal relationships and was used in the last stage of our study. As Narayan and Smyth (2009) point out, after estimating the long-run model to obtain the estimated residuals, the next step is to employ the following error-correction based on the Granger causality model. However, according to Bahmani-Oskooee and Alse (1993), if the variables are cointegrated, then the standard Granger Causality test results will be invalid. In this case, the Vector Error Correction model should be a starting point for the causality analysis.

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[1] The critical values (CVs) are reported in Narayan (2005) for sample sizes ranging from 30 to 80 observations.

Granger causality can be examined in three ways (Lee and Chang 2008, Ozturk and Acaravci 2011, Bildirici and Kay$\imath$kç$\imath$: 2012). First, short run or weak Granger causalities are tested by $H_0 : \phi_i = 0$ and $H_0 : \vartheta_i = 0$ for all i in Equations (3) and (4). Second, Long run Granger causalities are tested from the ECTs in those equations. Long-run causalities are tested by $H_0 : \varphi_1 = 0$ and $H_0 : \varphi_2 = 0$. Third, Strong Granger causalities are tested by $H_0 : \phi_i = \varphi_1 = 0$ and $H_0 : \vartheta_i = \varphi_2 = 0$ for all i in Equations (3) and (4).

4 *Empirical Results*

4.1 *Unit Root Tests*

In order to test for the presence of stochastic stationarity in our data, we first investigate the integration of our individual time-series, using the Augmented Dickey Fuller (ADF) test. The results reported in Table 2 clearly show that the levels are non-stationary and the first differences are stationary.

TABLE 2—Unit Root Test Results

Variable	Level	First Difference	Variable	Level	First Difference
ALBANIA			**BULGARIA**		
Y	-0.76	-3.41	Y	-1.18	-4.85
EC	-1.45	-4.21	EC	-1.23	-3.69

End of Table 2.

CZECH REPUPLIC			HUNGARY		
Y	-1.41	-4.09	Y	-0.93	-3.40
EC	-0.99	-5.66	EC	-2.03	-4.24
POLAND			**ROMANIA**		
Y	-1.62	-4.96	Y	-1.87	-3.01
EC	-0.62	-3.72	EC	-1.30	-3.26
SLOVAKIA			**LITHUANIA**		
Y	-1.11	-4.86	Y	-0.97	-3.75
EC	-1.92	-3.34	EC	-2.60	-5.64
BELARUS					
Y	-1.32	-3.97			
EC	-1.06	-3.78			

Source: Authors calculation

4.2   *Testing for Cointegration*

The lag length that supplies the smallest critical value is determined as the lag length of the model by using the Akaike Information Criterion (AIC). Models were determined after applying the LM test to all possible models. The results of the ARDL bounds tests are shown in Table 3. The null hypothesis of no long run relationship can be rejected at 1%, 5% and 10% level (only at the 10% level for some countries) of significance. That means, there is a long run equilibrium relationship between energy consumption and economic growth for the emerging countries of Europe. The majority of studies in the literature do not examine the coefficients with respect to both the sign (positive or negative) and the magnitude of the relationship between electricity consumption and economic growth. The

long run elasticities results (t-ratios in parenthesis) with literature comparisons are also displayed in Table 3.

TABLE - 3 Bound Testing for Cointegration[2]

Countries	ARDL Bound Test Results			Elasticities Literature		
	F (Y / EC) F (EC / Y)	Long-Run Coefficients	ECT	Author(s)	Income elasticity	Price elasticity
ALBANIA	2.125 4.184	0.083 (5.876)	-0.566 (3.826)	Iimi (2010)	0.164	-0.774
BELARUS	6.515 0.051	2.55 (2.901)	-0.630 (2.499)	-	-	-
BULGARIA	5.001 1.501	-1.231 (4.88)	-0.357 (2.515)	Iimi (2010)	0.089	-0.330
CZECH REPUBLIC	11.37 2.826	1.172 (2.772)	-0.156 (2.41)	Bruha and Scasny (2004)	0.68	-0.21
HUNGARY	0.42 6.338	-0.06 (2.99)	-0.131 (2.55)	Lee (2010)	0.464	0.079
LITHUANIA	2.065 5.287	3.919 (6.814)	-0.388 (2.273)	-	-	-

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[2] 95 percent boundaries are 3.39-4.42 for Albania, 3.24-4.26 for Bulgaria, 3.24-4.26 and 3.34-4.43 for Czech Republic, 3.27-4.29 for Hungary, 3.27-4.29 and 3.40-4.41 for Poland, 3.34-4.47 for Romania, 3.39-4.50 and 3.34-4.43 for Slovakia.

End of Table - 3.

POLAND	7.284	1.185	-0.585	Meyers et.all	0.25	
	0.114	(5.683)	(-3.847)	(1994)		
ROMANIA	5.329	0.007	-0.197	Bianco et.all	0.13(SR)	-0.07(SR)
	2.022	(14.717)	(2.168)	(2010)	0.49(LR)	-0.27(LR)
				Iimi (2010)	0.126	-0.210
SLOVAKIA	7.947	-2.941	-0.174	-	-	-
	0.334	(6.909)	(4.139)			

Source: Authors calculation

ECT coefficients were negative and statistically significant, as expected, for nearly all countries. ECT coefficients range from -0.35 to -0.63 for Albania, Belarus, Bulgaria, Lithuania and Poland which indicates that the speed of adjustment is fast. ECT coefficients range from -0.13 to -0.19 for Hungary, Czech Republic, Romania and Slovakia which indicates that the speed of adjustment is rather slow (5 to 7 years).

4.3   *Stability of the Cointegration Relation*

We have implemented CUSUM and CUSUM-Q tests to see whether the parameters in the models are stable. Since the sample includes many countries, we have presented only the results of CUSUM-Q tests. It is clear from the figures that parameters are stable; both sum of the residuals and sum of the squared residuals are moving inside the boundaries. The straight lines represent critical bounds at 5% significance level.
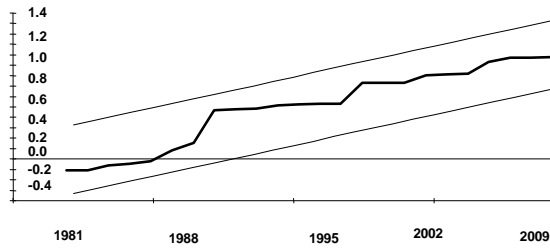
FIGURE 1— Plot of Cumulative Sum of Squares of Recursive Residuals for Albania
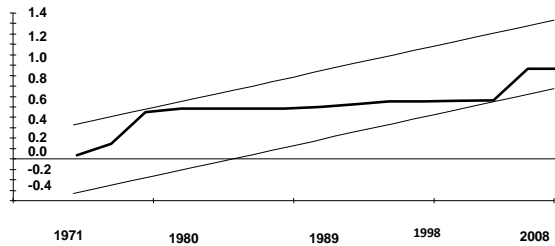
Source: Authors calculation

FIGURE 2— Plot of Cumulative Sum of Squares of Recursive Residuals for Belarus
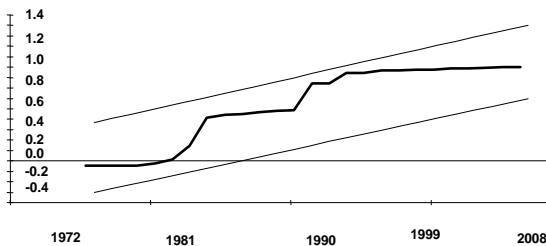
Source: Authors calculation

FIGURE 3— Plot of Cumulative Sum of Squares of Recursive Residuals for Bulgaria

Source: Authors calculation

FIGURE 4— Plot of Cumulative Sum of Squares of Recursive Residuals for Czech Republic
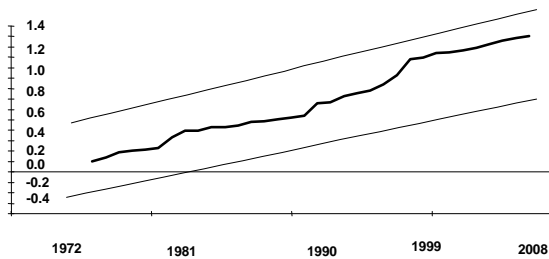
Source: Authors calculation

FIGURE 5— Plot of Cumulative Sum of Squares of Recursive Residuals for Hungary

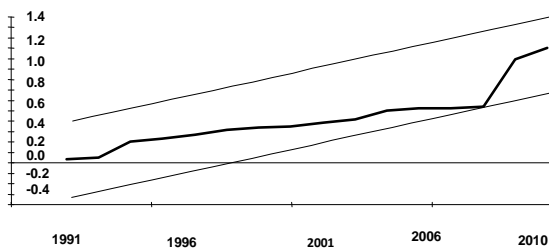Source: Authors calculation

FIGURE 6— Plot of Cumulative Sum of Squares of Recursive Residuals for Lithuania
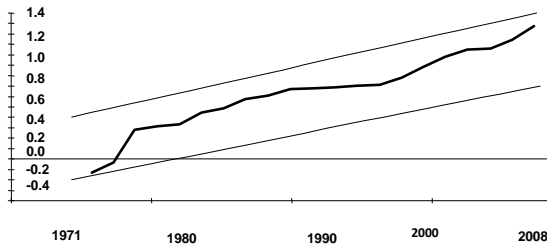
Source: Authors calculation

FIGURE 7— Plot of Cumulative Sum of Squares of Recursive Residuals for Poland

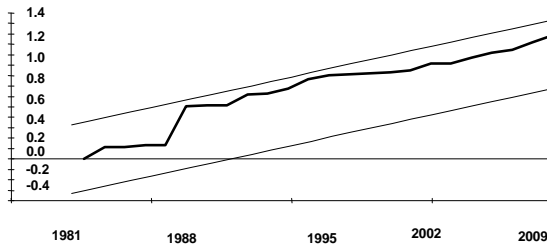Source: Authors calculation

FIGURE 8— Plot of Cumulative Sum of Squares of Recursive Residuals for Romania
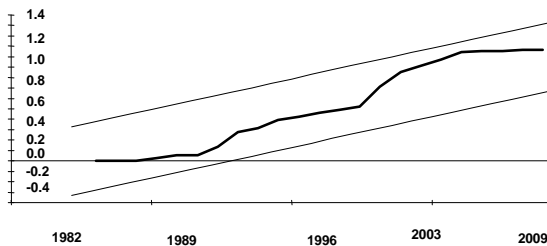
Source: Authors calculation

FIGURE 9— Plot of Cumulative Sum of Squares of Recursive Residuals for Slovakia

Source: Authors calculation

4.4   *Granger Causality Results*

The results in Table 4 show the results from Granger causalities. If the series are cointegrated, there are a causal relationship at least in one direction.

The causality results in the table seem to present the diversity of Emerging European Countries for the energy consumption and economic growth relationship. Table 4 suggests that there is unidirectional causality from the GDP to the energy consumption for Albania, Hungary, Lithuania and Poland in the short run causality which supports the conversation hypothesis. Bulgaria and Slovakia are the countries in which the causality supports growth hypothesis and runs from the energy consumption to the GDP in the short run causality. Furthermore, there is a bidirectional causality that supports the feedback hypothesis for the Belarus, Czech Republic and Romania. According to the long run causality result, there is a bi-directional causality that supports the feedback hypothesis for the Belarus, Czech Republic, Hungary, Poland and Romania. There is unidirectional causality from the GDP to the energy consumption only for Albania in long-run which supports the conversation hypothesis. Bulgaria and Slovakia are the countries in which the causality supports growth hypothesis and runs from the energy consumption to the GDP. There are bi-directional causality for Belarus, Bulgaria, Hungary, Lithunia, Romania and Slovakia in strong causality. There are evidence to support neutrality hypothesis for Albenia in strong causality result.

TABLE 4—Results of Granger Causality[3]

| Countries | $\Delta EC \rightarrow \Delta Y$ | $ECT \rightarrow \Delta EC$ | $\Delta EC, ECT \rightarrow \Delta Y$ |
	$\Delta Y \rightarrow \Delta EC$	$ECT \rightarrow \Delta Y$	$\Delta Y, ECT \rightarrow \Delta EC$
ALBANIA	4.96	3.29	1.01
	90.26	91.05	0.75
BELARUS	14.001	243.57	259.16
	31.17	51.16	252.16
BULGARIA	27.63	107.83	112.16
	4.44	0.66	108.53
CZECH REPUBLIC	58.50	81.16	5.77
	14.81	58.49	7.55
HUNGARY	4.39	398.16	414.41
	50.73	414.43	412.21
LITHUANIA	1.79	1.001	460.12
	45.98	1.58	459.51
POLAND	5.88	103.22	29.58
	23.31	99.05	0.15
ROMANIA	18.49	75.18	185.15
	47.54	20.95	176.47
SLOVAKIA	23.46	85.04	171.04
	3.52	0.08	172.17

Source: Authors calculation

5   Conclusion

We investigated the cointegration and causality relationship of the energy consumption and economic growth in Emerging European countries by using ARDL bounds test and Granger causality methods.

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[3]In this table, the symbol $\rightarrow$ shows the direction of causality

There is evidence to support the growth hypothesis for Bulgaria and Slovakia. Energy policies aimed at improving the energy infrastructure and increasing the energy supply are the appropriate options for these countries because energy consumption increases the income level. This is theoretically expected outcome for these countries since they are developing countries. However, there is evidence to support the conservation hypothesis for Albania in short and long run causality . This suggests that the policy of conserving energy consumption may be implemented with little or no adverse effects on economic growth, such as in a less energy-dependent economy. This finding also suggests that economic growth may stimulate increased consumption of energy. In addition, feedback hypothesis is validated for Belarus, Czech Republic and Romania that there is a bi-directional relationship between energy consumption and economic growth for short and long run causality. Thus, both type of energy policies are valid for these countries.

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EKONOMSKI RAST I POTROŠNJA ELEKTRIČNE ENERGIJE U EUROPSKIM ZEMLJAMA U RAZVOJU: ARDL ANALIZA

Sažetak

Struktura intenziteta energije nije važna samo za ekonomiste već i za kreatore politike s obzirom da doprinosi raspravi o vezi između potrošnje energije i ekonomskog rasta te sukladnog kretanja opskrbe energijom i politike rasta. Ovaj rad procjenjuje kauzalni odnos između potrošnje energije i ekonomskog rasta kako po glavi stanovnika tako i na ukupnoj razini za nekoliko tranzicijskih zemalja u Europi; Albaniju, Bjelorusiju, Bugarsku, Česku, Mađarsku, Litvu, Poljsku, Rumunjsku i Slovačku. Rad također prezentira elastičnost prihoda u ukupnoj potražnji energije koristeći ARDL (auto-regresijsku s vremenskim pomakom) metodu.

Ključne riječi: Rast, razvoj, potrošnja električne energije, ARDL

Melike Elif Bildirici, Fazil Kayikci - ECONOMIC GROWTH AND ELECTRICITY CONSUMPTION IN EMERGING COUNTRIES OF EUROPA: AN ARDL ANALYSIS

THE DETERMINANTS OF FOREIGN DIRECT INVESTMENT IN IRAN: BOUNDS TESTING APPROACH

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Abstract

Foreign direct investment (FDI) is counted to be an important variable to increase capital for domestic investors and improvement of capital formation in host country so almost all countries want to attract FDI. This paper attempted to investigate the impact of openness, exchange rate and infrastructures on FDI in Iran using the bounds testing (ARDL) approach

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to co integration. The data span is from 1975 to 2007. The results indicated that when FDI is the dependent variable there is co integration. We found all variables have positive and significant impact on Iran's FDI in long-run and short-run, except openness that has no impact on.

1   Introduction

Theoretically, economists believe that capital leads to economic development and growth, and then design all models and economic patterns based on this viewpoint. Using domestic and foreign investment tool by optimum use of product resources is one of the important factors of economic development. As we know countries prepare domestic capital formation costs from several ways such as internal saving, foreign debt and attracting foreign investment thus countries which don,t have enough capital, need foreign capital to develop (Zolqadr,2009,90).

Foreign direct investment inflow is counted to be an important variable to increase capital for domestic investors and improvement of capital formation in host country. It can stimulate local investment by increasing domestic investment through links in the production chain when foreign firms buy locally made inputs or when foreign firms supply or source intermediate inputs to local firms (Oteng et al, 2006,2079),(Azarbayejani,2009,2) and also provide greater exports, higher wages and greater productivity through technology spillovers to local firms (Goodspeed et al,2009,2).

Almost all developed and developing countries try to attract FDI to gain its benefits (Hojabr kiani, 2006, 163). They compete with each other to attract handsome amount of FDI by adopting different promotional policies, such as by liberalizing trade regimes, establishing special economic zones and offering incentives to the foreign investors (Mottaleb, 2007, 2). Since 1980s FDI has grown at a remarkable rate in result of information and communication technology and generally economic markets combination through globalization, however, more countries like Iran couldn't attract more FDI(Garretsen & Peeters, 2008, 2),(Nessabian, 2006, 101). Economists denote many factors that why some

countries can't attract FDI. For example, market size, exchange rate, inflation, openness, wage rate and Infrastructures are some of these factors (Mahdavi Aadeli, 2008, 89).

In comparison with other countries, Iran needs more investment because of high population growth rate in 1980-90s, having less capital efficiency (resulting of not using update technologies), using old machinery in production and restoring Iran and Iraq war demolitions in one hand and being balance with southeast economic growth on the other hand(Hojabr kiani,2006,163). Then this paper wants to investigate the impact of some factors such as openness, real exchange rate and Infrastructures on FDI in Iran.

2   Theoretical Review

United Nation Conference on Trade and Development (UNCTAD) define foreign direct investment like this:" Foreign direct investment (FDI) is a category of investment that reflects the objective by a resident enterprise in one economy (direct investor) of establishing a lasting interest in an enterprise (direct investment enterprise) that is resident in an economy other than that of the direct investor. Lasting interest implies the existence of a long-term relationship between the direct investor and the direct investment enterprise, and a significant degree of influence on the management of that enterprise" (UNCTAD, 2009, 38).

One of the most important reasons for FDI is the lack of market in buying and selling of technology. If host country could buy technology, FDI would never happen. But because no one sale technology and even no one can buy or sale technology like other goods and also ordinarily enterprises don't want to sale technology completely for some reasons: first they don't want their innovation to be revealed, second since management and technology are ever complement to each other, they can't left technology to other country with low management efficiency and finally foreign direct investment -that is done by enterprises - keeps enterprises benefits,(like availability to exclusively documented technology of enterprise, management skills that are special for specified managers and

special skills in marketing and trade mark ownership)(Nessabian,2006,100).

2.1   *Theoretical Link between FDI and Trade Openness*

Openness has two opposed effects on FDI: 1) develop export-oriented FDI. 2) Has a negative effect on market-oriented FDI. Low degree of openness attracts market-oriented FDI, because enterprises want to avoid tariffs, transportation cost and for producing in order to export using host country cheap resources and this would happen when tariffs decrease. The main purpose of this kind of investment is the exporting of goods not domestic market. Because this kind of FDI tendencies to get other markets, require using cheap local productions- without omitting market-oriented FDI- that openness attracts it(ShahAbadi,2006,101). High degree of openness leads to more economic relations of the host country with other countries and make them to have international markets, so prepares suitable conditions for multiple countries to invest in those countries (Nahidi, 2010, 111).

Studies have found a positive relationship between openness and FDI flows (Chakrabarti, 2001, Morisset, 2000). However, the relationship between openness and FDI is very complex, and needs careful explanation. To simplify this complexity, I recognize two categories of openness - "openness to trade" and "openness to capital flows." While the former refers to the ease by which goods and services are imported and exported, the latter refers to the absence of controls on the movement of capital. Trade openness attracts export-oriented FDI, while trade restriction attracts "tariff-jumping" FDI, whose primary interest is to take advantage of the domestic market (Onyeiwu, 2003, 5-6).

The degree of openness, which reflects the willingness of a country to accept foreign investment, has proved to be important in attracting capital (Nonnemberg et al. 2004) (Marial A. & Ngie Teng, 2009, 9)

In this study, we use the ratio of (exports+imports) to GDP to measure trade openness. Contrary to the previous studies, however, we expect the sign of the coefficient on OPEN to be indeterminate a priori in Iran. While a positive sign is the norm, a negative sign would suggest that FDI in a country is tariff-jumping, as foreign investors seek to locate in the host economy to avoid high tariffs.

Then high openness leads to more FDI flows.

2.2 *Theoretical Links between FDI and Foreign Exchange*

Traditionally, it was supposed that exchange rate level doesn't affect FDI, so determining where to invest has no relation to exchange rate level. But recently this belief has been objected (Hojabr kiani, 2006, 185).

Bouoiyour(2003) explain exchange rate effect on FDI as follows:

"The competitiveness is approximated by the real exchange rate. In theory, the influence of this variable on FDI is ambiguous, and depends on the motivation of foreign investors. For instance, depreciation makes local assets and production cost cheaper, leading to higher in inflows of FDI. However, it can also soften protectionism and hence reduce the incentive for foreign firms to enter the local market through producing locally, as tariff jumping becomes less useful (see Bénassy et al, 2000). In fact, the effect of the real exchange rate should depend on whether foreign production is to be re-exported (in this case, FDI and trade are complements, and hence an appreciation of the local currency reduces FDI inflows through lower competitiveness), or to serve the local market (FDI and trade are then substitutes, and an appreciation of the local currency increases FDI inflows due to higher purchasing power)" (Bouoiyour, 2007, 9).

The effect of real exchange rate, whether in the short run or long run has been consistently mixed. Based on the currency area hypothesis, the assumption is that firms would not invest in countries with weaker currencies. Aliber(1970) has observed that capital market bias arises because income streams from countries with weaker currencies are associated with an exchange rate risk, and therefore, an income stream is capitalized at a higher rate by the market when it is owned by a weaker currency firm(Marial A & Ngie Teng,2009,10).

From another viewpoint, attention to supply and demand of exchange, exchange rate fluctuations affect FDI from supply side. Exchange rate increase - in result of exchange supply shortage – make exchange movement volume to decrease thus FDI inflows reduce (Nahidi, 2010, 112).

Exchange rate stability improves certainty in domestic economy so increases investment probability in the current time and future. Expanded exchange rate

fluctuations make expanded changes in assets value, so make difficult projects benefit-cast analysis. Exchange rate variety prepares the way for financial abuses and deepens economic instability (ShahAbadi, 2006, 106).

2.3   *Theoretical Links between FDI and Infrastructures*

Foreign investors prefer economies with a well-developed network of roads, airports, water supply, uninterrupted power supply, telephones, and Internet access. Poor infrastructures increases the cost of doing business and reduces the rate of return on investment. Other things constant, production costs are typically lower in countries with well-developed infrastructures than in countries with poor infrastructures. Countries with good infrastructures are therefore expected to attract more FDI (Morisset, 2000) (ShahAbadi, 2006, 101).

Infrastructures is proxied by the number of telephone lines per 1000 people in a country, and is expected to be positively correlated with FDI. The use of this proxy is informed by the fact that countries with a large number of telephone lines are more likely to have better roads, modern airports/seaports, Internet access, and water/electricity supply (Onyeiwu, 2003, 5-6).

3   Review of Empirical Studies

Lim (2001), studies the causality relationship between FDI and its determinants, and finds that market size, infrastructure quality, openness and labor cost are important for FDI.

Ahmed et al. (2003), have applied Granger,s concept of causality on the data for the time period of 1972-2000, to examine the effect of export, domestic output and exchange rate on inflow of FDI in Pakistan. They conclude that export and exchange rate are effective factors on Pakistan's FDI.

Bouoiyour (2003), using an econometric model, he investigates the determining factors of foreign direct investment (FDI) in Morocco from 1960 to 2001. He finds that market size, infrastructures and openness have positive impact on FDI, and however, inflation and real exchange rate have negative impact on

FDI.

Onyeiwu (2003) investigates the determinants of FDI in MENA countries by using fixed effects panel regressions. The results indicate that some of the variables that influence FDI flows to developing countries are not important for flows to MENA countries. These include the infrastructures, economic growth, and inflation. While trade openness increases FDI flows to MENA countries.

Alaya (2004), using panel data, investigates how FDI can be beneficial for 7 countries of Mediterranean basin (Morocco, Tunis, Turkey, Algeria, Egypt, Jordan, Syria) during the years 1975-2002. He finds that economic growth, openness and telephone lines per 1000 people in countries have positive and significant effect while exchange rate has negative and significant effect on FDI.

Tanna & Topaiboul (2005), investigate the causal links between human capital, openness through trade and FDI, and economic growth using quarterly data for Thailand over the period 1973:2-2000:4. They find significant effects of domestic investment and trade openness, providing support for import-led growth, but direct support for FDI-led growth as well as growth-led FDI is again relatively weak, reinforcing the conclusion that trade openness has played a more significant role than FDI in influencing Thai economic growth.

Hojabr kiani & sabzi (2006), using ARDL approach, investigate the impact of effective factors on FDI during 1966-2002 in Iran. They find that there isn't a long-run relationship for FDI in Iran. And in short-run real exchange rate, human capital and GDP have positive impact on FDI.

ShahAbadi & Mahmoodi (2006), by using ordinary least squares (OLS) method they investigate the impact of effective factors on FDI flows in Iran over period 1959- 2003. They use FDI/GDP as FDI and results show: 1) human capital and infrastructures have direct and significant effect on FDI. 2) Revolution dummy variable has reverse and significant effect on FDI. 3) Openness has positive and insignificant effect and exchange rate has negative and insignificant effect on FDI.

Mottaleb(2007), by using panel data from 60 low-income and lower-middle income countries, he identifies the influential factors that determine FDI inflow in the developing countries and finds that countries with larger GDP and high

GDP growth rate and maintain business friendly environment with abundant modern infrastructural facilities, such as internet can successfully attract FDI. Azarbayegani et al. (2009), investigate the relationship between foreign direct investment, trade and economic growth during 1974-2005 periods in Iran. They use ARDL bound tests to investigate the existence of long-run relationship between variables. Results show that only when FDI is the dependent variable, there is cointegration relationship between variables.

Goodspeed et al. (2009), examine the impact of taxation, good governance and infrastructure of three host country on the host's FDI stock. The regression results indicate that FDI is sensitive to host country infrastructure quality in both developed and developing host countries.

Marial & Teng (2009), investigate the domestic short-run and long-run factors that influence FDI flows into Malaysia using annual data over period 1975-2006. They employ Johanson multivariate co integration analysis to estimate the model. The results of the long-run FDI equation indicate that FDI flows in Malaysia are positively influenced by real exchange rate, GDP growth, infrastructure and openness while negatively by exports. In the short-run FDI flows are negatively influenced by its own lags, GDP growth, infrastructure and exports, while positively affected by economy's openness and real exchange rate variables.

Mazbahul & Tanin(2010), study major factors determining FDI in Bangladesh over the period 1975- 2006. They find that degree of openness; exchange rate and infrastructures have positive impact on FDI in Bangladesh.

Nahidi (2010) examines the effect of main economic variables on FDI in Iran, under stable and instable conditions during 1973-2006. Stable condition study is on basis Auto Regressive Distribution Lag (ARDL), and instable condition is on basis heteroscedasticity group models. Results show positive effects of labor productivity, economic openness and investment security, also negative effect of exchange rate on FDI.

4 Econometric Methodology

4.1 *Data and Model*

The annual time series data used in this paper for Iran is from 1975-2007 and is sourced from world development indicators as follows:

FDI is net foreign direct investment as a percentage of GDP, OPN is trade openness that measured by the sum of export and import values to GDP ratio, REX is real exchange rate and INFR is infrastructures that proxied by number of telephone lines per 1000 people. Also DE is a dummy variable that is 1 for years 1978 to 88 (revolution and war years) and zero elsewhere.

All variables are in logs except FDI due to negative numbers in the series. So the semi-log model used in this paper is as follows:

$$FDI_t = \alpha LOPN_t + \beta LREX_t + \phi LINFR_t - \gamma DE_t + \,_t \qquad (1)$$

$_t$ is the white noise error term. The sign of the constant elasticity coefficient α, β and ϕ are all expected to be positive and the sign of γ expected to be negative. Equation (1) represents only the long-run equilibrium relationship and may form a co integration set provided all the variables are integrated of order 0 and 1, i.e. I(0) and I(1).

4.2 *ARDL Model Specifications*

To empirically analyze the long-run relationships and dynamic interactions among the variables of interest, the model has been estimated by using the bounds testing (or autoregressive distributed lag (ARDL)) co integration procedure, developed by Pesaran et al. (2001).The procedure is adopted for the following three reasons. Firstly, the bounds test procedure is simple. As opposed to other multivariate co integration techniques such as Johansen and Juselius, it allows the co integration relationship to be estimated by OLS once the lag order of the model is identified. Secondly, the bounds testing procedure does not require the pre-testing of the variables included in the model for unit roots

unlike other techniques such as the Johansen approach. It is applicable irrespective of whether the regressors in the model are purely I(0), purely I(1) or mutually co integrated. Thirdly, the test is relatively more efficient in small or finite sample data sizes as is the case in this study.

Following Pesaran et al (2001) as summarized in Choong et al (2005), we apply the bounds test procedure by modeling the long-run equation (1) as a general vector autoregressive (VAR) model of order p, in zt:

$$Z_t = c_0 + B_t + \sum_{i=1}^{p} \Phi_i Z_{t-i} + \varepsilon_t t = 1, 2, 3 \ldots, T \tag{2}$$

with c0 representing a (k+1)-vector of intercepts (drift), and β denoting a (k+1)-vector of trend coefficients. Pesaran et al (2001) further derived the following vector equilibrium correction model (VECM) corresponding to (2):

$$\Delta Z_t = c_0 + B_t + \Pi z_{t-1} \sum_{i=1}^{p-1} \Gamma_i \Delta Z_{t-i} + \varepsilon_t t = 1, 2, 3, \ldots, T \tag{3}$$

where the (k+1)x(k+1)-matrices $\Pi = I_{k+1} + \sum_{i=1}^{p} \Phi_i$ and $\Gamma_i = -\sum_{i=i+1}^{p} \Phi j$, i=1,2,...,p-1 contain the long-run multipliers and short-run dynamic coefficients of the VECM. z_t is the vector of variables y_t and x_t respectively. y_t is an I(1) dependent variable defined as FDI and $x_t = [OPN_t, REX_t, INFR_t]$ is a vector matrix of 'forcing' I(0) and I(1) regressors as already defined with a multivariate identically and independently distributed (i.i.d) zero mean error vector t =(1t , ʹ2t)ʹ, and a homoskedastic process. Further assuming that a unique long-run relationship exists among the variables, the conditional VECM (3) now becomes:

$$\Delta y_t = c_{y0} + B_t + \delta_{yy} y_{t-1} + \delta_{xx} x_{t-1} + \sum_{i=1}^{p-1} \lambda_i \Delta y_{t-i} + \sum_{i=0}^{p-1} \xi_i \Delta x_{t-i} + \varepsilon_{yt} \tag{4}$$

On the basis of equation (4), the conditional VECM of interest can be specified as:

$$\Delta FDI_t = c_0 + \delta_1 FDI_{t-1} + \delta_2 \ln OPN_{t-1} + \delta_3 \ln REX_{t-1} + \delta_4 \ln INFR_{t-1}$$
$$+ \sum_{i=1}^{p} \phi_i \Delta FDI_{t-i} + \sum_{j=1}^{q} \varpi_j \Delta \ln OPN_{t-j} + \sum_{l=1}^{q} \varphi_1 \Delta \ln REX_{t-l}$$
$$+ \sum_{m=1}^{q} \gamma_m \Delta \ln INFR_{t-m} + \eta DE_t + \varepsilon_t$$
$$\tag{5}$$

where δ_i are the long run multipliers, c_0 is the drift, and ϵ_t? are white noise errors.

4.3   *Bounds Testing Procedure*

The first step in the ARDL bounds testing approach is to estimate equation (5) by ordinary least squares (OLS) in order to test for the existence of a long-run relationship among the variables by conducting an F-test for the joint signifi-cance of the coefficients of the lagged levels of the variables, i.e., HN: $\delta_1 = \delta_2 = \delta_3 = \delta_4 = 0$ against the alternative HA: $\delta_1 \neq \delta_2 \neq \delta_3 \neq \delta_4 \neq 0$. We denote the test which normalize on FDI by F_{FDI}(FDI\OPN,REX, INFR). Two asymptotic critical values bounds provide a test for co integration when the independent variables are I (d) (where 0=d=1): a lower value assuming the regressors are I (0), and an upper value assuming purely I (1) regressors. If the F-statistic is above the upper critical value, the null hypothesis of no long-run relationship can be rejected irrespective of the orders of integration for the time series. Conversely, if the test statistic falls below the lower critical value the null hypothesis cannot be rejected. Finally, if the statistic falls between the lower and upper critical values, the result is inconclusive. The approximate critical values for the F-test were obtained from Pesaran and Pesaran, 1997, p.478).

In the second step, once co integration is established the conditional ARDL (p_1, q_1, q_2, q_3) long-run model for FDIt can be estimated as:

$$FDI_t = c_0 + \sum_{i=1}^{p} \delta_1 FDI_{t-i} + \sum_{i=0}^{q_1} \delta_2 \ln OPN_{t-i} + \sum_{i=0}^{q_2} \delta_3 \ln REX_{t-i}$$
$$+ \sum_{i=0}^{q_3} \delta_4 \ln INFR_{t-i} + \eta DE_t + \varepsilon_t \qquad (6)$$

Where, all variables are as previously defined. This involves selecting the or-ders of the ARDL (p_1, q_1, q_2, q_3) model in the four variables using Akaike information criteria (AIC).

In the third and final step, we obtain the short-run dynamic parameters by estimating an error correction model associated with the long-run estimates.

This is specified as follows:

$$
\begin{aligned}
\Delta FDI_t = u + \sum_{i=1}^{p} \phi_i \Delta FDI_{t-i} + \sum_{j=1}^{q} \varpi_j \Delta \ln OPN_{t-j} \\
+ \sum_{l=1}^{q} \varphi_1 \Delta \ln REX_{t-l} + \sum_{m=1}^{q} \gamma_m \Delta \ln INFR_{t-m} + \vartheta ecm_{t-1} + \varepsilon_t
\end{aligned}
\tag{7}
$$

Here ϕ, ϖ, φ, and γ are the short-run dynamic coefficients of the model's convergence to equilibrium, and ϑ is the speed of adjustment.

5   Estimatiom Results And Discussions

5.1   *Unit Roots Tests*

Before we proceed with the ARDL bounds test, we test for the stationary status of all variables to determine their order of integration. This is to ensure that the variables are not I(2) stationary so as to avoid spurious results. According to Ouattara(2004) in the presence of I(2) variables the computed F-statistics provided by Pesaran et al.(2001) are not valid because the bounds test is based on the assumption that the variables are I(0) or I(1). Therefore, the implementation of unit root tests in the ARDL procedure might still be necessary in order to ensure that none of the variables is integrated of order 2 or beyond.

We applied a more efficient univariate DF-GLS test for autoregressive unit root recommended by Elliot, Rothenberg, and Stock (ERS, 1996). The DF-GLS unit root tests results for the variables that obtain from Eviews 6 reported in Table 1 indicate that all variables are I(1).

We rejected the null hypothesis of unit root process in all cases based on the Schwartz Bayesian Criteria (SBC) and serial correlations diagnostic test from the unit root test regression results.

TABLE 1— DF-GLS Unit Root Tests on Variables

Variable	SBC Lag	DFGLS state	Variable	SBC Lag	DFGLS state	I(d)
FDI	2	-0.836725	ΔFDI	0	-5.918538	I(1)
LOPN	0	-1.245312	ΔLOPN	0	-5.099066	I(1)
LREX	3	-1.55297	ΔLREX	1	-5.026367	I(1)
LICT	1	-1.67304	ΔLICT	0	-4.266903	I(1)

Source: Authors calculation Note: All variables are in logs except FDI due to negative numbers in the series. Δ *is difference operator. MacKinon critical value (1%) = -3.77*

5.2   Bounds Tests for Co integration

In the first step of the ARDL analysis, we tested for the presence of long-run relationships in equation (2), using equation (5). We used a general-to-specific modeling approach guided by the short data span and Schwartz Bayesian Criterion SBC respectively to select a maximum lag order of 2 for the conditional ARDL-VECM Because computation of F-statistic is sensitive with lag length. Following the procedure in Pesaran and Pesaran, (1997, p.305), we first estimated an OLS regression for the first differences part of equation (5) and then test for the joint significance of the parameters of the lagged level variables when added to the first regression. According to Pesaran and Pesaran, (1997, p.305), "this OLS regression in first differences are of no direct interest" to the bounds co integration test. The F-statistic tests the joint null hypothesis that the coefficients of the lagged level variables are zero (i.e. no long-run relationship exists between them). Table 2 reports the results of the calculated F-statistics when each variable is considered as a dependent variable (normalized) in the ARDL-OLS regressions.

TABLE 2—Results from bounds Tests on Equation (5)

Dep. Var.	SBC Lags	F-statistic	Probability
F_{FDI}(FDI\ OPN, REX, INFR)	2	5.5834	0.004
F_{OPN}(OPN\ FDI, REX, INFR)	2	1.8243	0.168
F_{REX}(REX\ FDI, OPN, INFR)	2	2.3333	0.95
F_{INFR}(INFR\ FDI, OPN, REX)	2	2.0646	0.128

Source: Authors Calculation Notes: Lower bound I(0) = 3.372 and Upper bound I(1) = 4.797 at 1% significance level.

The calculated F-statistics F_{FDI}(FDI\OPN, REX, INFR)= 5.5834 is higher than the upper bound critical value 4.797 at the 1% level. Thus, the null hypotheses of no co integration are rejected, implying long-run co integration relationship amongst the variables when the regression is normalized on FDI_t (Table 2). However, we used FDI_t as the dependent variable. Once we established that a long-run co integration relationship existed, equation (6) was estimated using the following ARDL (2, 1, 0, 0) specification. The results obtained by normalizing on foreign direct investment (FDI_t), in the long run are reported in Table 3.

TABLE 3— Estimated Long Run Coefficients using the ARDL Approach

Equation (6): ARDL (2, 1, 0, 0) selected based on SBC. Dependent variable is FDI_t.				
Regressor	Coefficient	Standard Error	T-Ratio	T-Probability
LOPN	0.42317	0.16331	2.5911	0.016
LREX	0.099384	0.021417	4.6404	0.000
LINFR	0.12998	0.033553	3.8738	0.001
DE	-0.79169	0.22798	-3.4727	0.002

Source: Authors calculation

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The estimated coefficients of the long-run relationship show that openness in Iran has a very high significant positive effect on FDI. A 1% increase in trade openness leads to approximately 0.42% increase in FDI, all things being equal. The real exchange rate and infrastructures have very high significant positive impact on FDI too. A 1% increase in real exchange rate and infrastructures lead to approximately 0.1% and 0.13% increase in FDI. As we expected the dummy variable has a very high significant negative effect and show that revolution and war have negative effects on Iran's FDI and made it decrease during this period. The results of the short-run dynamic coefficients associated with the long-run relationships obtained from the ECM equation (7) are given in Table 4. The signs of the short-run dynamic impacts are maintained to the long-run except openness that is insignificant and have negative sign, then in Iran openness has no effect on FDI in short-run.

TABLE 4: Error Correction Representation for the Selected ARDL Model

ARDL (2, 1, 0, 0) selected based on Schwarz Bayesian Criterion. Dependent variable is ΔFDI_t				
Regressor	Coefficient	Standard Error	T-Ratio	T-Probability
dFDI1	0.19676	0.093112	2.1132	0.045
DlOPN	-0.17939	0.26369	-0.68032	0.503
dlREX	0.097755	0.015937	6.1338	0.000
dlINFR	0.12785	0.033728	3.7907	0.001
dDE	-0.77871	0.16803	-4.6344	0.000
ecm(-1)	-0.98361	0.14856	-6.6207	0.000
ECM= FDI – 0.42317*LOPN – 0.099384*LREX – 0.12998*LICT + 0.79169*DE				
R-Squared= 0.81191		R-Bar-Squared= 0.76489	F-state. F(5,25)= 0.7203[0.000]	
SER= 0.15648		RSS= 0.58764	DW-statistic= 2.2336	
Akaike Info. Criterion = 10.4802			Schwarz Bayesian Criterion = 5.4613	

Source: Authors calculation

The equilibrium correction coefficient, estimated -0.98361 is highly significant, has the correct sign, and imply a fairly high speed of adjustment to equilibrium after a shock. Approximately 98% of disequilibria from the previous year's shock converge back to the long-run equilibrium in the current year.

The regression for the underlying ARDL equation (5) fits well at R^2=75% and also passes the diagnostic tests against serial correlation, functional form mis-

specification, heteroscedasticity test and non-normal errors(Table 5).

TABLE 5: ARDL-VECM Model Diagnostic Test

LM Test Statistics			
Serial Correlation χ2 (1)= 0.93031[0.335]		Functional Form	χ2 (1)= 0.17122[0.679]
Normality	χ2 (2)= 1.4319[0.489]	Heteroscedasticity χ2 (1)= 0.080264[0.777]	

Source: Authors calculation

The cumulative sum (CUSUM) and cumulative sum of squares (CUSUMQ) plots (fig.1) from a recursive estimation of the model also indicate stability in the coefficients over the sample period for Iran.
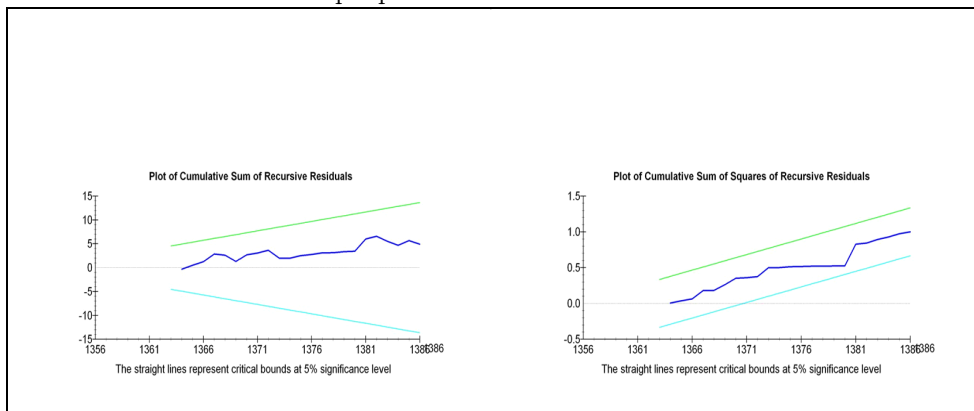

FIGURE 1: Plot of Cusum and Cusumq for Coefficients Stability for ECM Model

Source: Authors calculation

6   Conclusion

This study has employed the bounds testing (ARDL) approach to co integration to examine the long run and short run relationships between foreign direct

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investment, openness, real exchange rate and infrastructures during 1975-2007 using Iran as the case study. The associated equilibrium correction was also significant confirming the existence of long-run relationship. The equilibrium correction is very fast and is restored by the first quarter of the year.

The results also indicate that openness, real exchange rate and infrastructures are important in explaining foreign direct investment in the long-run in Iran. Also the dummy variable has a very high significant negative effect and shows that evolution and war have negative effects on Iran's FDI and make it decrease in this period.

From the results, policy suggestions for enhanced FDI in Iran will be to review the tariff system and any other barriers that may act to inhabit a smooth FDI flows into the country, because with liberalization and openness, the country has to move to higher value added, skill intensive and high wages industries. Policy makers and managers especially in developing countries should focus on infrastructures and try to well-developed network of roads, airports, telephones, internet access and water and power supply to attract more FDI.

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ODREDNICE IZRAVNIH STRANIH ULAGANJA U IRANU: PRISTUP GRANIČNIM TESTOVIMA

Sažetak:

Izravna strana ulaganja (FDI) se smatraju važnom varijablom za povećanje kapitala domaćih investitora i poboljšanja stvaranja kapitala u zemlji domaćinu tako da gotovo sve zemlje žele privući FDI. Ovaj rad je pokušao istražiti utjecaj otvorenosti, tečaja i infrastrukture na FDI u Iranu koristeći granične testove (ARDL) u pristupu kointegraciji. Raspon podataka ide od 1975. do 2007. Rezultati ukazuju da postoji kointegracija kada je FDI zavisna varijabla. Zaključili smo da sve varijable imaju značajan pozitivan efekt na FDI u Iranu kako dugoročno tako i kratkoročno, osim otvorenosti koja kratkoročno gledano nema nikakav utjecaj na FDI.

Ključne riječi: ARDL granični test, izravna strana ulaganja, model ispravljanja grešaka, Iran

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TESTING THE VALIDITY OF THE FELDSTEIN-HORIOKA PUZZLE FOR CROATIA

Hrvoje Jošić*   Mislav Jošić†

Abstract

The relationship between savings and investment is one of the fundamental issues in international economics. This topic comes in the centre of attention after pioneering work of Feldstein and Horioka (1980). The aim of the paper is testing of the Feldstein-Horioka puzzle in the case of Croatia since 1994. Johansen's cointegration approach and Granger causality test were used. In order to determine the dynamics of the savings-investment relation econometric VAR model was introduced. Using innovation analysis impulse response functions and variance decomposition analysis of the observed variables were given.

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1   *INTRODUCTION*

Savings and investment are the key factors for growth and economic develop-
ment. Lack of savings and investment is often the case in developing countries
which finance that deficit by borrowing abroad. On the other hand, a well known
fact in the international economics is the existence of high correlation between
domestic savings and investment in highly industrialized countries. Traditional
view on this issue says that the level of domestic savings determines domestic
investment from the impact on the interest rates and the cost of capital, which
affects the demand for a new capital. In this regard, the low level of investment
is related to the low level of domestic savings. In the work of Feldstein and
Horioka (1980) high correlation between savings and investment is interpreted
as an indicator of capital immobility. This interpretation represents the puzzle[1]
in the field of international economics, the so-called Feldstein-Horioka puzzle
that examines the relationship between savings and investment in the condi-
tions of capital (im)mobility. The aim of this paper is testing the interdepen-
dence between savings and investment using econometric methods of analysis.
For this purpose the Johansen approach to cointegration and Granger causality
were used. VAR model was formed and variance decomposition and impulse
response functions were presented. Theoretical part of the paper provides an
overview of empirical studies featuring Feldstein-Horioka puzzle. With the help
of econometric analysis the characteristics of relationship between savings and
investments in Croatia in the period between 1994 and 2010 were given and
Feldstein-Horioka puzzle tested. At the end of the paper the most important
research findings and concluding remarks were presented.

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[1] The term puzzle considers the empirical results from the economics practice that are
inconsistent with economic theory and needed validation.

2 THEORETICAL FEATURES OF THE FELDSTEIN - HORIOKA PUZZLE AND REVIEW OF EMPIRICAL STUDIES

Feldstein-Horioka puzzle is one of the most important questions in the field of macroeconomics and international finance[2]. Ideological founders are Martin Feldstein and Charles Horioka in their work "Domestic saving and international capital flows" from 1980. Feldstein and Horioka argued that if there is perfect capital mobility, there should be a low correlation between domestic investment and savings. Investors in this case does not depend on resources from the domestic savings, because they can borrow on international markets at world prices. With the same logic, domestic savers can fully borrow the entire amount of domestic savings to foreign investors.

The equation for the Feldstein-Horioka Puzzle is presented as follows:

$$(I/Y)_i = \alpha + \beta(S/Y)_i \tag{1}$$

where $(I/Y)_i$ and $(S/Y)_i$ are the share of gross domestic investment and gross domestic savings to gross domestic product in country i. In the case that the value of coefficientβ is equal to one, domestic savings are the main source of financing for domestic investment. On the other hand, if the value of coefficientβ is equal to zero, capital is perfectly mobile and international sources of financing supstitute domestic savings. According to the standard economic theory, in the absence of government regulations on the movement of international capital, the savings should be moving toward country with the most productive investment opportunities. In this case, the domestic savings rate was uncorrelated with the rates of domestic investment. The results of Feldstein-Horioka studies the sample of 16 OECD countries during the period from 1960 to 1974 have shown

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[2] Maurice Obstfeld and Kenneth Rogoff classify it among the six major puzzles in international economics. The others are the home bias in trade puzzle, the equity home bias puzzle, the consumption correlations puzzle, the purchasing power and exchange rate disconnect puzzle and the Baxter-Stockman neutrality of exchange rate regime puzzle (Obstfeld, M., Rogoff, K. (2000)).

a low capital mobility between them which is contrary to the standard economic theory .[3]

According to Feldstein and Horioka, if capital is perfectly mobile investors take into account only the rate of return on investment and are indifferent as to which country to invest. Problem of Feldstein-Horioka puzzle is that the high correlation between savings and investment implies a low mobility of capital which not necessarily might be the case. Numerous studies have attempted to tackle the Feldstein-Horioka puzzle. The development of econometric time-series analysis techniques in the 1980s and 1990s has opened new opportunities to explore the relationship between savings and investment. Existing empirical research on the relationship between savings and investment by the application of different methods of research can be divided into two basic groups.

The first group of research was based on non time series regression analysis. After the original work of Feldstein and Horioka (1980), early empirical studies often use a simple cross-section regression analysis to assess the relationship between investment and savings. This is evident in the work of Feldstein (1983), Murphy (1984), Penate and Dooley (1984), Obstfeld (1986) and Dooley *et al* (1987), which largely confirmed Feldstein and Horioka findings that two ratios are highly correlated. This hypothesis is also confirmed in the paper of Haque and Montiela (1991), Tesar (1991), Feldstein and Bacchetta (1991), Sinha and Sinha (1998), Narayan (2005), Ang (2007) and Jiranyakula and Brahmasrene (2008).

The second group of studies uses time-series techniques when examining the relationship between savings and investment. According to Miller (1988) US savings and investment rates are I(1) processes. He uses cointegration techniques to examine long-term relationship between the variables and founds that the two series are cointegrated under the fixed exchange rate regime and not under the flexible exchange rate regime. Ozmen (2004) points out significant effect of globalization on the relationship between savings and investment. Each economy is integrated with the rest of the world either from financial or politi-

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[3] Value of the coefficijent was in the range between 0,85 and 0,95 (Feldstein and Horioka (1980)).

cal point of view. The relationship between savings and investment is stronger under the fixed exchange regime, while under the floating exchange regime, this relationship is weaker. Using the same methodology, Jansen (1996), Coakley and Kulas (1997) also show positive long-run equilibrium relationship between savings and investment in OECD countries. These studies highlighted the potential problem of spurious regression in time series of savings and investment. Kim (2001), Kim *et al* (2007) concluded that the development of time series analysis allowed a broader range of regression coefficients for the relationship between savings and investment. In recent decades, when examining the relationship between savings and investment, panel regression analysis were often used. Krol (1996) uses panel data for 21 OECD countries. Through empirical testing he gets regression coefficient of 0,2 which is considerably less than the estimated regression parameter obtained in earlier studies. Jansen (2000) notes that the results from Krols analysis were unexpected due to the inclusion of Luxembourg in the sample. After the exclusion of Luxembourg from the analysis the ratio increased to 0,6. Coiteux and Olivierar (2000) also used panel cointegration techniques and found long-term correlation between savings and investment of 0,6 for 21 OECD countries.

After the 1980s new theories about the relationship between savings and investments were not supporting the Horioka and Feldstein findings. They poined out that this relationship is influenced by several important factors such as size of the country, characteristics and structure of the financial sector, immobility of factors, endogenous and exogenous shocks, exchange rate regimes and others. Fouquau *et al* (2008) formed theoretical framework when testing the impact of various factors on the relationship between investment and savings. They used panel regression model for 24 OECD countries during the period from 1960 to 2000 and concluded that the most important factors are the degree of country's openness, the size of the country and the current account balance. In spite of varied estimation techniques employed, these time series studies all start from the same premise: namely that the saving and investment rates are non-stationary, unit root processes (Grier *et al* (2008)). However, when making decisions about stationarity of time series we should take into account the

sample size and structural breaks that can occur in series, which can lead to the phenomenon of spurious regression and imprecise results.

3   ECONOMETRIC ANALYSIS

In this chapter the validity of the Feldstein-Horioka puzzle for Croatia is tested. Variable of interest are gross domestic savings (SAVINGS) and gross domestic investment (INVESTMENT) for the period since 1994 to 2010. Gross domestic savings are calculated as gross national income less total consumption, plus net transfers. Both variables are presented as a shares of gross domestic product (% of GDP). The data on variables are obtained from the website Economy Watch. Years 1992 and 1993 are not included into analysis because they were war years in Croatia. Values of variables for that years would significantly deviate from "normal" values and would represent outliers in the reference model. In conducting the econometric analysis Johansen approach for testing the cointegration, Granger causality and innovation analysis using a VAR model will be used.

Figure 1 shows the time series variables of investment and savings as a percentage of gross domestic product (% GDP). Investments were on average larger than the savings by about 5% in the whole observed period, except for the year 1994.
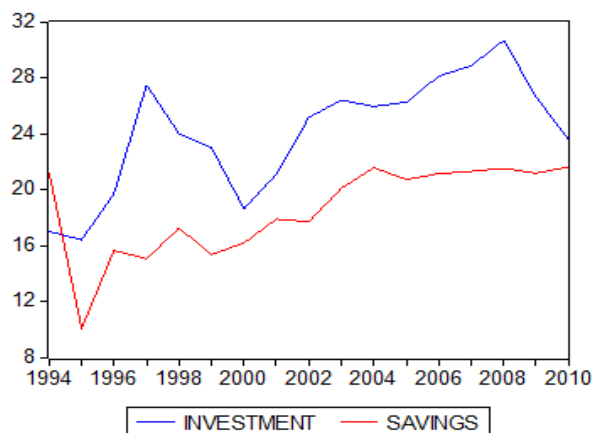
FIGURE 1 - Display of time series of variables investment and savings (% GDP)

Source: Author calculation

It indicates that domestic savings were not sufficient to cover the entire investment and the rest was compensated by borrowing abroad. It can be seen two structural brakes in investment in years 1998 and 2008. To decline in investment in the period between 1998 and 2001 came due to slow economic recovery after the war, while the fall in investment after the year 2008 came due to the global world economic crisis.
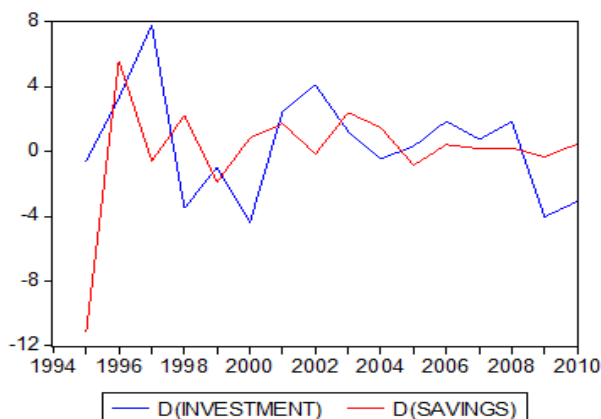
FIGURE 2 - Display of time series of variables investment and savings (% GDP) in first difference

Source: Author calculation

Both time series of variables show a trend component during the observed period which gives the hint that they are integrated of order one I (1). Structural break of savings is significant in 1995. Cointegration between saving and investment is present during observed period except in the case of a structural break in 2008 when there was a sharp decline in investment, while the savings did not significantly changed. Figure 2 shows time series of variables investment and savings (% GDP) in their first differences. The initial step in the analysis is determination of integration order of variables included in the analysis using Augmented Dickey-Fuller unit root test. Dickey-Fuller unit root test (Dickey and Fuller (1979)) is the simplest and most common unit root in economic practice. The null hypothesis of test assumes non-stationarity of the process, while the alternative hypothesis argues that the process is stationary. Results of ADF unit root tests on variables in their levels and first differences are presented in tables 1 and 2 . Test statistics for the ADF unit root test is $t = \frac{\hat{\lambda}}{SE(\hat{\gamma})}$. Critical values of ADF unit root test under the significance of 1%, 5% and 10% are -3,92035, -3,06558 and -2,67346 respectively. If the absolute value of the t-test statistics is greater than the absolute value of the critical value, it can be con-

cluded that the variable is stationary. For each variable, a test was conducted
including constant and constant and trend. Dickey-Fuller unit root test is ac-
tually a lower limit test. From Figure 1 we can see the existence of a trend in
all time series indicating the non-stationarity of variables in levels.

TABLE 1- ADF unit root test (variables in levels)

| | ADF unit root test | |
Variable	Constant, no trend	Constant and trend
INVESTMENT	-2,151988	-3,599992
SAVINGS	-2,223065	-9,476037*

Source: Authors calculation

*Note: Number of lags in the model was determined by minimizing Schwarz
information*

That confirms the results of ADF unit root tests conducted on selected variables
in levels and their first differences with included constant and constant and
trend.

TABLE 2- ADF unit root test (variables in first differences

	ADF unit root test	
Variable	Constant, no trend	Constant and trend
	-4,494495*	-4,227710*
INVESTMENT		
SAVINGS	-16,71442*	-16,51693*

Source: Authors calculatons

Note: indicates first differences,* indicates rejection of H0 at the significance of 5%

First differences of the variables showed that investment and savings are integrated of order one I (1). After determination of integration of the time-series next step in analysis is testing the cointegration among the variables.[4] In the case of nonstationary of data series classical method of linear regression can not apply be applied but linear combinations of these nonstationary series can still be stationary. Cointegration of these series can be determined since the unit root tests showed stationary of variables in first differences. In order to determine the cointegration relationship for testing the existence of long-term relationship between savings and investments Johansen procedure is used (Johansen, 1988; Johansen and Juselius, 1990; Johansen, 1995). For this purpose we use of λ *trace* statistics (trace of matrix eigenvalue) and λ *max* statistics

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[4]Maurice Obstfeld and Kenneth Rogoff classify it among the six major puzzles in international economics. The others are the home bias in trade puzzle, the equity home bias puzzle, the consumption correlations puzzle, the purchasing power and exchange rate disconnect puzzle and the Baxter-Stockman neutrality of exchange rate regime puzzle (Obstfeld, M., Rogoff, K. (2000)).

(maximum eigenvalue). Under the λ *trace* statistics null hypothesis requires that the number of cointegrating vectors is less than or equal to r as opposed to the alternative hypothesis. On the other hand, under the λ *max* statistics null hypothesis requires that the number of cointegrating vectors is equal to r as opposed to the alternative hypothesis.

TABLE 3- Results of Johansen cointegration method (λ_{trace} test) for a determination the number of cointegrating vectors

Number of cointegrating vectors	Eigenvalue	λ_{trace} statistics	Critical value	Probability**
None*	22.58968	15.49471	0.0036	22.58968
At most one	1.126203	3.841466	0.2886	1.126203

Source:Authors calculatons
*Note: * indicates rejection of H0 at the significance of 5%*
*** p-value under MacKinnon-Haug-Michelis (1999)*

TABLE 4- Results of Johansen cointegration method (λ_{max} test) for a determination the number of cointegrating vectors

Number of cointegrating vectors	Eigenvalue	λ_{max} statistics	Critical value	Probability**
None*	0.760906	21.46348	14.26460	0.0031
At most one	0.072331	1.126203	3.841466	0.2886

Source:Authors calculatons
*Note: * indicates rejection of H0 at the significance of 5%*
*** p-value under MacKinnon-Haug-Michelis (1999)*

In tables 3 and 4 are presented the results of Johansen method for determining the number of cointegrating vectors using the λ *trace* and λ *max* statistics. The maximum number of cointegrating vectors is one. Under the significance of 5%, the results from tables 3 and 4 indicates the existence of one cointegrating vector which is defined by the following equation: (2)

$$INVESTMENT \quad = \quad -8,633427 + 0,880187 * SAVINGS$$
$$(12,2892) \hspace{8cm} (2)$$

It can be concluded that there is a long-term equilibrium relationship between the variables gross domestic saving and gross domestic investment. The increase in savings by one percentage shown by the ratio in gross domestic product would result in long-term average increase in domestic investment by 0,88 percentage points shown by the ratio in gross domestic product[5]. The regression coefficientβ in the case of Croatia is 0,88 and indicates that there is a strong positive correlation between savings and investment. Having proven the existence of cointegration among the variables next step in analysis is determining the direction of causality between variables, because cointegration among the variables can not exist if there is no causality between them (Bahovec, V., Erjavec, N. 2009). The analysis is conducted using the Granger causality test (Granger, C., W., J. (1969), Granger, C., W., J., and Newbold, P. (1974)). Granger causality shows how change in one variable causes change in another variable and is often used in econometric researches.

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[5] The high t-value of the variable savings (12.2892) indicates that is statistically significant in the model

TABLE 5- Granger causality test

Null hypothesis	Number of observations	F-stat.	p-value
SAVINGS does not Granger cause INVESTMENT	15	**6,40716**	**0,01618**
INVESTMENT does not Granger cause SAVINGS	15	1,28809	0,76010

Source: Authors calculatons

The results of Granger causality test (Table 5) showed that there is a causal relationship between the variable SAVINGS and INVESTMENT[6]. Figure 3 shows the impulse responses of variables investment and savings with the help of impulse response function (IRF). Impulse response function represents the dynamic response of each endogenous variable to the shock in other variable.
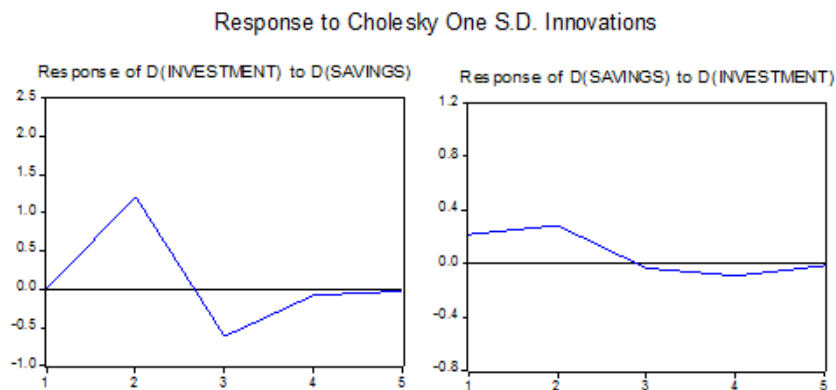

Response to Cholesky One S.D. Innovations

FIGURE3- Impulse responses of variables INVESTMENT and SAVINGS
Source: Authors calculation

[6] Under the significance of 5% optimal number of lags in the model is two

Increase in domestic savings by one standard deviation would increase domestic investment during the first two periods after which there would be decline in investment during the third period. On the other hand, increase in domestic investment by one standard deviation would lead to a slight increase in current savings during the first two periods after which there would be decline in savings.

TABLE 6- Variance decomposition of the variable D(SAVINGS)

Lag	S.E.	DINVESTMENT	DSAVINGS
1	2,457	100,000	0,000
2	2,775	80,888	19,111
3	2,904	78,028	21,972
4	2,921	78,205	21,794
5	2,923	78,226	21,774

Source: Authors calculatons

Variance decomposition of the variable D(SAVINGS) is presented in the table 6[7]. Decomposition of variance shows the relative proportion of individual variable in explaining other variables in future periods. From the table 6 it can be seen that the variable DINVESTMENT has no significant effect in explaining variations of the forecasting error of the variable DSTEDNJA. That contribution is 3,499%. Upon the expiration of the fifth period, this contribution increases and amounts to 7,693%.

From the table 7 it can be seen that in the next period (k = 1) variable DINVESTMENT explains 100% of its own variance. After two periods, variable DSAVINGS significantly explains the variations of the forecasting error of the variable DINVESTMENT. That contribution is 19,111%. Upon the expiration of the fifth period that contribution is still significant and amounts to 21.774%.

[7]VAR model is defined in the first differences of variables which are stationary

TABLE 7- Variance decomposition of the variable D(INVESTMENT)

Lag	S.E.	DSAVINGS	DINVESTMENT
1	1,168	96,500	3,499
2	1,292	92,257	7,742
3	1,328	92,601	7,398
4	1,342	92,312	7,687
5	1,343	92,306	7,693

Source: Authors calculatons

4   CONCLUDING REMARKS

The aim of the paper was testing the validity of the Feldstein-Horioka puzzle for Croatia through exploring the interdependence between savings and investment with the help of econometric methods of analysis. For this purpose we use Johansen cointegration approach, Granger causality, variance decomposition and impulse response functions using innovation analysis and VAR model. In the work of Feldstein and Horioka (1980) high correlation between savings and investment was interpreted as an indicator of capital immobility. This interpretation represents an enigma in the field of international economics, the so-called Feldstein-Horioka puzzle which states that developed countries should have a higher degree of capital mobility.

Econometric analysis started with testing the stationarity of variables. Augmented Dickey-Fuller unit root test was used. It showed that all variables in the model are integrated of order one I (1). After that, with the help of Johansen procedure, cointegration between the time series is examined. The results showed that in Croatia exist a long-term cointegration relationship between the variable gross domestic savings and gross domestic investment in the period after 1994. The maximum number of cointegrating vectors was estimated to one. Regression coefficientβ was estimated to 0,88 . It indicates

that there is a strong correlation between savings and investment in the country. Having proven the existence of cointegration between the variables, next step in the analysis was determining the causality between the variables using Granger causality test. The results of Granger causality test showed that there is a causal relationship between the variable SAVINGS and INVESTMENT in direction from variable SAVINGS to INVESTMENT. In order to explore the dynamics between variables econometric VAR model was established. The results of impulse response functions shown that the increase in domestic savings by one standard deviation would increase domestic investment during the first two periods after which there would be decline in investment during the third period. On the other hand, increase in domestic investment by one standard deviation would lead to a slight increase in current savings during the first two periods after which there would be decline in savings. Decomposition of variance confirmed the results of Granger causality test; variable SAVINGS significantly explains variations of the forecasting error of the variable INVESTMENT.

Testing the validity of the Feldstein-Horioka puzzle for Croatia has shown that it is still a puzzle. Specifically, cointegration relationship between savings and investment in Croatia indicates a strong dependency of domestic investment to domestic savings in the long run. This is contrary to the standard economic theory which states that in perfect capital mobility conditions, changes in domestic savings do not affect domestic investments.

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TESTIRANJE FELDSTEIN-HORIOKINE ZAGONETKE NA PRIMJERU HRVATSKE

Sažetak

Odnos izmeu štednje i investicija predstavlja jedno od temeljnih pitanja na području meunarodne ekonomije. Posebno dobiva na značaju tijekom 80-ih godina prošlog stoljeća zahvaljujući naporima Feldsteina i Horioke (1980). Cilj rada je testiranje Feldstein-Horiokine zagonetke na primjeru Hrvatske analizom meuovisnosti štednje i investicija u razdoblju od 1994. do 2010. godine. Pri tome se koristi Johansenov pristup kointegracije i Grangerov test uzročnosti. U svrhu odreivanja dinamike pojava formiran je ekonometrijski VAR model. Inovacijskom analizom daju se funkcije impulsnog odziva i analiza dekompozicije varijance promatranih varijabli.

Ključne riječi: *štednja, investicije, Feldstein-Horiokina zagonetka, kointegracija, VAR model*

IMPACTS OF PRICE FLUCTUATION ON RESOURCE ALLOCATION EFFICIENCY

Congming Ding[*]   Yanling Xi[†]   Zhongchang Chen[‡]

Abstract

This paper develops a dynamic model to analyze the effects of different levels of price fluctuations on resource allocation efficiency. The model shows two different strategies that enterprises adopt when they confront different levels of price fluctuations. In respond to small fluctuations, enterprises might adopt a conservative strategy of maintaining the ratio of factor inputs and leaving production plans unchanged of the adjustment cost. As a result, allocation inefficiency is unavoidable. However, greater fluctuations which increase the opportunity cost of a conservative strategy

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induce enterprises to accept an adjustment strategy; they must change the ratio of factor inputs and the production plans passively. This transformation indicates that a threshold effect exists in the price fluctuations' influence on resource allocation inefficiency. Using stochastic frontier analysis (SFA) and China's provincial panel data of 1978 to 2007, this paper confirms that price fluctuation has a nonlinear effect on allocation efficiency loss, and concludes that traditional analyses underestimate the adverse impacts of price fluctuation on China's economy.

1   INTRODUCTION

In recent decades, macroeconomists have tended to study the sources of fluctuations and the determinants of growth separately. They have concluded that fluctuations are mainly affected by lack of short-term effective demand, monetary shocks and exogenous cost shocks, while growth is impacted by capital investments, technical progress and institutional changes. A dichotomy between short- and long-term periods has resulted in different research paradigms between fluctuations and growth. Since Nelson and Plosser (1982)'s research on non-stationary macroeconomic, and Real Business Cycle Theory by Kydland and Prescott (1982), Long and Plosser (1983), economists have held that macroeconomic time serials cannot be simply separated into unrelated short-term fluctuation and long-term growth, and that fluctuations and growth can exist in a general equilibrium. In reality, more attention has been paid to the reintegration of fluctuation and growth.

Using the panel data for 92 countries from the period 1950-1985, Ramey and Ramey (1995) prove a negative correlation between short-term fluctuation and long-term growth. However, they also find no evidence of any relationship between investment and fluctuation. This conclusion has an important implication for policy: stable economic policies have not only tiny welfare effects (Lucas, 1987), but also significant long-term influence. Ramey and Ramey's study prompts us to consider how, instead of influencing capital investment, fluctuations negatively affect growth, as is confirmed by empirical studies.

Existing studies show three classes of transmission mechanism through which growth and fluctuations might relate. One class emphasizes the influences of fluctuations on factor inputs. The other two classes emphasize the impacts of structural factors of an economy and of total factor productivity (TFP), respectively. As discussed below, these three types of mechanism can explain, to some extent, the relationship between price fluctuations and growth.

The first class of transmission mechanism by which fluctuations influence growth, via factor inputs, is ambiguous both in theoretical and empirical studies. On the one hand, residents and enterprises increase investments out of precautionary motivation when they confront price fluctuations which, in turn, may raise the social savings rate and the investment rate. In addition, residents may increase human capital investment to avoid uncertainty about future income (Canton, 2002). On the other, investment irreversibility may cause negative correlation between fluctuation (uncertainty) and investment (Pindyck, 1991).

The second class estimates the structural factors that influence the relationship between fluctuations and growth. Hnatkovska and Loayza (2003) believe that the existence of structural factors leads to a nonlinear relationship between fluctuations and growth. That is, the less complete a country's financial system, and the lower its income level, the more severe the negative effects of fluctuations on growth. Kose, et al. (2006) emphasize the impact of foreign trade and financial liberalization on the fluctuation-growth relationship. Fatás and Mihov (2006) emphasize the negative effect of fiscal policy fluctuations on growth. However, both of the studies by Hnatkovska and Loayza (2003) and Kose, et al (2006) discuss little of the channels through which structural factors affect growth.

The third class focuses on the effects of TFP on growth. Rafferty (2004) confirms using empirical methods that the negative relationship between fluctuations and growth can be explained, to some degree, by the impact of price fluctuations on TFP. Moreover, TFP growth includes not only technological progress, but also changes in allocation efficiency caused by resource reallocation (Farrell, 1957; Aigner & Chu, 1968). As yet, studies mostly focus on technological progress. For example, Aghion, et al. (2005) analyze the impacts of price fluctuations

on research and development (R & D) and growth under the framework of endogenous growth. In an imperfect financial market, investment in R & D, with a long payback period, appears a pro-cyclical fluctuation and a lower average growth. Ahmet Faruk (2007) further emphasizes that since R & D requires capital intensive investment, price fluctuation may lead to a lack of R & D investment, and a decline in technological progress in an imperfect financial market. However, it has not yet been confirmed whether or not price fluctuations affect allocation efficiency, or by what mechanism the effect is achieved.

The objective of this paper is to pose further conclusions about how price fluctuations affect growth. Compared to existing studies, this paper proposes two main innovations. Whereas most-tend to emphasize the empirical relationship between fluctuation and growth, and attend mainly to factor inputs and technological progress, this paper focuses on the theoretical and empirical relationship between price fluctuations and allocation efficiency. Second, in order to avoid the omission bias caused by two-step decomposition, this paper uses SFA with maximum likelihood estimation (Wang 2002a) to evaluate the influence of price fluctuations on allocation efficiency directly.

The structure of this paper is as follows. The following section lays out the dynamic model describing how price fluctuation influences resource allocation efficiency. Section 3 contains the description of our methodology and data. Section 4 presents our econometric test results, and section 5 serves as the conclusion.

2   THEORY

Different levels of price fluctuation cause different levels of efficiency loss. Furthermore, as price fluctuation increases, the efficiency loss of whole society increases not in a linear trend, but in a parabolic trend in which a critical value exists.

To prove our theory, it is important to evaluate how a micro-enterprise reacts to different levels of price fluctuations. Using as reference the new Keynesian theory of incomplete market and the non-ignorable menu cost (Mankiw, 1991;

Romer, 1996), we determine that changes in relative price disrupt the factor allocation equilibrium of an enterprise, and the adjustment cost does exist when the production plan or factor proportion is adjusted. As a result, decision-makers don't respond in a timely and sensitive manner to slight price changes. For example, in the case of labor employment, dismissing staffs may induce labor disputes or disclosures of business information, as well as costs for re-recruitment or re-training, so an enterprise might rationally maintain the output and the factor input ratios even though the exogenous price has changed. Moreover, an increase in capital investment may also be delayed or even banned due to the irreversibility of capital adjustment. Therefore, if price fluctuation is relatively minor, near-rational decision-makers will choose to inertly maintain the current production plan and factor input density. However, if the price fluctuation is relatively large, decision-makers should choose to re-arrange production plans, and as a result, the benefit of adjustment may far outweigh the cost. In all, the maintenance strategy in response to a minor price fluctuation and the adjustment strategy in response to a substantial price fluctuation have important implications for the study of an enterprise's resource allocation efficiency.

Given the framework of the above-discussed strategies, we study the output adjustment behavior of an enterprise for which price is an exogenous and fixed factor. Given a random price P, the enterprise determines its own output Q, hence the supply curve is $P = a + b \cdot Q$, where $a > 0$, $b > 0$. Given price P_0, and the supply of the enterprise is $Q_0 = (P_0 - a) / b$.

Assume one-time adjustment cost F_i of the i th enterprise, and normalize the number of enterprise, so $i \in (0,1)$. If the return on adjustment is greater than F_i, the enterprise adjusts its output to an optimal one. Otherwise, the inert enterprise prefers to keep the output unchanged.

The enterprise's net profit $\pi = PQ - C(Q)$, where $C(Q)$ denotes the production cost. If price changes from P_0 to P_1, and the enterprise adjusts output to Q_1, then profit

$$\pi_1 = P_1 \frac{P_1 - a}{b} - \int_0^{\frac{P_1-a}{b}} (a + bQ)\, dQ \qquad (1)$$

where $P_1 \frac{P_1 - a}{b}$ denotes the gross earning given price P_1, and $\int_0^{\frac{P1-a}{b}} (a + bQ)\, dQ$
stands for the total cost when output $Q_1 = (P_1 - a) / b$. If the enterprise
keeps its output $Q_0 = (P_0 - a) / b$ unchanged, then profit under a changed
price

$$\pi_0 = P_1 \frac{P_0 - a}{b} - \int_0^{\frac{P_0 - a}{b}} (a + bQ)\, dQ \qquad (2)$$

Suppose the net income of the output adjustment is $\Delta\pi = \pi_1 - \pi_0$, and price
change $\Delta P = P_1 - P_0$, so $\Delta\pi = \Delta P^2 / 2b$ is obtained after simple calculations.
As long as $\Delta\pi$ is less than F_i, the enterprise will maintain the output level Q_0.
Otherwise, the enterprise will adjust it to Q_1.

The ith enterprise will suffer an efficiency loss $L_i = \Delta P^2 / 2b$ if it doesn't
adjust output. Instead, the efficiency loss is equal to the one-time adjustment
cost $L_i = F_i = f \cdot i$. We obtain the allocation efficiency loss of the ith enterprise
as follows:

$$L_i = \begin{cases} \Delta P^2 / 2b, & if \Delta P^2 / 2b < F_i \\ F_i, & if \Delta P^2 / 2b \geq F_i \ ;; \end{cases} \qquad (3)$$

Assume the existence of heterogeneous adjustment cost, and adjustment cost
F_i obeys the uniform distribution $F_i \sim U(0, f)$. Reorder the enterprises in
accordance with adjustment costs from low to high, and the adjustment cost of
the ith enterprise goes to $F_i = f \cdot i$.

When $\Delta P^2 / 2b = f$, all enterprises adjust their production plans. Each
enterprise's efficiency loss obeys $F \sim U(0, f)$, and entire loss suffered by the
economy is $L = f / 2$;

When $0 = \Delta P^2 / 2b < f$, the adjustment cost of the $\Delta P^2 / 2bf$th enterprise is
$\Delta P^2 / 2b$. Given price change ΔP, the first $\Delta P^2 / 2bf$ enterprises will adjust
their outputs because their adjustment costs are lower than the critical value
$\Delta P^2 / 2b$. As a result, each enterprise's efficiency loss is $F_i \sim U(0, \Delta P^2 / 2b)$; the other $(1 - \Delta P^2 / 2bf)$ enterprises which have higher adjustment costs
maintain original outputs, so each enterprise suffers efficiency loss $L_i = \Delta P^2 / 2b$. Finally, the entire economy's overall allocation efficiency loss

$$L = \begin{cases} \frac{f}{2}, & when \ \frac{\triangle P^2}{2b} \geq f ;; \\ \frac{\triangle P^2}{2bf}\frac{\triangle P^2}{4b} + \frac{\triangle P^2}{2b}\left(1 - \frac{\triangle P^2}{2bf}\right) = \frac{\triangle P^2}{2b} - \frac{\triangle P^4}{8b^2 f}, & when \ 0 \leq \frac{\triangle P^2}{2b} < f \end{cases}$$

(4)

From (4), we find that when price fluctuation increases, efficiency loss shows a decreasing nonlinear trend. The efficiency loss shows a parabolic increasing trend where price fluctuation $\Delta P^2 = 2bf$, However, when price fluctuation $\Delta P^2 > 2bf$, efficiency loss reaches a critical value $f/2$, and then it shows a horizontal trend, as shown in figure 1:
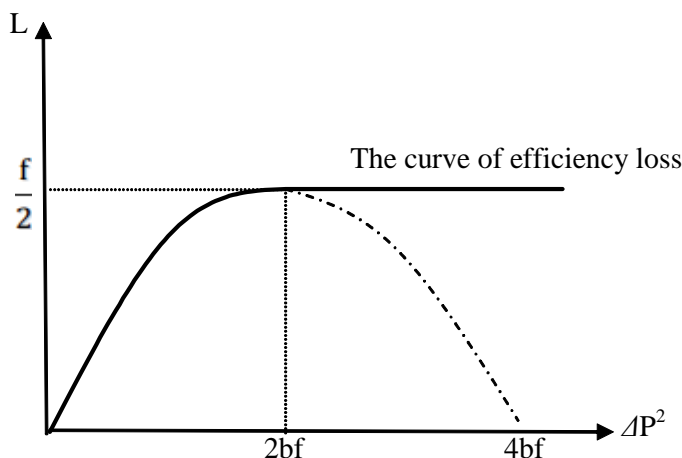
Source: Authors calculation

FIGURE 1—The Curve of Efficiency Loss

In figure 1, although price fluctuation increases allocation efficiency loss on average, the impacts of different levels of price fluctuations on efficiency loss are varied. Lower price fluctuations increase allocation efficiency loss, but the marginal efficiency loss coupled with the increase of price fluctuation shows a decreasing trend, which results mainly from the adjustment ability of enterprises. The opportunity cost of a conservative strategy rises with the increase in price fluctuation, and once the opportunity cost exceeds enterprises' one-time

adjustment cost, some enterprises will re-combine their factors to avoid the op-
portunity cost. Therefore, allocation efficiency loss does not increase in a linear
trend, but in a parabolic trend. The position that price fluctuations can in-
crease efficiency loss without limit actually neglects to account for the ability
of enterprises to actively adjust. Once the fluctuation exceeds the adjustment
cost of each enterprise, all enterprises will pay the one-time adjustment cost,
and the efficiency loss reaches the critical value of *f /2*.

3   METHODOLOGY AND DATA

3.1   Methodology

In order to capture the impact of price fluctuations on allocation efficiency, this
paper uses SFA with allocation efficiency equations. In the standard growth
accounting, TFP reflects the impact of factors (besides capital and labor) on
growth, including the inability of producers to produce on the production pos-
sibility frontier due to the exogenous environment and policy variables (Farrell,
1957). Along these lines, Aigner and Chu (1968) delineate TFP into technolog-
ical progress and resource allocation efficiency (or technical efficiency). Since
resource allocation efficiency may be influenced by a variety of random factors
or other exogenous policy factors, SFA with allocation efficiency equations can
best capture the impact on allocation efficiency.

There are two categories of random allocation efficiency modeling in empir-
ical research. One is represented by Kumbhakar, et al. (1991), Huang and Liu
(1994), Battese and Coelli (1995), whom estimate the mean model of exoge-
nous technical inefficiency term u (KGMHLBC). The other, used by Caudill
& Ford (1993), Caudill, et al (1995) and Hadri (1999) solve the problem of
heteroscedasticity of the random inefficiency term by modeling the allocation
efficiency variance σ_v^2 (CFCFGH). Wang (Wang, 2002a, 2002b) integrates the
above two models, and models both the mean and variance of allocation effi-
ciency loss using maximum likelihood estimation. The estimated equations of

this model are as follows:

$$lny_{it} = lny_{it}{}^* - u_{it} \qquad (5)$$

$$lny_{it}{}^* = X\prime_{it}\beta + v_{it} \qquad (6)$$

$$X\prime_{it}\beta = \beta_0 + \Sigma_k\beta_k lnx_{kit} + \frac{1}{2}\,\Sigma_k\Sigma_l\beta_{kl}lnx_{lit}lnx_k \qquad (7)$$

Allocation efficiency loss equations are as follows:

$$u_{it} \quad h\,(z_{it}\,,\,\delta)\cdot N^+\,(\tau,\,\sigma^2) \qquad (8)$$

$$h\,(z_{it}\,,\,\delta) = \delta_0\,\frac{exp(\Delta P^2)}{1\,+\,\exp(\Delta P^2)} + \delta_1\,open\,+\,\delta_2\,human\,+\,\delta_3\,fegdp \qquad (9)$$

$$v_{it} \quad N(0\,,\,\sigma_v^2) \qquad (10)$$

Equation (5) reflects the deviation of potential output $lny_{it}{}^*$ from real output lny_{it} caused by allocation efficiency loss u_{it}. (6) illustrates that potential output $lny_{it}{}^*$ is influenced by a number of factor input elements X and random imponderable v_{it}. Assume that composite residual term u_{it} and v_{it} are independent, as are irrelative to explaining variables of the regression. Composite residual variance $\sigma^2 = \sigma_v^2 + \sigma_u^2$. Define $\gamma = \sigma_u^2/\sigma_v^2 \in [0, 1]$, and if $\gamma = 0$, the deviation from potential output is mainly caused by v_{it}. Otherwise, if γ is close to 1, it is mainly caused by allocation inefficiency. (7) is the second order Taylor series approximation of the transcendental logarithmic production function (translog production function). (8) shows that technical inefficiency term is non-negative, so Tobit regression is adopted. Allocation efficiency loss u_{it} is impacted by the exogenous environment and policy variable z_{it}. Furthermore, Wang & Gong (2006) point out that variables impacting China's regional allocation efficiency include: human capital level, openness level and proportion of public expenditure. In order to study the threshold effect of the price fluctuation on allocation efficiency, this paper further controls the price fluctuation ΔP^2 besides the three variables above. (9) presents a logistic transformation of the price fluctuation. The first derivative of the price fluctuation ΔP^2 on allocation efficiency loss u_{it} is

greater than zero, the second derivative is less than zero, and the limits of the first and second derivative are both 0[1].This indicates that the price fluctuation increases allocation inefficiency, but such increase is not infinite; instead, there is a threshold equaling $\delta_0 N (\tau, \sigma^2)$. (10) shows the distribution of regression error v_{it}. In (6) - (11), maximum likelihood estimation is utilized in order to obtain unbiased and consistent estimates.

Equations (5) - (10) have three advantages in model-setting and estimation. Firstly, both the mean and the variance of allocation efficiency loss are modeled using the one-step maximum likelihood estimation. Compared with the two-step regression method which has bias because it first estimates efficiency loss term u_{it}, and then obtains parameter estimate δ, the one-step maximum likelihood estimation both avoids the bias, and improves the estimation efficiency in the KGMHLBC and CFCFGH by regressing u_{it} and policy variable z_{it}[2].Secondly, translog production function utilized in this paper can be seen as a rational second order approximation of the unknown production function, and is widely used in empirical studies because of its advantages, such as: variable elasticity of substitution, unknown production function, non-neutral technical progress and nonlinear effects of factor inputs, etc (Christensen, et al., 1973; Kim & Young, 1992). Thirdly, by logistically transforming price fluctuation, nonlinear effects of price fluctuations on efficiency loss can be well captured.

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[1]In complete curve y = logistic (x), if x <0 , then dy / dx$>$ 0, d2y / dx2$>$ 0; if x $\geq$ 0 , then dy / dx $\geq$ 0, d2y / dx2 $\geq$ 0. In this paper, $\Delta P2$ $\geq$ 0, so in equation (10), $\Delta P2$ increases the resource allocation efficiency loss, to the limit of 0N (,2).

[2]Problems existing in two-step estimation are as follows: allocation efficiency loss uit is assumed to be affected by external variable zit in the estimation of allocation efficiency equation. However, in order to avoid bias of uit obtained in the first step estimation, uit is assumed to be unaffected by other variables, or input variable xit is irrelevant to the relative variables in production function equation yit. Obviously, the assumptions of uit are contradictory in two-step estimation above (Wang, Gong, 2006).

3.2　Data description

Research data of this paper are mainly from "Comprehensive Statistical Data and Materials on 50 years of New China" [1999] and "China Statistical Year-book". Full samples are from 30 cities, provinces and autonomous regions of China of the period 1985–2007, combining data of Chongqing province with those of Sichuan province. Detailed descriptions of variables are as follows:

1. **Real GDP**. We use 1978 as the base year; we calculate real GDP mainly based on GDP growth index.

2. **Price fluctuation index.** ΔP is the inflation rate, so ΔP^2 is the square of inflation rate. Three indicators are used in measuring the inflation rate: consumer price index (CPI), price index of investment goods (PPI) and GDP deflator (DPI). GDP deflator is equal to nominal GDP-to-real GDP ratio, and is in a form of chain price index[3].

3. **Capital stock level.** We use estimated data by Shan (2008) for reference and adjust the base year to 1978 by using price index of fixed asset, so the latest economic census data after annual revisions is used. See details of data in Shan (2008).

4. **Employment level.** We use the sum of labor of each Chinese province, so the quality of labors cannot be measured. To solve this problem, an index of human capital level is constructed.

5. **Human capital level.** The number of students in Chinese colleges is used. In order to eliminate the impacts of China's policies such as policy of enrollment expansion in higher education, and the factor that workers hardly increase labor productivity without a few years of work experience, we use the average amount of college students of the past three years as the approximate value of the human capital level of provinces.

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[3] The official statistics of China's provincial price index of fixed asset investment start from 1992; we use as reference the approach by Shan(2008), namely, to obtain the weighted price index of fixed assets based on the compositions of fixed assets and the price index of each part of them, to calculate fixed assets price index of 1978 - 1991.

6. **Degree of openness.** The ratio of import and export volumes to GDP is used. Import and export volumes, mostly in dollars, are converted to comparable RMB prices by using the average exchange rate of the same year.

7. **Financial expenditure.** The ratio of local government budget expenditure to local nominal GDP level is used. A larger proportion of local government expenditure reflects greater governmental intervention in a local economy. Such involvement can improve allocation efficiency by increasing public goods supplies; on the other hand, it may cause market distortions, and hence hinder improvement of allocation efficiency.

4   ECONOMETRIC RESULTS

TABLE 1—Estimation Results of Price Fluctuation and Allocation Efficiency Loss (Sample Range: 1978-2007)

Estimation of Stochastic Frontier Production Function	Consumer Price Index		Investment Goods Price Index		GDP Deflator	
	I	II	III	IV	V	VI
Capital	0.6312 ***	0.5956 ***	0.4201 ***	0.4079 ***	0.4292 ***	0.4681 ***
	(6.38)	(5.97)	(4.46)	(4.33)	(4.57)	(5.01)
Labor	0.6815 ***	0.7025 ***	0.7404 ***	0.7568 ***	0.7401 ***	0.7505 ***
	(3.69)	(3.82)	(4.42)	(4.54)	(4.43)	(4.55)
Capital Labor	-0.0596 ***	-0.0572 ***	-0.0498 ***	-0.0481 ***	-0.0508 ***	-0.0547 ***
	(-4.44)	(-4.28)	(-3.85)	(-3.72)	(-3.94)	(-4.30)
Square of Capital	0.0412 ***	0.0416 ***	0.0422 ***	0.0422 ***	0.0420 ***	0.0415 ***
	(21.65)	(22.01)	(22.78)	(22.84)	(22.67)	(22.63)
Square of Labor	0.0006	-0.00085	0.0035	0.0019	0.0032	0.0024
	(0.04)	(-0.05)	(0.22)	(0.12)	(0.21)	(0.16)
Capital Time	-0.0081 ***	-0.0075 ***	-0.0022	-0.0023 *	-0.0023 *	-0.0029 **
	(-5.49)	(-5.02)	(-1.62)	(-1.68)	(-1.68)	(-2.11)
Labor Time	0.0070 ***	0.0062 ***	0.0001	-0.0002	0.0005	0.0018
	(3.68)	(3.22)	(0.05)	(-0.09)	(0.32)	(1.04)
Time	-0.0372 ***	-0.0357 **	0.0201 *	0.0229 **	0.0185	0.0109
	(-2.61)	(-2.48)	(1.71)	(1.93)	(1.58)	(0.91)
Square of Time	0.0014 ***	0.0013 ***	-0.0000	-0.0001	-0.0000	0.0000
	(5.91)	(5.75)	(-0.32)	(-0.40)	(-0.43)	(0.08)
Constant Terms	-1.4022 ***	-1.3537 ***	-1.4322 ***	-1.470 ***	-1.4364 ***	-1.4858 ***
	(-2.84)	(-2.75)	(-3.27)	(-3.36)	(-3.28)	(-3.43)

End of Table 1.

Estimation of Allocation Efficiency Loss Equations	Consumer Price Index		Investment Goods Price Index		GDP Deflator	
	I	II	III	IV	V	VI
Logistic Transformation of Price Fluctuation		0.5178 ***		0.2471 **		0.5710 ***
		(3.51)		(2.48)		(5.06)
Price Fluctuation	2.6729 **		0.6754 *		4.3608 **	
	(2.16)		(1.86)		(2.55)	
Openness	-4.8047 ***	-4.4200 ***	-3.2697 ***	-3.2822 ***	-3.4400 ***	-3.2853 ***
	(-7.46)	(-7.13)	(-6.90)	(-6.83)	(-7.00)	(-6.83)
Human Capital	-0.0424 **	-0.0530 **	-0.2704 ***	-0.2566 ***	-0.2518 ***	-0.2093 ***
	(-2.06)	(-2.48)	(-5.50)	(-5.38)	(-5.14)	(-4.82)
Financial Expenditure	0.4376 **	0.5112 ***	0.1081	0.1164	0.1584	0.5570 ***
	(2.43)	(2.84)	(0.61)	(0.67)	(0.90)	(3.01)
Likelihood Ratio	175.35	180.33	190.59	192.36	192.11	203.88
Sample Size	733	733	862	862	862	862

Source: Authors calculation

*Notes: 1. * represent the 10% significance level, ** represent the 5% significance level, *** represent the 1% significance level.*

2. lny_{it} is the explained variable in the production function; u_{it} is the explained variable in the allocation efficiency loss equation.

3. t statistics are shown in the brackets.

Table 1. presents the results of econometric test of (5) - (10) which uses the method of one-step maximum likelihood estimation (Wang, 2002b) and samples of 1978 to 2007[4]. The results contain two parts: Section 1 is the estimation

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[4] This article uses stata10 for empirical research. Stochastic frontier program of maximum likelihood estimation comes from http:/ / homepage. ntu.edu.tw/~wangh/

of stochastic frontier production function (SFPF). Section 2 is the estimation of allocation efficiency loss equations. A translog production function form is used for SFPF, so main variables include not only capital, labor and time, but also the product of them and their respective squared terms. In the equations of allocation efficiency loss, the main factors used to control efficiency loss are price fluctuation, degree of openness, level of human capital and level of financial expenditure. The same production function is set in models I and VI, and the difference lies in the construction of the price fluctuation index in the equations of allocation efficiency loss. CPI is utilized to measure the price fluctuation index in models I and II, unchanged squared CPI in model I and logistic transformation of CPI in model II respectively. In addition, squared price index of investment goods is utilized in models III and IV, unchanged PPI in model III and logistic transformation of PPI in model IV respectively. As for models V and VI, squared GDP deflator is used, unchanged deflator in model V and logistic transformation of deflator in model VI respectively.

Analyses according to the regression results shown in TABLE 1 are as follows:

1) Overall, influences of price fluctuations on allocation efficiency loss can be better determined using logistic transformation of price fluctuation. In other words, influences are quite noticeable and the results suggest a nonlinear decreasing correlation between price fluctuations and efficiency loss. In order to compare the indicators of horizontal price fluctuation with indicators of price fluctuation after logistic transformation, we calculate the likelihood ratio (LR) in each regression equation group. The model specification can simply be based on the values of LR, which reflects the significance degree of the whole regression. In detail, LRs respectively equal 175.35 and 180.33 in models I and II, 190.59 and 192.36 in models III and IV, and 192.11 and 203.88 in models V and VI. The results indicate that regression equations after logistic transformation fit better. Moreover, LR illustrates that generally, GDP deflators fit better than price index of investment goods in equations V and VI. Direct comparison of fitting results cannot be made between "consumer price" and "GDP deflator" because they have different sample sizes. However, according to the significance of the single variables, variables are all significant at a 5% level except the square

of labor in equation II, compared to equation VI, so the analyses below focus on equation II.

2) Translog production function adequately captures the nonlinear interaction between various factor inputs and output levels. According to the parameter estimation in TABLE 1 and the definition of average capital output elasticity, average capital output elasticity can be expressed as

$$E_k = \partial \ln y / \partial \ln k = 0.5956 - 0.0572 \ln l + 0.0832 \ln k - 0.0075t \quad (11)$$

We assign mean value to each variable, then the value E_k of is 0.578. Average labor output elasticity can be expressed as

$$E_L = \partial \ln y / \partial \ln l = 0.7025 - 0.0572 \ln k + 0.0062t \quad (12)$$

and the value of E_L is 0.448. $E_k + E_L = 1.026$, this result indicates that the production function has constant returns to scale. At the same time, estimates of the translog production function illustrate a trend of differentiation, with economic development, between capital output elasticity E_k and labor output elasticity E_L. In detail, in each additional year, the average output elasticity of capital falls by 0.0075, but the average output elasticity of labor increases by 0.0062. This result further supports the theory that capital deepening leads to inefficient use of capital (Jun Zhang, 2002).

3) According to efficiency loss estimate model ?, the effects of factors except for price fluctuation on allocation efficiency are presented as follows:

1. Openness has a significant positive spillover effect on allocation efficiency. Allocation efficiency loss as the explained variable, the negative value (-4.42) of estimated parameter indicates that a higher degree of openness of a region brings a lower allocation efficiency loss, that is, a higher allocation efficiency. Moreover, the result that openness index is significant at a 1% level in six regression equations proves that the estimate is robust and that openness has a positive effect on growth. Even without influencing factor input or technological progress, openness still can increase growth of a region by improving the allocation efficiency.

2. Human capital accumulation has a significant, positive spillover effect on allocation efficiency. The negative value of estimated parameter demonstrates that a region with higher human capital accumulation has higher allocation efficiency on average, which is significant at a 5% level. Estimates of the other five groups also prove this conclusion.

3. Although models ? and ? indicate that the increase of local government expenditure raises allocation inefficiency, namely, a higher ratio of government expenditure to GDP brings a lower efficiency, the conclusion is not robust, because the parameter estimate is positive but insignificant. This indeterminacy is mainly because of the uncertainty of impacts of government expenditure on allocation efficiency.

5   CONCLUSIONS

This paper studies the influence of price fluctuation on resource allocation efficiency from theoretical and empirical perspectives. The theoretical model demonstrates that price fluctuations may cause efficiency loss to enterprises which have adjustment costs. More importantly, in this process a certain pattern can be recognized. Due to the adjustment cost, enterprises may choose to inertly maintain original factor input ratios and production plans confronting small fluctuations. This conservative strategy brings an unavoidable increase in allocation inefficiency caused by price fluctuations. However, greater fluctuations bring a higher opportunity cost to the conservative strategy. As a result, most enterprises adjust their factor inputs to avoid the opportunity cost. The transformation from conservative strategy to adjustment strategy indicates a decreasing trend in the increase of allocation efficiency loss with the augmentation of price fluctuation. Moreover, the total loss of social resource allocation efficiency reaches a limit once price fluctuation exceeds the adjustment cost of each enterprise.

Using SFA with maximum likelihood estimation and China's panel data of 1978 to 2007, this paper calculate the provincial allocation efficiency loss of

China, and estimate the correlation between price fluctuation and allocation efficiency. Econometric test evidences the main inference that price fluctuations have a nonlinear influence on resource allocation.

This paper has a policy implication that a stable macroeconomic environment is important in obtaining sound resource allocation, not only because the former decrease consumption instability and social welfare loss which are caused by frequent price fluctuations (Lucas, 1987), but also because an unstable environment will lead to resource allocation inefficiency of microenterprises and further reduce TFP as a fundamental factor of growth. The adverse effects of efficiency loss, together with price fluctuation on factor accumulation, may further expand the negative impact of price fluctuation on long term growth[5].

This paper only focuses on the impacts of price fluctuation on resource allocation efficiency. Since growth of TFP can be delineated into technological progress and resource allocation efficiency, in order to analyze the impacts of price fluctuation on TFP comprehensively, it is also necessary to explore the impacts of price fluctuation on pure technical progress theoretically and empirically. Further research on the impact of price fluctuations on growth will advance this field of study, and inspire producers and policy makers.

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[5] Using the provincial panel data of China in 1978-2007, regressing price fluctuation $\Delta P2$ with the ratio of fixed assets to China's provincial GDP as capital accumulation index, we obtain I / GDP = 0. 3563 - 0. 844 $\Delta P2$, and t statistics =70.12 and -3.59. This result indicates that price fluctuation and capital accumulation are negatively correlated.

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TJEČAJ FLUKTUACIJE CIJENA NA EFIKASNOST RASPODJELE RESURSA

Sažetak:

Ovaj rad razvija dinamički model za analizu efekata različitih nivoa fluktuacija cijena na efikasnost raspodjele resursa. Model pokazuje dvije različite strategije koje poduzeća usvajaju pri suočavanju s različitim nivoima fluktuacije cijena. Kao odgovor malim fluktuacijama, poduzeća bi mogla usvojiti konzervativnu strategiju održavanja omjera faktorskih troškova i ostavljanja proizvodnih planova nepromijenjenim za troškove prilagodbe. Na taj način je neefikasnost raspodjele neizbježna. Ipak, veće fluktuacije koje povećavaju mogućnost troška konzervativne strategije prisiljavaju poduzeća da prihvate strategiju prilagođavanja; moraju pasivno promijeniti omjer faktorskih troškova i planova proizvodnje. Ova transformacija ukazuje na to da postoji efekt praga kod utjecaja fluktuacije cijena na neefikasnost raspodjele resursa. Koristeći analizu stohastičkih granica (SFA) i kineske provincijske panelne podatke od 1978. do 2007., ovaj rad potvrđuje da fluktuacija cijena ima nelinearni efekt na gubitak efikasnosti raspodjele te zaključuje da tradicionalne analize podcjenjuju negativne utjecaje fluktuacije cijena na kinesku ekonomiju.

Ključne riječi: fluktuacija cijena, efikasnost raspodjele, efekt praga, analiza stohastičkih granica

INTEGRAL APROACH TO ENTERPRISE CULTURE AS ONE OF THE ENTERPRISES' KEY SUCCESS FACTORS

Borut Milfelner[*]   Jernej Belak[†]

Abstract

Enterprise culture is judged by many acknowledged scientists and researchers now as a major determinant of any enterprise's success. The present article shows the research cognitions on the impact of enterprise culture to the success of the enterprises observed. It investigates the impact of customer and employee oriented enterprise culture on market and financial performance of the enterprise. Results suggest that enterprises, which are more customer (externally) oriented, show better market performance as well as better financial performance. The cognitions also show that more employee (internally) oriented enterprises, show positive impact to their market as well as to their financial performance.

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1   Introduction

Enterprise culture is judged by many now as a major determinant of any company's success in terms of performance, especially through improvements in employee morale (Igo and Skitmore, 2006). Various researches show that enterprise culture with its values is of essential meaning by fostering business ethics in a sense of assuring enterprise's success (e.g. Belak and Milfelner, 2011; Belak et al., 2010; Belak and Mulej, 2009). Hofstede (1998a, 1998b) argues that enterprise culture as the collective programming of the mind distinguishes participants of one enterprise from another. Such collective programming is possible if enterprise culture is considered as basic assumptions that people in an enterprise hold and share about that enterprise. Those assumptions are implied in their shared feelings, beliefs and values and embodied in symbols, processes, forms and some aspects of patterned group behavior. Further Hofstede (1998a, 2000) argues that enterprise culture distinct from both individual personality (one person) and human nature (all humans).

Considering the theories and research cognitions presented in this paper, we can state that organizational culture with its values and norms is of essential meaning for ensuring the long term success of an enterprise. Enterprise's culture has been defined as encompassing values, rules, beliefs and assumptions in handling and behaviour of (especially internal) enterprise's stakeholders which reflects internally as well externally the behaviour of an enterprise. Besides other relevant scientific literature and research cognitions, as well as world known models of enterprise management and governance, enterprise culture is perceived as one of the enterprise's key success factors in MER Model of Integral Management developed by the Institute for Management and Development (MER) in Slovenia (Belak, 2010). Considering MER Model of Integral Management (Belak, 2010) selected enterprise's key success factors are as follows: compatibility, competitiveness, efficiency, culture, credibility, ethics, ecology, entrepreneurship, synergy, and philosophy.

On the basis of MER Model of Integral Management (Belak, 2010) several researches were carried out to examine enterprise core values, culture and ethical

climate (considered as constitutional elements of enterprise ethical behaviour by MER Model of Integral Management) in relation to enterprise success.

In their research Belak et al. (2010) argued that in order to achieve the optimal effectiveness level of business by ethical behaviour, the initiated measures of business ethics should never be implemented as isolated tools, but only in the frame of a full and complete ethics program. The initiated business ethics measures have to be correctly adjusted and coordinated, as well as integrated, in a common business ethics concept, program or plan. An enterprise's top management can be considered as the "agent" responsible for harmonization of stakeholders' interests (as well as different cultures); therefore we argue that formulation and implementation of an ethics program strongly depend on top management. In our opinion, the top management can also be considered as the executor of the enterprise's culture (values and norms initiated by the enterprise owners), which represents one of the most important elements in the context of an enterprise's ethical behaviour.

For successful implementation of the ethics program or plan, it is important that it is internalized by all (especially internal) stakeholders within the enterprise (owners, managers on all management levels, experts and all other co-workers). We have shown that credibility and ethical behaviour of an enterprise can be achieved only through requisitely holistic enterprise planning (Belak et al., 2010). It should be implemented from top to bottom, starting with the enterprise owners' values that influence enterprise's vision and enterprise's policy (Thommen, 2003) and to the fundamental (basic) – realization process and in all of its own pore incorporated also in enterprise environment. One of the important authors' (Belak et al., 2010) argumentation is also that the proposed concept of the requisitely holistic planning of constitutional elements and implementation measures of enterprise ethics has a major impact to the environment of an enterprise functioning and vice versa.

Following the above described theoretical background Duh et al. (2010) carried out research, which examined the association between the degree of family involvement in an enterprise and its influence on the enterprise's core values, culture and ethical climate as the constitutional elements of enterprise ethical

behaviour. The research demonstrated that the majority of the enterprises examined have a positive attitude towards core values related to ethical content. These research cognitions indicate that the key stakeholders of the examined enterprises are aware of the importance of the ethical core values and of the fact that – without such a positive attitude – the ethical behaviour of the enterprise or the credible status of the enterprise at the market is impossible. Therefore, the key stakeholders of the examined enterprises link their positive attitude towards ethical core values with the success of the enterprises. The research revealed no significant differences between family and nonfamily enterprises. Such research cognitions can be supported also by the research carried out by Duh and Belak (2009).

In regard to the type of enterprise culture, the research results (Duh et al., 2010) demonstrated a stronger presence of clan culture characteristics in family than in nonfamily enterprises. In other words, family enterprises are more personal, in which employees act and feel like part of the family; leadership is considered to be mentoring. The management in the enterprises observed was characterized by teamwork and participation; employees showed a high level of mutual trust and commitment to their enterprises. The studied family enterprises emphasized human development, trust and openness.

Since the research results (Duh et al., 2010) show a stronger presence of hierarchical and market culture characteristics in non-family enterprises (albeit not at statistically significant levels in the case of hierarchical culture), non-family enterprises appeared to be more dynamic in the entrepreneurial sense: People are willing to take higher risks, are more competitive, and are achievement oriented. Although a high degree of 'care for people' is present in non-family enterprises, these enterprises showed a strong tendency for innovation and risk taking, market aggression and orientation towards results. The management in these enterprises expressed high demands and achievements. The research findings indicate that people in these enterprises trusted one another, but based on their significant commitment to innovation and goal accomplishment. Therefore, new challenges and prospects for new opportunities in these enterprises are very important. According to their desire for success, their primary goal is the domi-

nation at the marketplace. The results also point to a stronger culture in family businesses than in non-family ones. Although the difference is not statistically significant, the results are very similar to those of Vallejo (2008), demonstrating that in family businesses the level of Core Values, Culture and Ethical Climate adoption and acceptation of the values and norms is higher. Furthermore, the level of compatibility of values and norms within the examined enterprises (e.g. between various departments) as well as the level of compatibility of values and norms between enterprises and the environment of their functioning is higher in family businesses than in non-family ones.

The results (Duh et al., 2010) also highlighted that family enterprises are more caring than non-family ones; indeed, the characteristics of the caring climate are more present. As expected, the characteristics of the independence climate are also more present in family than in nonfamily enterprises. However, the law and code climate characteristics are unexpectedly more evident in family than in non-family enterprises. These research results in regard to ethical climate concur with Victor and Cullen's (1988) argument that climates in organizations reflect in part institutionalized societal norms. In other words, according to their research results, the presence of the caring climate implies that societal norms require organizations to develop at least a minimal caring environment. However, the results indicate that a caring climate is much more present in family than in non-family businesses, which suggests that benevolence (utilitarianism) prevails in family businesses. In a benevolent climate, the expectation is that members of the organization are concerned with the well-being of each other both within and outside the organization. The group process characteristics typical of a benevolent climate may establish a positive affective tone among organizational members, which may result in behaviours such as the spreading goodwill and good information about the organization and protecting the organization against threats to its proper functioning, which are indicative of higher commitment (Cullen et al., 2003). The prevailing benevolent climate in family businesses could be thus be explained as well with the presence of middle-to-strong organizational culture to a greater extent than in non-family business, where businesses with weak culture were also found (although differences were

not statistically significant).

Considering the research cognitions (Duh et al., 2010) we can conclude that some differences in ethical core values, climate and culture exist between family and non-family enterprises. As such, we argue that the functioning of non-family enterprises indicates a lower level of connection among co-workers, top management, and employees as well as less loyalty, anchoring of enterprise values and norms, and capacity for innovative behaviour, which can be considered one of the key success factors in business. Our research raises important issues regarding nonfamily enterprises' high level of hierarchical culture. Such enterprises are neither able to tolerate differences among employees or stakeholders nor are prepared to stimulate or use individuals' talents in accordance with the enterprises' visions, missions and policies. The alienation between top management and employees can have an important further implication, such as alienation between the enterprise and its environment, which can make the enterprise incapable of efficiency and effectiveness. Thus, these enterprises should implement all measures – informal as well as formal – of business ethics to foster, support, and transform the ethical core values in the higher presence of the clan culture and caring climate characteristics and achieve consistency among mission, vision, enterprise values and culture, which is of essential meaning for enterprise's long run success.

In their research Belak and Mulej (2009) revealed some differences in enterprise ethical climate per enterprise life cycle stages. The research indicated movement towards a more and more bureaucratic method of enterprise functioning, as an enterprise moves from the pioneer stage towards the stage of turn-over. This pattern of functioning can also indicate a lower level of connection between co-workers, top-management and employees, as well as less loyalty, anchoring of enterprise values and norms, and capacity for innovative behaviour, which can be considered as one of the key success factors in business. Our research (Belak and Mulej, 2009) raises important issues regarding the enterprises in mature stage or turn-over stage, which are neither able to tolerate differences among employees as well as between all stakeholders nor prepared to stimulate or use the individuals' talents in accordance with the enterprises' visions, missions and

policies. The alienation between top management and employees can have an important further implication such as alienation between the enterprise and its environment, which can make enterprise incapable of efficiency and effectiveness. The basis for creative work is trust among employees. Furthermore, by various authors trust is considered as the constitutional element of enterprise's ethical behaviour and constitutional basis for enterprise's ethical climate (Victor and Cullen, 1988; Kaptein, 1998). The above-mentioned enterprises should therefore implement all measures, institutional as well as structural, which would foster and support trust in their enterprises. Thus, the climate can provide for innovative behaviour.

The research cognitions about the enterprise climate type (Belak and Mulej, 2009) can be supported also by the research cognitions about the enterprise culture type (Belak, 2009). Those research findings show that, through the life cycle stages, enterprises make a transition from a "clan" culture, where a very personal and familiar way of functioning can be observed, towards a "hierarchy" culture, where formal structures and procedures are in focus. Besides, the dependency of an enterprise's culture type on its life cycle stage, the research indicated that the culture strength depends on the life cycle stage, as well. In the enterprise life cycle transition (from pioneer enterprise towards the enterprise in turn-over), the culture strength changes from strong towards weak, as well. The research results showed that pioneer and growing enterprises are more successful in implementing the enterprise's norms, values, vision, mission and strategic goals through the entire management and governance process (from the owners through the top and middle management to the operational level of the enterprise) than are mature enterprises and enterprises in turn-over. These results also reveal that the pioneer and growth enterprise culture is more compatible with the culture of the environment where they function than the culture in mature enterprises and enterprises in turn-over.

In a frame of business culture Belak and Milfelner (2011) carried out the research on Culture as Enterprise's Key Success Factor, which showed that enterprises, which are more customer (externally) oriented, show better market performance as well as better financial performance. The cognitions also show that more em-

ployee (internally) oriented enterprises, show positive impact to their market as well as to their financial performance. These cognitions also partly confirm the theoretical argument that enterprise long term success can be ensured only by practicing the external (effectiveness) as well as internal (efficiency) orientation of enterprise, both together.

The research cognitions (Belak and Milfelner, 2011) on informal and formal institutional measure of business ethics implementation (in relation to enterprise life cycle) revealed only one statistically significant difference regarding informal and formal measures of business ethics implementation, which is manager concern/role-modelling. The role-modelling is present more greatly in the pioneer and growing enterprises than in the mature enterprises and enterprises in turn over.

Despite this fact, as regards the informal institutional measures of business ethics implementation, the research (Belak and Milfelner, 2011) has shown that manager role-modelling and reward systems based on ethical standards are to some extent more present in enterprises in early (pioneer and growing) life cycle stages than in enterprises in late (mature and turn over) life cycle stages. As regards the role-modelling, the results are understandable since the demonstration of ethical behaviour by the management is above all important in early phases of organizational culture creation. In that phase, enterprises are usually smaller and the contacts between employees and management are more frequent. In addition, we can assume that there is a general lack of material for stories about ethical or unethical behaviours of employees. Higher revenues in the growing phase of the life cycle enable management to develop adequate reward systems to stimulate the desired ethical behaviour.

Candid ethical communication on the other hand is most frequent in enterprises in the mature life cycle stage. Such enterprises more often use communication of stories about ethical or unethical employees in order to foster ethical behaviour. The last two measures are very important since they can both be placed under the concept of corporate culture.

Concerning the formal institutional measures of business ethics implementation, a mission statement is mostly present in growing and mature enterprises and

only quite rarely in pioneer enterprises. This finding is to some extent surprising, since one would expect that smaller enterprises in pioneer life cycle would also have a clear vision and mission, which would enable them to clarify and develop proper objectives. Concerning compliance manual development, research results also showed that the vast majority of companies in Slovenia, especially those in late life cycle stages, are not well acquainted with ethical standards. This is above all true for European ethical standards.

Ethical behavior, ethical climate and informal and formal measures are important predecessors of enterprise culture and various lessons for managers can be learned from above described studies how to implement the needed cultural elements. However less is known about how cultural elements impact enterprise performance in developing industries and if enterprises with higher presence of different cultural elements are in fact more successful. The present research is based on the premise that by ensuring their success the enterprises have to be oriented towards the external environment of its functioning as well as towards the internal environment of its functioning in order to be able to disclose and fulfill the real needs of the environment (market) and to realize and fulfill the needs of the employees (as well as other internal stakeholders) in order to motivate and stimulate their innovative behavior as much as possible. Only this way the long term success of the enterprise will be assured.

2   HYPOTHESIS DEVELOPMENT

Enterprise/corporate culture is a multifaceted construct. Various authors define it differently. Huczynski and Buchanan (2007) focused on the observed behavioral regularities in people's interactions, Huczynski and Buchanan (2007) discussed the norms that evolve in working groups, Ouchi (1981) stressed the philosophy that influences organizational policy and Huczynski and Buchanan (2007) emphasized the rules for good understanding in an organization. More recently, enterprise/corporate culture has been defined as encompassing the assumptions, beliefs, goals, knowledge and values that are shared by organizational members (e.g. Belak, 2009; Deal and Kennedy, 1982; Huczynski and Buchanan,

2007).

Various types of enterprise/corporate cultures have been identified – related to the dynamic nature of the industry concerned (Gray et al., 2003) and to the size of the organization (Gray et al., 2003). Several classifications have been proposed, the most often cited being those of Schwartz and Davis (1981), Deal and Kennedy (1982), Hofstede (1990, 2000), Schein (1983, 1992), Sathe (1984) and Cameron and Quinn (1999). Hofstede (1983) proposed that enterprise culture could be classified by comparing the degree of individualism versus collectivism, the apparent power-distance metric, the tendency towards uncertainty avoidance, and the bias between masculinity and femininity. De Vries (1993), on the other hand, opted to derive his classification from characteristics of the prevailing mentality: a paranoid culture (a persecutory theme), an avoidance culture (a pervasive sense of futility), a charismatic culture (everything evolves around the leader), a bureaucratic culture (depersonalized and rigid), politicized culture (leadership responsibility is abdicated).

In Thommen's (2003) opinion, an enterprise should emphasize its culture as much as to bring it into accordance with the enterprise's vision and strategy. Thommen (43) differentiates between strong and weak enterprise cultures. An enterprise with a strong culture is the one with a high level of values and high-norms anchoring, a high level of agreement, as well as high-culture compatibility between enterprise and the environment of its functioning.

More recently, Cameron and Quinn (1999) have proposed a classification comprising four forms for culture audit and for comparison purposes – Clan, Hierarchy, Market and Adhocracy. Following the methodology developed by Cameron and Quinn (1999), these culture types can be assessed by observing the six key dimensions of enterprise culture: Dominant Characteristics, Organizational Leadership, Management of Employees, Organizational Glue, Strategic Emphasis, and Criteria for Success.

Webster (1995) defines market culture as the component of enterprise culture that relates to values and beliefs that help management and employees to understand market. It sets norms of behaviour in the enterprise and the meaning that is vital for enterprise performance on the market. As such market cul-

ture relates to the unwritten policies and guidelines which provide employees with behavioural norms, to the importance the enterprise as a whole places on the marketing function, and to the manner in which marketing activities are executed.

As a business philosophy, market oriented enterprise culture is an entity of three key elements. According to Narver and Slater (1990) the enterprises with strong elements of customer oriented culture demonstrate high customer and competitor orientation, and have the ability of interfunctional cooperation. Customer orientation is the key component of market culture which enables managers and employees to understand customer needs and wants as well as customer present and future product value evaluation. Competitor orientation on the other side brings understanding of short term competitor strengths and weaknesses and long term competitor strategies. This component is also important, since competitor strategies can strongly influence customer wants and needs, their value perceptions as well as their behaviour. The third component (interfunctional coordination) relates to customer information interchange throughout the enterprise and to coordination of efforts oriented towards customers. The third component is the most culture related and is also the most difficult to achieve. Customer oriented culture of an enterprise should enhance customer-perceived quality by helping to create and maintain superior customer value. Enterprises with strong customer orientation possess the basis for rapid adaptation to customers' manifest and latent needs, which may translate into superior new product success, market share and profitability (Baker and Sinkula, 2005; Narver et al., 2004). The customer oriented enterprise culture has been proposed as a key differentiating resource and a key predictor of enterprise performance (Atuahene-Gima et al., 2005). According to that we hypothesize:

H1: The presence of customer oriented enterprise culture positively impacts market performance of enterprise.

H2: The presence of customer oriented enterprise culture positively impacts financial performance of enterprise.

By drawing the analogy with customer oriented enterprise culture, employee elements can also define the kind of culture that stimulates the application of

marketing, human resource management, and allied theories, techniques, and principles to motivate, mobilize, and manage internal stakeholders at all hierarchical levels of the enterprise's process of management and governance to continuously improve the way they serve external stakeholders and each other. Although some early authors have referred to enterprise's internal stakeholders activities as the one that treats employees of the enterprises as internal customers (Berry, 1981), it is reasonable to argue that the cultural view is more suitable to explain in what way satisfied internal stakeholders (employees) can contribute to higher enterprise's performance. Such culture or behaviour as a result of culture is in literature frequently defined as enterprise's internal market orientation (e.g. Lings and Greenley, 2009, Gounaris, 2006). According to Lings (2004) activities resulting from employee oriented enterprise culture incorporate cultural and behavioural dimension and are referred to as internal market orientation in the sense of identifying and satisfying the wants and needs of employees as a prerequisite to satisfying the wants and needs of external customers. Such internal market oriented behaviour displayed by managers should foster employee identification with the organisation, reduce their dysfunctional behaviours and increase behaviours that are compliant with organisational strategies (32).

In the sense of Narver and Slater's (1990) and Kohli and Jaworsky's (1990) internally oriented enterprise culture can be operationalized as enterprise's orientation on: employees, competitors (on the employee market), and as interfunctional coordination on internal market. Measurement of those three dimensions shows the presence of the employee oriented enterprise culture. Each of these elements contain: internal market intelligence generation (e.g. conditions of external employee market, identification of value exchange), internal market intelligence dissemination (between employees and management) and internal market responsiveness (e.g. actions for delivering employee value).

Since the internally oriented enterprise culture can build a system of employee and management values that guide the enterprise's behaviour towards the goal of improving customer value such culture can also influence market and financial performance of the enterprise in the sense of being related with higher exter-

nal customer quality perception, external customer satisfaction, market shares and sales volume. All four market performance dimensions can be influenced by employee attitudes and behaviours that reduce dysfunctional behaviours and increases behaviours compliant with organisational strategies (Lings and Greenley, 2009). Consequently we hypothesise that:

H3: The presence of employee oriented enterprise culture positively impacts market performance of enterprise.

H4: The presence of employee oriented enterprise culture positively impacts financial performance of enterprise.

3 METHODOLOGY

Measurement instrument for the empirical model verification was developed in three phases. In the first phase some of the relevant items for the questionnaire were taken from the relevant literature. For the measurement of employee oriented culture we used adapted items from Gounaris (2006) and Lings (2004). The questions were adapted in the way that the cultural elements could be captured in the larger scale. Customer oriented culture was measured using the fourteen adapted items from Narver and Slater's (Narver and Slater, 1990) scale. Some additional items were added in order to ensure higher consistency of the measure. In the second phase, in-depth interviews were conducted with senior marketing executives in 17 enterprises in Slovenia. In the third phase the questionnaire was examined by 5 expert judges (4 in the field of marketing and marketing resources and 1 in the field of finance) in terms of content validity and in order to avoid redundancy of the questions. In the final study the items for employee oriented culture (12) and customer oriented culture (17) were measured on the 7 point Likert scale (from 1 "strongly disagree" to 7 "strongly agree"). Additional 4 items were generated for measurement of market performance. The respondents were asked to evaluate their market performance on the 7 point scale from "much worse" to "much better" in comparison with their key competitors in the period of past 3 years.

The main informants were selected from every company in the position of CEO

or member of the Board of Directors. The questionnaire was mailed to the 3000 randomly selected companies with more than 20 employees, selected from the population of 3475 companies in Slovenia with more than 20 employees. The final sample consisted of 415 companies, representing a response rate of 13.8%, which is rather low. This can be attributed due to the length of questionnaire, which besides the scales for measurement of customer oriented business culture, employee oriented business culture, market and financial performance also included additional scales which were not a subject of this research and was altogether 11 pages long. The second reason for low response might be the fact that this study was conducted on organizational level where top managers were the main informants. Still there is clear evidence in the literature that such studies with lower response rates are representative and may be published (Werner et al., 2007).

Responding companies came from a variety of industries (manufacturing 40.8%, construction 13.2%, wholesale and retail 11.0%, real estate 10.0%, transportation 5.1%, catering industry 4.9%, and other industries 14.7%).

Dimensionality of the single constructs (customer oriented business culture, employee oriented business culture, customer loyalty, market share/sales volume, and financial performance) was assessed. Confirmatory factor analyses

4   CONSTRUCT RELIABILITY AND VALIDITY

The dimensionality of the single constructs (customer oriented business culture, employee oriented business culture, customer loyalty, market and financial performance) was assessed with confirmatory factor analyses (CFA). Summary statistics in Table 1 show that according to our conceptualization customers and employee oriented business culture constructs are multi-dimensional constructs.

TABLE 1— Statistics of CFA for customer and employee oriented business culture, market, and financial performance

	Customer oriented business culture	Employee oriented business culture	Market and financial performance CFA
One-factor model	1 factor χ^2/df = 300.55 / 20 p < .05 RMSEA = .184 NNFI = .696 CFI = .783 GFI = .777	1 factor χ^2/df = 432.90 / 44 p <0.05 RMSEA = .164 NNFI = .682 CFI = . 746 GFI = .805	
Multi-factor model	3 factors* χ^2/df = 18.16 / 17 p = .378 RMSEA = .013 NNFI = .990 CFI = .994 GFI = .984	3 factors** χ^2/df = 34.36 / 24 p = .078 RMSEA = .032 NNFI = .977 CFI = .985 GFI = .978	2 factors χ^2/df = 32.68 / 8 p > .05 RMSEA = .086 NNFI = .955 CFI = .976 GFI = .973

Source: Authors Calculation

* Customer oriented business culture – employees orientation, competitors (on the employee market) orientation, and interfunctional coordination

** Employee oriented business culture - customer orientation, competitor orientation, and interfunctional coordination

The reliability (table 2) coefficient of the scales ranges from .76 to .91 which met the standard of 0.6 as suggested by Fornell and Larcker (1981). Evidence of convergent validity was determined by inspection of the variance extracted for each factor as shown in Table 3. According to Fornell and Larcker (1981), convergent validity is established if the variance extracted value exceeds 0.50 for a factor, and for all of the cases this criteria is meet.

TABLE 2— Items, standardized loadings, CR and AVE

		Loadings (λ coefficients)	CR	AVE
Customer oriented business culture - Customer orientation	We closely monitor and assess our level of commitment in serving customers' needs.	.826	.76	.52
	We pay close attention to after-sales service.	.549		
	Our strategy for competitive advantage is based on our understanding of customers' needs	.765		
Customer oriented business culture - Interfunctional coordination	Market information is shared with all departments.	.834	.79	.55
	All departments are involved in preparing business plans/strategies.	.763		
	Information about customers is freely communicated throughout our organization	.593		
Customer oriented business culture - Competitor orientation	We respond rapidly to competitive actions.	.734	.80	.56
	Top management regularly discuss competitors' strength and weaknesses.	.780		
	We regularly monitor our competitors' marketing efforts.	.739		
Employee oriented business culture - Employee orientation	We aspire to high employee satisfaction.	.871	.89	.72
	The appreciation of the single employee is stressed strongly.	.798		
	We place great value on a feeling of belonging along the employees.	.881		
Employee oriented business culture – Competitor orientation (on the employee market)	We systematically analyze the working conditions of employees working in competition.	.639	.81	.59
	We know the danger of losing our employees because of our competitors.	.835		
	We know about new jobs created that could attract employees in this firm.	.776		
Employee oriented business culture - Interfunctional coordination	In our company, we place great value on interfunctional teamwork. (marketing, R&D, production, etc,).	.893	.89	.80
	In our company, we aspire to a high degree of interfunctional information exchange.	.901		
Financial performance	Overall profit levels achieved compared to competitors (EBIT)	.881	.91	.78
	Return on investment compared to competitors (ROI)	.910		
	Profit margins compared to competitors	.863		
Market performance	Market share compared to competitors.	.879	.83	.62
	Sales volume achieved compared to competitors.	.896		
	Levels of customer satisfaction compared to competitors	.546		

Source: Authors Calculation

Additionally all items of the single measures loaded significantly on their underlying factors (all loadings were higher than .50 with significant t values). Discriminant validity was assessed with the pair-wise squared correlations comparison with the variance extracted estimates for the dimensions making up each

possible pair. In every case the Fornell-Larcker criteria was met which means that the variance extracted estimates exceeded the square of the correlation between the factors making up each pair.

5 RESULTS

In the second stage of the research, the hypotheses were tested with multivariate (Tables 3 and 4) regression analysis where the single constructs of customer and employee business culture were treated as predictor variables and market and financial performance as dependent variables. To obtain more favourable number of parameters to be estimated, we conducted an additional simplification from 23 indicators to final 8 factors computed according to CFA. This was achieved by averaging the corresponding indicators leading to a single composite factor. The final regression models are presented in tables 3 and 4.

TABLE 3— Regression model 1: Customer oriented business culture constructs impact on market and financial performance

	Beta	t	p values	Variance inflation factor
(Constant)		9.749	p<.01	
Customer orientation	.210	3.871	p<.01	1.500
Competitor orientation	.129	2.376	p<.05	1.502
Interfunctional coordination	.017	.327	n.s	1.375
Dependent variable: market performance; R^2=.099; p<.01; Durbin-Watson coefficient=1,96				
	Beta	t	p values	Variance inflation factor
(Constant)		7.290	p<.01	
Customer orientation	.282	5.219	p<.01	1.500
Competitor orientation	.091	1.688	p<.10	1.502
Interfunctional coordination	-.025	-.480	n.s	1.375
Dependent variable: financial performance; R^2=.107; p<.01; Durbin-Watson coefficient=1,90				

Source: Authors Calculation

As can be seen from table 3 the majority of impacts are positive and statistically

significant. Costumer orientation and competitor orientation significantly positively impacts market performance and financial performance. In both models interfunctional coordination link to both performances is non-significant. Variance inflation factors (VIF) in both models are low (under 5) suggesting that there is no problem with multicolinearity. According to that we can give support to hypotheses H1 and H2.

TABLE 4— Regression model 2: Employee oriented business culture constructs impact on market and financial performance

	Beta	t	p values	Varinace inflation factor
(Constant)		13.011	p<.01	
Employee orientation	.052	.798	n.s	2.025
Competitor orientation (on the employee market)	-.025	-.460	n.s	1.420
Interfunctional coordination on internal markets	.142	2.230	p<.05	1.918
Dependent variable: market performance; R^2=.024; p<.01; Durbin-Watson coefficient=2.10				
	Beta	**t**	**p values**	**Varinace inflation factor**
(Constant)		10.643	p<.01	
Employee orientation	.221	3.410	p<.01	2.025
Competitor orientation (on the employee market)	-.074	-1.369	n.s	1.420
Interfunctional coordination on internal markets	.035	.558	n.s	1.918
Dependent variable: financial performance; R^2=.047; p<.01; Durbin-Watson coefficient=1.90				

Source: Authors Calculation

Contrary to the table 3, the table 4 suggests that the employee oriented culture does not impact market and financial performance. In this case the majority of impacts are not statistically significant. Only interfunctional coordination on internal markets statistically significantly positively impacts market performance and employee orientation significantly positively impacts financial performance. All other relationships are non-significant. Variance inflation factors (VIF) in both models once again shows that there is no problem with multicolinearity. According to the research results we reject hypotheses H3 and H4.

6   CONCLUSIONS

The presented research examined enterprise culture as one of the enterprise's key success factors as thought and perceived by many models of integral man-

agement and also by MER Model of Integral Management (Belak, 2010), which was the theoretical basis of various researches as described in the present article also on topic of the model's selected enterprise's key success factors as enterprise ethics, and culture. Our research cognitions show that enterprises, which are more customer (externally) oriented, show better market performance as well as better financial performance. The cognitions also show that more employee (internally) oriented enterprises, show positive impact to their market as well as to their financial performance. However, the question persists, why competitor orientation (on the employee market), and interfunctional coordination on both (internal and external) markets do not influence market and financial performance. Direct measurement of competitor orientation and interfunctional coordination on internal markets impact on both types of performances can be one reason for non-existent relationships, since one can define possible mediators through which the employee oriented business culture indirectly influences enterprise performance. Customer oriented business culture, innovation orientation, social responsible behaviour, and customer relationship orientation can only be some of the possible mediating variables.

The herein presented research as well as other various research cognitions described earlier in this article give us the important owners' and managers' implication that in terms of enterprise long term success the owners and managers of the enterprises have to consider enterprise culture (one of the important constitutional elements of business ethics) as one of the enterprise's key success factors, which must not be neglected in any way. To achieve the enterprise success the owners with their managers have to assure such conditions (internally as well as externally) which would foster the enterprise growth and development, its effectiveness and efficiency. On the other hand the conditions fostering enterprise's effectiveness and efficiency should consider the enterprise's success based on the principles of business ethics, which is only possible way for an enterprise to attain the status of credible partner in the environment of such enterprise functioning.

As an effort to address a complex phenomenon, this study is subject to several limitations. Our cognitions partly confirm the theoretical argument that

enterprise long term success can be ensured only by practicing the external (effectiveness) as well as internal (efficiency) orientation of enterprise. Therefore, the further research should be done to in-depth explore the impact of both orientations (external and internal) to the enterprises' performance. In addition the research should explore also the impact of the social responsible behaviour (in relation to external and internal orientation) of the enterprises on their performance. Also other possible other mediators should be included in the culture – performance relationship models. The fact that the main respondents for this study were managers' from one function and not both managers and employees can provide unreliable results. Further, because of the regression design of the study, common method variance can potentially have an effect on the research findings, but is unlikely to occur since the factor analysis presented, resulted in a multi-factor solution, in which one factor did not accounted for majority of the variance. Finally, the results of the study are context-specific and relate to developing country in transition.

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INTEGRALNI PRISTUP KULTURI PODUZETNIŠTVA KAO JEDNOM OD KLJUČNIH FAKTORA USPJEHA U PODUZETNIŠTVU

Sažetak:

Mnogi priznati znanstvenici i istraživači smatraju kulturu poduzetništva jednom od osnovnih odrednica poduzetničkog uspjeha. Ovaj članak pokazuje rezultate istraživanja o utjecaju kulture poduzetništva na uspjeh promatranih poduzeća. Istražuje poduzetničku kulturu usmjerenu na klijenta i zaposlenika te njen utjecaj na tržište i financijsku performansu poduzeća. Rezultati ukazuju na to da poduzeća koja su usmjerenija na klijenta (eksterno), pokazuju bolje tržišne kao i financijske performanse. Rezultati također pokazuju da poduzeća orijentiranija na zaposlenike (interno) pokazuju pozitivan utjecaj na tržište i na vlastite financijske performanse.

Ključne riječi: integralni management, temeljne poduzetničke vrijednosti, organizacijska kultura i klima, uspjeh poduzeća, ključni faktori uspjeha poduzeća

JOB RESOURCES, WORK ENGAGEMENT, AND HOTEL EMPLOYEE OUTCOMES: A TIME-LAGGED ANALYSIS

Osman M. Karatepe*

Abstract

This study develops and tests a research model that investigates work engagement as a mediator of the effects of coworker and supervisor support on career satisfaction, service recovery performance, job performance, and creative performance. Data were obtained from frontline hotel employees with a time lag of one month and their immediate supervisors in Cameroon. The relationships were tested using LISREL 8.30 through structural equation modeling. The results demonstrated a better fit for the fully mediated model when compared to the partially mediated model. The results further revealed that work engagement fully mediated the effects of coworker and supervisor support on the previously mentioned outcomes. Implications of the results and their future research directions are offered.

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1   Introduction

In today's competitive market environment, astute hotel managers recognize that delivery of service quality is a must for organizational success and survival. Employees having intense face-to-face or voice-to-voice interactions with customers play the most critical role in this process (Cheng et al., 2008; Weber and placeCitySparks, 2010; Yavas et al., 2010). Such employees are also among the main actors who can return disgruntled customers to a state of satisfaction after a service failure (Yavas et al., 2010). In addition, according to the resource-based view, inimitable human resources (e.g., highly qualified frontline employees) are pivotal in service delivery process (Jerman and Završnik, 2006; Karatepe and Aleshinloye, 2009). Under these circumstances, hotel managers are in need of frontline employees who can deliver quality services to customers and deal with customer problems effectively (cf. Awang et al., 2010; Ivankoviè et al., 2010; Yavas et al., 2010).

Work engagement (WE), which refers to "a positive, fulfilling, work-related state of mind that is characterized by vigor, dedication, and absorption" (Schaufeli et al., 2002, p. 74), leads to positive employee outcomes (Bakker and Demerouti, 2008). In Schaufeli et al.'s (2002) study, vigor is defined as "high levels of energy and mental resilience while working, the willingness to invest efforts in one's work, and persistence even in the face of difficulties", while dedication refers to "a sense of significance, enthusiasm, inspiration, pride, and challenge" (p. 74). Absorption, which is another dimension of WE, is defined as "being fully concentrated and deeply engrossed in one's work, whereby time passes quickly and one has difficulties with detaching oneself from work" (p. 75). Engaged employees have elevated levels of energy while working and are dedicated. In addition, these employees are fully engrossed in their work. It has been shown that the availability of job resources such as coworker support (CS) and supervisor support (SS) enhances WE, which in turn results in positive employee outcomes (Bakker et al., 2004; Bakker and Demerouti, 2008).

Against this background, this study develops and tests a research model (see Figure 1) that examines WE as a mediator of the impacts of CS and SS on

employee outcomes based on the precepts of the motivational process of the Job Demands-Resources (JD-R) model. The model contends that CS and SS increase WE. WE in turn leads to career satisfaction (CSAT), service recovery performance (SRP), job performance (JP), and creative performance (CRP). Consequently, WE *fully* mediates the effects of CS and SS on the aforementioned outcomes. These relationships are tested using data collected from frontline employees with a time lag of one month and their immediate supervisors in the four- and five-star hotels in country-regionCameroon in the sub-Saharan placeAfrica.

Investigating such relationships is relevant and significant. First, WE is an important signal of occupational well-being for employees and organizations (Bakker and Demerouti, 2008). Despite this realization, empirical research regarding the impact of WE on hotel employees' behavioral outcomes in the workplace is scanty (Karatepe, 2011; Slåtten and Mehmetoglu, 2011). This is also valid for the antecedents of WE in frontline service jobs in the hotel industry (Karatepe and Olugbade, 2009). This is surprising, because management of the hotels has to retain a pool of engaged frontline employees who are satisfied with their career in terms of goals for income, advancement, and development of new skills, display high quality JP, effectively recover from service failures, and produce new ideas and display novel behaviors.

Second, there are a number of empirical studies about WE based on data derived from the developed Western countries such as the country-regionNetherlands (e.g., Bakker and Bal, 2010; Schaufeli and Bakker, 2004), country-regionFinland (e.g., Bakker et al., 2007; Hakanen et al., 2006), country-regionCanada (e.g., Saks, 2006), and placecountry-regionSpain (e.g., Salanova et al., 2005). However, there is a dearth of empirical research regarding WE using data collected from the developing non-Western countries (Chung and Angeline, 2010; Karatepe et al., 2010), especially in the African continent (Karatepe and Olugbade, 2009; Karatepe, 2011). Research indeed reveals that there is an underrepresentation of the African research data in the services marketing literature (Svensson et al., 2008).

Third, the preponderance of empirical research pertaining to WE has focused

on data obtained at one point in time and/or self-report data (Halbesleben and Wheeler, 2008). In Halbesleben and Wheeler's (2008) study, it is also stated that much of empirical research about performance variables has been operationalized using a single source. Consistent with the suggestions made by Podsakoff et al. (2003), this study uses a temporal separation between the measurement of the independent and dependent variables. The current study also tests frontline employees' performance outcomes as assessed by their supervisors.

By testing WE as a full mediator of the effects of CS and SS on attitudinal and behavioral outcomes through data collected from frontline hotel employees with a one-month time lag and their immediate supervisors in Cameroon, this study fills in the abovementioned voids and serves as a frame of reference for future research.

The next section of the article presents the study hypotheses. This is followed by discussions of the method and results of the study. The article concludes with implications of the results and avenues for future research.

2   RESEARCH HYPOTHESES

The JD-R model proposes that work characteristics can be classified into two general categories that are job demands and job resources, although every occupation may have its own specific characteristics associated with the work domain (Bakker et al., 2004; Demerouti et al., 2001). The JD-R model assumes two processes: the health-impairment process and the motivational process. The health-impairment process posits that the presence of high job demands (e.g., workload, role stress) in the workplace may exhaust employees' physical and mental resources and result in energy depletion and health problems (Xanthopoulou et al., 2007). Research shows that job demands positively influence exhaustion/burnout, which in turn leads to negative outcomes such as impaired JP (Bakker et al., 2004) and ill health (Hakanen et al., 2006). The motivational process contends that job resources (e.g., SS, CS, performance feedback) foster WE resulting in positive outcomes such as job satisfaction, organizational commitment, and JP (Bakker and Demerouti, 2008). Specifically, job resources,

due to their intrinsic and extrinsic motivational roles, mitigate job demands, stimulate employees' growth, learning and development, and foster goal accomplishment (Bakker and Demerouti, 2007; Xanthopoulou et al., 2007). Under these circumstances, such employees have high levels of WE, and therefore, display positive outcomes (Bakker and Demerouti, 2007; Hakanen et al., 2006). As depicted in Figure 1, CS and SS are linked to WE. Employees who are able to obtain sufficient support from their coworkers and supervisors are engaged in their work. In empirical terms, Schaufeli and Bakker (2004) found that job resources (i.e., supervisory coaching, colleague support, performance feedback) positively influenced WE among the Dutch employees in three different samples. Bakker et al. (2007) also showed that SS increased WE among Finnish teachers. Therefore, the following hypotheses are proposed:

H1(a): CS is positively related to WE.

H1(b): SS is positively related to WE.

Engaged employees display high levels of energy while working, are involved and feel happily absorbed in their work. Such engaged employees have desirable job outcomes for themselves and their organization (Bakker and Demerouti, 2008; Bakker et al., 2008). In this study CSAT, SRP, JP, and CRP are considered as the four important outcomes for employees and the organization. CSAT, which refers to "...personal satisfaction with various aspects of career progress and success ..." (Parasuraman et al., 1996, p. 283), is a critical career outcome (Greenhaus et al., 1990).
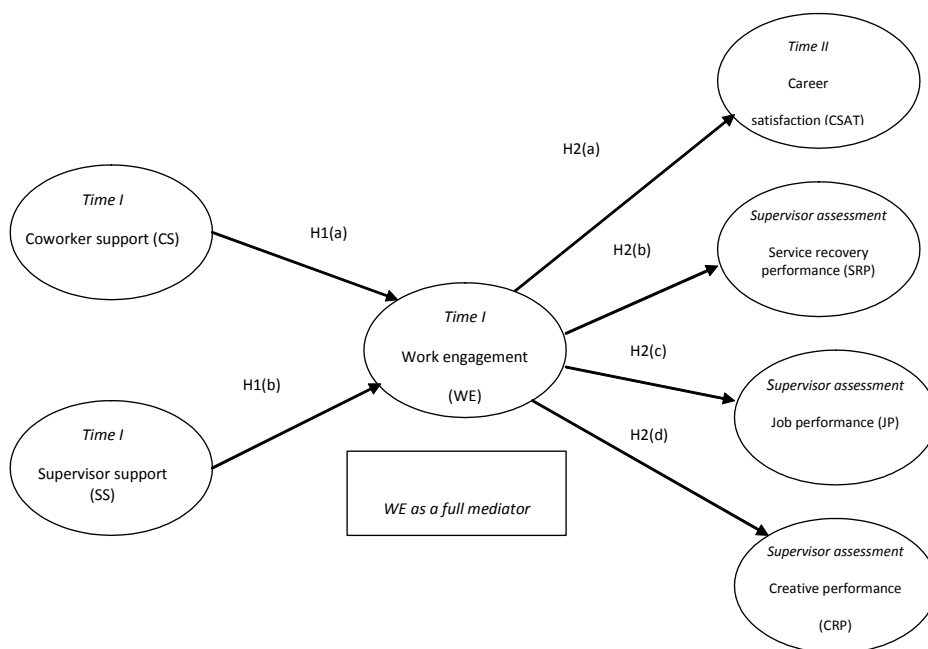
FIGURE 1 – Research Model
Source: Authors Calculation

SRP and JP are the two organizationally valued performance outcomes (Ashill et al., 2008; Yavas et al., 2010). SRP refers to frontline employees' abilities and actions to resolve a service failure to the satisfaction of the customer (Babakus et al., 2003). JP is defined as "the level of productivity of an individual employee, relative to his or her peers, on several job-related behaviors and outcomes" (Babin and Boles, 1998, p. 82). CRP refers to the amount of new ideas generated and novel behaviors displayed by employees in carrying out job-related tasks (Wang and Netemeyer, 2004). CRP that has not received much empirical attention in the relevant literature is also a critical performance outcome (Karatepe et al., 2008).

Engaged employees are likely to be satisfied with their career concerning goals for income, advancement, and development of new skills, can provide quality ser-

vices to customers, and display effective service recovery. In addition, they can create new ideas for service delivery process and display novel behaviors for the effective resolution of customer problems. Therefore, the following hypotheses are proposed:

H2: WE is positively related to (a) CSAT, (b) SRP, (c) JP, and (d) CRP.

As mentioned before, the motivational process of the JD-R model is used to develop hypotheses regarding the full mediating role of WE. That is, CS and SS foster employees' WE leading to CSAT, SRP, JP, and CRP. There is empirical evidence supporting similar relationships. For example, WE fully mediates the effects of job resources on organizational commitment (Hakanen et al., 2006), in-role and extra-role performances (Chung and Angeline, 2010), and turnover intentions (Schaufeli and Bakker, 2004).

In light of the precepts of the motivational process of the JD-R model and empirical evidence in the relevant literature, the following hypotheses are proposed:

H3: WE fully mediates the effect of CS on (a) CSAT, (b) SRP, (c) JP, and (d) CRP.

H4: WE fully mediates the effect of SS on (a) CSAT, (b) SRP, (c) JP, and (d) CRP.

3   METHOD

3.1   *Sample and Procedure*

Data were gathered from a sample of full-time frontline employees (e.g., front desk agents, food servers, bartenders, door attendants, bell attendants) with a one-month time lag and their immediate supervisors in the four- and five-star hotels in Yaoundé and CityDouala in placecountry-regionCameroon. There were 3 four-star hotels and only one five-star hotel in Yaoundé and 2 four-star hotels in placeCityDouala at the time of this study. These hotels were licensed by the National Tourism Council under the Ministry of Tourism in placecountry-regionCameroon. Permission for data collection was obtained from management of the five-star hotel and two four-star hotels in Yaoundé and only one four-star

hotel in placeCityDouala. The self-administered questionnaires that had information about the assurance and confidentiality of the study were distributed directly to frontline employees with the help of their immediate supervisors. The Time I questionnaire included the CS, SS, and WE measures and items regarding respondents' profile (i.e., age, gender, education, organizational tenure). The Time II questionnaire was composed of the CSAT measure. Finally, the supervisor questionnaire consisted of the SRP, JP, and CRP measures.

338 questionnaires were distributed to frontline employees at Time I. By the cut-off date for data collection at Time I, 269 questionnaires were retrieved, yielding a response rate of 79.6%. 269 questionnaires were then distributed to the same frontline hotel employees at Time II. By the cut-off date for data collection, 212 questionnaires were received for a response rate of 78.8% of the original sample and 62.7% of the entire population. 212 questionnaires that were matched with the Time I and Time II questionnaires were obtained from the supervisors.

16% of the respondents were between the ages of 18-27, while 47% were aged between 28 and 37 years. 30% of the respondents were between the ages of 38-47 and the rest were older than 47. 52% of the respondents were male. 14% of the respondents had primary school education and 36% secondary and high school education. 36% of the respondents had two-year college degrees and the rest had four-year college degrees. 4% of the respondents had tenure of below one year, 34% between one and five years, and 41% between six and ten years. The rest of the respondents had tenures more than ten years.

3.2 *Measures*

All perceptual variables in this study were operationalized using multiple items from different sources in the relevant literature. Broadly speaking, CS was measured through five items from Hammer et al. (2004). SS was measured using five items from Karasek et al. (1982). The shortened version of the Utrecht WE Scale (nine items) was used to measure WE (Schaufeli et al., 2006). CSAT was operationalized via five items from Greenhaus et al. (1990). Five items from Boshoff and Allen (2000) were used to measure SRP. Five items adapted from Babin and Boles (1998) were used to operationalize JP. Finally, six items

adapted from Wang and Netemeyer (2004) were used to measure CRP.

Responses to items in CS, SS, CSAT, SRP, and JP were recorded on five-point scales ranging from 5 (*strongly agree*) to 1 (*strongly disagree*). Response options for items in WE ranged from 6 (*always*) to 0 (*never*). Responses to items in CRP were elicited on a five-point scale ranging from 5 (*almost always*) and 1 (*never*).

All items in the three questionnaires were originally prepared in English and then translated into French using the back-translation method (Parameswaran and Yaprak, 1987), because data were collected from frontline hotel employees and their immediate supervisors in two-French speaking regions of placecountry-regionCameroon. The Time I and Time II questionnaires were tested with two different pilot samples of 10 employees. The supervisor questionnaire was also tested with a pilot sample of 10 supervisors. No changes were made in the questionnaires, because frontline employees and their supervisors did not have any difficulty in understanding items.

3.3 *Data Analysis*

This study employed a series of confirmatory factor analysis (CFA) for providing evidence of convergent and discriminant validity and used structural equation modeling (SEM) for assessing the hypothesized relationships through LISREL 8.30 (Joreskog and Sorbom, 1996). Specifically, in the present study a two-step approach including CFA and SEM was used (Anderson and Gerbing, 1988). The first step consisted of the measurement quality of scale items in terms of convergent and discriminant validity. The second step was related to a comparison of two models based on the χ^2 difference test. The overall χ^2 measure, GFI [Goodness of fit index], CFI [Comparative fit index], IFI [Incremental fit index], RMSEA [Root mean square error of approximation], and SRMR [Standardized root mean square residual] were used to assess model fit. In addition, the internal consistency reliability was evaluated on the basis of the 0.70 benchmark.

The following conditions were used for the mediation analysis (Baron and Kenny, 1986): (1) there are significant relationships between the predictor variables (CS and SS) and the mediator (WE), (2) there are significant relationships between

the predictor variables (CS and SS) and the criterion variables (CSAT, SRP, JP, and CRP), (3) there are significant relationships between the mediator (WE) and the criterion variables (CSAT, SRP, JP, and CRP), and (4) full mediation will hold if the predictor variables (CS and SS) have no significant relationships with the criterion variables (CSAT, SRP, JP, and CRP) when the mediator (WE) is controlled. The last condition was evaluated by comparing the fully and partially mediated models using the χ^2 difference test (cf. Chen et al., 2005).

4   RESULTS

4.1   *Measurement Results*

One item from the SRP measure and two items from the WE measure were dropped due to low standardized loading estimates during CFA. The results also revealed that several items loaded on more than one factor. Therefore, one item each from the CS, SS, and WE measures as well as two items each from the CSAT and JP measures and three items from the CRP measure were deleted during CFA. The final results of CFA demonstrated a good fit of the seven-factor model to the data based on a number of fit statistics ($\chi^2 = 455.41$, $df = 303$; χ^2 / $df = 1.50$; GFI = 0.86; CFI = 0.93; IFI = 0.93; RMSEA = 0.049; SRMR = 0.047). The magnitudes of the standardized loading estimates ranged from 0.51 to 0.86 and their t-values were significant. Seventeen out of 27 estimates were greater than 0.70. Overall, the results provided support for convergent validity (Anderson and Gerbing, 1988).

Discriminant validity was evaluated based on a series of χ^2 difference tests ($p < 0.01$) using measures of each pair of constructs. Specifically, a two-dimensional model for each pair of constructs was first fit, and then items representing each construct were forced into a single-factor solution. The χ^2 difference test produced a significant result for each pair of measures. Consequently, there was evidence of discriminant validity (Anderson and Gerbing, 1988).

Table 1 presents means, standard deviations, and correlations of study variables.

Coefficient alphas for CS, SS, WE, CSAT, SRP, JP, and CRP are also reported in Table 1.

4.2   *Structural Model Results*

A close examination of the results in Table 1 reveals that all direct linkages are significant and the first three conditions for a mediation analysis are met. Specifically, both CS ($r = 0.274$) and SS ($r = 0.335$) are positively correlated with WE. According to the results in Table 1, CS is positively correlated with CSAT ($r = 0.213$), SRP ($r = 0.171$), JP ($r = 0.244$), and CRP ($r = 0.126$). SS has a positive correlation with each of the employee outcomes (CSAT, $r = 0.337$; SRP, $r = 0.120$; JP, $r = 0.185$; and CRP, $r = 0.123$). The results in Table 1 also demonstrate that WE is positively correlated with CSAT ($r = 0.381$), SRP ($r = 0.241$), JP ($r = 0.342$), and CRP ($r = 0.135$).

The fully mediated or hypothesized model ($\chi^2 = 477.83$, $df = 312$) is compared to the partially mediated model ($\chi^2 = 460.90$, $df = 304$) using the χ^2 difference test ($p < 0.01$) to meet the last condition for a mediation analysis. That is, the result pertaining to the χ^2 difference test suggested a non-significant difference in fit ($\Delta \chi^2 = 16.93$, $\Delta df = 8$, non-significant). Accordingly, the fully mediated model appeared to have a better fit than the partially mediated model.

TABLE 1 - Scale Reliabilities, Means, Standard Deviations, and Correlations of Study Variables ($n = 212$)

Variables	1	2	3	4	5	6	7
1. Coworker support	1						
2. Supervisor support	0.284**	1					
3. Work engagement	0.274**	0.335**	1				
4. Career satisfaction	0.213**	0.337**	0.381**	1			
5. Service recovery performance	0.171**	0.120*	0.241**	0.273**	1		
6. Job performance	0.244**	0.185**	0.342**	0.360**	0.677**	1	
7. Creative performance	0.126*	0.123*	0.135*	0.224**	0.669**	0.689**	1
Mean	4.12	3.91	4.36	3.44	3.87	3.46	3.57
Standard deviation	0.58	0.7	1.01	0.8	0.62	0.81	0.69
Cronbach's Alpha	0.79	0.83	0.86	0.66	0.84	0.88	0.8

Source: Authors Calculation

Notes: Composite scores for each measure were obtained by averaging scores across items representing that measure. Higher scores indicated higher levels of each variable (e.g., coworker support, creative performance). * p < 0.05, ** p < 0.01, one-tailed test.

The hypothesized model fit the data reasonably well based on the following model fit statistics: ($\chi^2 = 477.83$, $df = 312$; $\chi^2 / df = 1.53$; GFI = 0.86; CFI = 0.92; IFI = 0.93; RMSEA = 0.050; SRMR = 0.062). The results for the hypothesized model are given in Table 2. The results of SEM in Table 2 showed that CS ($\gamma_{11} = 0.22$, $t = 2.63$) and SS ($\gamma_{12} = 0.33$, $t = 3.91$) depicted significant positive relationships with WE. Therefore, hypotheses 1(a) and 1(b) were supported. The results of SEM also revealed that WE exerted significant positive effects on CSAT ($\beta_{21} = 0.51$, $t = 4.93$), SRP ($\beta_{31} = 0.31$, $t = 3.80$), JP ($\beta_{41} = 0.41$, $t = 5.10$), and CRP ($\beta_{51} = 0.18$, $t = 2.20$). Therefore, hypotheses 2(a), 2(b), 2(c), and 2(d) were supported.

As for the results of SEM regarding the mediating effects in Table 2, all hypotheses were supported. Specifically, the results showed that the indirect impact of CS on CSAT (standardized indirect effect $= 0.11$, $t = 2.40$), SRP (standardized indirect effect $= 0.07$, $t = 2.23$), JP (standardized indirect effect $= 0.09$, $t = 2.42$), and CRP (standardized indirect effect $= 0.04$, $t = 1.72$) via WE was significant and positive. The results collectively illustrated that WE fully mediated the effect of CS on CSAT, SRP, JP, and CRP. Therefore, hypotheses 3(a), 3(b), 3(c), and 3(d) were supported.

According to the results in Table 2, WE also functioned as a full mediator of the impact of SS on CSAT, SRP, JP, and CRP. The indirect effect of SS on CSAT (standardized indirect effect $= 0.17$, $t = 3.26$), SRP (standardized indirect effect $= 0.10$, $t = 2.86$), JP (standardized indirect effect $= 0.14$, $t = 3.31$), and CRP (standardized indirect effect $= 0.06$, $t = 1.96$) through WE was significant and positive. Therefore, there was empirical support for hypotheses 4(a), 4(b), 4(c), and 4(d). The results accounted for 21% of the variance in WE, 26% in CSAT, 9% in SRP, 17% in JP, and 3% in CRP.

5   DISCUSSION

5.1   *Summary of Findings*

The results reveal that the fully mediated model provides a better fit to the data when compared to the partially mediated model. The results further indicate that all hypothesized relationships in the fully mediated model are supported. Specifically, frontline employees receiving adequate support from their coworkers and supervisors are engaged in their work. Such employees in turn are satisfied with their career, solve customer problems appropriately, deliver quality services to customers, and display CRP.

More importantly, the results reported in this study provide support for the motivational process of the JD-R model. In short, the results suggest that CS and SS enhance WE, which in turn results in CSAT, SRP, JP, and CRP.

TABLE - 2 Structural Model Results

Hypotheses	Standardized path estimate	t-value
H1(a): CS $\longrightarrow$ WE (γ11)	0.22	2.63
H1(b): SS $\longrightarrow$ WE (γ12)	0.33	3.91
H2(a): WE $\longrightarrow$ CSAT (β21)	0.51	4.93
H2(b): WE $\longrightarrow$ SRP (β31)	0.31	3.8
H2(c): WE $\longrightarrow$ JP (β41)	0.41	5.1
H2(d): WE $\longrightarrow$ CRP (β51)	0.18	2.2
H3(a): CS $\longrightarrow$ WE $\longrightarrow$ CSAT	0.11	2.4
H3(b): CS $\longrightarrow$ WE $\longrightarrow$ SRP	0.07	2.23
H3(c): CS $\longrightarrow$ WE $\longrightarrow$ JP	0.09	2.42
H3(d): CS $\longrightarrow$ WE $\longrightarrow$ CRP	0.04	1.72
H4(a): SS $\longrightarrow$ WE $\longrightarrow$ CSAT	0.17	3.26
H4(b): SS $\longrightarrow$ WE $\longrightarrow$ SRP	0.1	2.86
H4(c): SS $\longrightarrow$ WE $\longrightarrow$ JP	0.14	3.31
H4(d): SS $\longrightarrow$ WE $\longrightarrow$ CRP	0.06	1.96

R^2 for: WE = 0.21; CSAT = 0.26;

SRP = 0.09; JP = 0.17; CRP = 0.03

Model fit statistics:

χ^2 = 477.83, df = 312; χ^2 / df = 1.53; GFI = 0.86;

CFI = 0.92; IFI = 0.93; RMSEA = 0.050; SRMR = 0.062

Source: Authors calculation

Notes: CS = Coworker support; SS = Supervisor support; WE = Work engagement; CSAT = Career satisfaction; SRP = Service recovery performance; JP = Job performance; CRP = Creative performance. All standardized path estimates are significant ($p < 0.05$ or $p < 0.01$). T-values: one-tailed test $t > 1.3$, $p < 0.10$; $t > 1.65$, $p < 0.05$; and $t > 2.33$, $p < 0.01$.

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5.2 *Strengths of the Study*

Several strengths of this study are of note. First, the current study lends empirical support to WE as a full mediator of the effects of CS and SS on four important job outcomes in frontline service jobs in the hotel industry, which are CSAT, SRP, JP, and CRP. It also provides empirical support for the motivational process of the JD-R model.

Second, this study extends the research stream on the antecedents and consequences of WE to country-regionCameroon in the sub-Saharan placeAfrica. Finally, the present study minimizes the possibility of common method bias by testing the relationships through data collected from frontline employees with a one-month time lag and their immediate supervisors.

5.3 *Limitations and Future Research Directions*

Although this study contributes to the existing knowledge base, viable prospects for future research remain. First, incorporating other types of job resources (e.g., training, empowerment, rewards) into the research model that may also be equally important in frontline service jobs would enhance the understanding of their effects on CSAT, SRP, JP, and CRP via WE. Second, frontline male and female employees may have different reactions to SS, WE, SRP, JP, or CRP. With this realization, in future studies testing gender as a moderator of the strength of relationships among the variables used in the present study would be illuminating.

In addition, replication studies among other frontline employees in different service settings (e.g., banks airlines) in placecountry-regionCameroon are needed for cross-validating the results and broadening the database for further generalizations.

5.4 *Management Implications*

The results of this study provide various implications from a managerial perspective. Specifically, it is important for hotel managers to establish and maintain

a work environment where frontline employees and their supervisors pay utmost attention to the critical roles of CS and SS. Since CS and SS trigger WE, managers need to make sure that coworkers and supervisors provide support whenever needed. Managers can also benefit from hiring individuals who really fit well with the demands of frontline service jobs. This is a must for managers, because long work hours, irregular and inflexible work schedules, and excessive job demands are among the problems in frontline service jobs. If managers hire individuals whose expectations are not met, such individuals are likely to leave the organization or management of the hotels is likely to have layoff decisions for these individuals. Therefore, managers should use objective and scenario-based tests for hiring the most suitable individuals. By doing so, management of the hotels may plan to retain a pool of engaged employees who may display satisfaction with their career and have high quality performance outcomes.

In closing, managers can arrange various workshops in order to receive feedback from frontline employees for an effective customer complaint management and obtain new and creative ideas for a better service delivery process. When such employees feel that they are considered as strategic partners of the organization, they are likely to have high quality performance outcomes such SRP, JP, and CRP.

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POVEZIVANJE PERCIPIRANE ETIČKE KLIME S REZULTATIMA PERFORMANSI: POSREDNIČKA ULOGA UKORIJENJENOSTI RADNOG MJESTA

Sažetak:

Razvijen je i testiran konceptualni model koji ispituje ukorijenjenost radnog mjesta kao posrednika utjecaja percipirane etičke klime na performansu posla i pružanje usluga klijentima koje nadilaze dužnost. Podaci dobiveni u analizi dijade hotelski zaposlenik na prvoj liniji-nadglednik u Nigeriji, korišteni su kako bi se taj odnos ocijenio putem modeliranja strukturalnim jednadžbama. Rezultati pokazuju da ukorijenjenost radnog mjesta u potpunosti prenosi učinak percipirane etičke klime na rezultate rada zaposlenika na prvoj liniji. Točnije, zaposlenici s pozitivnom percepcijom etičke klime u tvrtki su ukorijenjeni na radnim mjestima. Takvi zaposlenici prikazuju visoki nivo poslovne performanse i spremni su pružiti uslugu klijentima koja nadilazi njihovu dužnost. Rad raspravlja o implikacijama ovih rezultata te nudi implikacije za buduća istraživanja.

Ključne riječi: etička klima, usluge klijentima koje nadilaze dužnost, hotelski zaposlenici, ukorijenjenost radnog mjesta, performansa posla, Nigerija

Osman M. Karatepe - JOB RESOURCES, WORK ENGAGEMENT, AND HOTEL EMPLOYEE OUTCOMES: A TIME-LAGGED ANALYSIS

THE SENSITIVITY OF CAPITAL SERVICES INDEX ON CONSTRUCTION PRICE INDICES

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Keywords: Capital measurement, Index of capital services, Perpetual inventory method, Fixed asset price indices, Construction price indices

JEL: C43, O47

Abstract

Measuring capital is a challenging task due to numerous conceptual dilemmas and practical problems. In this paper, we focus on the production side of capital measurement where the reliable measurement of capital services is of vital importance for derived production measures, such as multifactor productivity. While there has been a lot of debate regarding the choice of expected rate of return, the choice of expected capital gain, and the treatment of taxes in the user cost estimation when estimating capital, not much attention has been paid to the issues of appropriate price indices of assets. The use of inappropriate asset price indices results in a biased estimate of capital services index and, consequently, influences the estimate of the impact of capital on economic growth. The purpose of this paper is to develop a framework of the impact of asset price indices

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on capital services and to test the impact by the sensitivity analysis. The sensitivity analysis was carried out for the impact of construction prices on capital service index for the Slovenian manufacturing for the period 1995-2008.

1   Introduction

Measuring capital is a challenging task for researchers and national statistical offices (NSOs). Even within the comprehensive and consistent framework of the neoclassical theory of capital, there are still numerous problems regarding the methods of capital measurement.

In this paper, we focus on the measurement of capital services that is of vital importance for derived production measures, such as multifactor productivity. Conceptually, capital services are now well established thanks to the theoretical and methodological contributions of Jorgenson and Griliches (1967) and further contributions from Jorgenson (1995a, 1995b), Hulten (1990) and Diewert (2004). The issues regarding measuring the volume and price of capital services are mostly empirical, dealing with the choice of expected rate of return, the choice of expected capital gain, and the treatment of taxes in the user cost estimation (Baldwin et al., 2005, 127).

However, less attention has been paid to the issues of appropriate price indices of assets which are required in the process of assessment of capital services. The compilation of reliable price indices of fixed assets is particularly difficult due to heterogeneity of asset types and rapid technological improvement that makes the problems of separating value changes for capital goods into the price and volume components more complex than for other goods and services.

Compared to the statistics of consumption goods and production statistics, the statistics of capital goods is poorly developed, less reliable, and it exhibits some considerable gaps. This is also reflected on asset price indices the compilation of which is bound by available data, thus being far from recommended methodological standards (Eurostat, 2001).

The review of empirical research on the measurement of capital services reveals that under such circumstances, researchers have to adopt some other 'second-best' approaches, for instance, using input price indices to produce volume measures instead of output price measures, not paying particular attention to the bias introduced by inadequate price indices.

The purpose of this paper is to develop a framework of the impact of asset price indices on capital services and to test the impact by the sensitivity analysis. The sensitivity analysis was carried out for the impact of construction prices on the capital service index for the Slovenian manufacturing for the period 1995-2008. The decision to examine empirically the impact of asset price indices for construction assets was based on several reasons: first, the production of construction price indices together with a description of underlying methodology is a regular service of national statistical offices, thus giving us an opportunity to evaluate the deviations that are available from conceptually required data; second, the compilation of construction price indices exhibits all measurement problems and, consequently, possible sources of measurement errors, which are characteristic of asset price indices; third, constructions represent a considerable share of total assets in the majority of production processes.

2   MEASURING CAPITAL

When considering the contribution of a capital asset to the production process, it is generally agreed that the value of capital services produced by the asset is the appropriate measure and not the value of the asset itself. However, capital services that must be considered as a physical concept are not usually directly observable, rather approximated by the assumption that service flows are in proportion to the productive stock of a given type of asset.

The assessment of productive stock for each type of asset, most commonly done with the perpetual inventory method (PIM) described below, constitutes the first step towards measuring the quantity of capital services. In the second step it is necessary to construct an aggregate measure of the productive contribution of the different types of assets.

2.1 Construction of productive capital stock estimates by asset type

The perpetual inventory method (PIM) enables the construction of productive stock for a particular asset on the basis of cumulated investment expenditure in past periods. In the first step it is necessary to express gross fixed capital formation (GFCF) in each period in constant prices. In the next step it is necessary to correct gross investment values for assets that have already been excluded from the production process because of wear and tear. Assuming that older assets are less productive in comparison with newer ones because of increased downtime, higher maintenance requirements or reduced speed or accuracy, investment from all surviving vintages is multiplied by the coefficient of their (relative) efficiency (Hulten, 1990, 121):

$$K^P_{i,j,t} = \Phi_{i,0}I_{i,j,t} + \Phi_{i,1}I_{i,j,t-1} + ... + \Phi_{i,T}I_{i,j,t-T}; \Phi_{i,0} = 1 \qquad (1)$$

wherein:

$K^P_{i,j,t}$: *is the productive stock of the fixed asset i in industry j,*

$I_{i,j,t}, I_{i,j,t-1},..., I_{i,j,t-T}$: *is the gross investment in the fixed asset i in industry j in each individual period expressed in constant prices and*

$F_{i,0}, F_{i,1},...F_{i,T}$: *are the coefficients of relative efficiency of assets i of a given age.*

Weights $F_{i,t--v}$,reflect the relative efficiency of the assets i of age V in comparison with a new asset, whereas the productive stock of capital $K^P_{i,j,t}$ can be interpreted as the number of units of a new asset necessary to achieve the same production capacity of past investment ($I_{i,j,t}, I_{i,j,t-1},..., I_{i,j,t-T}$).

However, the capital estimation on the basis of PIM with (1) has to be considered as an approximation where its accuracy is mainly dependent on the accuracy of:

1. estimated efficiency coefficients F_{t-v} (age-efficiency profile),

2. asset price indices used to deflate GFCF.

Efficiency coefficients are rarely observed directly and so indirect methods of inferring relative asset efficiency are necessary. The most common approach is

to estimate the relative efficiency indirectly by assuming that the F's follow some pattern that depends on an observable useful life T. A plausible age-efficiency pattern for many asset types is a hyperbolic pattern (OECD, 2001a, 62) whereas the geometric form is widely used in theoretical expositions of capital theory because of its simplicity (Hulten, 1990, 125). For the same reason the geometric age-efficiency pattern is employed in this study.

The issues related to the estimation of asset price indices, being more complex and less explored, are discussed in detail in section 3.

2.2   Aggregation across different asset types

Since many different types of assets are used in modern production processes, an aggregate measure of different capital services must be constructed in the second step. Jorgenson (1963) and Jorgenson and Griliches (1967) were the first to develop an aggregate capital service measure that takes the heterogeneity of assets into account. They defined the flow of quantities of capital services individually for each type of asset, and then applied asset-specific user costs as weights to aggregate across services from the different types of assets.

Estimating user costs.— User costs are prices for capital services and, under competitive markets and equilibrium conditions, these prices reflect the marginal productivity of the different assets. Under the assumption of geometric depreciation pattern and in the absence of taxation, the user costs are expressed as:

$$\mu_{i,j,t} = i_{j,t} p^I_{i,j,t-1} + \delta_i p^I_{i,j,t} - \left[p^I_{i,j,t} - p^I_{i,j,t-1} \right] \tag{2}$$

wherein:

$\mu_{i,j,t}$: *is the price of capital services from asset type i in industry j,*

$p^I_{i,j,t-1}$: *is the price for asset type i in industry j at the beginning of period t,*

$p^I_{i,j,t}$: *is the price for asset type i in industry j at the end of period t,*

$i_{j,t}$: *is the nominal rate of return in industry j and*

d_i: *is the rate of depreciation for asset type i.*

Equation (2), derived from the neoclassical theory of investment, shows that the user cost, reflecting the per-period cost of using the service of the asset,

includes the cost for financing the purchase of the capital good, its economic depreciation and the capital gains-losses due to asset price changes.[1]

Despite the well developed theoretical paradigm, its empirical application is, however, not straightforward. If we ignore tax parameters in the user cost formulae, the most important issues in the user costs estimation can be considered the choice of expected rate of return and the choice of expected capital gains. According to the empirical evidence reported by Baldwin et al. (2005), Erumban (2008), Harper et al. (1989) and Iommi and Jona-Lasinio (2008), and theoretical advantages of the ex-post approach explicated by Baldwin et al. (2005), the model with internal rate of return (ex-post approach) and perfectly anticipated capital gain is employed in this study. The nominal rate of return in each industry is derived as a residual as follows:

$$i_{j,t} = \frac{R_{j,t} + \sum_i \left[p^I_{i,j,t} - p^I_{i,j,t-1} \right] K^P_{i,j,t} - \sum_i p^I_{i,j,t} \delta_i K^P_{i,j,t}}{\sum_i p^I_{i,j,t-1} K^P_{i,j,t}} \tag{3}$$

wherein:

$R_{j,t}$: *is the capital compensation in industry j in the period t,*

Index number formula.— Once we have estimated the productive stock for different asset types and its user costs then we have to choose the specific index number formula by which the aggregation is done. The economic literature (Diewert, 1976, 1978; OECD, 2001a) recommends the use of superlative index numbers or index numbers with flexible weights that include the Fisher ideal index and the Törnqvist index.

Given observations on the productive capital stock for different types of assets, $K^P{}_{i,j,t}$, and given a set of user cost weights, $\mu_{i,j,t}$, a Törnqvist index of capital services is given by the following expression:

Törnqvist quantity index of aggregate capital services $= \prod_i \left(\frac{K^P_{i,j,t}}{K^P_{i,j,t-1}} \right)^{\bar{v}_{i,j}}$ $\tag{4}$

Where $\bar{v}_{i,j} = 0,5 \left(v_{i,j,t} + v_{i,j,t-1} \right)$ and $v_{i,j,t} = \frac{\mu_{i,j,t} K^P_{i,j,t}}{\sum_i \mu_{i,j,t} K^P_{i,j,t}}$. $\tag{5}$

Cost share weights allow accounting for heterogeneity in the marginal product of each asset type since they assign a relatively greater weight to the rates of change

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[1] More comprehensive user cost definitions also include the net burden due to the tax structure for business income.

of the assets that have higher marginal product and allow accounting for the substitution among different asset types. This formulation is used in the capital service measurement in many studies on total factor productivity (Jorgenson, Gollop & Fraumeni, 1987, Jorgenson, Ho & Stiroh, 2005, EUKLEMS, 2007) as well as by several NSOs (US BLS, Australian Bureau of Statistics, for example).

3   A framework for assessment of the impact of asset price indices on capital services estimation

The price indices for a given asset type affect the aggregate index of capital services through estimates of the productive stock of the asset type as well as through relative user costs of the asset type in both a direct and indirect way. The relations between asset price indices and the index of capital services are rather complex. Figure 1 presents them schematically.

First, asset price indices have a direct impact on the estimates of GFCF in each period in constant prices of the chosen basic period (label 1 on Figure 1) reflected in the estimates of the productive stock of a given asset type (label 2 on Figure 1). Asset price indices also have a direct impact on the estimates of user costs of a given asset type since they include the capital gains/losses due to asset price changes (label 4a on Figure 1).

When the rate of return is estimated according to the ex-post approach, as a residual given the value of capital compensation from national accounts, the price indices for a given asset also have an indirect impact on user costs of all asset types through the altered internal rate of return (label 4b on Figure 1), a consequence of altered relative capital gains-losses (label 3a on Figure 1) as well as altered estimates of the productive stock of a given asset type (label 3b on Figure 1).

Thus, asset price indices do not affect capital services estimates only through the process of deflation of GFCF, as frequently presented, but also indirectly, through the impact on user costs being a factor of weighting scheme of calcula-

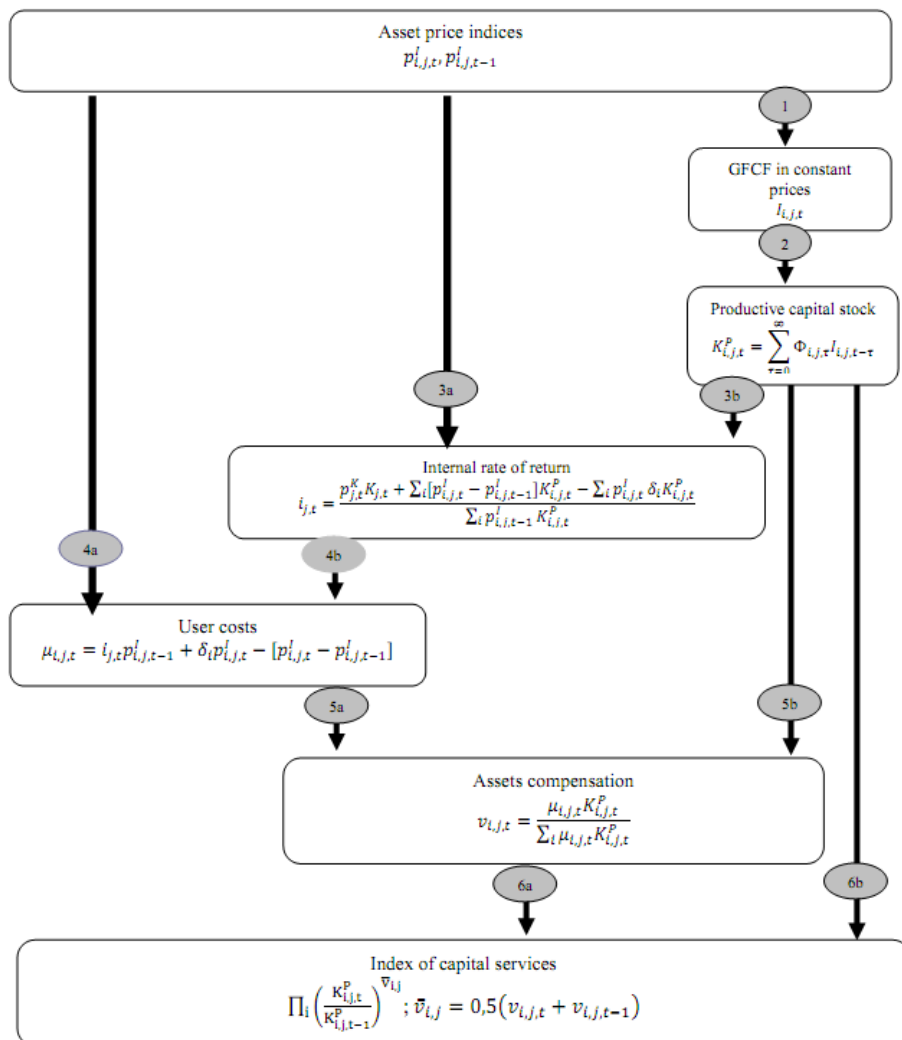tion index of capital services at aggregate level.

FIGURE 1- The impact of asset price indices on the index of capital services

Source: Author calculation

Taking into consideration the role asset price indices have in the process of

capital services estimation, they have to fulfill the following criteria in order to provide reliable deflated values of GFCF and user cost estimates (Eurostat, 2001, 43):

1. the price index must include coverage of exactly that (group of) product(s);

2. when compiling price index, changes in quality of the product(s) must be properly taken into account;

3. the price index is valued in purchasers' prices including non-deductible VAT; and

4. the concepts underlying the index correspond to those of national accounts.

However, fulfillment of these criteria can be hampered by several problems. One of the most difficult problems in price and volume measurement is the problem of quality changes[2] that are more severe for capital goods than for other goods and services. Many capital goods are unique or "one off',' representing a discontinuity in the calculation of price indices. This is particularly the case with most buildings, construction work and large equipment goods such as ships, oil rigs, aircraft, special purpose machinery and tailored business services.
Eurostat's handbook on price and volume measures in national accounts (Eurostat, 2001, 23-24) suggests two approaches for the calculation of price indices for unique products (services) - "model pricing" and "specification pricing". However, both of them are resource-intensive methods and not all NSOS can afford such practices.

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[2]In principle, whenever a characteristic of a product changes, it is to be considered a different quality of the product. These changes in characteristics are to be recorded as changes in volume and not as changes in price (cf. ESA95, par. 10.16).

4   Construction price indices as deflators of GFCF

As has already been explained, the compilation of construction price indices deserves particular attention. One of the major problems in the process of compilation of construction price indices is the problem of heterogeneity which is caused by the diversity of construction activity. The term construction covers a wide variety of activities, such as the construction of dwellings, non-residential buildings, and civil engineering works, as well as major improvements of existing structures and regular repairs and maintenance.

The methods used to compile construction price indices vary significantly between countries. Individual countries also use a variety of methods and data sources for the different construction price indices they produce. However, the majority of countries use input price indices for deflation purposes (Eurostat, 2001, 75), since they are the simplest and least expensive indices to construct.

Input price indices measure changes in the price of direct inputs in the construction process. This generally entails the compilation of a weighted index (fixed weights) of the costs of wages and materials for the representative object.

When assessing the relevance of input price indices used in the process of capital services estimation, we must take into consideration the basic criteria already discussed in section 3 - consistency with National Accounts concepts, use of the appropriate purchasers' price valuation, providing the full coverage of the activities under the classification heading and treatment of quality changes as volume changes. Of course, the price indices should be compiled from actual rather than list prices and should ensure that all measures are appropriate to the time period (Eurostat, 2001, 43).

The coverage of construction activities and the appropriate level of product detail is the biggest advantage of input price indices, since they are usually available for housing and estate buildings, civil engineering works, buildings for industrial use and building renovations. However, due to the methodological issues presented below, the use of input price indices is classified as an inappropriate way to produce volume measures (Eurostat, 2001).

First, the input price indices do not reflect the whole range of influences that im-

pact construction purchaser's prices - which are changes in productivity, profit, and trade margins of the construction contractor as well as costs incurred in the transfer of ownership and any taxes payable on the transfer.

The next important issue is the treatment of quality changes. The standard method of compilation of an input price index starts with the selection of a representative construction and evaluation of the quantities of each constituent element. The quantities of elements representing weights in the process of input price index calculation remain fixed. Consequently, an input price index measures changes of costs at constant technology and constant input mix that are associated with the implementation of a fixed amount of construction work (Eurostat, 2006, 76). Hence, the quality changes are ignored by definition, a big disadvantage of input price indices since structures are very heterogeneous.

According to the role asset price indices have in the process of capital services estimation, discussed in section 3, it can be easily understood that the use of inappropriate or biased construction price indices, like the direct use of input price indices, results in a biased estimate of capital services index, the magnitude of the bias being proportional to the contribution of constructions to the aggregated capital services. The empirical evidence on how the biased estimates of construction price indices affect the estimate of the aggregate index of capital services is provided in the following section.

5 Analysis of Impact of Construction Price Indices on Capital Services Index

5.1 Data and methodology

The assessment of the impact of construction price indices on the aggregate index of capital services has been made for Slovenian manufacturing industries during the period 1995-2008. We estimated both the productive capital stock and the user cost of capital for ten asset types that comprises GFCF: residential structures, non-residential buildings and other structures, transport

equipment, computing equipment, communications equipment, other machinery
and equipment, other tangible assets (cultivated assets), major improvements
to tangible non-produced assets and costs associated with the transfer of own-
ership of non-produced assets, software and other intangible fixed assets. Non-
residential buildings and other structures (NRBOS) mostly consist of industrial
and commercial buildings, since civil engineering objects are usually not owned
by production units classified in manufacturing industries.

At the lowest level of aggregation, we estimated productive capital stock and
the user cost of capital for 22 divisions of manufacturing industries (2-digit
numerical code).[3] The industries are classified according to Slovenian standard
classification of activities (SKD 2002 - national version of NACE Rev. 1).

Finally, we estimated the aggregate capital services index for manufacturing
industries with the use of the Törnqvist index number formula, wherein the
weights represented relative proportions of aggregate capital compensation by
divisions.

Data on gross capital stock by asset types for the reference year 1999, collected
with the census of fixed assets[4], were used as a key data source for an initial
benchmark estimate of productive capital, needed to implement the PIM, pre-
sented in section 2 with (1). Data on GFCF for the period 1995-2008 were taken
from National Accounts.[5]

It has to be noted, however, that the deflators used by SORS to produce of-
ficial National Account Data on GFCF in constructions are compiled as input

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[3] This level of detail (2-digit numerical code), also known as the A60 breakdown, is often
used in European statistics.

[4] The census, carried out in the years 2000-2001 for the reference year 1999, was carried out
as part of the subproject entitled "Methodology, Organisation and Implementation of Fixed
Capital Statistics" within the STATCOP 98 programme financed by EU. Data collected with
this project should present a basis to establish the PIM method for the estimation of gross
capital stock and capital stock consumption in accordance with ESA 95. The data used in
this study must be considered as preliminary.

[5] The only exception were deflators for computing equipment and application software, that
have been, according to harmonization procedure introduced by Schreyer (2002), estimated
on the basis of US price indices for computer and electronic products and application software
published by BEA

price indices with Laspeyres fixed weights, similar to the majority of countries, although this approach is considered an unacceptable way to produce volume measures (Eurostat, 2001, 75). As already pointed out in the section 4, input price indices are likely to be biased indicators of price changes of completed construction work, and as such affect several components which enter into the compilation of index of capital services (see Figure 1), proportionally to their contribution to aggregate capital services.

Considering the poor empirical evidence it was almost impossible to make a reliable estimate of the magnitude of this bias. Hence, we decided to conduct a sensitivity analysis with several different hypothetical scenarios which we designed according to the findings of the appraisal of input price indices as deflators presented in section 4 and findings reported by some studies considering various sources of bias in price indices.

5.2   Sensitivity analysis design

Our point of departure was the assumption that the shares of costs of the transfer of ownership, taxes payable on the transfer and trade margins in purchasers' prices, have not been changed in the given period. Consequently, neglected changes in productivity, profit and quality represented main sources of bias.

Due to the lack of other relevant data sources, the correction for changes in productivity in construction activity was the only one we could actually perform. We took estimates of total factor productivity (TFP) in construction activity for the period 1995-2006, published in the EUKLEMS database, as a benchmark. Since the data was available only for the period 1995-2006, we assumed no change in TFP occurred in 2007 and 2008.

When trying to define relevant assumptions regarding the sign and the magnitude of bias caused by neglected profits and quality changes, we considered empirical evidence presented by Feenstra (1995), Gordon (1990), Hobijn (2001, 2002), Pieper (1990) and Triplett (1972, 1988, 2002).

Since profits are pro-cyclical (Pieper, 1990) and the output growth was positive through the whole studied period, we assumed that input price indices understated the growth of construction prices. However, being unable to estimate

the size, we conservatively assumed input price indices underestimated the actual growth of construction prices by 1.00% annually, due to the bias caused by neglected profits, all other things remaining equal.

Even more problems were related to the assumption regarding the sign of the quality bias. It is commonly believed that price index methods tend to overestimate actual inflation in markets where there is a rapid turnover of goods due to technological progress. The support for such reasoning can be found in the evidence reported by the Boskin (1996) commission with respect to the U.S. Consumer Price Index, while Gordon (1990) used hedonic price indexes to correct for this bias in equipment price indexes (Hobijn, 2002). In contrast, Hobijn (2001, 2002), as well as Triplett (1972, 1988, 2002) and Feenstra (1995) have each made the point that quality adjustments in price index methods might actually lead to an understatement of inflation.[6] Hence, the quality bias in price indexes is not by definition upward.

Considering the results reported by Gordon (1990), that the official national income and product accounts' (NIPA) deflator for producers' durable equipment for the period 1947-83 overestimated the price rise for exactly the same commodities by 2.96% annually, we assumed the value of 3.00% as the upper margin of the possible positive quality bias.[7] In addition, we defined an alternative scenario assuming the negative quality bias. In this case we assumed the input price indices underestimated the actual growth of construction prices by 0.50% annually due to quality bias, all other things being equal, considering the findings reported by Hobijn (2002).

According to the assumptions presented above, we defined the following scenarios for the sensitivity analysis:

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[6] One reason that production costs per quality unit might be increasing in the number of quality units is that the best models are the newest and learning by doing reduces production costs over time at a higher rate than quality per model grows (Hobijn, 2002, 23).

[7] It has to be noted that Gordon's estimate referring to the period 1947-83 cannot be directly referred to regarding the period of our analysis, 1995-2008. However, from the methodological point of view limitations he identified for NIPA deflator for producers' durable equipment are much the same as in the case of official input price indices used by SORS for deflating GFCF in constructions.

1. *Scenario 1:* adjustment of official input price indices for changes in productivity only;

2. *Scenario 2:* adjustment for changes in productivity and profit rate;

3. *Scenario 3:* adjustment for changes in productivity, profit rate and downward adjustment due to assumed positive quality bias and

4. *Scenario 4:* adjustment for changes in productivity, profit rate and upward adjustment due to assumed negative quality bias.

Table 1 provides an overview of the adjustments made to input price indices according to each of the assumed scenarios.

TABLE 1 - Overview of scenarios for the sensitivity analysis

Scenario	Adjustment for changes in productivity	Adjustment for changes in profit rate	Adjustment for quality changes
Scenario 1	↑ / ↑ *	-	-
Scenario 2	↑ / ↑ *	↑ (1.00 %)	-
Scenario 3	↑ / ↑ *	↑ (1.00 %)	↓ (3.00 %)
Scenario 4	↑ / ↑ *	↑ (1.00 %)	↑ (0.50 %)

Source: Author calculation
*: According to estimated TFP

5.3   Results

Each of the scenarios was evaluated in accordance with the framework presented in section 3 where special attention was paid to effects that adjustments had on:

1. growth of prices of NRBOS;

2. productive stock of NRBOS estimates and

3. aggregate index of capital services.

Growth of prices. — The prices of NRBOS[8] in manufacturing industries in Slovenia have risen on average by 7.65% annually or by 160.70% over the given period (label 'Official' on Figure 2).

The result of correction for productivity change (label 'Scenario 1' on Figure 2) is most evident in the period 1996-2000, when the growth of productivity in construction activity was positive; hence, input price indices overestimated the actual inflation. However, we consider this correction as rather conservative, since TFP estimates published in the EUKLEMS database are based on output data in the construction industry being deflated with input price indices, thus very probably underestimating the actual productivity growth.

Additional correction for profits (label 'Scenario 2' on Figure 2) resulted in faster growth of NRBOS prices from 2000 on, in comparison to official estimates. The average growth of NRBOS prices, according to scenario 2, would be 8.73% annually.

Assuming the positive quality bias, in addition to adjusting input prices for changes in productivity and profit rate (label 'Scenario 3' on Figure 2), resulted in remarkable downward adjustment of input prices. The prices of NRBOS would rise, according to scenario 3, by only 5.46% annually or by 99.69% over the given period. In contrast, upward adjustment for quality change (label 'Scenario 4' on Figure 2) resulted in much higher growth of prices – 9.27% annually or by 216.58% overall.

FIGURE 2 - Deflators of items of non-residential buildings and other structures within GFCF, 1995-2008, 1995=100

Considering that Scenario 3 and Scenario 4 represent a lower and upper margin of the estimated growth of NRBOS prices, we concentrated on just these two scenarios in the following.

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[8] We focused on the impact of price indices of non-residential buildings and other structures only, since the contribution of residential structures in the aggregate capital services growth in manufacturing industries in the given period was negligible. However, the contribution of residential buildings is taken into account when calculating the aggregate index of capital services.

Productive capital stock. — Figure 3 shows benchmark estimates of productive stock of NRBOS in Slovenian manufacturing industries, compiled on a basis of official deflators, as well as estimates compiled according to Scenario 3 and Scenario 4.

Scenario 3, characterized by the slowest growth of NRBOS prices, led to the highest estimates of productive stock of NRBOS, which are on the average 23.95% higher than benchmark estimates in the whole studied period. The positive difference is to be expected since asset price indices have a direct impact on the estimates of GFCF in each period in constant prices, as is reflected in the estimates of the productive stock of a given asset type (Figure 1). An upward bias of an asset price index results in a downward bias of GFCF in constant prices of a given asset type and thus in an underestimated productive stock of a given asset type.

According to Scenario 4, NRBOS prices showed somewhat slower growth in the years 1996-1999, comparing to official estimates, resulting in higher estimates of productive stock of NRBOS in these early years. However, the gap is being closed due to accelerated growth of NRBOS prices from 2000 on.

FIGURE 3 - Productive stock of non-residential buildings and other structures in Slovenian manufacturing industries, 1995-2008, reference year 1995

Capital services. — Figure 4 shows estimates of the Törnqvist aggregate index of capital services based on official NRBOS prices, as well as on two alternative scenarios. As it has been already explained in Section 3, differences between various aggregate capital services estimates are the result of the direct impact of deflators of GFCF in constructions on productive capital stock estimates as well as direct and indirect effects on user costs of capital. Differences in aggregate capital services are almost negligible, especially between estimates based on official deflators and estimates based on Scenario 3, despite a quite different growth path of NRBOS prices considered in both cases (see Figure 2).

The volume index of aggregate capital services at the aggregate level, based on official deflators, shows an increase of 41.92% over the full period or 2.73% annually. Considering Scenario 3 - the increase would be 41.68% over the full period (2.72% annually), whereas the overall increase would be only 38.45%

(2.53% annually) when considering Scenario 4.

The magnitude of differences between capital services estimates based on alternative scenarios varies slightly in some divisions when looking at a disaggregate level depending on the contribution of NRBOS to overall capital services in the selected division. For example, in the division Manufacture of coke and refined petroleum products (DF), the difference between the capital services estimate based on official deflators and the estimate based on Scenario 4 is almost negligible, whereas the largest difference between the capital services estimate based on official deflators and the estimate based on Scenario 4, approximately 3.29%, can be seen in the division Manufacture of chemicals and chemical products (DG).

FIGURE 4 - Aggregate capital service in Slovenian manufacturing industries, 1995-2008, 1995=100

Rather small impact of construction price indices at aggregate level of capital services is expected. It has to be taken into account that the bias in price indices for selected asset type is translated into biased capital services estimate depending on the contribution of selected asset type to aggregate capital services – the larger the contribution of the selected asset type, the more the capital services estimate is sensitive to the bias in the selected asset price indices.

Despite very similar growth paths of aggregate capital services, it must not be overlooked substantially greater differences in the contribution from NRBOS services to overall growth of capital services, considering each of the scenarios. When using official deflators NRBOS account for about 35.02% of the overall growth of capital services over the full period, whereas the contribution would be only 27.28% considering scenario 4, with the highest growth of NRBOS prices.

6   Conclusions

The measurement of capital is one of the most difficult and contentious areas of official statistics. The methodological issues related to the measurement of capital are much more complex in comparison with other traditional topics of official statistics like the measurement of output or labour.

In this paper, we focused on the measurement of capital services and the frequently overlooked role of asset price indices in this process, developing a framework to assess the impact of asset price indices on the capital services estimation. The presented framework could be useful whenever considering the role of any asset type and its deflator in the capital services estimation. This is often the issue due to the important role of asset price indices in the process of capital services estimation. We tested the impact by the sensitivity analysis for the impact of construction prices on the capital service index for Slovenian manufacturing for the period 1995-2008.

The results show that input price indices are likely to be the biased indicators of the price changes of completed construction work, and as such affect derived estimates. In this paper, we illustrated, based on some hypothetical scenarios, that adjusting for some elements which are not respected in the current compilation of construction price indices, such as productivity, profit rate and quality changes, could have a noticeable effect on the growth path of construction price indices and, consequently, on productive stock and user costs estimates as well. In the case of the Slovenian manufacturing industries, the differences reflected in the aggregate capital services estimates in the sample period are very small or even negligible in some cases. The largest difference, identified between the capital services estimates for the period 1995-2008, based on the official construction deflators and the deflators corrected for productivity, the profit rate and the assumed negative quality bias is 3.46 index points.

However, when interpreting these results at the aggregate level, several factors have to be taken into account. First, the sensitivity of capital services estimates to the bias incorporated in asset price indices depends on the contribution of selected asset type, in our case constructions, to aggregate capital services. In some manufacturing industries where the contribution of constructions is larger than in manufacturing as a whole, the capital services estimates and, consequently, the total factor productivity estimates, which are primarily used for the index of capital services, could be more sensitive to the bias in construction price indices.

Second, despite negligible differences between the capital services estimates

produced by alternative hypothetical scenarios, there is a noticeable difference between estimated contributions of constructions to aggregate capital services growth, considering alternative scenarios. This finding has important implications for the identification of the sources of economic growth.

The case study of construction price indices for the manufacturing in Slovenia in the period 1995- 2008 based on the general framework for assessment of the impact of asset price indices on the capital services estimation revealed that the validity of various empirical economic studies related to capital services depends also on the quality of data input where asset price indices could have a considerable effect on the empirical results, particularly when studying the capital stock and contribution of assets to economic growth. The comprehensive evaluation of the asset price indices on the aggregate index of capital services would require further research efforts in the assessment of price indices of other assets (e.g., machinery, information and communication technology, etc). The importance of appropriate asset price indices for the economic analysis (not only for an appropriate measurement of price movements but also for the quality measurement of capital services) should also encourage official statistics to pay more professional attention to this field of economic statistics.

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OSJETLJIVOST INDEKSA KAPITALNIH USLUGA NA INDEKSE GRAĐEVINSKIH CIJENA

Sažetak

Mjerenje je kapitala još uvijek izazovan zadatak zbog brojnih konceptualnih dilema i praktičnih problema. U ovom se članku fokusiramo na produkcijsku stranu mjerenja kapitala gdje je pouzdano mjerenje usluga kapitala ključne važnosti za izvedene mjere proizvodnje kao što je višefaktorska produktivnost. Dok je bilo puno rasprava koje su se odnosile na problematiku očekivanog stupnja naknade, problematiku očekivanog dobitka od kapitala i tretiranje poreza u procjenjivanju troškova korisnika, mnogo manje pažnje bilo je posvećene pitanjima odgovarajućih cjenovnih indeksa sredstava koji su potrebni u procesu procjenjivanja usluga kapitala. Primjena neodgovarajućih indeksa cijena sredstava dovodi do pristrane procjene indeksa usluga kapitala i prema tome utječe na procjenu učinka kapitala na gospodarsku rast. Svrha je ovog članka postaviti generalni okvir utjecaja indeksa cijena sredstava na usluge kapitala i testirati taj utjecaj pomoću analize osjetljivosti. Analiza je osjetljivosti bila izrađena za utjecaj indeksa cijena građevinarstva na usluge kapitala za prerađivačku industriju u Sloveniji za razdoblje 1995–2008.

Ključne riječi: mjerenje kapitala, indeks usluga kapitala, metoda trajne inventure, indeksi cijena osnovnih sredstava, indeksi cijena građevinarstva, indeksi cijena proizvodnih čimbenika

MONOPOLY INNOVATION WITH EXHAUSTIBLE RESOURCE AND LABOR INPUT

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Abstract

This paper focuses on the propensity to innovate for a monopolist with two inputs, an exhaustible resource and labor. When this exhaustible resource is used up, the monopolist quits this industry. This paper characterizes the relationship between the two types of elasticity of innovation. With this relationship, the equilibrium is captured. This study argues that the lower the marginal cost incurred by innovation, the longer it takes for the monopolist to quit the industry and the higher the profits.

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1   Introduction

By the new growth theory, innovation can be seen the driving force to improve the quantity (quality) of intermediate goods, and obtains the sustained growth through endogenous technical change. Romer (1990) regarded innovation as the engine of growth and investigated the determinants of technological progress, and there are many important papers about innovations in economics that discuss how innovation is achieved under various economic circumstances. Arrow (1962) examined the relationship between innovation and market power. Vives (2008) addressed the relationship between innovation and competitive pressure and derived some interesting conclusions about innovation and competition. Sacco and Schmutzler (2011) recently confirmed the U-shaped relationship between competition and investment in laboratory experiments.

Some researchers focus on the innovation in human capital. Almeida and Carneiro (2009) studied how innovation and human capital are connected. Dakhli and De Clercq (2004) explored human capital innovation using a multi-country data set. Cosar (2011) further developed theory about innovation and human capital. Tales and Joiozo (2010) also examined the relationship between human capital and innovation. Nie and Ren (2011) identified the relationship between human capital and entry deterrence.

Another group of scholars pay attention on the innovation in exhaustible resources. Grimaud and Rouge(2003) achieved the equilibrium paths in the model of the exhaustible resource with vertical innovations. Bretschger(2005) stated that effective innovations act as a remedy for the natural resource scarcity to realize economic development. Di Vita(2006) considered the technical substitution with exhaustible and renewable resources in an endogenous growth model. Through the data in the past 100 years, Wils(2001) analyzed the different efforts among three types of technical innovation in the exhaustible resource exploitation. Nie (2012) addressed the emission of monopolist.

Recently, more researchers begin to pay close attention to the innovation both in human capital and exhaustible resource. Acemoglu(1998,2002,2003), and, Corrado and Simone(2008) developed the innovation models with directed technical

change, where final output is obtained by means of two inputs, e.g. resource and labor. The technical progress may be either labor or resource augmenting, or both. Acemoglu et al. (2012) studied the effect of exhaustible resources and human capital inputs on innovation and derived some significant conclusions. Moreover, Acemoglu et al. (2012) introduced a growth model with environmental constraints.

The existing literature has focused on various types of innovations. In reality, a firm seeks to innovate in diverse ways. For example, Shell Cooperation is a global group of energy and petrochemical companies. On one hand, Shell supports a series of Training Programmes of human capital[1]. On the other hand, Shell launches the innovation to improve the efficiency[2]. How about the relationship about various innovations? This is the motivation for this study.

This paper further focuses on innovators that have the constraint of an exhaustible resource as a production input among industrial companies. As it is expressed in Acemoglu et al. (2012), exhaustible resource inputs are a variable considered in monopoly innovation models. To expand upon the existing research, this study focuses on two types of monopoly inputs: human capital and exhaustible resources. Additionally, this study focuses on two types of innovations, increasing the efficiency of the use of the exhaustible resource and human capital. The relationships between the two types of innovations are illustrated in this work. Based on a theory developed from social phenomena, this study develops a theory about innovations with multiple dimensions.

This work also employs dynamic models to analyze exhaustible resources. This is different from Acemoglu et al. (2012) and Acemoglu et al. (2012) focused on a growth model and just one type of innovation. This work considers exhaustible resources in industrial organizations and pays attention to two innovations, simultaneously.

This paper is organized as follows. The model of the monopoly innovation defined with variables representing exhaustible resources and human capital is

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[1] Innovation in human capital, see the webpage http://www.shell.com/home/content/sdo/ environment_society/shell_in_the_society/social_investment/ training_programmes/training_for_employment.html

[2] http://www.shell.com/home/content/innovation/

formally outlined in Section 2. Analysis and results are presented in Section 3. In Section 3 , the strategies about investment of the innovations both in the exhaustible resource and in the human capital of the monopolist are all characterized. Some existed empirical evidence is outlined in Section 4. Some concluding remarks are given in the final section.

2 The Model

Consider an industry with a unique producer. For production in this industry, human capital and an exhaustible resource are required. The exhaustible resource is continuously reduced because it is consumed at each stage. When this resource is exhausted, this monopolist quits this industry. We further assume that there are no alternative inputs. We formally establish a dynamic model of monopoly innovation with variables for human capital and an exhaustible resource.

Demand. p_t is the vector of price and the quantity of production is $D_t = q_t$ at time t. The utility function at time t is

$$u_t(p_t, q_t) = Aq_t - \frac{1}{2}q_t^2 - p_t q_t, \tag{1}$$

where $A > 0$ and is a constant. The inverse demand function, which is the same as that in Sacco and Schmutzler (2011), is given as follows

$$p_t = A - q_t \tag{2}$$

Please note that the inverse demand function is directly induced by the above utility function.

Producer variables: We postulate that the production inputs are human capital and a type of exhaustible resource. The following notation is employed throughout.

h_t: human capital for production at time t.

S_0: stock of the exhaustible resource at time $t = 0$.

S_t: stock of the exhaustible resource at time t.

er_t: consuming exhaustible resource at time t.

w_0: reservation wages for each worker .

$c(S_t)$: marginal cost incurred to consume the stock of exhaustible resourceS_t, also described as the price to consume a unit of the exhaustible resource. $c(S_t)$ is decreased in S_t, or the higher the marginal cost, the less the consumption of the exhaustible resource . It is apparent that

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$$S_t = S_0 - \int_0^t er_t dt \, or \, er_t = -\frac{dS_t}{dt} \qquad (3)$$

(3) is also employed in Acemoglu et al. (2012). This paper employs a continuous model while Acemoglu et al. (2012) used a discrete time model. There is a unique final good using human capital and the exhaustible resource. The variable I^h represents an innovative investment intended to promote efficiency in human capital and Ier is an innovative investment intended to promote efficiency in the use of the exhaustible resource. The production function is a Cobb-Douglas production function

$$q_t = (1 - e^{-I^h})^\alpha (1 - e^{-I^{er}})^\beta h_t^\alpha (er_t)^\beta, \qquad (4)$$

where $1 \geq \alpha > 0$ and $1 \geq \beta > 0$ are two constants.

The cost function of the monopolist is mainly determined by two parts: one is incurred by the use of the exhaustible resource and the other comes from the cost of labor. The profit function of the monopolist is given as follows:

$$\pi_t = p_t q_t - c(S_t) er_t - \varpi_0 h_t, \qquad (5)$$

$$\pi = \int_0^T e^{-\delta t} \pi_t dt - \tau_h I^h - \tau_{er} I^{er}, \qquad (6)$$

where $S_T = 0$. At $S_T = 0$, the monopolist quits this industry because the resource is exhausted. In this model, the discounting factors are postulated to be δ, τ_h and τ_{er}, two positive constants, which represent the marginal cost of innovative investment. The term $\tau_h I^h$ represents the costs incurred by making innovative investments in human capital and $\tau_{er} I^{er}$ represents the costs incurred by making innovative investments to promote the efficiency in the use of the exhaustible resource.

The timing of this pattern is outlined as follows. At the initial stage, the monopolist determines the amount of innovative investments in both human capital and the exhaustible resource. At the second stage, the monopolist determines the amount of labor to hire, the price and the quantity of the products for all $t < T$. At the last stage, the exhaustible resource is used up and the firm quits the market. Moreover, no potential entrants are considered in this work. No substitutes are introduced in this industry.

2.1 Analysis and Primary Results

Here the models (1)-(6) are discussed. The model above is a type of fixed endpoint optimal control problem, which is also a type of Euler equation. The problem is restated as follows.

$$\max_{I^h, I^{er}, S_t, h_t} \pi = \int_0^T \begin{array}{l} e^{-\delta t}\{[A - (1 - e^{-I^h})^\alpha (1 - e^{-I^{er}})^\beta h_t^\alpha (er_t)^\beta] \cdot \\ (1 - e^{-I^h})^\alpha (1 - e^{-I^{er}})^\beta h_t^\alpha (er_t)^\beta - c(S_t)er_t - \varpi_0 h_t\}dt \end{array}$$
$$-\tau_h I^h - \tau_{er} I^{er}$$
$$S.t. \qquad (3) \quad and \quad S_T = 0. \tag{7}$$

The solution is determined by the following optimal conditions.

$$\frac{\partial \pi}{\partial I^h} = -2\alpha e^{-I^h}(1 - e^{-I^h})^{2\alpha-1}(1 - e^{-I^{er}})^{2\beta} \int_0^T e^{-\delta t} h_t^{2\alpha}(er_t)^{2\beta} dt$$
$$+ \alpha e^{-I^h}(1 - e^{-I^h})^{\alpha-1}(1 - e^{-I^{er}})^\beta \int_0^T A e^{-\delta t} h_t^\alpha (er_t)^\beta dt - \tau_h = 0 \tag{8}$$

$$\frac{\partial \pi}{\partial I^{er}} = -2\beta e^{-I^{er}}(1 - e^{-I^h})^{2\alpha}(1 - e^{-I^{er}})^{2\beta-1} \int_0^T e^{-\delta t} h_t^{2\alpha}(er_t)^{2\beta} dt$$
$$+ \beta e^{-I^{er}}(1 - e^{-I^h})^\alpha (1 - e^{-I^{er}})^{\beta-1} \int_0^T A e^{-\delta t} h_t^\alpha (er_t)^\beta dt - \tau_{er} = 0 \tag{9}$$

er_t and S_t are determined by the following equation:

$$e^{-\delta t}\frac{\partial \pi_t}{\partial er_t} + \lambda_t = \lambda_t + e^{-\delta t}[A\beta(1 - e^{-I^h})^\alpha (1 - e^{-I^{er}})^\beta h_t^\alpha (er_t)^{\beta-1}$$
$$- 2\beta(1 - e^{-I^h})^{2\alpha}(1 - e^{-I^{er}})^{2\beta} h_t^{2\alpha}(er_t)^{2\beta-1} - c(S_t)] = 0 \tag{10}$$

where λ satisfies

$$\frac{d\lambda_t}{dt} = -e^{-\delta t}\frac{\partial \pi_t}{\partial S_t} = e^{-\delta t}er_t \frac{dc(S_t)}{dS_t}. \tag{11}$$

The human capital investment function is explained with the following relation

$$e^{-\delta t}\frac{\partial \pi_1}{\partial h_t} = e^{-\delta t}[\alpha A(1 - e^{-I^h})^{\alpha-1}(1 - e^{-I^{er}})^\beta h_t^\alpha (er_t)^\beta$$
$$- 2\alpha(1 - e^{-I^h})^{2\alpha}(1 - e^{-I^{er}})^{2\beta}h_t^{2\alpha-1}(er_t)^{2\beta} - \varpi_0] = 0 \qquad (12)$$

The equilibrium state is determined by the above system of equations (8)-(12). The equilibrium solution is denoted as $(I^{h,*}, I^{er,*}, S_t^*, h_t^*, er_t^*)$ along with equilibrium value π^*. After examining the second-order optimal conditions, the equilibrium is then characterized.

For the second-optimal conditions, we have reached the following conclusions.

Proposition 1: π is concave in both I^h and Ier. Moreover, π is concave in both h_t and er_t for all t.

Proof. See in Appendix. |

 Remarks: Proposition 1 manifests that the equilibrium is a local maximum. The existence and uniqueness of the solution is, therefore, guaranteed.

 The equilibrium is then characterized.

 1. Innovative investment

The innovative investment is described by equations (8)-(9). Based on (8) and (9), by the implicit function theorem, we have $\partial I^h / \partial \tau_h < 0$ and $\partial I^{er} / \partial \tau_{er} < 0$. The higher marginal cost of an innovative investment yields lower levels of the corresponding innovative investment. For the parameter δ, by the comparative static analysis approach, we can see that $\partial I^h / \partial \delta < 0$ and $\partial I^{er} / \partial \delta < 0$. This means that more patient producers launch into more innovative investments when they are a monopoly.

For the parameters α and β, by the comparative static analysis method, under $\ln h_t + \ln(1 - e^{-I^h}) > 0$ and $\ln er_t + \ln(1 - e^{-I^{er}}) > 0$, we have $\partial I^h / \partial \alpha > 0, \partial I^h / \partial \beta > 0, \partial I^{er} / \partial \alpha > 0$ and $\partial I^{er} / \partial \beta > 0$. Under $\ln h_t + \ln(1 - e^{-I^h}) > 0$ and $\ln er_t + \ln(1 - e^{-I^{er}}) > 0$, the innovative investments are improved with a more elastic coefficient of inputs. We note that $\ln h_t + \ln(1 - e^{-I^h}) > 0$ and $\ln er_t + \ln(1 - e^{-I^{er}}) > 0$ manifest that the innovation increases the output. Therefore, this assumption of $\ln h_t + \ln(1 - e^{-I^h}) > 0$ and $\ln er_t + \ln(1 - e^{-I^{er}}) > 0$ is very moderate.

Moreover, equations (8) and (9) jointly indicate the interesting formulation

$$\frac{(1 - e^{-I^{h,*}})\tau_h}{\alpha e^{-I^{h,*}}} = \frac{(1 - e^{-I^{er,*}})\tau_{er}}{\beta e^{-I^{er,*}}}. \tag{13}$$

Here we consider the elasticity of innovation. We denote the elasticity of labor innovation function at time t to be $\varepsilon_{I^h,t} = \partial q_t / \partial I^h \cdot I^h / q_t$. Similarly, we define the elasticity of the exhaustible resource innovation function at time t to be $\varepsilon_{I^{er},t} = \partial q_t / \partial I^{er} \cdot I^{er} / q_t$. By definition, we find the following proposition:

Proposition 2: The ratio of the two types of elasticity of innovation is the corresponding ratio of two types of innovation cost at any time t. Or $\varepsilon_{I^h,t} / \varepsilon_{I^{er},t} = \tau_h I^{h,*} / \tau_{er} I^{er,*}$.

Proof. See in Appendix. |

Remarks: The relationship between the two types of innovative investments is captured and an interesting conclusion is achieved. The ratio of the two types of innovation elasticity is exactly the same as the ratio of the costs of the two types of innovation at any time t.

We also note that the elasticity of innovation is closely related to time t in general, while $\varepsilon_{I^h,t} = \alpha e^{-I^h} I^h / (1 - e^{-I^h})$ and $\varepsilon_{I^{er},t} = \beta e^{-I^{er}} I^{er} / (1 - e^{-I^{er}})$ have no relation with time t in this work because of the special production function.

Moreover, (13) is rewritten as $(e^{I^{h,*}} - 1)\tau_h / (e^{I^{er,*}} - 1)\tau_{er} = \alpha / \beta$ or

$(1 - e^{-I^{h,*}})\tau_h / (1 - e^{-I^{er,*}})\tau_{er} = \alpha e^{-I^{h,*}} / \beta e^{-I^{er,*}}$. This means that the ratio of the elastic coefficient of inputs is equal to the ratio of marginal cost incurred by innovation multiplying a ratio related efficient to the innovation, which is a very interesting result. As we known, there is no relationship between multiple innovations in the existed papers and this conclusion firstly describes the relationship between two innovations.

1. Equilibrium exhaustible resource and human capital input

By comparative statistical analysis, equations (10), (11) and (12) are manifestly $\partial er_t / \partial \tau_h > 0, \partial er_t / \partial \tau_{er} > 0, \partial h_t / \partial \tau_h > 0$ and $\partial h_t / \partial \tau_{er} > 0$ for all t.

Under the conditions of lower marginal costs incurred by innovation, the monopolist consumes less of the exhaustible resource and human capital at each stage.

Moreover, because we have $\partial S_t/\partial \tau_h < 0$ and $\partial S_t/\partial \tau_{er} < 0$ for all t the stock of exhaustible resources decreases with the marginal cost incurred by innovations in both human capital and the use of the exhaustible resource for all t. Similarly, under $\ln h_t + \ln(1 - e^{-I^h}) > 0$ and $\ln er_t + \ln(1 - e^{-I^{er}}) > 0$, the inputs are correspondingly improved with a more elastic coefficient of inputs. Equations (11) and (12) indicate that $\partial er_t/\partial \delta > 0$ and $\partial h_t/\partial \delta > 0$ for all t. This means that more patient producers consume less exhaustible resource and hire less labor at each stage in monopoly conditions. $\partial er_t/\partial \delta > 0$ yields $\partial S_t/\partial \delta < 0$ for all t, which means that the more patient producer cares more about the stock of exhaustible resources.

For price and quantity, we have $\partial p_t/\partial \tau_h > 0, \partial p_t/\partial \tau_{er} > 0, \partial q_t/\partial \tau_h < 0$ and $\partial q_t/\partial \tau_{er} < 0$. These inequalities address the conditions that determine the quitting time of the monopoly producer. Obviously, $\partial T/\partial er_t < 0$, or T is decreased in er_t, under the definition of quitting time. Based on the relation $\partial er_t/\partial \tau_h > 0, \partial er_t/\partial \tau_{er} > 0, \partial h_t/\partial \tau_h > 0$ and $\partial h_t/\partial \tau_{er} > 0$, we reach the following conclusion.

Proposition 3: Quitting time T is decreased in marginal cost incurred by innovative investment τ_h and τ_{er}.

Proof. Combined with $\partial T/\partial er_t < 0$, this is a direct conclusion from the above relationship $\partial er_t/\partial \tau_h > 0, \partial er_t/\partial \tau_{er} > 0, \partial h_t/\partial \tau_h > 0$ and $\partial h_t/\partial \tau_{er} > 0$. The proof in detail is deleted and the proof is complete. |

Remarks: Under the condition of lower marginal costs for innovation, the monopolist will increase its innovative investments and the exhaustible resources will take longer to be used up. With higher marginal costs for innovation, an exhaustible resource is consumed faster. This is consistent with the reality. The oil industry in Indonesia is a suitable example. Indonesia is the only member of OPEC organization in Asia & Pacific area and its oil output accounts for the 20th in the world. But because of the poor circumstance of technical innovation, the margin cost incurred by both crude oil refinement and human

capital investment are very high. The technical innovation lagging behind the resource exploitation leads the increasing consumption of oil and the outstandingly declining stock of oil. The stock is near to 50 millions ton until 2010, which only equivalently one third of 1980. In 2004, Indonesia had became the net importer.[3]

The profit function is addressed here. The envelope theorem indicates the relation $\partial \pi / \partial \tau_h < 0$ and $\partial \pi / \partial \tau_{er} < 0$. Lower marginal costs are incurred as a result of innovation yielding higher profits for the monopolist. Under $\ln h_t + \ln(1 - e^{-I^h}) > 0$ and $\ln er_t + \ln(1 - e^{-I^{er}}) > 0$, the profits of the monopolist are improved with a more elastic coefficient of inputs. For the discounting factor, we have $\partial \pi / \partial \delta < 0$.

The costs incurred through the use of the exhaustible resource are further discussed here. These costs are exogenously determined. The monopolist has no other choice but to accept this price. For example, in many mining industries, when the stock of the corresponding mine is reduced, the cost to develop mine is increased. Moreover, the reservation wages for each worker in production are exogenously given and the human capital is abundant enough that the producer can hire human capital with those reservation wages.

3   Existed Theoretic and Empirical Evidence

Some other theoretic conclusions are consistent with the above results. Bretschger (2005) confirmed that innovation is potential to compensate for natural resource scarcity. Under natural resource scarcity, innovation elasticity of exhaustible resource is small. By Proposition 2, the innovation investment in human capital becomes large while exhaustible resource innovation becomes small. This is a case of Proposition 2.

Because of page limitation and data restriction, we did not launch the empirical study. There exists some empirical research supporting the above theoretical conclusions. Subramanian and Nilakanta (1996) confirmed the existence of the

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[3] $http : //www.eia.gov/countries/$

substantive relationship between two types of innovations based on the questionnaire about bank industry of United States. Battisti and Stoneman (2010) used the information contained in CIS4 to explore the pattern of use of innovations in UK industry and to test for the existence of complementarities among seven types of innovations, i.e. process, product, machinery, marketing, organization, management and strategic innovations. Binswanger(1974) measured the technical change biases of multiple types of innovations and the empirical evidence also supports the relationship between multiple innovations.

By Proposition 2, given the innovation elasticity, the optimal innovation in the human capital increases with the exhaustible resource innovation. Based on the patents of the German Federal Ministry of Education and Research, Ostertag, Sartorius and Espinoza (2010) examined that two types of patents keep pace with the general increase of patent applications. This highly supports our theoretic conclusions.

4   Concluding Remarks

In this paper, the innovation patterns of the monopolist are highlighted in relation to human capital competition and the limitations of an exhaustible resource. The equilibrium solution is achieved and characterized. The conditions for quitting the industry are also discussed. This study argues that the equilibrium innovative investment and inputs have a close relationship to the elasticity coefficient of inputs and marginal costs to innovate. When the properties of an exhaustible resource are introduced, the firm strategy changes correspondingly. This is the beginning of the research on the effects of an exhaustible resource in industrial organizations. In actuality, the exhaustible resource has deep effects on firms' strategies. This work focuses on innovative investments. Other strategies of firms with exhaustible resource inputs will be the subject of our future research.

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6 Appendix

Proof of Proposition 1

Equation (8) indicates

$$\frac{\partial \pi}{\partial I^h} = \frac{-2\alpha e^{-I^h}}{1-e^{-I^h}} \int_0^T e^{-\delta t}(1-e^{-I^h})^{2\alpha}(1-e^{-I^{er}})^{2\beta} h_t^{2\alpha}(er_t)^{2\beta}dt$$
$$+ \frac{\alpha e^{-I^h}}{1-e^{-I^h}} \int_0^T A(1-e^{-I^h})^{\alpha}(1-e^{-I^{er}})^{\beta} e^{-\delta t} h_t^{\alpha}(er_t)^{\beta}dt - \tau_h = 0$$

,

or
$$2\int_0^T e^{-\delta t}(1-e^{-I^h})^{2\alpha}(1-e^{-I^{er}})^{2\beta} h_t^{2\alpha}(er_t)^{2\beta}dt$$
$$< A \int_0^T e^{-\delta t}(1-e^{-I^h})^{\alpha}(1-e^{-I^{er}})^{\beta} e^{-\delta t} h_t^{\alpha}(er_t)^{\beta}dt$$

.

This indicates that there exists a unique solution to equations (8) and (9). We further consider the second-order optimal conditions. According to equation (8), we have

$$\frac{\partial^2 \pi}{\partial (I^h)^2} = -2\alpha(2\alpha-1)(e^{-I^h})^2(1-e^{-I^h})^{2\alpha-2}(1-e^{-I^{er}})^{2\beta} \int_0^T e^{-\delta t} h_t^{2\alpha}(er_t)^{2\beta}dt$$
$$+ 2\alpha(e^{-I^h})(1-e^{-I^h})^{2\alpha-1}(1-e^{-I^{er}})^{2\beta} \int_0^T e^{-\delta t} h_t^{2\alpha}(er_t)^{2\beta}dt$$
$$+ \alpha(\alpha-1)(e^{-I^h})^2(1-e^{-I^h})^{\alpha-2}(1-e^{-I^{er}})^{\beta} \int_0^T Ae^{-\delta t} h_t^{\alpha}(er_t)^{\beta}dt$$
$$- \alpha(e^{-I^h})(1-e^{-I^h})^{\alpha-1}(1-e^{-I^{er}})^{\beta} \int_0^T Ae^{-\delta t} h_t^{\alpha}(er_t)^{\beta}dt.$$

The first-order optimal conditions yield

$$2\alpha(e^{-I^h})^2(1-e^{-I^h})^{2\alpha-1}(1-e^{-I^{er}})^{2\beta} \int_0^T e^{-\delta t} h_t^{2\alpha}(er_t)^{2\beta}dt - \alpha(e^{-I^h})^2$$

$$(1-e^{-I^h})^{\alpha-1}(1-e^{-I^{er}})^{\beta} \int_0^T Ae^{-\delta t} h_t^{\alpha}(er_t)^{\beta}dt < 0. \tag{14}$$

Moreover, for $\alpha \leq 1$, we have

$-2\alpha(2\alpha-1)(e^{-I^h})^2(1-e^{-I^h})^{2\alpha-2}(1-e^{-I^{er}})^{2\beta}\int_0^T e^{-\delta t}h_t^{2\alpha}(er_t)^{2\beta}dt$

$+\alpha(\alpha-1)e^{-I^h}(1-e^{-I^h})^{\alpha-2}(1-e^{-I^{er}})^{\beta}\int_0^T Ae^{-\delta t}h_t^{\alpha}(er_t)^{\beta}dt$

$= \alpha e^{-I^h}(1-e^{-I^h})^2[(\alpha-1)A\int_0^T e^{-\delta t}(1-e^{-I^h})^{\alpha}(1-e^{-I^{er}})^{\beta}e^{-\delta t}h_t^{\alpha}(er_t)^{\beta}dt$

$\quad -(4\alpha-2)\int_0^T e^{-\delta t}(1-e^{-I^h})^{2\alpha}(1-e^{-I^{er}})^{2\beta}h_t^{2\alpha}(er_t)^{2\beta}dt]$

$= \alpha e^{-I^h}(1-e^{-I^h})^2[(\alpha-1)A\int_0^T e^{-\delta t}(1-e^{-I^h})^{\alpha}(1-e^{-I^{er}})^{\beta}e^{-\delta t}h_t^{\alpha}(er_t)^{\beta}dt$

$\quad -(2\alpha-2)\int_0^T e^{-\delta t}(1-e^{-I^h})^{2\alpha}(1-e^{-I^{er}})^{2\beta}h_t^{2\alpha}(er_t)^{2\beta}dt$

$\quad -2\alpha\int_0^T e^{-\delta t}(1-e^{-I^h})^{2\alpha}(1-e^{-I^{er}})^{2\beta}h_t^{2\alpha}(er_t)^{2\beta}dt]$

$< 0.$

The last inequality comes from the relation

$$-2\alpha\int_0^T e^{-\delta t}(1-e^{-I^h})^{2\alpha}(1-e^{-I^{er}})^{2\beta}h_t^{2\alpha}(er_t)^{2\beta}dt < 0,$$

and

$$
\begin{array}{l}
(\alpha-1)A\int_0^T e^{-\delta t}(1-e^{-I^h})^{\alpha}(1-e^{-I^{er}})^{\beta}e^{-\delta t}h_t^{\alpha}(er_t)^{\beta}dt \\
-(2\alpha-2)\int_0^T e^{-\delta t}(1-e^{-I^h})^{2\alpha}(1-e^{-I^{er}})^{2\beta}h_t^{2\alpha}(er_t)^{2\beta}dt \leq 0
\end{array},
$$

For $\alpha \leq 1$, the first-order optimal conditions yield the above inequality.

We thus find that π is concave in I^h. In a similar way, for $1 \geq \beta > 0$, we find that π is concave in Ier. Similarly, π is concave in both h_t and er_t for all t. The method is highly similar to the above case.

Conclusions are obtained and the proof is complete. |

Proof of Proposition 2

The equation (4) and the definitions of the two types of the elasticity of innovation functions jointly indicate the following relation

$$\varepsilon_{I^h,t} = \frac{\partial q_t}{\partial I^h}\frac{I^h}{q_t} = \frac{\alpha e^{-I^h}(1-e^{-I^h})^{\alpha-1}(1-e^{-I^{er}})^{\beta}h_t^{\alpha}(er_t)^{\beta}I^h}{(1-e^{-I^h})^{\alpha}(1-e^{-I^{er}})^{\beta}h_t^{\alpha}(er_t)^{\beta}}$$

and

$$\varepsilon_{I^{er},t} = \frac{\partial q_t}{\partial I^{er}}\frac{I^{er}}{q_t} = \frac{\beta e^{-I^{er}}(1-e^{-I^h})^{\alpha}(1-e^{-I^{er}})^{\beta-1}h_t^{\alpha}(er_t)^{\beta}I^{er}}{(1-e^{-I^h})^{\alpha}(1-e^{-I^{er}})^{\beta}h_t^{\alpha}(er_t)^{\beta}}.$$

Taking equation (13) into account, we immediately have the relationship $\varepsilon_{I^h,t}\big/\varepsilon_{I^{er},t} = \tau_h I^{h,*}\big/\tau_{er} I^{er,*}$. The conclusion is achieved and the proof is therefore complete.

INOVACIJA MONOPOLA S POTROŠNIM RESURSIMA I UTROŠKOM RADA

Sažetak:

Ovaj rad je usredotočen na sklonost koju monopol s dva utroška, potrošnim resursom i radnom snagom, ima ka inovacijama. Kad se potrošni resursi istroše, monopolisti gase tu industriju. Ovaj rad analizira vezu između dva tipa elastičnosti inovacija. Ovom se vezom postiže ravnoteža. Članak postavlja tezu da što je manji marginalni trošak inovacije, monopolistu treba duže vremena da ugasi industriju a profit je isto tako veći.

Ključne riječi: inovacija, ljudski kapital, potrošni resursi, industrijska organizacija

FIRM SIZE-PROFITABILITY NEXUS: EVIDENCE FROM PANEL DATA FOR NIGERIA

Anthony Enisan Akinlo *

Abstract

The paper investigates the long run relationship and causality issues between firm size and profitability in 66 firms in Nigeria by using the panel cointegration method for the period 1999 –2007. The empirical results show that there is long run steady-state relationship between firm size and profitability. The short run causal relationship shows that there is bidirectional relationship between firms' size and profitability. This implies that firm size Granger causes profitability and profitability Granger causes firm size. The results clearly refute the general assumption that causation runs from only firm size to profitability on which most existing studies have been based.

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1   INTRODUCTION

Studies on the relationship between firm size and profitability occupy a substantial portion of economic literature. However, previous empirical investigations of the issue have yielded conflicting results. Some studies have obtained a weak or negative relationship or none at all (Marcus 1969; Samuels and Smyth 1968; Haines 1970; Shepherd 1972; Ammar et al. 2003); others have reported a positive association (Hall and Weiss 1967; Gale 1972; Punnose, 2008; Vijayakumar and Tamizhselvan, 2010). Still others have found a positive association that disappears or reverses itself among the firms with the largest assets (Alexander 1949; Crum, 1939). Besides the conflicting results on the relationship between firm size and profitability, almost all known existing studies have focussed on the impact of the former on the latter neglecting the possibility of feedback effect. However, it is possible for profitability to affect firm size and not vice versa. It is contended in the literature that the profit rates of the firms can persist over time, and increasing levels of profits can help firm grow faster. In the same way, it is not impossible to have a case of mutual causation between firm size and profitability. Interestingly, no known study have addressed the question of direction of causation between firm size and profitability. This is, no doubt, a big gap in the literature that needs to be filled. Hence, the objectives of this paper are twofold. The first is to determine whether or not firm size and profitability are cointegrated and the second to ascertain the direction of causality between firm size and profitability.

This paper contributes the following. First, we use cointegration test for a panel of firms which provides more powerful tests and allows us to increase the degrees of freedom compared to the cross-section approach. Next, we specify and estimate an error correction model appropriate for heterogeneous panels, which distinguishes between long run and short run causality.

The paper is organised as follows. Section 2 presents the model and data description. Section 3 discusses the methodology and section 4 reports the empirical findings of the study. The last section concludes the paper.

2   MODEL SPECIFICATION AND DATA

To investigate the causality between firm size and profitability in Nigeria, we employed panel cointegration and panel causality methods. Following the empirical literature, the log linear functional specification of long run relationship between firm size and profitability may be specified as[1]:

$$PROF_{it} = \alpha_{ij} + \sigma_{it} + \beta_i SIZ_{it} + \delta_i SGR_{it} + \varepsilon_{it} \tag{1}$$

where it allows for cointegrating vectors of differing magnitudes between firms, as well as firm (α) and time (σ) fixed effects. PROF is firms' profitability measured as profit before interest and tax divided by total assets[2]. SGR is the firm growth rate[3], SIZ is firm size measured as log of sales and ε_{it} is the error term. All variables are employed with their natural logarithms form (except sales growth that is already in growth form) to reduce heteroscedasticity and to obtain the growth rates of the relevant variables by their differenced logarithms.

The annual time series data are obtained from 66 firms listed in the Nigerian Stock Exchange for the period 1999-2007. The 66 firms selected for the study were chosen based on the availability of the relevant data.

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[1] The incorporation of a control variable equally helps to make our analysis multivariate as against bivariate. This is important because some studies have shown that two variables might not be cointegrated under bivariate analysis but cointegrated when control variables are included (see the work of Nzue, 2006).

[2] We measured profitability as return on total assets. By convention, it is calculated as profit after tax divided by investment represents the pool of funds supplied by shareholders and lender; while profit after tax represents residue income of shareholders. Hence, it is conceptually unsound to use profit after tax in the calculation of return on assets. This explains the use of profit before interest and tax divided by total assets in this work. This measure enables us to compare the operating efficiency of the firms.

[3] In the literature, several measures of growth are in vogue. Some studies have used the rate growth of employment while some others have generated growth using the formula g = (E/B)1/n – 1 where g is compound growth rat , E is size of firm at end of growth period, B is the size of the firm at the beginning of growth period, and n is the number of years in the growth period. Also, many studies simply calculated growth as g = (Salest – Salest-1)/Salest . For details of these measures one may consult LaDue (1977) and Hall (1987) among others. In this work, we adopted the last measure of firm growth. Since the variable is already in growth form, we need not log it again.

3   METHODOLOGY

This paper utilizes recent heterogeneous panel data techniques for a group of 66 non financial firms. Recent literature on panel data econometrics widely emphasized that traditional unit root, cointegration and causality tests have low power performance when the time series sample is small. However, an increasing finite sample performance can be achieved by using either longer time horizons or pooling time series and cross sections. Indeed, several studies have shown that the power of the unit root tests using panel data is substantially improved over univariate testing procedures (Abuaf and Jorion, 1990, Choi 2001 and Im et al. 2003)[4]. Moreover, Jun (2004) argues that adoption of panel data may provide more useful information on the nature of the economic system of equations for a group of firms, rather than individually analyzing single equation for each firm. Thus, in this work, we adopt the panel data techniques to eliminate the problems associated with the low power of the traditional tests for 66 firms which have a short data span and some differences in characteristics. Taking cue from the Engle and Granger (1987) two-step procedure, we explore the nexus of relationship between firm size and profitability. First, we test for a panel unit root and panel cointegration. Second, we test the causal relationships by using error correction based causality models.

3.1   Panel Integration Analysis

In this study, we test for the stationarity of the variables by employing three recently developed heterogenous panel unit root tests. These tests are the Fisher ADF (Choi, 2001), IPS (Im et al., (2003) and Hadri (2000). Choi (2001) considers the model as:

$$y_{it} = d_{it} + \chi_{it}(i = 1, \ldots, N; t = 1, \ldots, T_i) \tag{2}$$

where $d_{it} = \beta_{i0} + \beta_{i1} + \ldots + \beta_{imi}t^{mi}$, $\chi_{it} = \alpha_i \chi_{i(t--1)} + \mu_{it}$ and μ_{it} is integrated of order zero. Choi allows each time series v_{it} to have a different sample

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[4]In the same way, Pedroni (1997, 1999, and 2004) demonstrates the power improvement of the panel cointegration approach.

size and a different specification of nonstochastic and stochastic components depending on i. The null hypothesis is that all the individual series in the panel are nonstationary (H_0:$\alpha_i = 1$ for all $_i$) and against the alternative of some of the time series stationary (H_1:$|\alpha_i| < 1$ for all i's). Choi proposed a Fisher-type test as:

$$Z = \frac{1}{\sqrt{N}} \sum_{1}^{N} \Theta^{-1}(p_i) \tag{3}$$

where Θ is the standard normal cumulative distribution function. Since $0 = \rho_i = 1$, $\Theta^{-1}(\rho_i)$ is a $N(0, 1)$ random variable and $Ti \rightarrow 8$ for all i $Z => N(0, 1)$.

In the same way, Im et al. (2003) developed a unit root test for dynamic heterogeneous panels based on the mean of individual unit root statistics. They propose a standardized t-bar test based on the ADF statistics averaged across the groups. The stochastic process, y_{it}, is generated by the first- order autoregressive process:

$$y_{it} = (1 - \rho_i)\mu_i + \rho_i y_{i,\,t-1} + \varepsilon_{it} \, i = 1, \ldots N; t = 1, \ldots T \tag{4}$$

where initial values, y_{io}, are given. In the testing the null hypothesis of unit roots, $\rho i = 1$ for all i. Equation 4 can be expressed:

$$\Delta y_{it} = \alpha_i + \beta_i y_{i,\,t-1} + \varepsilon_{it}. \tag{5}$$

The null hypothesis is that each individual series in the panel has a unit root and alternative hypothesis that allows for α_i to differ across groups:

$$H_0 : \beta_i = 0 \, for \, all \, i \tag{6}$$

$$H_1 : \beta_i < 0, i = 1, 2, \ldots N_1, \beta_i = 0, N_1 + 1, N_1 + 2, \ldots, N \tag{7}$$

The modified standardized t_{IPS} statistic below is distributed as $N(0, 1)$ when $T \rightarrow \infty$ followed the $N \rightarrow \infty$ sequentially:

$$t_{IPS} = \frac{\sqrt{N}\left(\bar{t} - \frac{1}{N}\sum_{i=1}^{N} E\left[t_{iT} \,|\beta_i = 0\right]\right)}{\sqrt{\frac{1}{N}\sum_{i=1}^{N} var\left[t_{iT} \,|\beta_i = 0\right]}} \tag{8}$$

However, Hadri (2000) is of the view that the null should be reversed to be the stationary hypothesis in order to have a stronger power test. Hadri's (2000) Lagrange multiplier (LM) statistic can be written as

$$L\hat{M} = \frac{1}{N} \sum_{i=1}^{N} \left(\frac{\frac{1}{T^2} \sum_{t=1}^{T} S_{it}^2}{\hat{\sigma}_{\varepsilon}^2} \right), S_{it} = \sum_{j=1}^{t} \hat{\varepsilon}_{ij} \tag{9}$$

where $\hat{\sigma}_{\varepsilon}^2$ is the consistent Newey and West (1987) estimate of the long-run variance of disturbance terms.

3.2   The panel cointegration tests

For the 66 firms, heterogeneity may arise as a result of differences in the stage of development and other characteristics of the firms. In order to ensure broad applicability of any panel cointegration test, it is necessary to allow for as much as heterogeneity as possible among individual members of the panel. To take this into consideration, Pedroni (1997, 1999, 2004) developed a residual-based panel cointegration method that also allows a lot of heterogeneity through individual effects, slope coefficients and individual linear trends across firms. Pedroni (1999) considers the following time series panel regression

$$y_{it} = \alpha_{it} + \delta_{it}t + X_i\beta_i + \varepsilon_{it}, \tag{10}$$

where y_{it} and X_{it} are the observable variables with dimension of (N*T) × 1 and (N*T) × m, respectively. He develops asymptotic and finite-sample properties of testing statistics to examine the null hypothesis of non-cointegration in the panel. The tests allows for heterogeneity among individual members of the panel, including heterogeneity in both the long-run cointegrating vectors and in the dynamics, since there is no reason to believe that all parameters are the same across countries.

Two types of tests are suggested by Pedroni. The first type is based on the within-dimension approach, which includes four statistics. They are panel v-statistic, panel ρ-statistic, panel PP-statistic, and panel ADF-statistic. These statistics pool the autoregressive coefficients across different members for the

unit root tests on the estimated residuals. The second test by Pedroni is based on the between-dimension approach, which includes three statistics. They are group panel p-statistic, group panel PP-statistic, and group panel ADF-statistic. These statistics are based on estimators that simply average the individually estimated coefficients for each member. Following Pedroni (1999), the heterogeneous panel and heterogeneous group mean panel cointegration statistics are calculated as follows:

panel v-statistic:

$$Z_v = \left(\sum_{i=1}^{N} \sum_{t=1}^{T} \hat{L}_{11i}^{-2} \hat{\varepsilon}_{it-1}^2 \right)^{-1} \tag{11}$$

panel ρ-statistic:

$$Z_\rho = \left(\sum_{i=1}^{N} \sum_{t=1}^{T} \hat{L}_{11i}^{-2} \hat{\varepsilon}_{it-1}^2 \right)^{-1} \sum_{i=1}^{N} \sum_{t=1}^{T} \hat{L}_{11i}^{-2} \left(\hat{\varepsilon}_{it-1} \Delta \hat{\varepsilon}_{it} - \hat{\lambda}_i \right) \tag{12}$$

Panel PP-statistic:

$$Z_t = \left(\hat{\sigma}^2 \sum_{i=1}^{N} \sum_{t=1}^{T} \hat{L}_{11i}^{-2} \hat{\varepsilon}_{it-1}^2 \right)^{-1/2} \sum_{i=1}^{N} \sum_{t=1}^{T} \hat{L}_{11i}^{-2} \left(\hat{\varepsilon}_{it-1} \Delta \hat{\varepsilon}_{it} - \hat{\lambda}_i \right) \tag{13}$$

Panel ADF:

$$Z_t^* = \left(\hat{s}^{*2} \sum_{i=1}^{N} \sum_{t=1}^{T} \hat{L}_{11i}^{-2} \hat{\varepsilon}_{it-1}^{*2} \right)^{-1/2} \sum_{i=1}^{N} \sum_{t=1}^{T} \hat{L}_{11i}^{-2} \hat{\varepsilon}_{it-1}^* \Delta \hat{\varepsilon}_{it}^* \tag{14}$$

Group ρ-statistic:

$$\tilde{Z}_\rho = \sum_{i=1}^{N} \left(\sum_{t=1}^{T} \hat{\varepsilon}_{it-1}^2 \right)^{-1} \sum_{t=1}^{T} (\hat{\varepsilon}_{it-1} \Delta \hat{\varepsilon}_{it} - \hat{\lambda}_i) \tag{15}$$

Group PP – statistic:

$$\tilde{Z}_t = \sum_{i=1}^{N} \left(\hat{\sigma}^2 \sum_{t=1}^{T} \hat{\varepsilon}_{it-1}^2 \right)^{-1/2} \sum_{t=1}^{T} \left(\hat{\varepsilon}_{it-1} \Delta \hat{\varepsilon}_{it} - \hat{\lambda}_i \right)$$

$$\tag{16}$$

Group ADF- statistic:

$$\tilde{Z}_t^* = \sum_{i=1}^{N} \left(\sum_{t=1}^{T} \hat{s}_i^2 \hat{\varepsilon}_{it-1}^{*2} \right)^{-1/2} \sum_{t=1}^{T} \left(\hat{\varepsilon}_{it-1}^* \Delta \hat{\varepsilon}_{it}^* \right) \tag{17}$$

Here, $\hat{\varepsilon}_{it}$ is the estimated residual from Eq. (10) and $\hat{L}_{11i}^2$ is the estimated long-run covariance matrix for $\Delta \hat{\varepsilon}_{it}$. Similarly, $\hat{\sigma}_i^2$ and $\hat{S}_i^2 \left(\hat{S}_i^{*2} \right)$ are, respectively, the long run and contemporaneous variances for individual i. The other terms are properly defined in Pederoni (1999) with the appropriate lag length determined by the Newey-West method. All seven tests are distributed as being standard normal asymptotically. This requires standardization based on the moments of the underlying Brownian motion function. The panel v-statistic is a one-sided test where large positive values reject the null of no cointegration. The remaining statistics diverge to negative infinitely, which means that large negative values reject the null. The critical values are also tabulated by Pedroni (1999).

3.3   Granger causality Model

Panel cointegration technique only ascertains whether or not firm size and profitability are cointegrated; it does not show the direction of causality. Once the variables are cointegrated, the next step is to implement the Granger causality test. We adopt a panel-based error-correction model to account for the long-run relationship using the two-step procedure from Engle and Granger (1987). The first step is the estimation of the long run model for eq. (10) in order to obtain the estimated residuals ε_{it}. The second step is to estimate the error-correction based Granger causality models. The error-correction based causality allows for the inclusion of the lagged error correction term derived from the cointegration equation. Essentially, inclusion of the lagged error-correction term ensures that the long run information that is lost through differencing is reintroduced in a statistically acceptable way (Narayan and Smyth, 2008). Therefore, the Granger causality model with a dynamic error correction model employed is as

follows:

$$\Delta PROF_{it} = \theta_{1j} + \lambda_{1i}\varepsilon_{it-1} + \sum_k \theta_{11ik}\Delta PROF_{it-k} + \sum_k \theta_{12ik}\Delta SIZ_{it-k} +$$
$$\sum_k \theta_{13ik}\Delta SGR_{it-k} + \mu_{1it} \tag{18}$$

$$\Delta SIZ_{it} = \theta_{2j} + \lambda_{2i}\varepsilon_{it-1} + \sum_k \theta_{21ik}\Delta PROF_{it-k} + \sum_k \theta_{21ik}\Delta SIZ_{it-k} +$$
$$\sum_k \theta_{23ik}\Delta SGR_{it-k} + \mu_{2it} \tag{19}$$

Where Δ denotes first differencing and 'k' is the lag length and is chosen optimally for each firm using a step-down procedure up to a maximum of two lags. The firm growth equations are omitted because they are not relevant to the focus of our work.

The source of causation is identified by testing for the significance of the coefficients of the dependent variables in equations (12) and (13). For the short run causality we test H_0: $\theta_{12ik} = 0$ for all i and k in equation (12) or H_0: $\theta_{21ik} = 0$ for all i and k in equation (13). The long run causality is ascertained by examining the significance of the speed of adjustment λ, which is the coefficient of the error correction term ε_{it-1}. The significance of λ indicates the long run relationship of the cointegrated process, and so movements along this path can be considered permanent. For long run causality, we test H_0: $\lambda_{1i} = 0$ for all i in equation (12) or H_0: $\lambda_{2i} = 0$ for all i in equation (13). Finally, we use the joint test to verify for a strong causality test, where variables bear the burden of a short-run adjustment to re-establish a long run equilibrium, following a shock to the system (Asafu-Adjaye, 2000; Oh and Lee, 2004 and Lee, 2005). As all variables enter the model in stationary form, a standard F-test is used to test the null hypothesis.

4   EMPIRICAL RESULTS

Table 1 presents the results derived from the three heterogeneous panel unit root tests for the order of panel intergration. The results of the unit root test are

as shown in table 1 indicate that at 1% significant level except for firm size in level under ADF-Choi Z-Statistic and IPS W-Statistic, other statistics confirm that the three series have a panel unit root. Employing these

TABLE 1-Nigeria: Panel Unit Root Tests

Variables	ADF-Choi Z-Stat	IPS W-Stat	Hadri-Z-Stat
PROF	-5.84***	-4.99**	3.24**
SGR	-6.83***	-6.29**	3.44**
SIZ	2.04	1.44	12.70**
Δ PROF	-10.45***	-9.79***	8.32***
Δ SGR	-12.28***	-13.52***	6.53***
Δ SIZ	-9.42***	-8.22***	5.91***

Source: Authors calculation

Note: Δ denotes first differences. All variables are in logarithms.

*** indicate significance 1% level.

results, we proceed to test for cointegration among profitability, firm growth, and size in order to determine if there is a long run relationship to control for in the econometric specification. Table 2 reports the panel cointegration estimation results. In the table, all the statistics significantly reject the null hypothesis of no cointegration. Thus, it can be seen that Prof, Siz and Sgr move together in the long run. That is, there is a long run steady-state relationship between firm size and profitability for a cross-section of firms in Nigeria after allowing for a firm-specific effect.

TABLE 2: Nigeria: Panel cointegration Tests (Prof., Sgr and siz)

	Without Trend	With intercept and Trend Time effect fixed
Panel Variance	-2.39***	-5.11***
Panel ρ	2.11***	4.71***
Panel pp	-9.37***	-22.56***
Panel ADF	-5.16***	-10.23***
Group ρ	5.62***	8.42***
Group PP	-10.09***	-19.29***
Group ADF	-6.13***	-10.11***

Source:Authors calculation

Note: Statistics are asymptotically distributed as normal., The variance ratio test is right-sided, while the others are left sided.

*** Reject the null hypothesis of no cointegration at the 1% level

Once, the three variables are cointegrated, the next step is to implement the Granger causality test. This study used a panel-based error correction model to account for the long run relationship using the two-step procedure from Engle and Granger (1987). The results of a panel causality test between profitability and firm size is presented in tables 3. The results from table 3 show that there is bidirectional long run and short run causal relationship between firm size and profitability. The bidirectional causality shows that firm size has significant affect profitability and profitability equally has significant effect firm size in the case of Nigeria.

TABLE 3-Nigeria: Panel Causality Test

Dependent Variable	Sources of causation Short run		(Independent variable) Long run		
	Δ Prof	Δ Siz	ECT	ECT/Δ Prof	ECT/Δ Siz
Δ Prof	-	9.48*** [0.00]	49.19*** [0.00]	-	16.55*** [0.00]
Δ Siz	14.39*** [0.00]	-	3.44** [0.06]	4.95** [0.02]	-

Source: Authors calculation, Note: p-value in parenthesis *** and ** indicate statistical significant at 1% and 5% levels respectively

Anthony Enisan Akinlo - FIRM SIZE-PROFITABILITY NEXUS:
EVIDENCE FROM PANEL DATA FOR NIGERIA

5   CONCLUSION

There is a growing literature on the relationship between firm size and profitability. However, the bulk of this literature focuses on the effect of firm size on profitability without considering the possible feedback effect. To our knowledge, there is no study that examines the co-movement and causal relationship between firm size and profitability in literature.

Our goal was to examine if there is any long run relationship and causality between firm size and profitability for 66 firms in Nigeria for the period 1999 – 2007 using the heterogenous panel cointegration technique. The empirical results show that firm size and profitability are cointegrated. According to the short-run and the long-run dynamics of firm size and profitability, we refute the neutrality and unidirectional hypotheses advanced in some existing studies. Firm size is found to Granger cause profitability and vice versa. The results of bidirectional long-run and short-run causal relationship between firm size and profitability show that increased firm size can enhance firm profitability in Nigeria. Likewise, increased firm's profitability can lead can lead to increased firm size. This implies that greater attention to efficiently managing firms' size to optimal level will impact positively on the firms' level of profit. In the same way, efficient management of the firms to achieve high profit level will impact positively on firms' size in Nigeria.

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ČVRSTA VEZA VELIČINE I PROFITABILNOSTI: DOKAZI IZ PANEL PODATAKA ZA NIGERIJU

Sažetak

Rad proučava dugoročnu vezu i pitanja kauzalnosti između veličine tvrtke i profitabilnosti u 66 tvrtki u Nigeriji koristeći metodu panelne kointegracije za period od 1999. do 2007. Empirijski rezultati pokazuju da postoji dugoročna stabilna veza između veličine tvrtke i profitabilnosti. Kratkoročna kauzalna veza pokazuje da postoji dvosmjerna veza između veličine tvrtki i profitabilnosti. To ukazuje na činjenicu da Granger veličine tvrtke uzrokuje profitabilnost a Granger profitabilnosti uzrokuje veličinu tvrtke. Rezultati jasno pobijaju opću pretpostavku da uzročna veza postoji samo od veličine tvrtke prema profitabilnosti, na čemu se bazira većina dosadašnjih istraživanja.

Ključne riječi: veličina tvrtke, profitabilnost, panelna kointegracija, kauzalnost

HOW DOES MANAGEMENT ACCOUNTING CHANGE UNDER THE INFLUENCE OF ERP?

Slobodan Malinić *   Mirjana Todorović †

Abstract

Given the intensive application of Enterprise Resource Planning Systems (ERP), the focus of this study was to assess the ERP influence on management accounting of industrial enterprises. That is, the objectives are the identification and analysis of the ERP impact on the management accounting and management accountants. In order to realize these goals, nine Serbian companies of different industry, which use SAP as a liding ERP software, have been surveyed. The conclusions are that SAP reduces the time required for the traditional tasks of management accounting, while increasing the time required for the activities of data analysis, performance measurement and subtle strategic reporting. Also, there is a significant change in the role of management accountants.

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1   INTRODUCTION

The management of industrial enterprises expects from modern management accounting to provide the answer to the challenges of constant changes. Having in mind the requirements set for the management accounting system, there are continuous efforts for improving its information support to the management. The application of new concepts, cost accounting systems and cost management techniques provides significant opportunities in that domain, and especially in the domain of managing the objectives, strategies and performances of a modern industrial enterprise. Apart from general approaches of improving management accounting system, the evolutionary path of management accounting was especially contributed by the development of ERP system. Due to the mentioned efforts modern management accounting becomes able to create various informations in order to meet various needs of numerous users. Having in mind the objectives set out by this paper, the attention will be dedicated to considering the effects of ERP (*in this paper we will analyse SAP, as one of the ERP sowfare*) to management accounting system, which primarily requires the reference to the essence and characteristics of these systems "Mauldin and Richtermeyer (2004)", "Koch (2007)", "Sutton (2000)", "Nicolaou (2004)" and then the identification, assessment and analysis of its impacts "Bredford and Florin (2003)", "Poston and Grabski (2001)", "Hanton *et al.* (2003)", "Moldin and Rihtermajer (2004)", "Hivonen (2003)", "Granlund and Malmi (2002)", "Scapens and Jazayeri (2003)", "Caglio (2003)", "Kihn *et al.* (2011)". The remainder of this paper is organized as follows. Section 2 reviews the literature. Section 3 describes the research objectives, reviews the developed hypotheses and presents the results of the empirical analysis. Finally, Section 4 discusses the conclusions.

2   *BACKGROUND LITERATURE*

Modern era of networked computing is characterized, in software sense, by the domination of client-server architecture. Key software elements of this configuration are network software and management database system. By their

technical characteristics and performances, they provide, as service providers, for the users (clients) to access and use the data and information from databases in network environment. On the bases of client-software architecture, business information or integrated information system *(ERP)* was developed. This software for enterprise resourse planning has emerged as an answer to continuously growing information needs of management, in terms of market globalization, internationalization of business, intensive development of modern production and communication technologies "Bradford and Florin (2003)". The acronym ERP should not represent a dilemma in understanding the essence of integrated information systems, although it can point out to "planning" and "resources" and thus lead to wrong conclusions. The real focus and ambition of ERP is integration of all the departments and functions of enterprise into one information system, which can meet specific needs of various users.

Although it is structured of modules, ERP represents a highly integrated system based on the best business practice, which implies data archiving in a single base, by which the enterprise is provided with an efficient control of basic business functions, as well as the planning of strategic actions "Koch (2007)". Additionally, data entry is provided at the sources or the nearest places, multiuser operating mode, e-business and communication over the Internet, shaping ad hoc and reports in the real time for various needs of users. As a result of extreme flexibility and adaptibility, the rapid information flow, minimal response time to the requirements of buyers and suppliers, better interactions with business partners, higher quality of provided services and increased satisfaction of clients are achieved. Decision-making at lower levels, as a result of reliable and timely informing and possibility of simulating the real business processes, leads to the reduction of costs and inventories and flexibility in managing the transactions and shorter duration of production cycles provides higher efficiency and better performances of enterprise "Nicolaou (2004)".

Having in mind that incentives for ERP implementation mostly come from the accounting (even more than 45%), and then from management (approximately 35%), the issue of its effects on organization and functioning of the overall AIS, and especially management accounting system, becomes logical "Hyvo-

nen (2003)". It is undeniable that this influence is multiple "Sutton (2000)". Numerous research studies deal with this issue.

All studies, according to their character, can generally be classified into two groups, structural and procedural. *Structural* research studies start from the basic assumption that the information systems *(IS)* are the cause of organizational changes in the enterprise. Concretization of that assumption in the domain of management accounting implies that ERP is the factor of improving organizational performances "Bredford and Florin (2003)", "Poston and Grabski (2001)", "Hanton *et al.* (2003)", "Moldin and Rihtermajer (2004)", "Hivonen (2003)". TABLE 1 testifies about the most interesting results and studies conducted.

Interesting results were obtained by "Hyvonen (2003)", whose research included precisely the large industrial enterprises in Finland, chosen in a controlled way from the list of 500 the largest, so that all the industries are involved. Subject of analysis were the effects of transition from non-integrated software applications to ERP, as well as the consideration management accounting functioning and practice in both system types. It was determined that out of the total number of respondents, 27% implemented the Activity Based Costing (ABC) as a modern cost accounting system. Out of that number, more than 65% has implemented ERP. Balanced Scorecard (BSC) was implemented by 24% of respondents (62% of them uses ERP). It is interesting that besides the modern ones, the traditional techniques and tools of management accounting are simultaneously being used. Although it exists, there is no particularly significant impact of ERP on the practice of management accounting, i.e. ERP does not significantly encourage the implementation of new accounting techniques.

TABLE 1 - Overview of the results of structural empirical studies

Poston, Robin and Grabski, Severin (2001), Financial impact of enterprise resource planning implementations	
Focus	Whether the implementation of ERP has a positive or negative impact on the performance of enterprise?
Sample	Sample consisted of 54 enterprises, which have officially announced that they have implemented ERP in the period from 1980 - 1997 (PR Newswire press releases in Lexis-Nexus and in The Wall Street Journal): These enterprises were observed in a five-year period.
Conclusion	It was determined that there are no direct significant improvements of organizational performances (expressed by financial indicators) immediately during the period (three years) after ERP implementation, as well as that there is no significant reduction of operating costs, except for the costs of final product in whose case a decline was recorded. The existence of time gap between the moment of system implementation and achieving of the first positive effects was identified
Hyvonen Timo (2003), Management accounting and information: ERP versus BOB	
Focus	The effects of transition from non-integrated software application to ERP, as well as the consideration of functioning and practice of management accounting in both systems types are analyzed.
Sample	The study has included 300 large industrial enterprises in Finland, chosen in a controlled way from the list of 500 the largest, so that all the industries are involved.
Conclusion	There is no particulary significant impact of ERP to the practice of management accounting, i.e. The ERP does not significantly encourage the implementation of innovative tehniques in industrial enterprises.

Source: Authors calculation.

In the focus of research studies based on the *process* approach, there are two

key issues – acceptance and application of new accounting practice in organization and functioning of the accounting department. The conclusions are that basic logic of accounting is not changing under the influence of ERP and that there are no dramatic changes in the accounting itself, but that, in most cases, there are changes in the work of accountants. Their work becomes more complex and broader and more demanding, although some of the traditional accounting tasks are transferred to the other employees in the enterprise. The most significant results were obtained by "Granlund and Malmi (2002)", "Scapens and Jazayeri (2003)" and "Caglio (2003)". In addition to the mentioned, there were other studies with different approach to the problem. Namely, "Quattrone and Hopper (2004)" have paid a special attention to the impact of ERP on management control, while "Nicolaou (2004)" has observed post-implementation phase of ERP and its peculiarities. TABLE 2 testifies about the results of these studies.

TABLE 2 - Overview of the results of process empirical studies

Granlund, Markus and Maimi, Teemu (2002), Moderate impact of ERPS on management accounting: a lag or permanent outcome?	
Focus	The objective was to evaluate whether the ERP adds the value to the system of management accounting for the needs of decision-making and control, as well as whether the new system influences the budgeting process and performances measurement.
Sample	Sample consisted of the large companies from Finland, mostly users of SAP R/3 software, 16 workers from 10 companies were interviewed.
Conclusion	ERP has a stabilizing effect on the management accounting , i.e. Does not lead to the adoption of new accounting techniques. It was observed that the time necessary for analysis is being prolonged and the time necessary for routine tasks is being reduced.
Scapens, W. Robert and Jazayeri, Mostafa (2003), ERP systems and management accounting change: oportunities or impact? A reserach note.	
Focus	The objective was to observe the process of SAP implementation and identify the changes in management accounting.
Sample	A case study was conducted on the example of Italian multinational company. The data were obtained by interviewing the accountants and other employees.
Conclusion	Results indicate that ERP increases the level or routine tasks, and thus there are more evolutionary than revolutionary changes in management accounting. Additionally the responsibility of managers is being increased, since they need to posses a much higher level of accounting knowledge. Finally, although ERP encourages team work and cooperation, the changes that occur under its impact are incremental.
Caglio, Ariela (2003), Enterprise Resource Planning systems and accountants: towards hybridiyation?	
Focus	The study considers the impact of ERP on the accountatns.
Sample	Case study was conducted on the example of Italian company from Milan. The date were obtained by interviewing all the key participants of ERP implementation process and on the basis of internal documents
Conclusion	The results show that accountants spend less time on reporting because these tasks are mostly automated., which leaves more room for complex business analysis. The job of accountants becomes hybrid, especially from the aspect of the need for possessing multidisiplinaty knowledge of the management accountants.

Source: Authors calculation.

The results of all these studies are not completely consistent. Analyses of ERP impact on management accounting depend on the perception and understanding of ERP. Poor or inadequate understanding of ERP causes poor comprehension of its impact on accounting. There are also other reasons for fragmented results, for example high level of data aggregation, use of various research methods, research coverage, whether it is conducted on the level of divisions or enterprises etc. However, it needs to be pointed out once again that the characteristics of integrated applications, facilitate already initiated changes in enterprises conditioned by their changes, but they also open new possibilities, especially in the domain of management accounting system. The observed changes are incremental, with minimal disruption of the existing policies and procedures, more focused on rebuilding and modification of the existing system.

However, for a more detailed discussion of ERP impacts on management accounting practice, apart from the review of the results of empirical research, the peculiarities of ERP should firstly be pointed out and then it is necessary to attempt to develop a particular theoretical framework, which will serve for an additional analysis.

3   IDENTIFICATION AND ANALYSIS OF SAP EFFECTS ON MANAGEMENT ACCOUNTING SYSTEM OF INDUSTRIAL ENTERPRISES

There are not a large number of serious studies and analyses concerning the ERP imact on management accounting of industrial enterprises. Such a situation can be explained by the fact that the tasks, techniques and organization of management accounting almost the same to the all enterprises, even industrial ones "Fullerton and McWatters (2004)". Having in mind that industrial enterprises today face the changes in their operating mode, then their specificities whose reflection is obvious in the field of management accounting, as well as

the requirements of industrial management, the attention should be focused on some specific issues. Identification and analysis of ERP impact on management accounting of industrial enterprises are largely conditioned by organizational structuring of accounting department itself. The results of considering the relation between ERP and management accounting will largely depend on the organizational options, which should be conceived primarily in the interest of meeting information needs of numerous users. However, we should have in mind the broader dimension of ERP implementation and building of information platform for the level of eneterprise, in which AIS module represents only one segment.

Research Objectives. – The subject and focus of research is the impact of SAP (as one of the leading and one of the most common ERP software) on management accounting and management accountants of the large industrial enterprises in Serbia. The objective can be defined as the determination of the effect of SAP on management accounting system, i.e. the answer to the question whether there was an improvement of management accounting performances after SAP implementation. The focus of research is the application of the new accounting techniques, increasing the work efficiency and reduction of the time necessary for performing the tasks of management accountants, as well as the reconsideration of the possible revitalization of their role and significance. For this purpose will serve a model, ie. theoretical framework developed by "Rom and Rohde (2007)" and which is applied by "Yu Ho Tin (2006)". This model will be partially modified in order to meet the specifics of the concrete research. Modification of the model includes the research only of the following relevant areas, namely: the relation between SAP and tasks and techniques of management accounting, changed roles of management accountants and changes in the organization and functioning of AIS and management accounting system. With respecting the possibility of existance and different approach to observing the relation between ERP and management accounting system, and based on the research of the relevant literature, the FIGURE 1 shows this framework for the analysis.
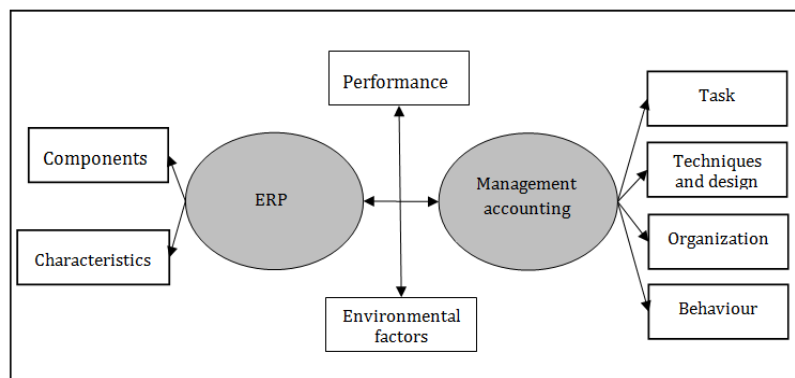
FIGURE 1 - Theoretical framework for investigating the relationship between ERP and management accounting   *Source: Author calculation*

Hypothesis Development. – Bearing in mind the abovementioned, three basic research hypotheses are identified.

Hypothesis 1: After the SAP implementation there are changes in the organization of management accounting and SAP contributes to the introduction of new advanced management accounting techniques.

Our key variables (The advanced management accounting techniques) are the ABC, BSC*,* Benchmarking, Customer Satisfaction Surveys, Financial Key Performance indicators, Non-financial key performance indicators, Target Costing *(TC)* and Lifecycle costing. Numerous researchers have identified only minimal effects of different ERP software on the management accounting practice in terms of introducing new management accounting techniques "Booth (2000)", "Granlund and Malmi (2002)", "Scapens and Jayazeri (2003)".

Hypothesis 2: After the implementation of SAP there is the change in the role of management accountants and their tasks.

In the function of testing *Hypothesis 2* we will analyze the following management accountants skills: reporting skills, knowledge of information systems, teamwork and possessing interfunctional knowledge. Our aim is to conclud

whether the change in the role of management accountants occurred after the SAP implementation. Also we will give assessment of the changes in the management accountants tasks. We will examine the time needed for management accounting activities (budgeting, reporting, data analysis, cost accounting and performance measurement) before and after the implementation of SAP. In this regard, some authors "Granlund and Malmi (2002)" emphasise that SAP provides more time for sophisticated analyses and the changes in the processes of budgeting and planning after the implementation of SAP were identified as minimal, while other "Scapens and Jayazeri (2003)" suggest more expressed role of management accountants as analysts and the reduction of time necessary for routine accounting tasks and indicate that the budgeting process becomes increasingly directed towards the future.

Hypothesis 3: The length of using SAP determines the level of customer satisfaction with SAP.

The assumption is that with the passage of time of use, due to better understanding of the functioning and seeing all the benefits, the level of satisfaction using SAP increases. At the beginning of use of any ERP software problems occur due to inexperience and insufficient knowledge of employees. Over time, these problems are overcome. This is consistent with the conclusions of researchers who claim that the full effects of the SAP implementation become visible and apparent only after prolonged use "Poston and Grabski (2001)", "Hunton *et al.* (2003)".

4   EMPIRICAL METHOD

In methodological sense, the interviewing includes large industrial enterprises in Serbia, which use SAP. It is about leading business software, which is used by more than 105.000 different economic entities in 120 countries of the world. More than 2/3 companies from Forbs list -TOP 500 use SAP. Since the most common software in Serbian market is SAP only those industrial enterprises that are the SAP users were interviewed, as in the case of "Hivonen (2003)". Additionally, it needs to be pointed out that the users of SAP in Serbia contribute with

more than 1/3 to the gross domestic product of the country. In addition, the enterprises in various industries were considered due to the equal presence of all industries. During the formation of the sample, the attention was paid on the lenght of period of SAP use. In above-mentioned enterprises, the accounting, finance, plan and analysis, i.e. controlling managers were involved. The survey was conducted by direct surveys, e-mail or telephone.

In our country were no similar studies. The authors have in mind only studies which test SAP efect on management accounting and management accountant in Serbia. The authors are aware of all possible limiting factors. Disputing may be small sample size, which consists of nine large industrial companies, users of SAP. The authors used firm size criteria defined by the applicable regulations of Serbia (Law on accounting and auditing). We decided to choose nine enterprises because our research had a feature of multiple case methods. The multiple case method is suited to researching unknown subjects, i.e., for getting in-depth and first-hand understanding of a particular situation "Yin (2004)". Unlike single case studies, multiple case studies permit replication and extension between individual cases, which helps researchers to understand patterns more easily, to eliminate chance associations, and to form better theoretical structure. While there is no ideal number of cases, a number between four and ten usually works. So we choose nine. Small and medium enterprises were not taken into consideration, which is compatible with similar research studies in the world "Hivonen (2003)". Specifically, the assumption is that in the case of small and medium enterprises, the very size of the enterprise may be a limiting factor in identification SAP effect on management accounting. The company size is not a limiting factor in implementing SAP solutions. About 75% SAP users are small and medium companies. Also, the survey included only companies of Serbia, which can also be noted as a potential limitation. However, during the entire work and in presenting the conclusions, we were guided by a similar research in the world and accordingly we did some comparisons. Despite all this, the authors are confident in the reliability of the results obtained, particularly because the obtained conclusions largely coincide with the findings of similar surveys carried out in the world.

5   *EMPIRICAL RESULTS*

For the purposes of describing the sample, basic *descriptive* statistical measures will be used. TABLE 3 provides a descriptive analysis of variable *time* of using SAP in months. The above sample includes nine units tested with a range of results 72, the minimum score is 21 month and maximum is 93 months. The mean is 51.89 months of using SAP. Standard deviation as the most precise measure of the variability of occurrence is 23.961, and shows deviations from the distribution of its mean, while the most frequent time of use is 58.00 months.
TABLE 3 - Descriptive statistic for the time of using SAP

N	Min	Max	Mean	Median	σ
9	21	93	51.89	58.00	23.961

Source: Authors calculations.

Bearing in mind the presented theoretical model, established goals and hypotheses, the following relevant issues should be considered.

The relation between SAP and management accounting techniques. – The analysis that follows will be directed to two already mentioned management accounting techniques ABC and BSC. The mentioned techniques, although available and useful, they are not widespread due to the numerous barriers "Rom and Rohde (2007)". With the emergence of the advanced IS, it is expected that their application will be increased. This is supported by ABC and BSC softwares, which are much more efficient and flexible in terms of analysis and reporting "Baxendale (2003)".

The survey shows that before the implementation of SAP in four companies in Serbia ABC was implemented. Results obtained for the period after SAP implementation, are not promising (FIGURE 2). About, 60% of respondents use some form of ABC within the framework of SAP. It is important to emphasize that the usage of ABC was identified only in two companies more than before the SAP implementation. Specificity reflects in that the ABC is not entirely implemented and that it is used almost in all cases as an additional system of cost accounting and cost management, i.e as a system complementary to the

existing one "Kneževiæ and Mizdrakoviæ (2010)".

The application of TC is recorded in about 40% of industrial enterprises included in the survey, and BSC in about 20% of cases. It is significant the use of financial key performance indicators in about 30% of the surveyed companies after the implementation of SAP. In more than 20% of cases, there was no implementation of new innovative technques and tools of management accounting.
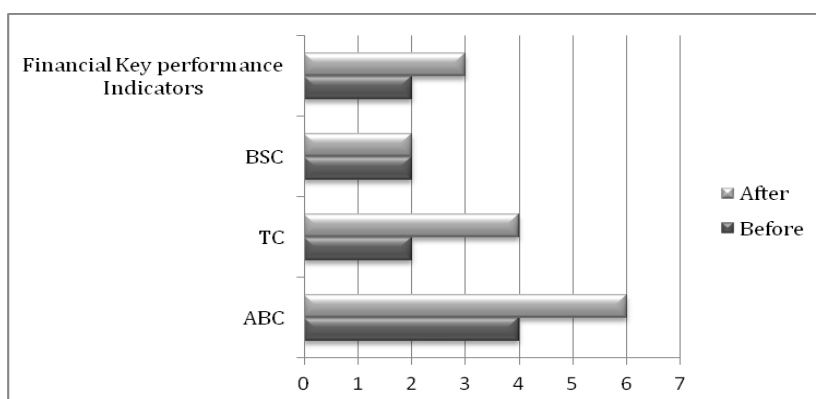

FIGURE 2 - The application of management accounting techniques before and after SAP

Source: Authors calculation

In order to answer the first hypothesis, it can be concluded that management accounting techniques have not been drastically changed under the influence of SAP. However, SAP represents an important source of support to the new accounting practice, i.e. it provides the initiative to the implementation of some new accounting techniques, primarily ABC, TC and BSC, which were not so widespread before the SAP „Kaplan (1998)". It is realistic to expect that in the future the SAP will influence the advent of the new ones and support the changes in the existing techniques of management accounting.

The relation between SAP and the management accounting tasks. – Drawing conclusions on the mentioned relation requires the decomposition of management accounting system into segments of transaction processing, reporting and support to decision-making. In relevant literature, it is claimed that SAP per-

forms the tasks more successfully in the domain of transaction processing and producing operational information. This is evidenced by the example of production module, i.e. cost acounting, which confirms the statement on the high efficiency of SAP in the domain of processing and reporting for operational purposes. Operational activities of this module are very efficiently implemented by SAP, providing the high quality of processing, much better and flexible information, as well as more accurate and coherent financial flows. The reports produced from such a system, with a large scope of extremely detailed information, are the most useful for operational management. The information produced in this way are generally similar to the information produced by previous sytems, but in SAP environment, they are more available, with the possiblity of the management to access them directly, without waiting for their shaping into various reports. Also, it is pointed out that there is much lower level of SAP efficiency in the support decision-making process, i.e. that its information support for the needs of strategic decision-making is limited.

The question of informational support for the needs of middle and top management remains open "Ribeiro and Scapens (2004)", „Scapens *et al.* (1998)". Our aim was to conduct a detailed analysis of SAP reporting potential. This especially having in mind that the first association to the SAP is „more and better information", "Booth *et al.* (2000)". The potential dilemma can only be resolved by the analysis of details and aggregation of information, determination of the management levels towards which they are directed, as well as which is their purpose. Exceptional orientation on operational activities and operational management, as well as the high level of information details, indeed make the SAP information support in some cases inadequate for the needs of strategic business decision-making (the survey results). But the company SAP Inc. has developed the solution SAP Strategic Enterprise Management, especially for these puroprses. Also, the SAP potential is enormous. SAP reports are well known for their precision and reliability.

The fact is that SAP improves and standardizes information flows, but at the same time it centralizes them. Although it is very successful in the domain of transaction processing and efficient in the creation of numerous financial,

manufacturing, statistical and management information, sometimes it does not provide all the necessary information for a long-term and strategic decision-making or does not provide information directly. Hence, can the SAP really meet these needs in an adequate way? The answer is affirmative, but conditional as well. Yes, only with the support of management accountants, who reamain irreplaceable for the needs of support to this decision-making. Management accountants prepare the necessary information and reports by their exraction from the system and analysis for the needs of middle and top management. Also in this research we did not interested in technical aspect or aspect of different SAP modules. We were interested in different date and information from whole SAP software.

An example is the budeting process, as one of the tasks of management accounting. Instead of being statistical or fixed plan for the entire enterprise for the whole year, the budget becomes dynamic and flexible. In addition, it is possible to make good predictions on a monthly basis, so that the comparison with the achievements can be made on monthly basis. Hence, the reports of management accountants for the needs of management are less focused on comparison with the budget and more on the comparison with predictions. Although it is more extensive, this task of management accountants requires less time after SAP implementation, as evidenced by the figure 3.
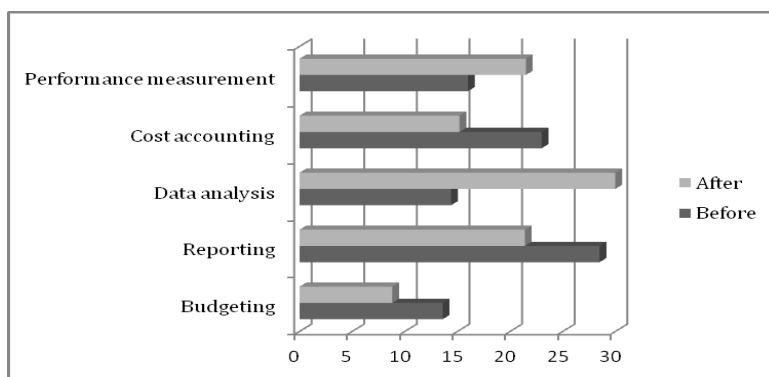

FIGURE 3 - Time required for the tasks of management accounting before

and after the SAP implementation

Source: Authors calculation

TABLE 4 shows descriptive statistics for the variables *types of tasks* for management accountants, and the time required for the realization of these tasks before and after the implementation of SAP.

TABLE 4 - - Descriptive statistics for the variables types of tasks for management accountants

	N	Mean	σ	Median	Min	Max
Time for budgeting before SAP	9	14.00	10.512	15.00	0	30
Time for reporting before SAP	9	27.22	11.211	30.00	10	40
Time for analysis before SAP	9	14.33	5.500	15.00	4	20
Time for cost accounting before SAP	9	24.44	9.167	25.00	10	40
Time for performance measurement before SAP	9	15.00	8.660	15.00	5	30
Time for budgeting after SAP	9	9.22	6.553	10.00	0	20
Time for reporting after SAP	9	20.44	13.983	20.00	5	49
Time for analysis after SAP	9	30.00	8.660	30.00	20	50
Time for cost accounting after SAP	9	15.78	6.553	15.00	10	30
Time for performance measurement after SAP	9	21.11	9.280	20.00	5	35

Source: own calculations.

The average time for budgeting expressed in percent before the implementation is 14.00% and after the implementation of SAP is 9.22%. In 6 cases time for budgeting after the implementation of SAP is less than the required time before implementation, in only one case, the time required for budgeting is greater after the implementation and in 2 cases there was no change in the time required for budgeting (*Ties*). Since the p = 0.09 we can conclude that the time needed for budgeting is significantly shorter after the implementation of SAP, based on Nonparametric Test/2 Related Samples or Wilcoxon signed

rank. The Wilcoxon signed-rank test is a non-parametric statistical hypothesis test used when comparing two related samples, matched samples, or repeated measurements on a single sample to assess whether their population means ranks differ. It is used as alternative non-parametric methods of paired sample t-test. When the normality assumption is not satisfied or the sample size is too small parametric t-test is not valid and we should use non-parametric test.

Similarly, for reporting the conclusion is that the time required for the reporting activities is less than the required time before SAP implementation, but results is not significant. However, we must not neglect the fact that the respondents made ??a difference between the operational and strategic reporting. In this sense, according the respondents the time required for operational reporting is shorter, and for the needs of strategic reporting is longer. Furthermore, results for the task of data analysis shows a significant increase in time required for these jobs after the implementation of SAP. The time required for the activities of the performance measurement is longer than the required time before SAP implementation, but results also is not significant. In terms of activities of cost accounting, there was recorded a significant reduction of required time after the implementation.

As an answer to the second hypothesis, it can be concluded that it is obvious that after the implementation of SAP, the time necessary for budgeting, cost accounting and reporting is reduced, but simultaneously the requirements in the domain of analysis and performance measurement are increased. SAP directly provides a lot of information for the needs of operational decision-making "Caglio (2003)", but for the needs of medium-term and long-term decision-making, it is necessary to use additional tools for the creation of information (the survey results are largely consistent with the results obtained by "Yu Ho Tin (2006)". The role of Exel is enormous, as well as the role of tools for business intelligence (BI). Strenghtening the information sources is contributed by the applications for connecting the companies with strategic partners, known as the applications for partner relationship management (PRM), by which better communication with business partners is provided, especially in the creation of information in the real time.

Changing the role and satisfaction level of management accountants under the influence of SAP. – Today, management accountants perform a wide range of tasks. Apart from the traditional, management accountatnt perform the tasks from the domain of general management and tasks of the maintenance of IS. Also, the tasks of management accounting are mostly done by the managers at all levels. Our research was focused on four basic types of management accountants knowledge (skills) and those are the following: understanding the financial and management accounting, possessing the knowledge from other functional fields (manufacturing, sale and marketing), knowing and using information systems and the necessity of team work.

The survey found that the implementation of SAP sets higher requirements for each type of knowledge, i.e. skills mentioned, which shows TABLE 5. The leading position still occupies possessing basic knowledge from the domain of accounting. More significant becomes the knowledge from various functional fields. The results on the necessary decentralization of accounting knowledge towards operational managers, primarily the managers of production functional area, are particularly interesting. Namely, the specificity of ERP software generally is entering the data only once, which makes the entry itself more demanding, complex and responsible. The role of the manager of production functional area is particularly increasing, having in mind the scope and significance of entered information for which they are directly responsible. The increasing of significance and necessity of teamwork is logical with the previous. The requirements for the possession of IT knowledge of management accountants are at the lowest level and that time is the same. Namely, in about 60% of the interviewed enterprises, it was pointed out that the employed already possessed the sufficient level of basic IT knowledge, so the transition to SAP did not require any additional training of this type. Of course, it was necessary to get to know the peculiarities of this software package and its procedures.

TABLE 5 - The importance of skills before and after SAP

	Mean Before SAP	Mean After SAP
The importance of knowing IS	2.33	2.33
The importance of having functional knowledge	2.56	2.89
The importance of team work	3.33	3.67
The importance of reporting skill	3.67	3.78

Source: own calculations.

However, for all four cases statistical significant changes can not be identified after the implementation of SAP, based on Nonparametric Test/2 Related Samples. It is obvious that on average the greatest importance after the implementation of SAP has the skills of reporting, also on average the importance of all these skills is increasing, except the importance of knowing and using IS. But these increase is not statistical significant.

It is very interesting to point out the partial reduction of management accountants responsibility under the ERP influence. On the other side, there is the trend of increasing the responsibility of management for financial aspects of activity. Owing to the computer technology, which integrates managing systems with the systems of operational control, management has on line access to all the information, especially those necessary for controlling the costs. In the period before ERP that work was carried out by accountants "Cooper and Kaplan (1998)". Consequently it is possible that management accountant will loss simple and basic skill, i.e. their transformation into mere analysts of the system. They are not engaged in simple measuring and reporting on performances anymore. More than 50% of the respondents pointed out: „*the accountants turn into operators and supervisors*". Management accountant still remains irreplaceable in the jobs of interpreting various indicators of performances and analysing their mutual relations. It is expected from them to be internal consultants, who will not only assist the managers in the creation of strategies and decision-making, but also actively participate in those processes through integral approach to the analysis and understanding operational and financial performances. Providing such a support is possible only on the basis of possession of the new skills and knowledge, more precisely, the consulting,

communication and interpersonal skills, broader knowing of the entire business, adopting new way of thinking and behaving and development of new business culture in accordance with the requirements of changes "Ribeiro and Scapens (2004)".

Finally, retaining the role of the creator, consultant, supervisor and analyst of the cost accounting and management accounting, AIS and IS of enterprises, management accountants become irreplaceable managers at all levels of management, with the actual ability to support the management of a modern enterprise and to actively participate in corporative management, to participate in planning, control and decision-making, to help in the adaptation to the changes and their creation, to contribute to the formulation of strategies and tactics, increase of efficiency and improvement of performances, and all of that for the purpose of a successful market, competitive and strategic orientation of the enterprise.

In connection with this directly follows the answer to the third hypothesis, that the period of using SAP determines the level of customer satisfaction. The satisfaction level, as a key variable, was tested on a scale of 1 to 5. The obtained results are shown in TABLE 6 and they are very interesting.

TABLE 6 - Descriptive Statistics for Satisfaction level

	N	Min	Max	Mean	Std. Deviation
Satisfaction level	9	2	5	3.89	1.269
Valid N	9				

Source: own calculation.

The average satisfaction level of SAP users is 3.89. To determine the correlation between period (TABLE 7.), that is to say the length of use, and satisfaction level of respondents, rank correlation coefficient will be used (*Analyze / Correlate / Bivariate / Spearman*).

TABLE 7 – Correlations

			The length of use in months	The level of customer satisfaction
Spear man's rho	The length of use in months	Correlation Coefficient	1,000	**.791***
		Sig. (2-tailed)		**.011**
	The level of customer satisfaction	Correlation Coefficient	.791*	**1.000**
		Sig. (2-tailed)	.011	.
*Correlation is significant at the 0.05 level (2-tailed).				

Source: own calculations.

It can be concluded that the correlation between the length of using SAP and the level of customer satisfaction is 0.791 and that it is statistically significant at the level 0.05. The obtained conclusion is entirely logical, since with the time of use the level of familiarity with the system increases, as well as the methods and specifics of how it works. In addition, the benefits of using SAP become more apparent.

Changes in organization and functioning of AIS and management accounting system. – AIS development has going upwards in the direction of a continious improvement of the quality of their information potential, in its all segments (financial accounting and management accounting). Both segments of AIS are significantly influenced by IS and IT "Sutton (2000)". There are a number of essential aspects of improvement in the domain of management accounting, as traditionally the most reliable information support of the management. The most important is the issue of adequate, high-quality information support to the management.

Owing to the ERP, a large part of routine accounting tasks is done centrally and automatically, while the coordination and preparation of various operational reports is trusted to the ERP. On the basis of advanced information technology, the so-called centers of excellence arise, i.e. the teams of specialists who perform more demanding tasks, such as statutory (financial) and tax reporting, but also the internal audit "Nicolaou (2004)". Both, the information generated by the specialists and computer system become easily accessible and they are rapidly shared at all the levels of organizational hierarchy of the enterprise.

Another systemic change in accounting is already mentioned decentralization of accounting knowledge towards management structures. The progress, due to the sharing of knowledge and information, as the only resource which is increased by dividing, has been made only in the direction of more efficient and better decision-making of the management.

In modern era of networked computing the application of ERP has contributed to numerous changes in accounting information and management accounting system "Ribeiro and Scapens (2004)". The most significant are:

1. Elimination of routine tasks of the accountants, since the tasks that were once performed by accountants are now performed by the computers. On the contrary, they are aimed at much serious tasks of analyzing and performance measurement.

2. Although it can imply the loss of some basic, traditional accounting skills, the requirements that are set before the accountatnts are not of the reduced scope and complexity.

3. Operational management possesses a lot more accounting knowledge, which confirms the necessary decentralization of that knowledge. Additionally, the management is responsible for the financial aspects of its own activities.

4. The management accountants are required to have a much higher level of knowledge multidisciplinarity and fulfillment of a wide range of tasks. Broader and more demanding role of management accountants implies the high analyticity and ability of data interpretation, then a broad knowledgee of the business and information technology, willingness for the teamwork and strategic thinking, communication and interpersonal skills, as well as the ability of ethical evaluation and decision-making.

Cntemporary accounting is facing many challenges. Some of them are significant presence of IT, then new altered roles of accounting and managerial profession with new specific tasks, increased respect for the international professional regulations, code of professional ethics are the fields of big changes

with a direct impact on the accounting, AIS and accounting profession. These dynamics changes set the more requirements for a more uniform and quality accounting report, especially having in mind the unbreakable connection between such a reporting and efficient management.

6   CONCLUSIONS

This is the one of the first studies according the SAP effect on management accounting in Serbian industrial enterprises. We study nine enterprises from different industry to explore the relationship between SAP, as only one of the ERP software and management accounting changes. Although we conclude that there is the impact of SAP on the management accounting, that impact is relatively modest in relation to the expectations "Granlund and Malmi (2002)". Also, can be concluded that there is no strong causal relationship between the implementation of SAP and changes in practice of management accounting, i.e. the stabilizing effect on management accounting is more widespread "Scapens and Jazayeri (2003)", „Hyvonen (2003)". SAP is one of the best, the most popular and the most widely accepted ERP software in Serbia. That was the main reason for choosing SAP for our research. Our results show the following:

1. The process of the implementation of SAP is complex and in its initial phases, more attention is devoted to configuring the basic modules. The mentioned complexity of the system can be hindered by the advanced development of accounting.

2. Long time necessary for the full implementation of SAP can condition a subsequent appearance of the expected effects. In one of the enterprises included in the survey, the implementation process itself has lasted for more than 18 months, it is still not ended and both SAP and the old software solution are simultaneously used. Such a situation greatly complicates the work of accountants.

3. There is a time gap identified between the moment of the implementation of the system and the first positive effects. Can be to expected that the

enormous potential of SAP will be more completely used in the later phases of functioning, with the maturing of the idea of its significance and effects (*the attitude of one of the interviewed managers is that abbreviation* **SAP** *means „***S***lowly* **A***nd* **P***ainfully“*).

4. The replacement of the existing system by the new one causes a larger number of problems, such as: information transfer from a several different existing applications to the new system for the purpose of integration, complex technical and operational, but also the social questions, especially the organizational resistance to the changes and specificities of corporative culture. Orientation of the system towards the whole of the business, and not the individual functions, can cause rigidity as well. This is supported by the attitude of one of the interviewed managers *"too much specialization and the lack of flexibility"*.

5. The reason for the limited impact of SAP, as the ERP software, should also be looked for in the area of failures and errors in its implementation. Most frequently, it is the wrong choice of implementation strategy, choosing the wrong ERP, selection of bad consultants, due to the reengineering of business processes etc. In one of the respondent enterprises, the comment of the finance manager was *"good consultants can save you, but they can destroy you, as well"*.

6. SAP reduces the time required for the traditional tasks and increase of the time required for the needs of analysis and performance measurement. The time necessary for a more subtle managerial reporting is particularly extended (numerous information can be obtained by using Excel, BI or other tools, which additionally increases the significance of management accountants).

Finally, the fact is that the new information technology causes changes in the system of management accounting. The future of management accounting cannot be predicted with certainty, but it is certain that the future will be characterized by the change in reporting system, conditioned by the emergence

and implementation of ERP. It contributes to the increase of flexibility of the information of management accounting, saves time and money, and thus the interest for its implementation increases significantly.

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KAKO SE UPRAVLJAČKO RAČUNOVODSTVO MIJENJA POD UTJECAJEM ERP-a?

Sažetak

S obzirom na intenzivnu primjenu sustava planiranja resursa poduzeća (ERP), posebno u industrijskom poduzetništvu, cilj ovog istraživanja je bio utvrditi utjecaj ERP-a na upravljačko računovodstvo u industrijskim poduzećima. Dakle, ciljevi su identifikacija, evaluacija i analiza utjecaja ERP-a (u ovom radu analiziramo SAP kao ERP software) na upravljačko računovodstvo i upravljačke računovođe. Kako bi se ti ciljevi ostvarili, promatrano je deset tvrtki različitih proizvodnih aktivnosti. Zaključeno je da SAP umanjuje vrijeme potrebno za implementaciju tradicionalnih zadataka upravljačkog računovodstva, dok produljuje vrijeme potrebno za analizu podataka, mjerenje performanse i potanko strateško izvješćivanje. Isto tako, dolazi do značajne promjene uloge upravljačkih računovođa.

Ključne riječi: ERP, AIS, upravljačko računovodstvo, upravljački računovođa, inovativna računovodstvena praksa

CAUSALITY AMONG CARBON EMISSIONS, ENERGY CONSUMPTION AND GROWTH IN INDIA

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Abstract

This study attempts to investigate the long-run Granger causality relationship between energy consumption, carbon dioxide emission and economic growth in India over the period 1971-2007. The augmented Dickey–Fuller test (ADF), Phillips-Perron test (PP) and KPSS test are used to test for Granger causality in cointegration models which take account of the stochastic properties of the variables. The most important result is that there is feedback causal relationship between energy consumption and economic growth in India which implies that the level of economic activity and energy consumption mutually influence each other; a high level of economic growth leads to a high level of energy consumption and vice versa. The value of the error correction term confirms the expected convergence process in the long-run for carbon emissions and growth in India which

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implies that emission reduction policies will hurt economic growth in India if there are no supplementary policies which seek to modify this causal relationship.

1   INTRODUCTION

With rapid industrialization, increased population and significant change in life style, the threat of global warming and climate change is increasing for the last two decades. Carbon dioxide (C02) emission is considered as the main cause to the Green House Gases (GHGs). It is responsible at least 60% to the cause of global warming. Since 1990, the link between emission and economic growth has been studied extensively as global warming is raising the concern of environmental quality. In order to reduce the emission of GHGs, there have been several international attempts, of which the Kyoto protocol agreement, signed in 1997 is the most notable one. The Kyoto Protocol is a protocol to the United Nations Framework Convention on Climate Change (UNFCCC) and the key feature of the Kyoto protocol is to reduce the collective emission of GHGs of 39 industrialized countries and the European Union by 5.2% from 1990 level during the period of 2008-2012. As of 2010, 191 countries have signed and ratified the protocol with a view to reduce global emission level.

However, with the pace of development, as suggested by the Environmental Kuznets Curve (EKC) hypothesis, the level of carbon emission is expected to rise for many of the economies, contributing further to global warming. The validity of the EKC, on the other hand is itself a debatable issue and depending on the level of development, countries might differ significantly in terms of their growth-pollution nexus. This linkage of emission and growth is also closely related to the relationship between energy consumption and carbon emission as combating energy use will, on one hand reduce the level of emission and on the other might affect economic growth in a negative manner. In addition, depending on several other factors, e.g. the composition of growth, type of economic activities, intensity of foreign trade etc. this growth-emission-energy

consumption nexus is likely to be altered.

In the backdrop of climate change, India has been quite at the focus, since its average annual growth at around 7% for the last ten years has cost the climate substantially, especially through the emissions of carbon dioxide (CO_2). India, being a signatory of UNFCC does not have the responsibility to reduce emissions below the current level; however it is committed to slow down the emissions growth. The choice of India, in this paper, is motivated due to the fact that India is the fifth largest consumer of energy after USA, China, Russia and Japan and the fourth largest emitter of CO_2 after USA, China and Russia.

Being a key tourist location of Asia and a highly commercialized country, India's demand for energy is also increasing at a tremendously high speed. All such commercial and industrial activities have posed the environment of the country under risk. In addition, Indian economy has historically been integrated to the outside world with labor migration, tourism and export of goods and services, all such activities are expected to contribute significantly to not only high economic growth but also increased energy demand and carbon emission. Especially, India's growth agenda needs that primary energy supply to be increased by at least 3 to 4 times by 2031 with respect to 2003 as the base year, where coal will be the dominant source of energy due to its affordability and availability. But coal is labeled as dirty fuel, owing to its highest CO_2 emission coefficient (IEP-India, 2008). Therefore, India faces a challenge to balance between her need for growth and environmental commitment.

India has experienced a significant rise in energy consumption and carbon emissions in recent decades; it is an emerging economy and one of the important countries which has a high carbon emission in the world. The highest direct emissions are due to electricity sector followed by manufacturing, steel and road transportation. Given its ever increasing trend of economic activities and industrialization, coupled with its intensive integration to the global economy, analysis of such inter-linkages of India is expected to offer important implications for not India economy but also for other developing economies with high global integration and rapid industrialization.

Recently, Parikh et. al (2009) investigate the carbon dioxide (CO_2) emis-

sions of the Indian economy based on an Input–Output (IO) table and Social Accounting Matrix (SAM) for the year 2003–04 that distinguishes 25 sectors and 10 household classes. Total emissions of the Indian economy are estimated to be 1217 million tons (MT) of CO_2, of which 57% is due to the use of coal and lignite. The per capita emissions turn out to be about 1.14 tons. Balachandra et al. (2010) investigate that India has made substantial progress in improving energy efficiency which is evident from the reductions achieved in energy intensities of GDP to the tune of 88% during 1980–2007. Mallah and Bansal (2010) found that exploitation of energy conservation potential and an aggressive implementation of renewable energy technologies lead to sustainable development. Coal and other fossil fuel (gas and oil) allocations stagnated after the year 2015 and remain constant up to 2040. After the year 2040, the requirement for coal and gas goes down and carbon emissions decrease steeply. By the year 2045, 25% electrical energy can be supplied by renewable energy and the CO_2 emissions can be reduced by 72% as compared to the base case scenario. However, literatures do not strongly supported time series analysis on India to reveal the relationship between emission, energy consumption and growth.

This paper is an attempt to fill up that research gap. In this paper, we have attempted to examine the long run and causal relationship between economic growth, energy consumption, square of per capita income, trade openness and carbon emissions in India taking 36 years of data, from 1971 to 2007.

The rest of paper is as follows: In section metricconverterProductID2, a2, a brief review of the recent literature is provided whereas section 3 describes the data and outlines the methodology of the analysis. In section 4, econometric analysis is described and finally section 5 concludes the paper.

2   LITERATURE REVIEW

There has been basically three research strands in empirical literature to examine the relationship between economic growth, energy consumption and environmental quality (of which CO_2 emission is an important variable). The first strand focuses on the environmental pollutants and economic growth nexus. The

literature on environmental quality and economic growth study mainly focuses on the testing of the existence of environmental Kuznet's curve (EKC). The pioneering work of Kuznet (1955) which claimed for an inverted U-shaped relationship between economic growth and income inequality has been later reformulated to test similar inverted U relationship between economic growth/income and environmental quality. In this context, Grossman and Krueger (1991), Shafiq (1994), Heil and Selden (1999), Friedl and Getzner (2003), Dinda and Coondoo (2006), Ang (2007), Acaravci and Ozturk (2010), Pao and Tsai (2011) among others attempted to test the existence of EKC for different economies. The results of such research are however contradictory and in many cases researchers failed to establish the inverted U-shaped relationship with real life data.

A second strands looks at the link between energy consumption and output, suggesting that energy consumption and output may be jointly determined and the direction of causality between these two variables needs to be tested. Following the seminal work of Kraft and Kraft (1978), several others including Masih and Masih (1996), Yang (2000), Wolde-Rufael (2006), Narayan and Singh (2007), Narayan et al. (2008), Apergis and Payne (2009), Ozturk et al., (2010), Lau et al. (2011) tested the energy consumption and economic growth nexus with a variety of techniques and for different panel of countries. Ozturk (2010) provides a detailed literature survey on the empirical studies of energy-GDP nexus.

Finally, a third stream of research has emerged, which combines earlier two approaches by examining dynamic relationship between carbon emissions, energy consumption and economic growth. Some of the recent studies using this approach are as follows: Soytas et al. (2007), Akbostanci et al. (2009), Soytas and Sari (2009), Zhang and Cheng (2009), Jalil and Mahmud (2009), Ozturk and Acaravci (2010), Apergis and Payne (2010), Acaravci and Ozturk (2010), Pao and Tsai (2011), and Alam et al. (2011). The recent study of Alam et al. (2011) examined the causal relationships among energy consumption, carbon dioxide emissions and income in India using a multivariate framework of Toda and Yamamoto for the 1971-2006 period. Their results provide evidence

of the existence of bidirectional (feedback) Granger causality between energy consumption and CO2 emissions in the long-run but neither CO2 emissions nor energy consumption causes movements in real income. In addition, there is no long-run causality relationship between income and CO2 emissions but in the short-run causality exists in India.

In addition, researchers have looked not only at output/income or economic development variables but also extended their analysis to include other aspects such as financial development or trade openness or trade intensity of a country. The branch of literature which emphasizes the relationship between carbon emission and foreign trade considers the fact that the developed economies would specialize in human or physical capital intensive activities which are less emission intensive than those activities pursued in developing countries. Trade therefore may result in increased pollution in developing countries due to the increased production of these emission intensive goods in these countries. The study of Grossman and Krueger (1991) is pioneering in this regard while similar research question has also been addressed by Lucas et al. (1992), Wyckoff and Roop (1994), Suri and Chapman (1998), Anderson et al. (2010), etc. The results of these studies in terms of the relationship between trade and environmental quality is however inconclusive.

3   DATA AND METHODOLOGY

This study utilizes annual data on CO2 emissions (C) (metric tons per capita) per capita, energy use (E) (kg of oil equivalent) per capita, real GDP (Y) (both in constant 2000 US$) per capita and openness ratio (T) which is used as a proxy for Foreign trade for India. We collect the data on India's CO2 emissions (C) per capita, energy use (E) per capita, real GDP (Y) per capita from the World Development Indicators (WDI) published by the World Bank. Although the output and CO2 emissions series commences in 1960, the energy use series begins in1971 in the WDI. Thus, the year of 1971 is defined as the starting point. The analysis is confined to the period 1971-2007 due to data availability. Thus, we get 36 observations on each series ranging from 1971 to 2007 – the

longest possible joint dataset on India's CO2 emission, energy and GDP. All the data used in the study are in logarithmic form. This transformation can reduce the problem of heteroskedasticity as log transformation compresses the scale in which the variables are measured (Gujrati, 1995).

The relationship between carbon emission, energy consumption, national income, square of per capita real income and trade openness of a nation can be expressed in the following basic multivariate model:

$$C_t = \alpha + \beta_1 E_t + \beta_2 Y_t + \beta_3 Y^2_t + \beta_4 T_t + \varepsilon_t \tag{1}$$

where, ε_t is white noise. Logarithmic transformation of the above equation and inclusion of a trend variable would leave the basic equation as follows:

$$LC_t = \alpha_0 + \alpha_t + \beta_1 LE_t + \beta_2 LY_t + \beta_3 LY^2_t + \beta_4 LT_t + \varepsilon_t \tag{2}$$

where, t is the trend variable, LC: Log of Carbon Emission; LE: Log of Energy Consumption; LY: Log of Real GDP per capita; LY^2 is square of per capita real income, and LT: Log of Trade Openness ratio as proxy for foreign trade.

Generally, it is expected that the higher level of energy consumption should result in greater economic activity and stimulate CO2 emissions; therefore, it is expected that β_1 is greater than metricconverterProductID0 in0 in Eq. (2). Under the EKC hypothesis, the sign of β_2 is expected to be positive where as a negative sign is expected for β_3. The expected sign of β_4 is mixed depending on stage of economic development of a country. This may be negative in the case of developed countries, as it may reduce the production of pollution intensive goods and instead import these from other countries with less restrictive environmental protection laws. On the other hand, the sign of β_4 may be positive in the case of developing countries as they tend to have dirty industries with heavy share of pollutants (Grossman and Krueger,1995).

The main significance of this paper from the research work conduct by Stern (2004) and Perman and Stern (2003). Stern (2004) points out that the empirical

evidence in support of the stocktickerEKC is weak. In addition, our work suggests that several of the studies (see, interalia, Perman and Stern, 2003; Canas et al., 2003; Dinda et al., 2000; Galeotti et al., 2006) that model emissions as a function of income augmented by income-squared and income-cubed and trade openness type variables suffer from an additional problem—that of multicollinearity. We confirm this by undertaking a test for collinearity between income and income-squared and income-and Trade openness for our time series dataset from 1971-metricconverterProductID2007 in2007 in India. In this paper, we found that income-squared and trade openness variables suffer from multicollinearity problem that is why this study does not consider these two variables in the model for India. Therefore, the paper is constructed on carbon emission, energy consumption and growth in India.

$$C_t = \alpha + \beta_1 E_t + \beta_2 Y_t + \varepsilon_t \tag{3}$$

where, ε_t is white noise. Logarithmic transformation of the above equation and inclusion of a trend variable would leave the basic equation as follows

$$LC_t = \alpha_0 + \alpha_t + \beta_1 LE_t + \beta_2 LY_t + \varepsilon_t \tag{4}$$

where, t is the trend variable, LC: Log of Carbon Emission; LE: Log of Energy Consumption; LY: Log of Real GDP per capita.

The estimation process would begin with studying the time series properties of the variables and testing the order of integration. In order to establish the line of causality among variables, the famous Granger causality tests would be carried out. The proposed research would estimate the impact of energy consumption, and income on emission using cointegration approach so as to ensure long run relationship between them. In this study, we also estimate model with the system based reduced rank cointegration approach by Johansen and Juselius (1990). While there are several ways to examine interaction between variables, the influential work of Sims (1980) made VAR model and innovation accounting useful in time-series studies. Other works in this line include Blanchard and Quah (1989), Evans (1989), King et al. (1991), Pesaran and Shin (1998). As

Hamilton (1994:291) asserts, impulse response functions and variance decompositions are used to summarize the dynamic relations between variables in a VAR.

The objectives of our empirical estimation are to examine how the variables are related in the long-run and to assess the dynamic causal carbon emission, energy consumption and growth in India. Hence, our methodological approach in this paper includes three steps:

1) We need to check for a unit root in CO2 emissions (C) per capita, energy use (E) per capita, real GDP (Y) per capita in levels. We are using three different types of unit root tests: the augmented Dickey–Fuller (ADF) test (Dickey and Fuller, 1979; 1981), the Phillips– Perron (PP) test (Phillips and Perron, 1988) and the Kwiatkowiski–Phillips–Schmidt–Shin (KPSS) test (Kwiatkowski et al., 1992).

2) If the variables are I(1) then they have a long run relationship. VAR will be inappropriate. Hence, we need to test them for cointegration. If the variables are cointegrated, i.e. C (1, 1), a vector error correction (VEC) model will be used to discover the long run relationship. So, the third step is to test for causality by employing the appropriate types of causality tests.

3) If the cointegration relations between the variables are absent, we can run them in a VAR and there by get variance decompositions and impulse responses.

Figure 1 shows the series in log. A clear upward trend is evident in LC stand for the Log of Carbon Emission; LE stands for the Log of Energy Consumption; LY stand for the Log of Real GDP per capita series. Figure 1 shows the movement of the variables (in logarithmic form) over time
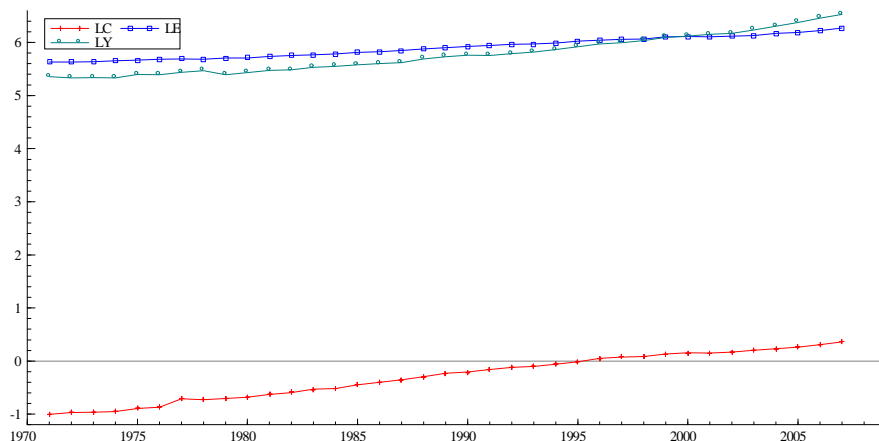
FIGURE 1 - Graphical representation of the data for India

Source: Authors calculation

In order to obtain a better understanding of the behavior of CO2 emissions (C) (kt) per capita, energy use (E) (kt of oil equivalent) per capita and real GDP (Y) (both in constant 2000 US$) per capita for India, a preliminary analysis of the data is first carried out. Table 1 presents summary of the logarithms of the CO2 emissions (LC) per capita, energy use (LE) per capita, real GDP (LY) per capita for India.

TABLE 1- Descriptive statistics

India	Mean	Median	Maximum	Minimum	Std. Dev.	Skewness	Kurtosis	Observations
LC_{IN}	-0.313	-0.263	0.307	-1.002	0.419	-0.174	1.674	36
LE_{IN}	5.892	5.890	6.225	5.630	0.187	0.120	1.645	36
LY_{IN}	5.748	5.711	6.456	5.330	0.334	0.479	2.040	36

Source: Authors calculation

Note: LC: Log of Carbon Emission; LE: Log of Energy Consumption; and

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LY: Log of Real GDP per capita, IN=India; and Data Range: India: 1971-2007.

Source: World Development Indicators (WDI-World Bank, 2010)

4   EMPIRICAL RESULTS

4.1   Unit Roots Tests

Table 2 presents the results of the unit root tests based on the Augmented Dickey-Fuller (ADF), Phillips-Perron (PP) and Kwiatkowiski–Phillips–Schmidt–Shin (KPSS) statistics on the natural logarithms of the levels and the first differences of the variables. All tests are providing us with a consistent set of results on unit root tests. For example, while the carbon emission, energy consumption, and output series have unit roots regardless of the tests, the first differences of these series, Δ emission, Δ energy and Δ output respectively, are clearly stationary under both the ADF and PP tests. For KPSS, the null hypothesis is the series is stationary. Thus, KPSS test issued to complement ADF and PP tests in order to have robust results. Hence, the results of unit root tests reveal that carbon emission, energy consumption and output are integrated of order one, I(1), in India. All the I(1) variables can only be regressed on each other if they are cointegrated. Thus, we proceed to testing the variables using the Johansen cointegration approach.

TABLE 2 - Unit root test results

Variables	Augmented Dicky-Fuller (ADF) Tests		Phillips-Perron (PP) Tests		Process	Kwiatkowiski–Phillips–Schmidt–Shin(KPSS)	Process
	Statistics	*P*-values	Statistics	*P*-values		Statistics	
LC_{IN}	-1.754(0)	0.705	-1.754(0)	0.705	I(1)	0.173** (4)	I(0)
LE_{IN}	-2.122(0)	0.5164	-2.122(0)	0.516	I(1)	0.137* (4)	I(0)
LY_{IN}	-0.796(0)	0.956	-0.657(1)	0.968	I(1)	0.719*** (5)	I(0)
ΔLC_{IN}	-7.265*** (0)	0.000	-7.632*** (0)	0.000	I(0)	0.121(8)	I(1)
ΔLE_{IN}	-5.573*** (0)	0.000	-5.569*** (0)	0.000	I(0)	0.085(0)	I(1)
ΔLY_{IN}	-7.181*** (0)	0.000	-7.342*** (3)	0.000	I(0)	0.742(3)	I(1)

Source: Authors calculation

Note: The variables LC stand for the Log of Carbon Emission; LE stand for the Log of Energy consumption; LY stand for the Log of Real GDP per capita; IN stands for the India and Δ denotes the first difference of the variable. The null hypothesis states that the variable has a unit root.

*, ** and *** denotes rejection of the null at 10%, 5% and 1% level of significance.

Figures in Parentheses ( ) indicate Lag Length.

The critical values and details of the tests are presented in Dicky and Fuller (1979, 1981) and Phillips and Perron (1988). The AIC determines the lag length (P) in the ADF tests (see Stock and Watson, 2007:561 for details), MacKinnon (1996) one-sided p-values in the ADF Tests.

PP test with automatic lag selection based on Newey–West, lags=3.

Critical values for the KPSS test are from Kwiatkowski et al., (1992)

4.2   Cointegration Test

Table 3 presents Johansen cointegration tests with C02, Energy and GDP. The λ_{trace} and λ_{max} statistics are calculated as per Johansen (1995). We have three variables and null hypotheses are thus two in number under each test. The null hypothesis for the trace test is that there are, at most, r cointegrating vectors, while the alternative is that there are more. The test is performed sequentially, beginning with the null hypothesis that there are at most zero cointegrating vectors, and if this null hypothesis is rejected, continuing with the null hypothesis that there is at most one cointegrating vector. For the maximum eigenvalue test, the null hypothesis is that there are exactly r cointegrating vectors, while the alternative is that there are exactly r+1. Again, the test is carried out sequentially, beginning with the null hypothesis that there are no cointegrating vectors. Since the Johansen approach (1995) is sensitive to the lag length used, the optimal lag length of the VAR model was examined by the Akaike Information Criterion (AIC) or the Schwartz Bayesian Criterion (SBC). In this study we use the SBC as a lag selection criterion. Empirically, SBC never selects lag values that are larger than AIC, while AIC selects relatively higher lag values. AIC and SBC are used to determine the appropriate lag length. The order of the distributed lag on the dependent variable and the regressors can be selected using either the AIC or SBC. However, depending on Monte Carlo evidence, Pesaran and Smith (1998) found that SBC is preferable to AIC, as it is a parsimonious model that selects the smallest possible lag length, while AIC selects the maximum relevant lag length

TABLE 3 - Johansen cointegration tests

Cointegration Rank Tests:			λ Statistics	Critical Values	P-values	Cointegrating Equations
λ_{trace} Tests						
	H_0: r =0	H_A: r >0	37.36743*	29.79707	0.0055	1
	H_0: r =1	H_A: r >1	8.148322	15.49471	0.4497	0
	H_0: r =2	H_A: r >2	0.052604	3.841466	0.8186	0
λ_{max} Tests						
	H_0: r =0	H_A: r =1	29.21911*	21.13162	0.0029	1
	H_0: r =1	H_A: r =2	8.095717	14.2646	0.3691	0
	H_0: r =2	H_A: r =3	0.052604	3.841466	0.8186	0

Source: Authors calculation

Note: The trace and max are calculated as per Johansen (1995) Critical Values are calculated for the 5 percent significance level. indicates Trace and states Maximum Eigen value unrestricted co-integration rank Test, P-values are calculated as per Mackinnon et al. (1999). One asterisk (*) denotes significance at 5% level. denotes the number of co-integrating vectors. The trace and max test statstics are computed by allowing for linear deterministic trends in the data. The lag length is determined by the SBC (see Enders 2004:363).

R stands for the rank of the matrix, which denotes the number of the cointegrating equations between the variables.

The corresponding λ-statistics and their critical values are shown in the column. As long as each λ-statistic is below its critical value, we will fail to reject the corresponding null hypothesis of no cointegration. The p-values reported here follow the MacKinnon et al., (1999) procedure. The p-values from the Osterwald-Lenum (1992) procedure are not statistically different from those of the previous procedure, and thereby not reported here to save space. If we fail to reject the first hypothesis of no cointegrating relation, the second null hypothesis automatically becomes redundant. The last column against each null hypothesis in the table gives the number of cointegrating equations. The

results of the cointegration tests in Table 3 are consistent, suggesting at least one cointegrating relationships among the variables in the series at 5% level of significance for India.

4.3   Granger Causality

The multivariate Granger proposed by Granger (1969) and popularized by Sims (1972) methodology will be applied to identify direction of causality among the variables of interest, i.e. carbon emission, energy consumption and GDP. The causality test assumes that the time series at hand are mean reverting process. However, it is highly likely that variables of this study are nonstationary. Formal tests will be carried out to find the time series properties of the variables. Engle and Granger (1987) assert that if the series X and Y (for example) are individually I(1) and cointegrated then there would be a causal relationship at least in one direction. However, the direction of causality can be detected through the Vector Error Correction model (VECM) of long-run cointegrating vectors. Granger-causality test is a convenient approach for detecting causal relationship between two or more variables. A time series (X) is said to Granger-cause another time series (Y) if the prediction error of current Y declines by using past values of X in addition to past values of Y. Thus, then augmented with an error correction term (ECT) as shown below:

$$\Delta LC = \delta_0 + \sum_{t=1}^{q} \delta_{1i}\Delta LC_{t-1} + \sum_{t=1}^{q} \delta_{2,i}\Delta LE_{t-1} + \sum_{t=1}^{q} \delta_{3,t}\Delta LY_{t-1} + \delta_4 Z_{t-1} + \upsilon_t$$

(5)

$$\Delta LE = \varphi_0 + \sum_{t=1}^{n} \varphi_{1i}\Delta LE_{t-1} + \sum_{t=1}^{n} \varphi_{2i}\Delta LC_{t-1} + \sum_{t=1}^{n} \varphi_{3t}\Delta LE_{t-1} + \varphi_4 Z_{t-1} + \varepsilon_t$$

(6)

$$\Delta LY = \beta_0 + \sum_{t=1}^{m} \beta_{1i}\Delta LY_{t-1} + \sum_{t=1}^{m} \beta_{2i}\Delta LC_{t-1} + \sum_{t=1}^{m} \beta_{3t}\Delta LE_{t-1} + \beta_4 Z_{t-1} + \mu_t$$

(7)

where Z_{t--1} is the ECT obtained from the long run cointegrating relationship between carbon emission, energy consumption and GDP per capita. The above error correction model (ECM) implies that for each of the model possible sources of causality are two: lagged dynamic regressors and lagged error correction term.

There is casual flow running from energy consumption to carbon emission in India. Since the majority of India's commercial energy comes from coal, the coal has the highest CO2 emission coefficient. There is a feedback causal relationship between energy consumption and economic growth in India which implies that the level of economic activity and energy consumption mutually influence each other; a high level of economic growth leads to a high level of energy consumption and vice versa. Next we estimate the ECM along with the short-run parameters. The sign of the error correction (EC) coefficient must be negative and significant to ensure convergence of the dynamics to the long-run equilibrium. The value of the EC coefficient, which signifies the speed of convergence to the equilibrium process, the most important term in Table 4 is the sign and value of the coefficient on the EC term. The negative sign on the EC term confirms the expected convergence process in the long-run for carbon emissions and growth.

Table 4 - Results of Granger causality tests

India	DLC	DLE	DLY	ECT_{t-1} (t-statistic)
DLC		4.88**	0.007	0.053 [1.518]
DLE	1.742		8.529**	0.009 [0.689]
DLY	0.198	5.114**		-0.125** [-3.964]

Source: Authors calculation

Note: (**) rejects the null at 5% level of significance

5   CONCLUSION AND POLICY IMPLICATIONS

The relationship between carbon emission, energy consumption and economic growth for India, using the Johansen–Juselius maximum likelihood procedure

in a multivariate framework during the period of 1971-2007, is investigated. The empirical results give support for unique and robust long term Granger causality between carbon emissions and economic growth for India in the form of an increasing linear relationship between per capita stocktickerGDP and per capita emission. This can be explained as follows. Although India is rich in coal and abundantly endowed with renewable energy resources in the form of solar, wind, hydro and bio-energy, around 53% of India's total energy needs has been met by coal followed by oil (31%) and natural gas (8%), and only 6% from hydro electric power, 1% from nuclear and 1% from renewable energy sources. The majority of India's commercial energy comes from coal (IEP, 2008). Thus, coal has the highest CO_2 emission coefficient. There is causal relationship from energy consumption to carbon emission in the case of India. In addition, there is feedback causal relationship between energy consumption and economic growth in India which indicates the level of economic activity and energy consumption mutually influence each other in that a high level of economic growth leads to a high level of energy consumption and vice versa.

To change this unidirectional causal relationship, India must focus attention on the use of clean coal technologies and also try to shift the use of energy from coal to alternative cleaner sources like natural gas, nuclear, renewable and hydrogen energy. Such measures will help to allow India to maintain its future growth aspirations as well as implementing its National Action Plan on Climate Change (NAPCC, 2008). At present, Indian government wants to achieve an 8–10% economic growth rate to eradicate poverty and meet its human development goals. The NAPCC also states categorically that India's per capita greenhouse gas emissions will "at no point exceed that of developed countries".

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KAUZALNOST IZMEĐU EMISIJE UGLJIKA, POTROŠNJE ENERGIJE I RASTA U INDIJI

Sažetak

Ovaj rad istražuje dugoročnu Grangerovu kauzalnost između potrošnje energije, emisije ugljikovog dioksida i ekonomskog rasta u Indiji u periodu od 1971. do 2007. Za testiranje Grangerove kauzalnosti u kointegracijskim modelima koji uračunavaju stohastička svojstva varijabli korišteni su prošireni Dickey-Fuller test (ADF), Phillips-Perron test (PP) i KPSS test. Najvažniji rezultat je da je utvrđena povratna kauzalna veza između potrošnje energije i ekonomskog rasta, što ukazuje na međusoban utjecaj razine ekonomske aktivnosti i potrošnje energije; veliki ekonomski rast dovodi do visokog stupnja potrošnje energije i obrnuto. Vrijednost korekcije greške potvrđuje dugoročno očekivani proces konvergencije za emisiju ugljika i rast u Indiji što upućuje na zaključak da će politika smanjenja emisije ugljika oštetiti ekonomski rast Indije ukoliko ne bude zamjenskih politika koje će pokušati modificirati kauzalnu vezu.

Ključne riječi: emisije ugljika, potrošnja energije, rast, Indija

Ilhan OZTURK, Gazi Salah UDDIN - CAUSALITY AMONG CARBON EMISSIONS, ENERGY CONSUMPTION AND GROWTH IN INDIA

LIQUIDITY OF THE CROATIAN STOCK MARKET: AN EMPIRICAL ANALYSIS

Jelena Z. Minovic *

Abstract

In this paper we analysed liquidity of the Croatian stock market. Low level of liquidity is one of the key problem areas facing this small market. As the measures of liquidity we used the Zero Rates return by Lesmond et al. (1999), Price Pressure of non-trading as in Bekaert et al. (2007), and Turnover. For calculating the Zero Rates return, and Price Pressure measures we used prices of all stocks listed at the the Zagreb Stock Exchange in the period: 2005 - 2009. Results showed that the level of liquidity for the Croatian market is very low. For this market the least illiquid year was 2007 (the pre-crises year), and most illiquid year for Croatia was 2009. We showed that illiquidity is persistent in this market. The first measures of correlation between all illiquidity measure are given. Particularly, we demonstrated that the Croatian market is less illiquid than the Serbian market.

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1   Introduction

The financial market in Croatia is, by its type, a Frontier Market. Frontier markets describe the smallest, less developed, less liquid countries that make up emerging markets . The main problem of the frontier markets impacting market liquidity are: small number of stocks with significant capitalization, small numbers of shares outstanding, infrequent and irregular trading, etc. Additionally, there are typically short time series of past trades, lack of transparency and readily accessible information about traded companies, as well as the appearance of the so-called invisible forms of risk, where illiquidity is the most important one. Due to all these factors frontier markets suffer from the increased level of systematic (market) risk (Latković and Barac, 1999). In frontier markets, non-trading problems are particularly acute. The time period between two subsequent trades can be several weeks. Such a situation is certainly not common for traded securities in developed capital markets (Latković, 2001). Frontier markets have some specific features that cannot be found in developed markets (Latković and Barac, 1999). These markets are characterized by a relatively large number of illiquid stocks (Benić and Franić, 2008). Undeveloped market often features low liquidity and infrequent trading. Investors in these markets are attracted by the high return potential but, at the same time, are scared by the liquidity risk in the market (Zhang, 2010).

Hacibedel (2007) listed some of the major differences between emerging and developed markets: difference in the level of information efficiency (the cost of information, and asymmetry of information between domestic and foreign investors); difference with respect to the investor base; distinction between foreign and local investors in emerging markets, both in terms of risk taking behaviour and weight; difference in terms of level of homogeneity of the assets, i.e. 'within market segmentation'; difference is the stock liquidity, and difference in the level of integration with the world markets.

There are many available research papers on liquidity and its measuring. These papers are mainly focused on developed markets. There are no major research ventures on stock market liquidity and its measuring in the South Eastern Eu-

rope countries. This paper contributes to this field of research in terms of determining level of the Croatian market illiquidity and comparing it's with level of the Serbian market illiquidity.

Benić and Franić (2008) determined the level of liquidity on the Croatian stock market and on the developing markets that are part of Central and Eastern Europe. They compared the Croatian market liquidity with other markets in the region and then compared those results with the German market in order to perceive differences between developing and developed markets. Rouwenhorst (1999) analysed returns and liquidity in 20 emerging markets. Bekaert and Harvey (2002, 2003) analysed different emerging markets. Clark (2008) studied history and measurement of liquidity risk in frontier markets. Bekaert, Harvey, and Lundblad (2007) analysed measuring of liquidity for 19 emerging equity markets. Cajueiroa i Tabak (2004) analysed emerging markets, too. They showed that these markets tend to become more efficient in time. Lesmond (2005) studied and tested different liquidity measures for emerging markets. Yeyati, Schmukler, and Van Horen (2008) described behaviour of emerging market liquidity in crises period. Hearn, Piesse, and Strange (2009) analysed liquidity in African emerging markets. Živkoviæ and Minoviæ (2010) explored illiquidity of the Serbian stock market.

There are many risks associated with investing in frontier markets. Živković and Minović (2010) showed that market illiquidity and its volatility significantly varies over time on the Serbian market. In these smaller frontier markets unpredictability of liquidity is also important source of risk. The simple fact is that for periods of time, there may be no market for a stock in a frontier market company. The regulatory scheme within these countries varies and often provides far less oversight than in more developed countries .

Liquidity is a market characterized by the ability to buy and sell securities with relative ease. Another definition that could be used in frontier markets explains that illiquidity arises when an asset or security cannot be converted to cash quickly, thus defining liquidity as the opposite of same (Clark, 2008). Liquidity on stock exchange is generated by the so called market makers (Campbell, Lo, and MacKinlay, 1997). Speculative investors and market makers are the

key players that bring about market or assets liquidity (Huberman and Halka, 2001). Liquidity is one the favourable characteristics required by the investors. Indeed, liquidity is the condition for investors (regardless of the investors being individuals or institutions) to get returns from the expected changes in prices. They, however, generate demand which enables liquidity.

To measure illiquidity for the Croatian market we use zero-return (ZR) proportion (by Lesmond, Ogden, and Trzcinka, 1999), "price pressure" (PP) measure as in Bekaert, Harvey, and Lundblad (2007), and turnover. Many of the more sophisticated measures of liquidity are unusable for estimation of liquidity of the Croatian stock market, because of the lack of data and specific features of this market. We used daily data for stocks from the Croatian Stock Exchange Index - CROBEX (http://zse.hr/), as well as data for all stocks listed at the Zagreb Stock Exchange in the period: October 14, 2005 – December 31, 2009. In order to obtain and apply the corresponding illiquidity measures, we have written a computer program within Microsoft Access package. We analysed level of liquidity for the whole Croatian market, and for CROBEX index, as well as for liquid and illiquid portfolio in the pre-crises and post-crises period. Particularly, we found which year is the most illiquid and the least illiquid year in observed sample period. Additionally, we compared Croatian and Serbian markets illiquidity by ZR measure.

The rest of the paper is organized as follows. The Section 2 describes liquidity, its definition and dimensions. The Section 3 presents different liquidity measures used in empirical analysis of Croatian market, and their advantages and disadvantages. The Section 4 shows changes in the level of illiquidity for each year in observed sample period, as well as the level of illiquidity in the pre- and post-crises eras, for CROBEX index, and for liquid and illiquid portfolio. The Section 5 concludes.

2   Liquidity: definition and dimensions

Liquidity is not easy to define and there is no common definition of liquidity anyway (Wyss, 2004). Liquidity is easier to recognize than to define (Crockett,

2008). Liquidity generally denotes the ability to trade large quantities quickly, at a low cost, and without moving the price. Market liquidity refers to the ability to undertake transactions in such a way as to adjust portfolios and risk profiles without disturbing underlying prices. The dimensions of market liquidity include:

1. (a) market depth, or the ability to execute large transactions without influencing prices unduly (Crockett, 2008). Market depth can be measured, aside from the depth itself, by the order ratio, the trading volume or the flow ratio (Wyss, 2004);

    (b) tightness, or the gap between bid and offer prices (Crockett, 2008). Tightness shows in the clearest way the cost associated with transacting or the cost of immediacy. Measures for tightness are the different versions of the spread (Wyss, 2004);

    (c) immediacy or the speed with which transactions can be executed (Crockett, 2008);

    (d) resilience, or the speed with which underlying prices are restored after a disturbance (Crockett, 2008). The resiliency dimension takes the elasticity of supply and demand into account (Wyss, 2004);

    (e) trading time is the ability to execute a transaction immediately at the prevailing price. The waiting time between subsequent trades or the inverse, the number of trades per time unit are measures for trading time (Wyss, 2004).

Obviously, there is a strong interaction between each of these dimensions and all of them must be monitored since the quality and availability of data varies widely across markets. These dimensions need to be applied at a disaggregated level for segmented markets and for individual products where substitutability from an investor's standpoint is limited or absent (Fernandez, 1999). It was believed that market liquidity could be analysed in terms of objective exogenous factors. A market was thought likely to be liquid if:

1. (a) market infrastructure was efficient, leading to low transactions costs and thus narrow bid-ask spreads;

(b) there was a large number of buyers and sellers, implying that order imbalances could be quickly adjusted by small movements in prices;

(c) and the assets transacted had transparent characteristics, so that changes in perceptions of underlying value would be quickly translated into prices (Crockett, 2008).

Amihud, Mendelson, and Pedersen (2005) noted some of the main factors that affect the liquidity of assets:

1. (a) Exogenous transaction costs: these are costs incurred by the buyer and/or seller of a security each time it is traded, including brokerage fees, order processing costs and transaction taxes.

    (b) Inventory risk: sellers also incur costs when they are forced to sell to market makers because „natural? buyers of the security are not present in the market at the time of sale; the market maker holds the security in inventory until such time as buyers appear but needs to be compensated for the risk of performing this role.

    (c) Private information: in a situation where either the buyer has private information that an investment is likely to appreciate in value or the seller has private information about anticipated asset write downs, a trading loss will arise for the uninformed counterparty. Dealers must adjust their quoted spreads to protect (on average) against losses incurred on trades with these „informed? counterparties.

    (d) Search friction: when an investor experiences difficulties in finding a counterparty who is willing to execute a trade this may result in him making price concessions he would not make in a perfectly competitive environment where buyers and sellers were immediately available; agents thus face opportunity costs between immediate execution of the deal at a discount and searching for a more attractive deal (Hibbert, Kirchner, Kretzschmar, Li, and McNeil, 2009).

Liquidity risk is considered to be one of the indirect barriers that foreign investors face while investing in emerging markets. The level of liquidity is

much higher in developed markets than in emerging markets (Hacibedel, 2007). Chuhan (1994) notes the small size of the frontier markets and their poor liquidity as the main factors impeding interest in frontier markets. Živković and Minović (2010) showed that in most cases the cause of the dramatic falls and rises in market illiquidity and of increases in the liquidity risk is the growth and fall in the foreign investor's participation. Penev and Rojec (2004) find that the main obstacles to foreign direct investment flows into the South-East Europe region are high investment risks, the lack of adequate physical infrastructure, delays in bank restructuring and rehabilitation, underdeveloped financial markets, delays in large–scale privatization and enterprise reform, inadequate development level of institutional infrastructure, administrative barriers to foreign direct investment, and an unfavourable legal environment. Benić and Franić (2008) pointed that a higher level of illiquidity directly leads to a higher risk on investments where investors face the possibility of higher losses, but also higher gains, when compared to more developed and liquid markets due to price volatility. In more illiquid markets (frontier markets) investors cannot be certain they would be able to execute large volume transactions at any time without significant price change, thus resulting in higher losses. Therefore, the presence of illiquidity represents an obstacle to further stock market development due to lower inflows of capital, which confirms that market liquidity is a fundamental aspect of market development.

Liquidity has several aspects and cannot be described by one indicator only. Some of the most common measures (il)liquidity are as follows: Turnover, Bid-Ask Spread, Roll's model (1984), Kyle's measure (1985), LOT's model (named by Lesmond, Ogden, and Trzcinka, 1999), Amihud's measure (2002), Pástor-Stambaugh factor (2003), and others. Thus, it is very difficult to cover liquidity with only one variable. Liquidity can be well described as a function of a number of variables, where each variable is an approximation for incomprehensible concept of liquidity (Amihud, 2002). So far evolution of ideas in this field shows that measuring market liquidity is not a trivial issue. Lesmond (2005) concludes that any measuring of liquidity has its advantages and disadvantages when used for estimation of liquidity among countries or within some country.

Lesmond (2005) points out that it is very important to choose appropriate measure of liquidity because these measures are necessary for adequate estimation of the market efficiency. However, the important issue for our analysis in this paper is the choice of appropriate measures of liquidity for frontier capital markets. Many of the more sophisticated measures of (il)liquidity could not be used for estimation of liquidity of the Croatian stock market, because of the lack of data and specific features of this market.

3 Choosen Illiquidity Measures for the Croatian market

3.1 The Zero - Return Measure (The LOT's measure)

Lesmond, Ogden, and Trzcinka (1999) proposed an illiquidity measure based on the portion of zero return days out of possible trading days. The zero-return measure is the ratio of the number of zero-return days to the total number of trading days in a given month (Lee, 2006). LOT's measure is defined as follows:

$$ZR_{i,t} \equiv \frac{N_{i,t}}{T_t}, \tag{1}$$

where T_t is a number of trading days in month t, and $N_{i,t}$ is the number of zero-return days of stock i in month t.

The economic intuition for the zero return measure is derived from simple trade-offs of the cost and benefit of trading for informed investors: when the trading cost is too high to cover the benefit from informed trading, informed investors would choose not to trade and this non-trading would lead to an observed zero return for that day. Importantly, the zero-return measure is defined over zero-volume days as well as positive volume days since this measure assumes that a zero-return day with positive volume is a day when noise trading induces trading volume (Lee, 2006).

Lesmond (2005), and Bekaert, Harvey, and Lundblad (2007) found that each countries liquidity is best measured by LOT's model. Practical drawback

of LOT's measure that it requires long enough period (i.e. longer than one month) in order to estimate parameters. Moreover a lot of zero-returns (i.e. if there are more than 80% for estimation period) make this measure invaluable. Bekaert et al. (2007) employed LOT's measure and they indicated that only this measure is applicable as illiquidity measure for emerging markets.

3.2   The Price Pressure Measure

Bekaert, Harvey, and Lundblad (2007) used this illiquidity measure for emerging markets, and it turned reliable in estimation of illiquidity of these markets. This measure aims to incorporate potential price impact by using the length of the non-trading (or zero return) interval. Bekaert et al. (2007) called this measure as price pressure of non-trading.

Daily price pressure (PP) measure is defined as follows:

$$\mathrm{PP}_{i,t} = \frac{\sum_{j=1}^{N} \omega_j \delta_{j,t} \left| R_{j,t,\tau} \right|}{\sum_{j=1}^{N} \omega_j \left| R_{j,t,\tau} \right|}, \tag{2}$$

where ω_j represents the weighting of the stocks in the market index (Bekaert et al., 2007). In our case, the market index is CROBEX index. N is number of stocks, each indexed by j. Coefficient $\delta_{j,t}$ indicates no trade days (as proxied by zero return days) and the first day after a no trade interval when the price impact is felt.

$$\delta_{j,t} = \begin{cases} 1, & \text{if} \quad R_{j,t} \text{ or } R_{j,t-1} = 0 \\ 0, & \text{otherwise} \end{cases}. \tag{3}$$

Also,

$$R_{j,t,\tau} = \begin{cases} R_{j,t} & \text{if} \quad R_{j,t-1} \neq 0 \\ \prod_{k=0}^{\tau-1} (1 + R_{m,t-k}) - 1, & \text{if} \quad R_{j,t-1} = 0 \end{cases}. \tag{4}$$

Here τ represents the number of days the stock has not been trading and $R_{j,t,\tau}$ is an estimate of the return that would have occurred if the stock had traded. Because in frontier and emerging markets market-wide factors may dominate return behaviour with respect to idiosyncratic factors, we use the value-weighted market return, $R_{m,t}$, as our proxy for the unobserved return. Note that when

a stock does not trade for a lengthy interval, $R_{j,t,\tau}$ may become quite large and the price impact illiquidity measure (PP_t) may move to 1.0 (Bekaert et al., 2007).

Bekaert et al. (2007) specified the limitations of this measure. First, information less trades (such as a trade by an index fund) should not give rise to price changes in liquid markets. The fact that there is no actual measure for non-trading, but only a zero return, creates a potentially serious limitation. The market reaction to such a trade may also depend on the particular trading mechanism in place. Another concern is that there is no trading because of a lack of news. Also, it is possible that our price pressure measure artificially reflect other characteristics of the stock market. For example, markets with many small stocks may automatically show a higher level of non-trading compared to markets with larger stocks. The focus on a value-weighted measure mitigates this concern (Bekaert et al., 2007).

3.3   Turnover

Turnover (TO) is:

$$\text{TO}_{iy} = \frac{1}{N_{iy}} \sum_{t=1}^{N_{iy}} \frac{V_{iyt}}{n_{iyt}}. \tag{5}$$

Where V_{iyt} is trade volume in shares of stock i on day t in year y, and n_{iyt} is number of shares outstanding of stock i on that day (Amihud, 2002).

Benić and Franić (2008) used Amihud's (2002) illiquidity measure in order to compare the most liquid stocks of the Croatian, Bulgarian, Serbian, Hungarian, Slovenian, Polish, and German markets. These authors showed that the Croatian market is more liquid than Bulgarian and the Serbian market, significantly more illiquid than Hungarian, Polish and German market and at a similar level of liquidity as the Slovenian market.

The characteristics of emerging markets could lead to liquidity being measured with more noise, if the existing liquidity proxies proposed based on the US market are used. Compared to the US market, emerging markets have more insider trading and weaker corporate governance. Investors, especially retail in-

vestors, have the expectation that they can be expropriated by the management or more informed investors. They also have relatively low disposable income to invest in the stock market and limited resource to obtain information. All these factors result in the on average low trading activity in the emerging markets. In other words, trading frequency becomes particularly important in emerging markets but the existing liquidity proxies rarely consider it. On the other hand, trading activeness vary across individual markets (Zhang, 2010).

Models based on the volume such as Amihud's measure and Turnover could be misleading in case of weak liquidity markets. This shortage is practically manifested in reduced scope of revenue which affects turnover, as well as null returns which influence Amihud's measuring (Lesmond, 2005). Findings by Lesmond (2005), Bekaert, Harvey, and Lundblad (2007) show that turnover are not a sustainable measure of liquidity in emerging markets. Neither is it a good measure for estimation of liquidity among countries nor within each country (Lesmond, 2005), (Bekaert et al., 2007).

4   Empirical Results

4.1   Data

The Zagreb Stock Exchange (ZSE) operations were suspended in 1945. Croatia's exchange did not see its revival until as late as 1991. In 1994, an electronic trading system was introduced. In the first five years following the introduction of the electronic trading system, between 1995 and 2000, the Zagreb Stock Exchange market capitalization grew almost 10 times.[1]

We used relatively short time-series (length of 4.5 years), from October, 2005 to December, 2009, compared with similar researches conducted on developed markets, where available time-series are above 20 years long. Another problem is that global economic crises happened during covered estimation period.

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[1] http://zse.hr/default.aspx?id=32877 (accessed July 29, 2011).

We have daily data[2] for all stocks[3] listed at the Zagreb Stock Exchange for the period: 2005-2009. Daily returns are calculated as difference in log price at closing, as follows:

$$R_t^i = \log(P_t^i) - \log(P_{t-1}^i) = \log\left(\frac{P_t^i}{P_{t-1}^i}\right). \tag{6}$$

where $\log(P_t)$ is log value of stock price on day t, and $\log(P_{t-1})$ is log value of stock price on day t - 1.

We got data for Croatian Stock Exchange Index (CROBEX) and for its structure for period: 2005-2009, from the Zagreb Stock Exchange (http://zse.hr/). The value-weighted return of this index is calculated using equation (6). After calculating returns for each stocks and index, we calculated liquidity measures for each stocks in each particular month of the observed period.

In order to obtain level of illiquidity for whole the Croatian market, we used Zero Rates (ZR) return by Lesmond, Ogden, and Trzcinka (1999) as a measure of stock illiquidity. In order to obtain and apply the corresponding illiquidity measure, we have written a program within Microsoft Access package. ZR is calculated for each stock in each particular month. After calculating return and illiquidity series on a daily level, we have been averaged by months in order to obtain series on a monthly level. Then, we sorted all stocks in each particular month according to value of ZR in ascending order, using the same program. For further analysis we rejected stocks that had zero returns in over 80% cases, in each month.[4] The stocks would be grouped in two portfolios. This would be two equally-weighted portfolios consisted of the 20 most liquid and the 20 least liquid stocks. These two portfolios are rebalanced monthly. Daily log returns for CROBEX index, and for both portfolios are presented on Figure 1.

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[2] Prices got on request from firm QuoteStation, http://www.quotestation.com/ (accessed January 25, 2010).

[3] In the period: 2005-2009 at the Zagreb Stock Exchange listed about 350 stocks.

[4] A lot of zero-returns (i.e. if there are more than 80% for estimation period) make this measure invaluable.
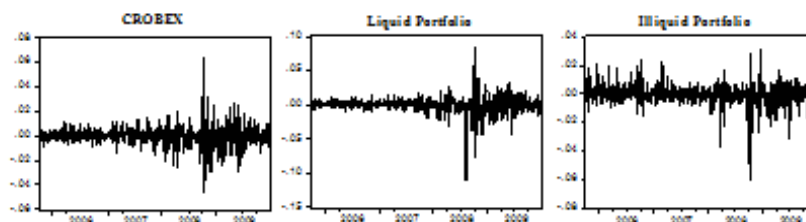
Source: Author calculation

FIGURE 1— Daily log returns for CROBEX index, liquid, and illiquid portfolio for period: 2005-2009.

For calculating the level of illiquidity for CROBEX index, and for two portfolios liquid and illiquid, on a daily level, we used price pressure (PP) of non-trading as in Bekaert, Harvey, and Lundblad (2007). This measure is calculated using a program that we have written within Microsoft Access package. We have daily turnover of all stocks listed at the Zagreb Stock Exchange in observed period. We calculated daily turnover for CROBEX index and for two portfolios in the pre-crises and post-crises periods. In Appendix in Table A1 there are descriptive statistics of returns, PP measures, and turnover for CROBEX index, liquid and illiquid portfolio, respectively.

4.2   Liquidity behaviour on the Croatian market

Many of the more sophisticated liquidity measures which are applicable for developed markets require the use of high-frequency transactions and quotes data, which may not be available for some markets, especially emerging and frontier markets (Zhang, 2010). These sophisticated measures of liquidity could not be used for estimation of liquidity of the Croatian stock market, because of the lack of the data and specific features of this market. In case of Croatian market, illiquidity is measured using three measures, Zero Rates (ZR) return, Price Pressure of non-trading (PP), and Turnover (TO). The Zero Rates, and Price Pressure of non-trading measures are used in Bekaert, Harvey, and Lundblad (2007). These authors applied this two illiquidity measures for 19 emerging

markets, and it turned out reliable in estimation of illiquidity of these markets. For the construction of these two measures only data on stock prices and index at closing were sufficient. Selected measures of illiquidity, ZR and PP, have values ??in the range between 0 and 1. If the value of these measures is closer to 1, this means that illiquidity is extremely high. For calculating ZR measure we used equation (1). This measure can be obtained for every stock on a monthly basis. Then, its value is averaged for all the stocks and the whole of the observed period.

Bekaert, Harvey, and Lundblad (2007) found that the least liquid country is Colombia according to the value of ZR measure (average value of ZR = 0.773). The country with average value of ZR = 0.109 is Taiwan (Bekaert et al., 2007), interpreting that Taiwan is the most liquid country of all 19 analyzed emerging markets. In order to find level of markets' liquidity in Croatia, we have established some critical value. An average value of ZR for all 19 analyzed emerging markets in Bekaert, Harvey, and Lundblad (2007) was 0.495.

We decided to denote all average values of ZR measure above 0.495 as state of low liquidity. For whole the Croatian market, value of ZR measure in the case when excluded stocks have more than 80% of zero returns, is 0.361 (Table 1), indicating that the Croatian market is liquid. However, from Table 1 we can see that mean value of ZR measure in the case when excluded stocks have more than 99% of zero returns, is 0.524. This would be the most realistic representative of the level of illiquidity. As the number of 0.524 is higher than the critical value of 0.495, we can say that the Croatian market is low liquid (illiquid).

TABLE 1— The mean of ZR measure for whole the Croatian market and for the whole observed period.

	to 80%	to 90%	to 99%
ZR measure			
whole market	0.361	0.438	0.524

Source: Author's calculation

Notes: The mean of ZR measure in cases when excluded stocks have more than 80%, 90%, and 99% of zero returns, respectively.

According to the data in Table 2, for every year, value of ZR measure was above the critical value of 0.495, except in 2007, indicating that in the Croatian market, illiquidity is persistent. Indeed, persistence of liquidity are empirically proved by the following authors: Amihud (2002), Chordia, Roll, and Subrahmanyam (2000, 2001), Hasbrouck and Seppi (2001), Huberman and Halka (2001), Pástor and Stambaugh (2003), Acharya and Pedersen (2005), and others. Živković and Minović (2010) empirically demonstrated persistence of illiquidity and its volatility on the Serbian market. Croatian market was the most illiquid in 2009, while it was the least illiquid in 2007. This is an interesting result, since in the pre-crises period, market has reached "the peak" in the sense that it was the least illiquid. Then the market suffered a fall almost by Gaussian law, in the sense that it has reached maximum illiquidity.

TABLE 2— An average value of ZR measure for every year in observed period for whole market.

	2005	2006	2007	2008	2009
ZR measure – whole market to 99%	0.540	0.519	0.494	0.519	0.572

Source: Authors' calculation

Notes: The mean of ZR measure in case when excluded stocks having more than 99% of zero returns.

We calculated ZR measure for the Serbian market in order to compare market illiquidity in Croatia and Serbia. From Figure 2 we can see that average value of ZR measure for the Serbian market in the case when excluded stocks having more than 99% of zero returns, is significantly higher than average value of ZR for the Croatian market. Thus, the Croatian market is less illiquid than the Serbian market.
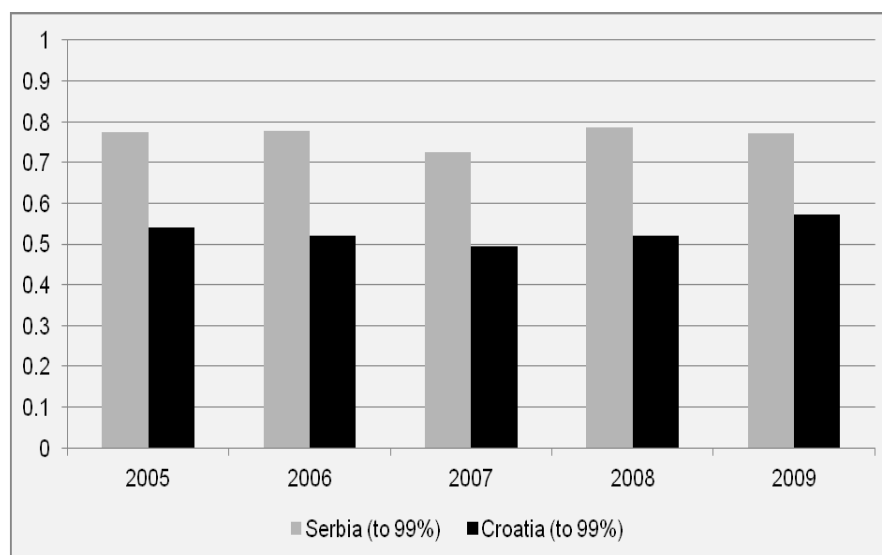
FIGURE 2— An average values of ZR measures for whole the Croatian and Serbian market, for every year in observed period, in case when excluded stocks having more than 99% of zero returns.

   Source: Authors calculation

We sorted all stocks in each particular month according to value of ZR in an ascending order, using the program. For further analysis we rejected stocks that had zero returns in over 80% cases, in each month. The stocks were grouped in two portfolios. These were two equally-weighted portfolios consisted out of the 20 most liquid and the 20 least liquid stocks. These two portfolios are rebalanced monthly. For calculating price pressure (PP) measure as in Bekaert, Harvey, and Lundblad (2007), we used equation (2). This measure is obtained for CROBEX index and for two portfolios liquid and illiquid, on a daily level. PP measure is calculated using a program written in Microsoft Access package. Figure 3 presents equally-weighted PP measures for both portfolios and for CROBEX index. These PP measures are averaged for each month of observed period: 2005-2009. From Figure 3 we can observe that the level of illiquidity

(measured by PP) is very unstable for both portfolios, and for index. The value of PP for CROBEX index is closer to the value of PP for liquid portfolio than the value of PP for illiquid portfolio (average values of PP measures are given in Table 3). Bekaert, Harvey, and Lundblad (2007) found that Indonesia is the least liquid country according to the value of PP measure (mean of PP = 0.776). Taiwan has a mean of PP measure = 0.158, implying that Taiwan is the most liquid country of all 19 analyzed emerging markets. PP's average value for all 19 analyzed emerging markets was 0.552 in Bekaert, Harvey, and Lundblad (2007). We have then decided to denote all values of PP measure above 0.552 as low liquidity. From Table 3 we can see that average value of PP for illiquid portfolio is 0.820 that is higher than critical value of 0.552. Opposite, average value of PP for liquid portfolio is 0.012 that is significantly lower than critical value of 0.552. Živković and Minović (2010) showed that the mean of illiquidity measure PP is 0.605 for Serbia's BELEXline index, for the same period: 2005-2009. These authors interpreted this result that the Serbian market is illiquid. This PP average value is significantly higher than average value of PP for CROBEX index 0.067. We can say that BELEXline index is more illiquid than CROBEX index. Even that the Serbian market is more illiquid than the Croatian market. On these two markets there are big differences in features of stocks. Consequently, there is big difference in structure and constructing market index.
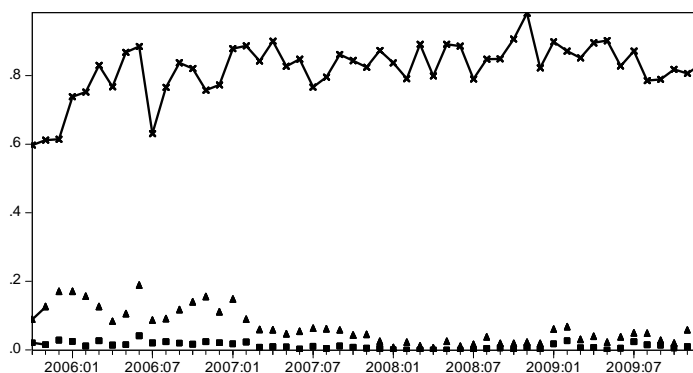
FIGURE 3— The equally-weighted Illiquidity measures (PP) for CROBEX index, liquid and illiquid portfolio, on monthly basis, for period: 2005-2009.
   Source: Authors calculation

We calculated daily turnover for CROBEX index, and for two portfolios in the pre-crises and post-crises periods (see Table 3). In Table 3 we presented relative changes in turnover of CROBEX index and for two portfolios liquid and illiquid in the crises period (October, 2008).

From Figure 4 we can observe that a large turnover existed on the Zagreb Stock Exchange in the pre-crises period. In the post-crises period turnover significantly decreased. Turnover of CROBEX index decreased for 36%, turnover of 20 the most liquid stocks decreased for 31%, while turnover of the 20 illiquid stocks decreased over 68% (see Table 3). Consequently, when turnover (trading activity) decreased, illiquidity increased in the market.
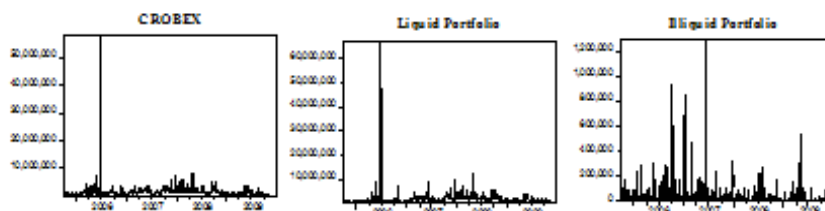
FIGURE 4— Daily turnover in KN for CROBEX index, liquid, and illiquid portfolio for period: 2005-2009.

Source: Authors calculation

TABLE 3— Average values of PP, ZR measures, and daily turnover for CROBEX index, liquid and illiquid portfolio.

	Average PP	Average ZR	Average TO (kn)	TO (kn) to 30/09/08	TO (kn) from 01/10/08	Relative changes in TO
CROBEX	0.067	0.107	1,397.47	1,562.48	1,001.65	-35.9%
Liquid portfolio	0.012	0.027	1,522.55	1,676.05	1,154.35	-31.1%
Illiquid portfolio	0.820	0.746	33,927	42,471	13,432	-68.4%

Source: Author's calculation

Notes: Average value of daily turnover in KN for CROBEX index, liquid and illiquid portfolio is given, in the pre-crises and the post-crises period, as well as relative changes of TO in the crises period.

The correlation coefficients between two illiquidity measures ZR and PP are pretty high, 0.96, 0.84 and 0.62, for CROBEX index, liquid and illiquid portfolio, respectively (see Tables 4 and 5). The correlation coefficient between turnover and ZR measure for CROBEX index is -0.30, and it is statistically significant (see Table 4), while for liquid portfolio the correlation coefficient is -0.40, and it is statistically significant (see Table 5). Negative values of these correlation coefficients between level of illiquidity and turnover (or trading activities) means

that high level of illiquidity (big values of ZR or PP), leads to smaller trading activities, or smaller turnover.
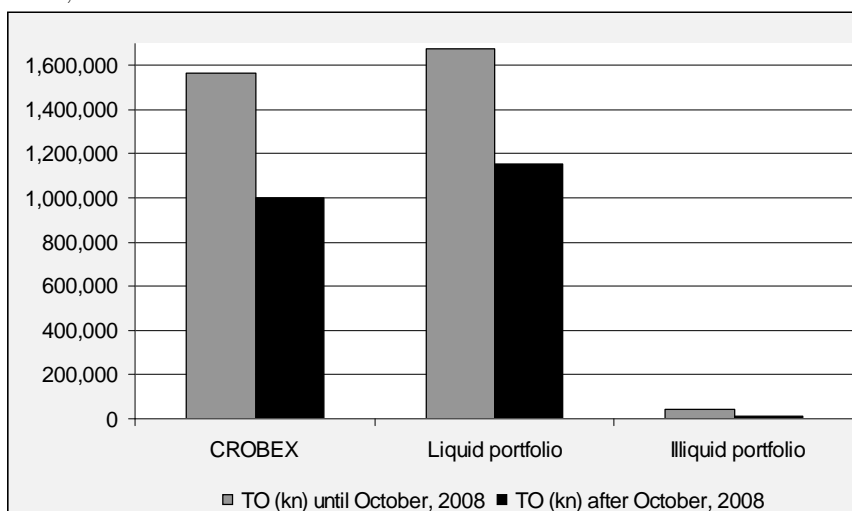
FIGURE 5— Daily turnover in KN for CROBEX index, liquid, and illiquid portfolio before and after October, 2008.
   Source: Authors calculation

TABLE 4— The correlation matrix between different liquidity measures for CROBEX index.

	ZR	PP	TO
ZR	1.00		
PP	0.96	1.00	
	[23.03]		
	(0.00)		
TO	-0.30	-0.18	1.00
	[-2.12]	[-1.27]	
	(0.04)	(0.21)	

   Source: Author's calculation.

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Notes: The values of t-statistics are given in angle parenthesis, and p-values are in standard parenthesis. The first measure of correlation is presented between Zero Rates Return (ZR), price pressure of non-trading (PP) and Turnover (TO). For illiquid portfolio there is no statistically significant correlation coefficient between any illiquidity measure (ZR or PP) and turnover (Table 5). It means that on the Croatian market, for the observed period, mainly liquid stocks are traded (see Figure 5). The big impact on market liquidity, in different times, had stocks of the following companies: INA, Croatian Telekom, Adris grupa, Atlantska plovidba, Ericsson-Nikola Tesla, and Podravka. These liquid stocks have impact on turnover and on the level of market liquidity.

TABLE 5— The correlation matrix between different liquidity measures for liquid and illiquid portfolio.

	ZR	PP	TO
Liquid portfolio			
ZR	1.00		
PP	0.84	1.00	
	[10.90]		
	(0.00)		
TO	-0.40	-0.28	1.00
	[-3.01]	[-2.01]	
	(0.00)	(0.05)	
Illiquid portfolio			
ZR	1.00		
PP	0.62	1.00	
	[5.55]		
	(0.00)		
TO	-0.09	-0.07	1.00
	[-0.60]	[-0.51]	
	(0.55)	(0.61)	

Source: Author's calculation.

Notes: The values of t-statistics are given in angle parenthesis, and p-values are in standard parenthesis. The first measure of correlation is presented between

Zero Rates Return (ZR), price pressure of non-trading (PP) and Turnover (TO).

5   CONCLUSION

This paper presents empirical analysis of liquidity for the Croatian market. For this analysis we used three measures: Zero Rates (ZR) returns, Price Pressure (PP) of non-trading as in Bekaert, Harvey, and Lundblad (2007), and turnover (TO). We used daily data for stocks from CROBEX index, as well as data for all stocks listed at the Zagreb Stock Exchange in the period: October, 2005 – December, 2009. In order to obtain and apply the corresponding illiquidity measures (ZR and PP), we have written a computer program in Microsoft Access package. Results showed that the level of liquidity for the Croatian market is very low. For this market the least illiquid year was 2007 (the pre-crises year), and most illiquid year for Croatia was 2009. The first measures of correlation between all illiquidity measure are given. We found that for illiquid portfolio there is no statistically significant correlation coefficient between any illiquidity measure (ZR or PP) and turnover. It means that on the Croatian market mainly liquid stocks are traded. The big impact on market liquidity, in different times, had stocks of the following companies: INA, Croatian Telekom, Adris grupa, Atlantska plovidba, Ericsson-Nikola Tesla, and Podravka. These liquid stocks have impact on turnover and on the level of market liquidity. Our results demonstrated that in the crises period turnover of liquid stocks decreased for 31%. On the illiquid segment of the Croatian market stocks turnover decreased over 68% in the crises period. Consequently, illiquidity of both segment, liquid and illiquid, of the Croatian market increased in the post-crises period. The presence of illiquidity is one of the key barriers that foreign investors face while investing in frontier markets. It represents main barrier to further stock market development due to lower inflows of capital. Market liquidity is a fundamental aspect of market development. Our results indicated that level of illiquidity (measured by PP) in Croatia is very unstable. Since the Croatian market belongs to frontier markets, it should be transformed to emerging markets in order to become a developed market. One of the major requirements for

this to happen is to improve market liquidity. Additionally, we showed that the Croatian market is less illiquid than the Serbian market according to the values of the ZR measure.

Future research should examine the impact of liquidity in explaining price formation in the Croatian market. I wish to investigate whether investors are compensated for holding Croatian' assets whose returns are sensitive to low level of liquidity.

Acknowledgement

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7   Appendix

TABLE A1— Descriptive Statistics for daily log prices, then for daily log returns, as well as for daily illiquidity measures of the CROBEX index, liquid and illiquid portfolio, respectively.

	E(R)	S.D.	S	K	JB
CROBEX					
$P_{M,t}$	3.46	0.17	-0.03	1.78	65.89
$R_{M,t}$	-0.00	0.01	-0.10	12.35	3841
$PP_{M,t}$	0.07	0.08	2.06	8.58	2116
$TO_{M,t}$	1398199	2012863	21.54	601.93	15865428
Liquid					
$R_{p,t}$	0.00	0.01	-1.23	24.78	21120
$PP_{p,t}$	0.01	0.03	4.11	29.38	33580
$TO_{p,t}$	1523328	2352009	20.81	570.82	14262392
Illiquid					
$R_{p,t}$	-0.00	0.01	-1.60	17.37	9525
$PP_{p,t}$	0.82	0.21	-1.27	4.11	339
$TO_{p,t}$	33929	80629	8.18	94.37	379124

Source: Author's estimation.

Notes: $P_{M,t} = logCROBEX$; $R_{M,t} = dlog(CROBEX)$; $PP_{M,t} = PP\_CROBEX$; $TO_{M,t} = TO\_CROBEX$; $R_{p,t}$ is return of liquid or illiquid portfolio, $PP_{p,t}$ is illiquidity measure of liquid or illiquid portfolio, $TO_{p,t}$ is turnover of liquid or

illiquid portfolio. E(R)= the mean value; S.D.= Standrad Deviation; S=the coefficient of skewness; K=the coefficient of kurtosis; JB= the Jarque-Bera test.

LIKVIDNOST HRVATSKOG TRŽIŠTA DIONICA: EMPIRIJSKA ANALIZA
Sažetak

Ovaj rad analizira likvidnost Hrvatskog tržišta dionica. Nizak nivo likvidnosti je jedan od ključnih problema s kojima se suočava ovo malo tržište. Kao mjere likvidnosti koristili smo nultu stopu prinosa Lesmonda, Ogdena i Trzcinke (1999), cjenovni pritisak netrgovanja kao kod Bekaerta, Harveyja i Lundblada (2007) te Promet. Za izračun nulte stope prinosa i mjera cjenovnog pritiska korištene su sve dionice prisutne na Zagrebačkoj Burzi u periodu od 2005. do 2009. Rezultati pokazuju da je nivo likvidnosti hrvatskog tržišta vrlo nizak. Na ovom je tržištu najmanje nelikvidna godina bila 2007. (godina prije krize) a najnelikvidnija godina bila je 2009. Pokazali smo da je nelikvidnost stalno prisutna na ovom tržištu. Ponuđene su prve mjere korelacije između svih mjera nelikvidnosti. Posebno se pažnja usmjerila na dokazivanje da je hrvatsko tržište manje nelikvidno od srpskog.

Ključne riječi: rubno tržište, (ne)likvidnost, Hrvatska, nulta stopa prinosa (ZR), cjenovni pritisak (PP), promet (TO).

FIRM VALUATION - NEW METHODOLOGICAL APPROACH

Ivo Šperanda*

Keywords: valuation; value; DCF; CCF; method; investment; financial statement
JEL:

Abstract

Valuating theory and practice recognize numerous methods of firm valuation, but one of the most frequent one is DCF method of valuation. Mentioned method is based upon two essential attributes: recognizing time value of money and calculating firm value as a sum of presumptive future net incomes discounted by the discretionary hurdle rate. On the opposite, the CCF (Compounded Cash Flow) method is based upon historical Financial Statements and historical data as well as reliable and publicly published data used for revising certain data in Balance Sheets and P&Ls and deflating the Cash Flow. This method, basically leaned on real and actual data, assures valuation much more reliable and positive.

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1   Introduction

Firm valuation in international business has been one of the crucial issues of microeconomic financial analysis for few decades. It doesn't only imply valuating certain firms but different investments as well.

Considering frequent usage of this term it is necessary to clearly define it. The statement in B. Graham's capital work "The Intelligent Investor" – *An investment operation is one which, upon thorough analysis, promises safety of principal and an adequate return* - (Graham, 2006, 27) would be the most appropriate, according to the author of this paper.

The most common method of valuation is certainly the DCF (**D**iscounted **C**ash **F**low) with all its numerous variants. The main feature of this dynamic method is using the concept of time value of money and basing the final value on present value of future cash flows.

Other common methods (accounting, enterprise multiple and similar ones) are so called static methods and are mainly used as supplement or control of DCF method.

The main disadvantage of the DCF method, which has been seriously criticized for the last few years, is that it relies on the future business events and cash flows forecasts which are based on historical data and certain assumptions. CCF method (**C**ompounded **C**ash **F**low) uses new methodology approach by using historical data of firm's balance sheet which is evaluated in certain period of time. Balance sheet information are adjusted according to reliable and available information (inflation rate, market price and similar), supposing the concept business as usual.

In other words, DCF method is based on the future income projection decreased for arbitrary discount rate. Since CCF is a posteriori method and operates with historical data, those data are not discounted but moreover, they are compounded at the most logical rate, Internal Rate of Return and at its variants.

This paper brings all advantages of the CCF method by which certain disadvantages of other valuation methods (such as quality of entry parameters and

their manipulation) are eliminated. Theoretically, this paper demonstrates the CCF as a model-based procedure, while in practice it serves well for valuation of investments in different business actions.

2   SHORT OVERVIEW OF MOST COMMONLY USED VALUATION METHODS

Three firm value methods, each based on the specific problem approach, have lately distinguished in business practice.

Accounting or Cost Based Method is considered the easiest to apply and is based on firm's balance sheet which is valuated along with additional modifications of assets and liquidation costs liabilities (asset sale costs, debts collection, obligations towards the employees, providers, depreciation adjustments and similar). Balance sheet is examined and adjusted to the actual situation, as International accounting standards imply.

Firms with greater physical assets, i.e. capital intensive (factories, hotels and similar) are more protected when using this method, i.e. are more valuable than firms having so called intangible assets, meaning non-material assets.

After the valuation and revision of all accounting entries, all liabilities are deducted from total assets and book value is gained.

$$TotalAssets - TotalLiabilities = Firm\prime sNetValue \tag{1}$$

Thus calculated firm value very often represents the lowest value under which a firm should not be sold.

The advantages of this method are simplicity, speed, transparency, foundation on balance sheet information, and the convenience to evaluate those firms which have just started doing business, i.e. are in the early development phase.

The disadvantage of the method is that it is very static. The valuation is performed on a specific date without considering prior business events or

business potentials. In other words, only the firm's asset is evaluated and not firm's business and its possible effects.

Market Method or Enterprise Multiple is very popular method due to its simplicity. P/E (**P**rice / **E**arnings Ratio) is simply multiplied by firm's earnings. This method is based on the assumption that it is possible to find firms whose shares are listed on the stock market and that are similar to firm which is being evaluated, and to determine adequate multipliers for certain firm, bearing in mind the differences between the comparable firm and the one being evaluated. Besides simple and fast value calculation, other advantages would be the simple presentation of gained values and finally the fact that they reflect current market situation. However, the flaws or this value method outnumber its advantages, the main flaw being over simplifying and neglecting key indicators of every firm's business (sources and generators of income, expenditure and profit). Such calculated value (regardless to multipliers type) is approximate and very often gives wrong valuation and enables at the same time information manipulation.

DCF (_Discounted Cash Flow_) or Income Value Approach[1] is basic valuation model which calculates discounted future values of expected cash flows; calculated as

$$DCF = \sum_{t=1}^{n} CF_t \left[\frac{1}{(1+k)} \right]^t \tag{2}$$

Where:

DCF = discounted cash flow

CFt = cash flow for the year t

k = discount rate

n = number of periods

In difference to models of multipliers, Discounted Cash Flow method is based on the firm's business. During valuation it is important to consider basic firm's characteristics and, at the same time to understand type of business. Finally, this method evaluates business, and not only the assets.

The possibility to manipulate entry information is rather big (and present), even with concrete entry information and parameters. The valuation is based upon the projected sizes founded on historical information and discounted at

rather arbitrary discount rate, especially in Croatia where correct rate calculation of return according to CAPM (**C**apital **A**sset **P**ricing **M**odel) is very doubtful.[2]

This model determines an expected return rate E(R) at certain asset as a function of included risks.

$$E\left(R\right) = RFR + \left(ERP \cdot \beta\right) + \alpha \qquad (3)$$

Where:

E(R) = expected rate of return

RFR = risk free investment return

ERP = estimated market return

β = measure of market volatility (systematic risk)

α = firm's volatility (unsystematic risk)

3   SHORT OVERVIEW OF MOST COMMONLY USED VALUATION METHODS

Valuation concept i.e. different methodology approach to firm valuation which this works suggests and describes in short, is based on the DCF valuation concept, simultaneously aiming at eliminating the disadvantages of the method, firstly the possibility of manipulating with entry information for valuation (income, expenditure, profit and similar) and manipulating with arbitrary (regardless to skillfully disguised complicated math formulas) determination of discounted rate. By looking at the relation number 3, it is evident that the costs of owner's equity or discounted rate are composed of rate of return to *risk free* (although such literally doesn't exist) asset which itself is composed of inflation rate and real rate of return. In AAA credit rating countries (USA, Great Britain, France...), T-Bonds have risk-free rate of return. In other countries with lower credit rating (Honduras, Bulgaria, Croatia and similar), T-bonds

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[2]Since CAMP and WACC are widely used methods for determining discount rate, and volatility and industrial branches of the firm (β and α) are needed for calculation, which has been impossible in Croatia so far.

have Country Risk Premium which must be considered as well. In the table number 1, there is a comparable overview of certain countries, including Croatia (Baa3).

TABLE 1: Certain Countries Rating Overview

Country	Long-Term Rating	Typical Interest Rate	Country Risk Premium
United States	Aaa	6.10%	0.00%
Andorra	Aa2	6.75%	0.65%
Argentina	Ba3	10.10%	4.00%
Australia	Aa2	6.75%	0.65%
Austria	Aaa	6.10%	0.00%
Belgium	Aaa	6.10%	0.00%
Belize	Ba2	9.10%	3.00%
Bolivia	B1	10.60%	4.50%
Brazil	B2	11.60%	5.50%
Bulgaria	B2	11.60%	5.50%
Canada	Aa2	6.75%	0.65%
Chile	Baa1	7.30%	1.20%
China	A3	7.05%	0.95%
Colombia	Baa3	7.55%	1.45%
Costa Rica	Ba1	8.60%	2.50%
Croatia	Baa3	7.55%	1.45%
Cyprus	A2	7.00%	0.90%
Czech Republic	Baa1	7.30%	1.20%
Denmark	Aa1	6.70%	0.60%
Dominican Republic	B1	10.60%	4.50%
Ecuador	B3	12.60%	6.50%
Estonia	Baa1	7.30%	1.20%
Finland	Aaa	6.10%	0.00%
France	Aaa	6.10%	0.00%
Germany	Aaa	6.10%	0.00%
Greece	Baa1	7.30%	1.20%
Guatemala	Ba2	9.10%	3.00%
Guernsey	Aaa	6.10%	0.00%
Honduras	B2	11.60%	5.50%
Hong Kong	A3	7.05%	0.95%
Hungary	Baa2	7.40%	1.30%
Iceland	Aa3	6.80%	0.70%
Liechtenstein	Aaa	6.10%	0.00%
Lithuania	Ba1	8.60%	2.50%
Luxembourg	Aaa	6.10%	0.00%
Slovenia	A3	7.05%	0.95%

Source: www.sjsu.edu/faculty/watkins/countryrisk.htm

Ivo Speranda - FIRM VALUATION - NEW METHODOLOGICAL APPROACH

Abbreviation ERP stands for extra return; it is actually the rate that certain investor demands in order to invest into stocks and not in T-bonds, enlarged for systematic risk (ß) of firm's economic sector. Finally, there is ? representing the risk measure (volatility) of certain firm. So, future profits, resulting from the cost / income difference and based on firm's business plans for the next 3, 5, 10 years (being the plans made by the very management of the firm) are discounted by the rate (gained by the previously described procedure). The investor is now buying firm's value, along with presumptive future profits on which the valuation was based.

The concept of the new approach (method):

1. (a)   i. A. Usage of historically (relatively) reliable information from the firm's financial documents in certain past period of time (n=3, 5, 10, 15... years).

2. Income and similar categories from the financial statements are discounted to present value at the rate equal to internal rate of return (IRR) of the firm realized in the observed period of time (Fig. 1).

3. All information are previously deflated by using official inflation rates (provided by the Croatian National Bank, Croatian Bureau of Statistics or similar sources).

4. *Business as usual* is starting point, and so called *residual value* is not taken into account.

It is completely clear that the concept is based on actual, logical and easily available information, making this model reliable in terms of evaluation.

FIGURE: 1 Compounted Flow
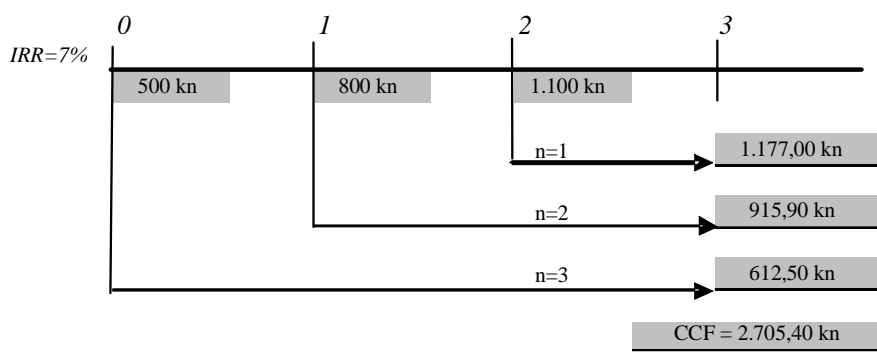
Source: Vidučić Lj.:"Financijski menadžment "(II edition)- RRIF Zagreb,2001. p.41.

TABLE 2. Inflation Rates in Croatia

Year	Inflation rate
1997	2.50%
1998	5.20%
1999	2.80%
2000	3.30%
2001	1.40%
2002	1.10%
2003	1.10%
2004	2.30%
2005	2.90%
2006	2.40%
2007	4.70%
2008	4.50%
2009	0.30%

Source: www.hnb.hr/public/prezent/spf-cro-ppt

Mathematical illustration of the proposed model is[3]:

$$CCF = \sum_{t=1}^{n} CF_t \left(1 + k\right)^{n-t} \tag{4}$$

Where:

CCF = compounded cash flows

CFt = cash flow in the year t

k = internal rate of return, i.e. real rate of return

n = number of periods

   In this model, CCF equals the firm's value obtained as a sum of historical, revised cash flow income, gross income and similar categories in „n" periods and compounded at the IRR in final observed period. Appraisal's choice of category (profit, gross profit, FCF, EBIT, NOPAT...) differs from case to case provided that thorough explanation about chosen category is given.

   Proposed average compound rate is IRR which should be spread to so-called TRR (**T**rue **R**ate of **R**eturn) as it contains calculated reinvestment rate.[4]

   It is in fact often considered that the net profit, for the given period of time, is reinvested at rate defined by the discount rate. This assumption naturally does not need to be true and the reinvestment rate can be different from the discount rate.

   As initial investment is required for the TRR calculation, when evaluating firm's business it is advisable to use firm's capital value, i.e. shareholder's equity; relation of TRR is hence calculated:

$$TRR = \sqrt[n]{\frac{\sum \left(CF\right) \cdot \left(1 + rR\right)^{n-i}}{\sum Ki \left(1 + r\right)^{-i}}} - 1 \tag{5}$$

Where:

TRR = true rate of return

rR = reinvestment rate

Ki = investment (capital)

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[3] Designation of the CCF model (Compounded Cash Flow) is determined by the analogy of the DCF (Discounted Cash Flow)

[4] Consult : Nušinović M.: "Planiranje investicijskih projekata u funkciji optimizacije društveno-ekonomskog razvoja "-Ekonomski institut-Zagreb, 1989. pp.144-146.

n = number of periods

r = discount rate

When determining IRR, the problem of multiple internal rate of return might appear. There are many approaches and possibilities of resolving such a problem.[5]

4   COMPARABLE EVALUATIONS

By one concrete example comparable evaluations will demonstrate the advantages of the proposed concept (and obstacles of classic DCF model) and a calculation of CCF.

An example[6] of accounting or cost-based method calculation would be as follows in the table 3.

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[5] Consult :Martić Lj.:" Kvantitativne metode za financijske i računovodstvene analize"- Informator, Zagreb,1980. pp.25-28. ; also see: www.stern.nyu.edu/-adamodar/pc/cf2Eil

[6] Information for this example was taken from the real industrial firm valuation from 1999.

TABLE 3 : Book Value as of December 31st, 1998

No.	Description	Revised amount (kn)
	ASSETS	
	Long term assets	
1	Land and forests	2.406.346
2	Buildings	25.791.243
3	Plant and equipment	6.701.847
4	Physical assets in preparation	5.305.702
5	Total	40.205.138
	Provisions	
6	Raw and other materials	5.242.781
7	Work in progress	956.572
8	Finished goods	9.987.130
9	Advance payments	86.148
	Total	16.272.631
	Receivables	
10	Trade receivables	6.732.527
11	Receivables from employees	14.272
12	Receivables from government institutions	207.991
13	Other receivables	321.294
	Total	7.276.084
	Financial assets	
14	Securities	197.078
15	Cash in bank and on hand	4.210.481
	Total	4.407.559
A	**TOTAL ASSETS VALUE**	**68.161.412**
16	Lease liabilities	2.971.257
17	Liabilities for advances, deposits and guarantees	7.922
18	Trade payables	2.460.067
19	Liabilities toward employees	628.012
20	Liabilities for taxes, contributions and similar	442.285
21	Liabilities based on share in result	742.133
22	Other current liabilities	112.848
23	Accrued payment of expenses	213.940
B	**TOTAL LIABILITIES**	**7.578.464**
C	**FIRM'S BOOK VALUE (A-B)**	**60.582.948**

Source: Authors calculation

Book value is obtained by having used the relation (1), as shown in the table 3.

Market method, i.e. evaluation method based on usage of multipliers will be left out in this work for two reasons: this method has a controlling character

due to its approximation and short horizon. Since this concrete case was dealing with the Croatian firm, it was not possible to find adequate multipliers for valid valuation.

For the DCF evaluation method it is necessary to calculate the Profit and Loss Account for the period of five years.

TABLE 4: Profit and Loss Account for the Period of 1999. – 2003.

Item / Year	1999.	2000.	2001.	2002.	2003.
1.Income	27.295.843	25.564.036	23.092.919	21.651.046	20.849.101
2. Operating cost (2.1.+2.2.)	33.249.027	32.457.375	31.297.823	30.763.988	30.394.678
2.1. Production costs (2.1.1.2.1.3.)	33.249.027	32.457.375	31.297.823	30.763.988	30.394.678
2.1.1. Material costs	18.242.720	17.451.067	16.291.515	15.757.680	15.388.370
2.1.2. Depreciation	3.282.869	3.282.869	3.282.869	3.282.869	3.282.869
2.1.3. Gross salaries	11.723.439	11.723.439	11.723.439	11.723.439	11.723.439
2.2. Financial expenses	-	-	-	-	-
3. Gross profit/loss (1.- 2.)	5.953.184	6.893.338	8.204.904	9.112.942	9.905.577
4. Tax	-	-	-	-	-
5. Net profit (3.-4.)	-	-	-	-	-
5.1. Reserves	-	-	-	-	-
5.2. Share for owners in net profit	-	-	-	-	-
5.3. Retained profit	-	-	-	-	-

Source: Authors calculation

An insight into Profit and Loss Account shows that the income in the valuation period does not cover for the business costs, so there is loss in business for all years ranging from 5.953.184 kn to 9.905.577 kn for the last valuation period. Such a big loss is firstly the result of big material business costs and big amounts of gross salaries. While material costs are variable and their amounts decrease as the production volume decreases, gross salaries are fixed and represent constant burden for smaller production volume. Rather intense production and engagement of large number of workers are one of the causes of big gross salaries costs. From information from Profit & Loss Account it can be concluded that business is in deficit during the entire valuation period, and that the coun-

try does not levy taxes and the owners cannot expect share of profit. Coverage for loss is impossible with this kind of production volume as it is realized in all years with a tendency to increase in future. Next methodological step in DCF valuation is creating a *Cash Flow* which represents specific financial statement on future business by which the effect of all engaged firm's resources is measured. Namely, the firm disposes of all working and non – working capital and uses them to realize planned impacts.

TABLE 5: Cash Flow for the Period 1999 – 2003

Item / Year	1999.	2000.	2001.	2002.	2003.
I Income	35,140.536	25,564.036	23,092.919	21,651.046	85,218.000
1. Total income	27.295.843	25,564.036	23,092.919	21,651.046	20,489.101
2. Existing receivables	5,298.213	-	-	-	-
3. Active money	2,546.480	-	-	-	-
4. Residual value	-	-	-	-	64,730.037
4.1. Capital assets	-	-	-	-	45,590.604
4.2. Working capital	-	-	-	-	19,139.433
4.3. Reserves	-	-	-	-	-
II Expenditures	33,956.655	29,174.506	28,014.954	27,481.119	27,111.809
5. Current liabilities	3,990.496	-	-	-	-
6. Material costs	18,242.720	17,451.067	16,291.515	15,757.680	15,388.370
7. Gross salaries	11,723.439	11,723.439	11,723.439	11,723.439	11,723.439
8. Financial costs	-	-	-	-	-
9. Tax	-	-	-	-	-
10. Reserves	-	-	-	-	-
11. Owners' share in net profit	-	-	-	-	-
III Net income	1,183.881	3,610.470	4,922.035	5,830.073	58,106.191
IV Discounted factors (p=12%)	1,00	0,8929	0,7972	0,7118	0,6355
V Discounted value NP^n	1,183.881	3,223.789	3,923.846	4,149.846	36,926.484
VI Present value	**24,445.122**				

Source: Authors calculation

Cash flow contains income, expenditures and net income. All items that increase economic potential of a firm in valuation period - total income, current and long-term receivables, existing money and residual value of firm - make an income. Since the discounted rate (p) of 12 % was an average cost of the capital in the Croatian banking system at the time (1998 / 1999) and, taking into account an alternative use of capital, this average rate was taken as discount

rate. By using relation (2) we got the firm's value as shown in the table 5.

Despite the fact that the evaluated firm will realize more than 40 million kuna of gross loss of nominal value in the next five years, according to information from P & L projection (Table 4), and despite relatively high discount rate, by applying DCF method and due to very high value of evaluated *residual value of assets* at the end of the fifth year of the observed period, for whose discounted value was increased a sum of discounted cash flows (Table 5), we get the present firm's value amounting 24,4 million kuna. Thus the firm which continually achieves negative business results, according to projections based on business flow, gains positive value when DCF method is applied. To simplify, let us assume that information from previous tables do not represent projections but the historical data from already realized business years and adjusted for inflation rates (Table 2). This assumption will enable the demonstration of new suggested CCF method and it will operate with identical sizes in order to compare the results of applied valuation methods more reliably. The only difference from the information in the table 5 will be elimination of residual value evaluation in 2003 amounting 64.368.899 kuna.

TABLE 6: Cash Flow 2

Item / Year	1999.	2000.	2001.	2002.	2003.
I Income	35,140.536	25,564.036	23,092.919	21,651.046	20,489.101
1. Total income	27.295.843	25,564.036	23,092.919	21,651.046	20,489.101
2. Existing receivables	5,298.213	-	-	-	-
3. Active money	2,546.480	-	-	-	-
4. Residual value	-	-	-	-	-
4.1. Capital assets	-	-	-	-	-
4.2. Working capital	-	-	-	-	-
4.3. Reserves	-	-	-	-	-
II Expenditures	33,956.655	29,174.506	28,014.954	27,481.119	27,111.809
5. Current liabilities	3,990.496	-	-	-	-
6. Material costs	18,242.720	17,451.067	16,291.515	15,757.680	15,388.370
7. Gross salaries	11,723.439	11,723.439	11,723.439	11,723.439	11,723.439
8. Financial costs	-	-	-	-	-
9. Tax	-	-	-	-	-
10. Reserves	-	-	-	-	-
11. Owners' share in net profit	-	-	-	-	-
III Net income	1,183.881	3,610.470	4,922.035	5,830.073	6,.262708
IV Compounding factors. (p=12%)	1,5735	1,4049	1,2544	1,1200	1,0000
V Value (NP^n)	1,862.860	5,072.450	6,262.009	6,529.682	6,262.708
VI Present value II	**19,727.001**				

Source: Authors calculation

By applying the CCF method in accordance to the relation (**??**) with supposed discounted rate of 12% which is not equal to realized IRR (as it is meaningless to calculate it due to the negative net income), present value is expectedly negative.

Here is information interpretation and the result obtained from the Table 6: by applying the CCF, net income was compounded in the period of five years (1999 – 2003) on "future" value regardless the negative results, i.e. losses. The sum of such net income represents present value (SvII) which is an expression

of true and not projected economic potential of the firm. In this case it is a sum of business losses (Sv II = -19,7 mil) meaning that the firm accumulated in five-year period such a sum of losses expressed in present value. In other words it is a "negative firm value". So, in difference to results obtained by DCF valuation method which demonstrates that firm is 24,4 million worth (Sv = 24,4 mil), the result of CCF method suggests completely opposite conclusion. In the CCF, information obtained from five-year Profit & Loss Account are treated as realized results, and the final calculated value shows that the firm is not worth buying unless a new owner intends to invest in necessary reconstruction and reorganization, which is by far some other issue.

Syntagma "negative firm value" must not be confused with the negative price, and falsely concluded that the seller would have to pay the buyer for the firm. "Negative value" simply means that the valuated firm accumulated financial losses in the observed period. It does not mean that the firm has no potential[7] which can be reflected on the price, moreover, it means that the method is based on realized results and not possible results whose realization demands certain organizational, human, investing and similar interventions. So, the CCF method considers the realized results on which it bases the value, and the price is completely other category subjected to different parameters and it does not need to correlate with the value. Anyway, the price (of certain thing) can at certain period of time be above or below the value (of that certain thing), so we can talk about overrating or underrating. The firm which realizes negative results in the observed period might have negative value (not price), as the price is the amount that the buyer is ready to pay and seller to accept. This paper deals with the issue of determining the value of certain business (firm).

Another characteristic of the CCF is that it does not calculate residual value because the method is based upon realized results, i.e. business effects which represent the base to value determination. Besides, "residual value" is the result

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[7] The term „potentials" means "the unused option" and thus defined:

e(max)-e(p)=I(p), where potential, measured by the degree of business efficiency, is equal to difference of maximal and obtained degree of efficiency. For different definition of the term "potential" and "economy potential", consult: Dragičević A.: "Ekonomski leksikon"-Informator Zgb. 1991; pp.163. and pp. 569. also see: www.thefreedictionary.com/economic+potential

of balance sheet i.e. static valuation, thus having more the characteristic of liquidation value of firm's assets. Since the CCF values financial results realized in a certain period of time and it indirectly measures firm's potential, it would be wrong to correct such a value for residual value, methodologically speaking. Previous practical example nicely demonstrates the impact of the calculated residual value on the estimated value. It is completely clear that the CCF indicates to the fact that the firm is completely inefficient and that only the physical assets has liquidation value. So, the firm is seriously threatened by the possible production break or reorientation of its business which demands new investments, which is the subject of some new analysis and valuation.

5   INSTEAD OF CONCLUSION: WHY THE CCF (Compounded Cash Flow)?

The relation between the CCF valuation method of certain firm (business) and rather notorious DCF method can be clearly illustrated as in Fig. 2.
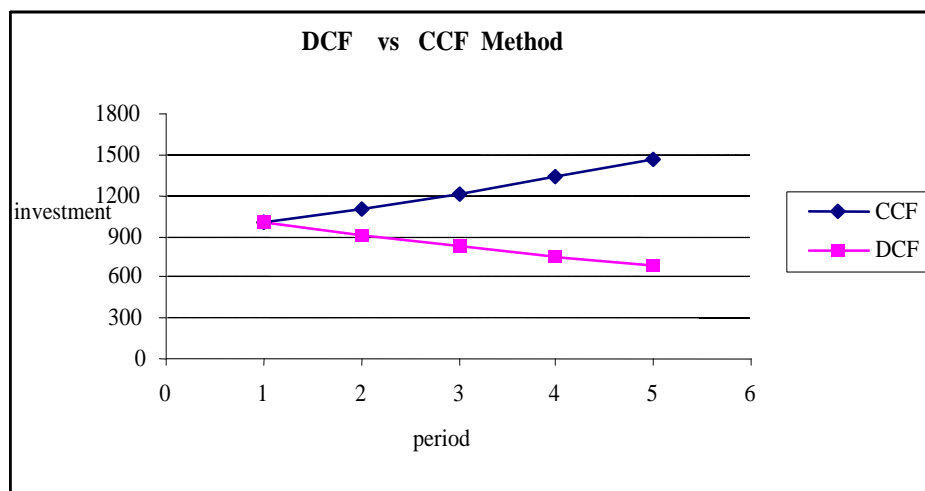

FIGURE. 2: Graphic Illustration of DCF and CCF Methods
Source: Authors calculation

Two sides of one medal, compounding and discounting, when observed from mathematical point of view, are related by number of periods and interest rates, i.e. discounted rates. Observing the problem in the means of functions, the mentioned methods which are based on discounting, i.e. compounded are inverse functions.

Operating with historical and real information obtained from the firm's financial statements which reflect business events, in difference to using projections of the statement which are more or less subjected to different manipulations would be the biggest advantage of CCF method. Besides, as the method relies on historical database, the adjustments of those information (deflation, determination of market values of balance sheet items) are considered more reliable, being known and publicly available (information on inflation rates, market prices and similar). The compounding rate in this method is IRR (Internal Rate of Return), i.e. TRR (**T**rue **R**ate of **R**eturn), actually the average rate at which the invested money in certain business (investment) is compounded, and in this case the firm's valuation is observed as valuation of possible investment into some business (firm). So, the CCF method evaluates real business results and those firms with better financial results within longer period are much more highly ranked. Thus, when using the CCF it is recommendable to consider longer period of time and the length depends on an individual valuation and firm. Anyway, there is no unique valuation method which can be equally valuable in all valuation cases. Basic advantages of CCF method are: reliability, accuracy, confidentiality of information, basing the firm's present value on realized business effects, looking at the realized effects as the results of material, organizational, human and other factors. Withal, this method corresponds very well with EVA (**E**conomic **V**alue **A**dded) as a metric of economic profit, i.e. firm's success and worthiness, and is defined like this:

$$EVA = EBIT \ (Profit \ Prior \ to \ Interest \ Rate \ and \ Tax \ Deduction) - Cost \ of \ Capital \tag{6}$$

It is clear that proposed CCF method is actually dynamized ($\sum CF$, i.e. $\sum EBIT$) and somewhat adapted IRR, i.e. TRR instead of cost of capital, i.e. WACC.

It has already been emphasized that CCF valuation method does not consider residual value at the end of the observed period because this method measures firm's business potential (investment) with assumption business as usual. Introducing assets value or "residual value" would suppose certain methodological and conceptual confusion. Finally, in difference to CCF method, the DCF belongs to the part of economic models which are based upon projections, i.e. certain assumed relations in future. All obstacles, limitations and possible consequences of mistakes of such models and their procedures are elaborated in research work "Economic Methodology" by S. C. Dow. [8]

This work does not suggest elimination of former method(s), on the contrary, it suggests a new one as alternative or corrective.

This method, just like the others, has its advantages and limitations and it is very important to know when and how to use it: CCF is appropriate for firm's valuation from the potential buyer's point of view. Why? As it has already been shown and explained in the Fig. 2, the CCF represents inverse method of DCF. Namely, DCF is based on business plan, on possible future business and other accomplishments and values which are then discounted and thus given present value. In other words, future business events are "brought" into present. The CCF uses past, accomplished events and seizes that are easy to examine and revise. Such values reflect real firm's (business) potentials, moreover, they can be adjusted and made more real because we are familiar with past parameters (such as inflation rate and similar). Those sizes are then compounded and reduced to present value. That is why this valuation method could be called "regressive dynamic method". So, instead of travelling to future (and who can say for sure what will happen?), the CCF recommends travelling to familiar past.

The basic question (for buyers) is: do I buy the firm (business) basing on what it has been doing so far or basing on the assumptions what and how it will do business in future? What gives more realistic picture?

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[8] Dow S.C.: „Ekonomska metodologija" – Politička kultura, Zagreb, 2005. Author is dealing with the problem in details in the chapter 4 (pp.45 – 58); on reliability of forecasts of firm's business in the means of contemporary technological changes. Consult: The Economist, Feb.12-18, 2011,pp.11;69-71.

To resume, as previously illustrated in Fig. 1, CCF gives present values by compounding realized sizes, just like bank investment, while DCF gives present values of more or less based promises.

The question: which method suits the buyer more, and which one the seller?

By using efficient combination of both methods, and starting from defining the term "potential" as it is defined in note number 7, the value of firm's (business) potential could be achieved because CFF measures realized efficacy, while DCF measures future maximal business potentials.[9]

The intention is to offer appraisals another helpful method, another possibility to consider the problem of determining value of certain firm, business and investment. The corrective role of the CCF method should be specially emphasized because appraisals would be "forced" to thoroughly explain possible big discrepancy between the results of the DCF and CCF for the same firm (business) and it should slightly eliminate insider information. The basic concept of the CCF is coherent to investment philosophy of B. Graham and W.Buffett (and similar investors)[10] who were, and W.Buffett still is, advocates of basic and reliable fundamental analysis of each investment, i.e. purchase, whether those are securities, concrete firm or real estate.

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[9] It is interesting that very often in their business plans, firms plan significant improvements in business, production, placement, efficiency and similar. Comparing them with their financial statements of the previous period, you get the impression it is not the same firm.

[10] Consult: Graham B.: „Inteligentni investitor"- Masmedia, Zagreb, 2006 ; also consult: Hagstrom R.G.: „Buffettova načela"- Katarina Zrinski d.o.o., Varaždin, 2008.; also: Jain P.C.: „Buffett Beyond Value"- Wiley Inc., N.J. USA, 2010.

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PROCJENA TVRTKE – NOVI METODOLOŠKI PRISTUP
Sažetak

Procjenu vrijednosti nekog poduzeća moguće je odrediti na više načina, a najčešća metoda je metoda diskontiranih novčanih tokova (DCF).Spomenuta metoda ima dvije osnovne karakteristike: vodi računa o vremenskoj preferenciji novca i promatra vrijednost poduzeća (posla) kao zbir mogućih budućih neto prihoda.Dakle,sadašnju vrijednost ova metoda temelji na eventualnim budućim neto prihodima diskontiranim po diskrecijskoj diskontnoj stopi. Nasuprot tome, u ovom radu opisana CCF (Compounded Cash Flow) metoda procjene se bazira na povijesnim podacima iz financijskih izvješća i na poznatim i javno dostupnim parametrima za ispravke bilančnih stavki i deflacioniranje novčanih tijekova. Na taj način se postiže pouzdanija i vjerodostojnija procjena vrijednosti poduzeća koja se temelji na realnim vrijednostima.

Ključne riječi: procjena ; vrijednost; DCF, CCF; metoda, ulaganje; financijska izvješća

Ivo Speranda - FIRM VALUATION - NEW METHODOLOGICAL APPROACH

ACCOUNTING PRACTICES IN ITALIAN HIGHER EDUCATION SYSTEM

Carlotta del Sordo*   Rebecca L. Orelli†

Emanuele Padovani‡

Abstract

The aim of this paper is to investigate whether the accounting systems and techniques in use in higher education system in Italy allow key users to have useful information for a rational decision-making process. The paper develops on a specific case, the Italian context of state and non-state universities. The research is conducted through a survey addressed to all Italian universities and investigates accounting conditions during the academic year 2008-2009. It reveals the most common approach to the building of the accounting information system and the level of diffusion and development of cost accounting techniques, identifying areas of improvement.

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1   INTRODUCTION

The Higher Education System (HES) is a community of people carrying out their institutional goals: education through teaching activities and discovery/ innovation through research activities. These are the academic priorities that every university is committed to pursuing. The main purposes of the higher education sector are to advance knowledge and understanding through scholarship and research and to contribute to an economically successful and culturally diverse nation. Universities are supposed to play a central role in the economic and social development process so they have to be accountable to their stakeholders and to clearly communicate how they have managed the public resources.

In Italy, the government has been slow to initiate reforms, but has more recently (since 1989) introduced significant changes in higher education sector determining resources flowing from central government, which contributed to the budgetary devolution, for increasing their autonomy in deciding teaching programmes and accounting and reporting systems. The increased autonomy and the decentralisation of several decisions have indeed given new opportunities to universities, but at the same time it has posed challenges to their management and academic boards, highlighting many difficulties in defining and developing their strategies.

The paper focuses on the role of the accounting and reporting systems in the public sector tertiary education institutions in the Italian context; particularly we put our attention on how accounting information is interpreted and used by key decisions makers in these organizations. The aim of this work is to ascertain whether the accounting information system of state universities is able to support decisions, in a context of rapid and constant transformation. In this vein the research question is the following: *Does the accounting system and cost accounting techniques of universities allow users to have all the information for a rational decision process?*

This aim is pursued through the development of five sections. The theoretical framework is outlined trough the review of the NPM literature; the idea of university has undergone significant changes in recent years (par. 2). Looking

over the Italian normative and environmental perspective, particular attention will be paid to those laws and pressures that had a considerable impact on the information needs of such institutions, due to their implication for autonomy, evaluation and planning of the activities (parr. 3.1, 3.2). The mixed effect of both administrative reform and external forces has lead to a new accounting system (par. 3.3). Having clarified the peculiarities of this context, it will be investigated the Italian accounting systems and cost accounting techniques in use in HES. In particular, the paper provides the results of a survey conducted on university, aimed at assessing the actual implementation of the reform (parr. 4, 5)[1].

2   LITERATURE REVIEW

Since 1990 HEShas been going through a deep revision, together with other areas of public administration. Thus, over the last two decades, public sector reforms have been adopted in many countries. The public sector reforms have given accounting a central role (Hood, 2000, 2005) and many of these reforms show a number of characteristics often summarized in terms of New Public Management (NPM) (Hood, 1991, Osborne and Gaebler, 1992). An accounting dimension is regularly included in public sector reforms (Pollit and Bouckaert, 2004), and that is the reason for the significant volume of research that has been conducted in the field of public sector accounting, widely discussed and described for many countries (OECD, 1997; Pallot, 1999; Pollitt, 2002; Jackson and Lapsley, 2003; Van Helden and Jansen, 2003; Carlin, 2005; Chia and Koh, 2007; Christiaens and Van Peteghem, 2007).

The modernization of the academic system is mainly oriented to make the financial statement more comprehensive and accountable. Further, the academy accounting reform is also linked to the resource allocation system (Spathis and Ananiadis, 2004; Coy and Pratt, 1998), which is related to the performance

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[1] Paragraphs 1, 2 and 3.1 are to be attributed to Emanuele Padovani, paragraphs 3.2, 3.3 and 4 are to be attributed to Rebecca L. Orelli and paragraphs 5 and 6 are to be attributed to Carlotta del Sordo.

measurement and monitoring process.

In each of the countries where NPM was introduced, a different policy was followed to obtain an efficient and effective organization using private sector-style management instruments (Olson et al., 2001).

As a consequence, universities are not only considered as social institutions, but also as "firms" to which certain logic and rules apply, typical of the managerial culture in the private sector, such as the well-known principles of efficiency, effectiveness and accountability. Most financial guidance to universities (Mitchell, 1996) emphasizes the need for private sector accounting techniques and rational costing of courses, departments and other programmes, supporting the use of techniques, such as responsibility accounting, ABC (activity based costing), etc. The underlying logic is that without these NPM-like accounting techniques, it is not possible to appropriately support decisions (Olson et al, 2005).

Accounting reforms were often a first phase of reforming governments, followed by the reform of governmental management, organization, and other parts of public administration. On the other hand, it is possible that accounting reforms have taken place without having a strict NPM perspective in mind (Luder and Jones, 2003), but the accounting reform is an important condition for the success of NPM reforms, because it can be seen as a key ingredient in managerial decision-making process (Pettersen, 2001).

A considerable number of studies have explored accounting changes in the public sector reform (Boston et al., 1996; Hood, 1998). In many of these changes, management techniques were introduced to many public sector organizations. In particular, public universities are facing increasing pressure to be accountable and report performance (Arnaboldi and Azzone, 2004; Christiaens and Wielemaker, 2003; Doost, 1998; Pursglove and Simpson, 2007; Venieris and Cohen, 2004; Welsh and Dey, 2002) to fund agencies, students and the general public. To date, there has been very little research on the type, scope or impact of these performance measurement and reporting activities. Given the importance of the topic (Cullen et al., 2003; Lapsley and Miller, 2004; Parker and Guthrie, 2005; Pounder, 1999), there appears to be an urgent need to begin examining such performance and social reporting (Farneti and Guthrie, 2008; Herremans

and Allwright, 2000; Gray, 1995).

In many European countries the reforming process affected higher education, with different path and time, however, sharing some common characteristics (OECD, 2003; OECD, 2006) more emphasis on universities' autonomy, both in academic and management issues; the use of financial models for allocating public funds as incentives schemes for promoting better performances; and the role of the assessment procedures and agencies for guaranteeing the quality of educational processes (Deem, 2004; Doost, 1997; Fischer et al., 2004; Goddard and Ooi, 1998; Cropper and Cook, 2000).

3   ITALIAN HIGHER EDUCATION SYSTEM (HES)

3.1   The background of Italian HES

In Italy HES is provided by many different types of institutions and the overall system is structured in a binary system, consisting of two main articulations: the university and the non-university sector (the latter includes a few specific fields, e.g. archiving, diplomatics, restoration, military studies, etc).

In the 2009-10 academic year the university sector was made up of 89 universities which were classified in state (no. 61) and non-state universities (no. 28, whose 11 are telematic). University is structured as a matrix and staff experiences are shaped on one hand by the Faculties and on the other hand by the Departments. Faculties are responsible for the teaching activity, but departments are the real core of the research activities. State universities (SU) are public entities endowed with scientific, teaching, managerial, financial and book-keeping autonomy. The main governing authorities within a university are the Rector, the Academic Senate and the Board of Directors. For the achievement of common research and teaching purposes, they are endowed with specific structures, such as faculties (schools), departments, institutes, libraries, and service centres.

Non-State universities (n-SU) have to be legally recognized by a decree of the Ministry of Education. The degree has the same legal value as that of SU. N-SU have to comply with the same general rules and criteria as defined by the national university legislation for SU. The differences between SU and n-SU concern funding and governance. Since n-SU receive less money from the national government, they have a much higher degree of autonomy in fixing entrance fee without any limitations, unlike the State ones. The State recognizes the public value of the n-SU and supplies funds, covering about 10% of the needs of such universities (for SU about 90%). This scarcity of fund forced the n-SU to be highly independent from the Ministry that granted them a higher level of autonomy. In country-regionplaceItaly there is not a polarization in terms of public and private universities, since the education is considered by Italian Constitution (article no. 33) a public good and a public responsibility, consequently private universities do not exist. University is and must remain an organization aimed at having and developing the public function of serving the community.

3.2   The institutional and political issues

Recent years have witnessed a substantial change in environmental forces that require Universities to become more accountable and financially sustainable, whilst Italian universities pursue their institutional purposes in a very complex situation. The rise in organizational complexity drives universities to manage a large number of students, as well as staff members and activities, because of the widening of access to a greater range of socio-economic groups. This implies a larger amount of students and a growing demand for high quality training. Consequently universities have been introduced to a quasi-market system, where competition among different universities plays an increasing role and constraints the higher education sector to become a global market. At the same time, whilst new international commitments concerning the European unification agenda (such as Bologna Process 1999) strengthen the economic globalization process, Italian decentralization/federalism public policy has sought for by the Education Ministry.

In this context the decrease of available financial resources caused by the rise of public debt and the expanding of diseconomies, should give an impetus to obtain information on resource consumption. For the first time in metricconverterProductID1993 a1993 a new funding formula has been introduced (from line item budgeting to lump sum budgeting), recognizing an economic responsibility related to the ability to achieve results coherent with defined goals. In fact Law no. 537/1993 made a number of provisions relating to financial autonomy, providing a system of institutional accountability by reforming the funding system.

Considering the level of public and private investment in education, the country-regionItaly's total investment in education is equals 0.7% of the GNP (Gross national Product), is below the OECD average of 1.4%, whilst the placecountry-regionUSA percentage is 2.9%. This puts country-regionItaly, together with country-regionplacePoland, at the last position. The total public expenditure on tertiary education is 1.6% of total public expenditure in country-regionplaceItaly, well below the OECD countries average (3.1%). The best performer is country-regionplaceNew Zealand with 5.5% (OECD, 2010).

The institutional and political factors described are changing the landscape of university education and forcing the path to a season of big legislative renewals within traditional universities in a way that underlines the visibility of accounting and performance management. Accounting literature points out that environmental force are often the main pressure for system changes.

3.3   The accounting system

Following many OECD countries the Italian government has been changing academic system rules, giving more autonomy, locally to universities, through a plethora of laws. In 1948 the Constitution declares that «...universities have the right to give themselves an autonomous legal and administrative order, within bounds of what established by state laws» (art. no. 33). Even so only in 1989 Law no. 168 establishes the right to statutory autonomy, promised in the Constitution but never enacted. «Universities are endowed with legal status and, through article 33 of the Constitution, universities have didactical, scientific, organisational, financial and accounting autonomy; the universities

create their own autonomous systems with statutes and regulations» (art. no. 7). Thus, at present universities do not have to comply with any legislative requirements covering budgets or financial statements set by the State or accounting standards issued by standard setter. Although there are not specific requirements for universities, research shows that institutions mostly have the same financial disclosure as before the introduction of such a great autonomy. Opportunities for radical reforms provided by Law 168/1989 have been largely ignored by the academic community.

This lack of uniformity in providing financial disclosure causes a rather scarce comparability, not only among different universities, but also inside the university itself. Nevertheless the international public sector accounting standards board puts among its main principles the Comparative Information (IPSAS 1, point 48). The time horizon of the budgetary system only covers the short term (one year), whilst no information on the medium-long term are available, consolidated financial statements are neither required nor provided. The extreme fragmentation of accounting practices in universities is generating widespread "evaluation uncertainty" and "accounting anarchy" leading to situations which are difficult to compare and, as a consequence, not at all transparent.

The described heterogeneous situation makes it clearly difficult to compare data of different universities and, not a minor issue, to consolidate the State financial statement. Therefore, a complete accounting autonomy for universities does not appear to be viable, also because the academic system is mainly financed by the community, to which it is essential to provide a more transparent picture about the use of the resources. Financial statements are difficult to be read by stakeholders and to be used for decision-making purposes.

In order to improve the degree of comparability both with the entity's financial statements of previous periods and with the financial statements of other entities (e.g. local governments) the legislative body should prescribe the manner in which financial statements have to be presented. Even though country-regionplaceItaly is among advanced economies in terms of tasks performed, certainly it is an anomaly in accounting terms, considering that its basis of accounting is authorization-based, with mixed accrual criteria. This leaves Italian

universities with a model that has neither the merits of simplicity typical of the cash basis of accounting nor the merits of reliability typical of the full accrual basis of accounting.

At present universities build up their accounting system by choosing among three alternatives. Under the traditional alternative, they do not introduce accruals accounting, and simply derive their balance sheets and operating statements from their budgetary accounting statements at year-end. Under the parallel-systems alternative, universities do introduce accruals accounting, but keep it completely independent of budgetary accounting to safeguard its specific goals and techniques. Under the integrated-system approach, universities set up an integrated accounting system including both budgetary and accruals accounting (IPSAS 1, point 49).

4 OBJECTIVES, METHODOLOGY AND DATA COLLECTION

In order to understand whether the changes in legislation have been effectively played into operative terms, and to verify the consequences of such changes, it will be investigated the Italian accounting systems and cost accounting techniques in use in HES as well as the needs to identify a reporting system able to represent the value of material and immaterial resources, providing an information basis for the creation of knowledge.

Given the structural and institutional specificities and the problems arising in the context in which universities operate and the feasibility of use of business-like tools, this study explores the accounting system features and the cost accounting techniques in the Italian higher education institutions. It has three specific objectives: to ascertain the extent to which Italian universities make use of different types of accounting systems and cost accounting techniques; to identify the specific purposes for which the cost accounting techniques are being used by the adopters; to ascertain the degree of dissemination of the information provided to the different users.

The paper is based on a country case study in Italian HES. The study is a survey investigating the population of Italian state universities in the academic year 2008-09. For the purpose of the paper a questionnaire was sent to administrative directors or equivalent staff members. The considered variables are namely the type of accounting adopted, the cost accounting techniques used and their purposes and the users of such information provided. The project used a field study methodology to analyze such phenomenon, thus the results of this study cannot be generalized beyond country-regionplaceItaly. However, the results and their implications are of wider interest. The field study approach entails the use of multiple methods of data collections to capture key dimensions of this research. For this reason contemporary to the survey we collected the hard copy of statutes and accounting regulations of the respondent universities.

In 2008-09 country-regionplaceItaly counted 83 universities, and 59 of them are state (including polytechnic institutes, and excluding advanced schools of academic studies and other institutions). We take into account the 59 state universities due to the larger homogeneity of the group, since public universities are subject to the same set of rules, with no exceptions, and the same type of financing, as opposed to what happens in non state universities or in advanced schools of academic studies and other peculiar institutions. The survey, based on a postal questionnaire, was conducted late in 2009 and early 2010. Respondents were requested to answer regarding the academic year 2008-09.

To investigate the Italian accounting systems and cost accounting techniques in Universities the survey is divided into three different sections. The first part aims to determine which of the three kinds of accounting systems is adopted (traditional, integrated and parallel alternative), and sheds light on the quality of information produced for decision processes. Subsequently, some questions on the extent to which cost accounting techniques are in use and the purposes of such use are arisen; this section helps in understanding the kind of techniques implemented and ones that are considered most important for the decision process. The third part concerns the identity of the users of the cost information derived by the information system; this helps to understand the actors that play a role in defining the need of cost accounting information for the decision process and

the way of satisfying such need.

The questionnaire is mainly comprised of a Likert scale multiple-choice questions. The use of a multiple-choice format has reduced the time used for the analysis of the answers and has undoubtedly facilitated the answers from AD. Nonetheless, this format may have drawn some of the respondents to forego a more complete answer in favour of the provided ones. There were also some open-ended questions, which leave freedom of response. The main advantage of this kind of question is to allow the respondent to answer the question in an unbiased fashion. Ultimately, we chose to use a shared language system and a terminology commonly adopted among the administrative directors. In order to achieve maximum clarity, some questions have been introduced by a short glossary, providing a clarification of the terminology used. Phone solicitation, often followed by mailing of the questionnaire. After said solicitation, the response rate went up to 45.76% (27 out of 59). The dimensional distribution of universities respondent and not respondent to the survey is represented in figure 1.
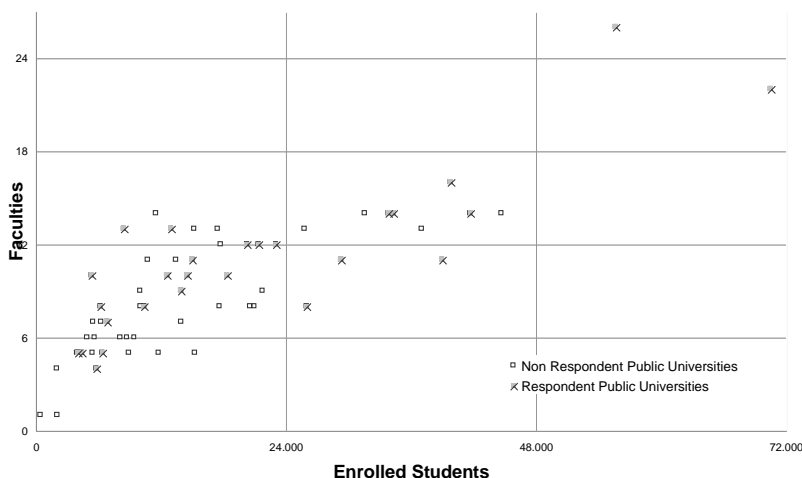

FIGURE 1 - Dimensional Distribution of the Italian Public Universities
Source: Authors calculation

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As can be seen in Figure 1the most part of Italian Universities have a number of enrolled students of less than 24.000 people and a number of Faculties comprised between 2 and 14. Then there are 11 Universities with a number of enrolled students between 24.000 and 48.000 people and a higher number of Faculties, between 8 and 16. Lastly there are two so called 'Mega' universities, with more than 48.000 students and more than 22 Faculties.

5   RESULTS

Results are presented in relation to the main research question. *Do the accounting system and cost accounting techniques of universities allow users to have all the information for a rational decision process?* The main research question has been analyzed with reference to the three sub-objective previously defined, namely the kind accounting systems is adopted, to shed light on the information produced; the extent to which cost accounting techniques are in use and the purposes of such use, to understand the kind of techniques implemented and which one are considered most important by users; the users' identity of the cost information, to understand which actors play a role in defining the need of cost accounting information and the way of satisfying such need for the decision process.

Figure 2 provides a summary of the adoption of the accounting system adopted by universities, according with definition of Italian accounting system previously described (traditional, parallel and integrated systems). As can be seen, whilst the 48.15% of the respondents use the traditional alternative, the integrated system is chosen by the 14.81% and the 37.04% of the respondent universities declare to adopt the parallel one. Evidences denote a rather high preponderance of the traditional system (cash basis). This is not surprising considering that universities' autonomy determines the absence of a general mandatory accrual-based accounting.
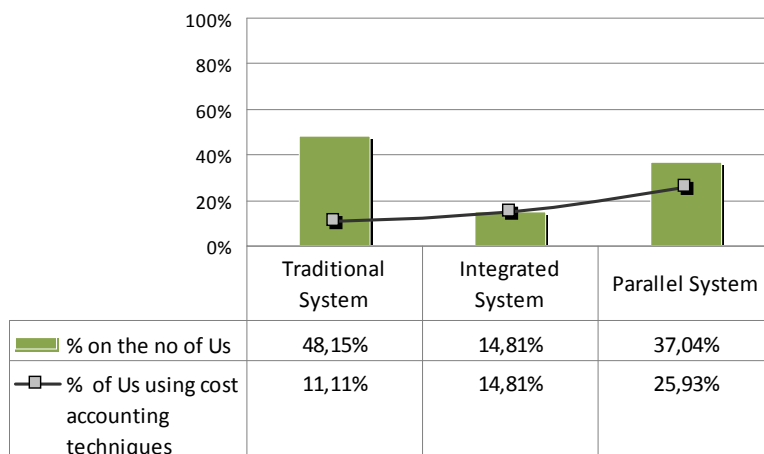
	Traditional System	Integrated System	Parallel System
% on the no of Us	48,15%	14,81%	37,04%
% of Us using cost accounting techniques	11,11%	14,81%	25,93%

FIGURE 2 - The accounting system
Source: Authors calculation

The same figure also analyses the number of universities using cost accounting techniques for each accounting alternative. All the institutions that adopt the integrated alternative make use of such kind of techniques, whilst in the case of the parallel system the percentage decreases to 70% (25.93% on 37.04%), still remaining a high value. Finally considering the traditional system the percentage diminishes significantly to 23.08% (11.11% on 48.15%). The major hindrances to the introduction of cost accounting techniques in the university refer to the fact universities are multi-business (didactics and research) and multi-product (courses and research projects) organizations. This causes that they sustain high overhead costs related to central administration, interdepartmental units, libraries, laboratories, etc. Moreover, the strong interrelations among faculties and departments, and their consequent "accounting ambiguity", determine a confusing use of production factors for educational and research processes. Furthermore, universities are a multi-business organization with basically two different institutional purposes, namely education and research, and in which the boundaries of business areas (Faculty and Departments) are highly "blurred"

and indistinct, sometimes even seamless. Such interconnection provides the
Universities their peculiar nature of "Knowledge intensive, public utility service
businesses". The result of a research (as a publication), for example, can be-
come an input for the educational process and, on the contrary, the study and
the preparation of a course can originate scientific curiosity and bring forth a
closer examination of the related topics. After examining the extent to which
accounting systems and cost accounting techniques are adopted, we consider
the purposes of the implemented accounting techniques. The main purposes
of the use of cost accounting techniques for Universities can be identified with
the followings: resources consumption analysis, cost reduction, determining cost
object, budgeting, make or buy decision. As shown in figure 3, the most suc-
cessful purpose concerns resources consumption analysis (100%) and the second
and third largest grouping occur with cost reduction (93%) and determining
cost object (86%). The remaining purpose of budgeting (64%) and make or
buy decision (57%) have a lower showing across Italian universities. Consider-
ing the purposes, results show that Italian universities are heavily engaged with
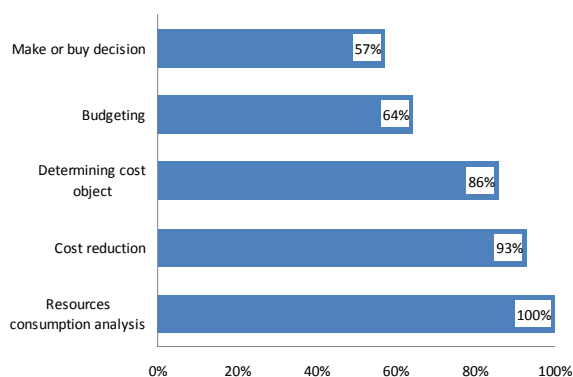cost accounting techniques whether they are interested in pursuing the first two
purposes.

FIGURE 3 - Main purposes of cost accounting techniques implementation
Source: Authors calculation

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Having examined the purposes of cost accounting techniques implementation, we now consider the users of the information provided by such adoptions. Results show that all the universities declare that they make use if such information internally, whilst only 14% makes information available for external users. Of course each university has to comply with compulsory rules giving the required information to external entities, such as the Ministry of Education (Miur), the Audit Commission and the Statistic Institute (Istat) for periodical analysis. Considering the internal users, the most part of them consists of administrative roles (44%), such as administrative director, executives, and elective roles (35%), such as chancellor, vice- chancellor, members of the academic senate and of the board. Other internal staff is unit managers, evaluation groups, teachers, etc.
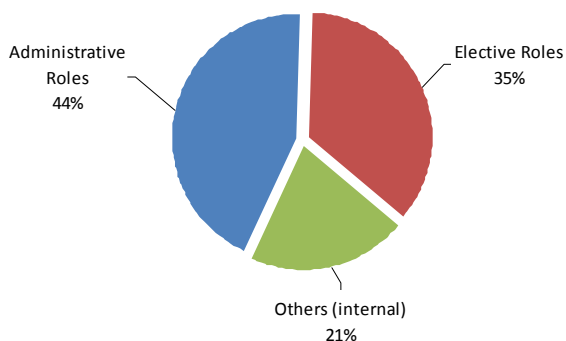

FIGURE 4 - The internal users of information in the universities
Source: Authors calculation

6   CONCLUDING REMARKS AND FURTHER DEVELOPMENT

Universities have always been considered as places where knowledge is created and transferred, playing a fundamental role for the social and economic growth of a country. A strategic priority for any country to ensure an adequate level of wealth and quality of life for its citizens is to develop a high-quality research and didactics. Hence, the need for universities to introduce and apply business criteria and principles in order to adequately combine a good and unbiased administrative action with effective intervention policies by the public administration, efficient resource use and cost-performance in management.

The aim of this work was to ascertain whether the accounting system and cost accounting techniques of universities allow users to have all the information for a rational decision process. The paper focuses on a specific case: the Italian HES investigated thorough a survey. To answer the main research question we investigated three different aspects.

The first aspect is the kind of accounting systems adopted (traditional, integrated and parallel alternative) The survey reveals that the most common kind of accounting system in use is cash based accounting and sheds light on the quality of information produced for decision processes, that are very limited and that is able to inform on the economic aspects of the university only at year end, consequently too late for taking decisions during the year.

The second aspects are about the extent to which cost accounting techniques are in use and the purposes of such use. The survey results show that there is a rather scarce diffusion and a quite limited development of cost accounting techniques. This evidence does not surprise in a system with a large use of a cash basis of accounting, and it helps in understanding why the main purposes of cost accounting techniques are related to resources consumption analysis and cost reduction, kind of information impossible to obtain under a cash accounting system.

Lastly, the third aspect concerns the identity of the users of the cost information derived by the information system, and is seems quite clear that administrative

roles are the most important actors that play a role in defining the need of cost accounting information for the decision process and the way of satisfying such need.

Gather together these three aspects answer to our main research question, showing that at present the cost accounting system and cost accounting techniques of universities does not allow users to have all the information for a rational decision process.

Particularly, the tools for accounting measurement, which still depend on short term accounting conventions, seems to be inadequate, as they are not able to catch the tangible items and the signals of strategic effectiveness. Moreover, budget, accrual accounting and and-financial reporting systems constitute a necessary managing apparatus, but they are not enough.

The dynamic nature of the competitive environment compels the implementation of multidimensional control tools, such as the balanced scorecard. But "management autonomy" is not to be confused with "accounting autonomy": it is possible to combine a standardization of accounting information for users with a maximum flexibility for accounting and management as in businesses, where accounting rules affect management operation modes only in an extremely mediated way.

The possible implementation of different kind of accounting systems (parallel and integrated alternatives) seems to be in line with the current delegation process of economic responsibilities. In fact, because of the introduction of marketing principles in the academic environment, which has for long banished the concept of competition, the acquisition of competitive advantages will be more and more influenced availability of information provided by the accounting system and better cost accounting techniques.

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RAČUNOVODSTVENE PRAKSE U TALIJANSKOM SUSTAVU VISOKOG ŠKOLSTVA

Sažetak

Cilj ovog rada je istražiti da li računovodstveni sistemi i tehnike korišteni u talijanskom sustavu visokog školstva korisnicima daju korisne informacije za racionalni proces donošenja odluka. Rad se razvija na specifičnom slučaju, talijanskom kontekstu državnih i nedržavnih sveučilišta. Istraživanje je provedeno putem ankete poslane svim talijanskim sveučilištima i istražuje računovodstvene uvjete u akademskoj godini 2008-2009. Otkriva najuobičajeniji pristup izgradnji računovodstvenog informatičkog sistema i razinu rasprostranjenosti i razvoja tehnika troškovnog računovodstva, ukazujući na mjesta za poboljšanje.

Ključne riječi: sustav visokog školstva, izvješćivanje, Italija, sveučilišta, računovodstveni sustavi, tehnike troškovnog računovodstva, reforme javnog sektora, prakse

THE PURPOSES OF SOCIAL ACCOUNTING IN ITALIAN PUBLIC HEALTH ORGANIZATIONS

Sabrina Gigli*   Marco Tieghi†

Abstract

In recent years, within the panorama of Italian public organization, information and management tools are making their mark. Public health organization find themselves as part of those organization mentioned above, and the number of subjects who have decided or who have been "forced" to adopt the social report – or tools similar to it – is, by now, noteworthy. The current work aims to analyse the "mission statement" project carried out by the Emilia-Romagna Region for the purpose of verifying how it shapes out not just as an accountability tool, but also (or perhaps especially) as a tool whose aim is to support the mechanisms of governance within the regional health system.

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1   Introduction

In recent years, within the panorama of Italian public organization, information and management tools are making their mark. They have been certainly for a long time already used in private enterprises, and may be traced back to the will/necessity to provide an answer to a communications need that is definitely directed towards the social field.

Public health organization find themselves as part of those organization mentioned above, and the number of subjects who have decided or who have been "forced" to adopt the social report – or tools similar to it – is, by now, noteworthy.

The current work aims to analyse the "mission statement" project carried out by the Emilia-Romagna Region for the purpose of verifying how it shapes out not just as an accountability tool, but also (or perhaps especially) as a tool whose aim is to support the mechanisms of governance within the regional health system.

The contribution that we intend to offer with this paper is based upon a case study and it has the main aim of illustrating an innovative instrument directed towards supporting the system of dynamic relations which exist between the public health organizations and their main "institutional" interlocutors.

The choice of following a single case study is justified by the fact that the experience is, at the moment, the most significant and complex undertaken in Italy and, therefore, the case offers us the chance to analyse a contextual and contemporary phenomenon (Yin, 2003).

In the first part of the paper we explain the National Health System within the current Italian legal framework in order to contextualize the working of the national health system. After this we try to find out the relationship with social responsibility and health care in the Italian context, in fact "social responsibility" cannot be considered as an option for public subjects, rather it consists of a "morphological presupposition", to ask oneself on how the issues of social responsibility impact within the public health sector requires some thought, both of a general nature and a more precise one, in order to better picture the theme

as well as its own specificnesses. After this theoretical contextualization we explain the aim of the paper: the Emilia-Romagna Region "Mission statement" project. The current work aims to analyse the "mission statement" project carried out by the Emilia-Romagna Region for the purpose of verifying how it shapes out not just as an accountability tool, but also (or perhaps especially) as a tool whose aim is to support the mechanisms of governance within the regional health system.

2 The National Health System within the current Italian legal framework

In order to fully understand the evolutionary process of Italian public health organizations, which has led to the so-called "corporatization", we can depart from the constitutional text, where at article 32 it states that "*the Italian Republic guards health as fundamental right of the individual and interest of the collectivity and guarantees free treatment to the needy*" (Rea, 1998; Anselmi-Volpatto, 1990).

An initial hint of the following reform was in 1991 with law 11, the later law 421/92, containing the mandate to the government for the reform of the health sector, will be put into effect by Legislative Decree 502/92 and by Legislative Decree 517/93.

As a result of such reforms, the USLs assumed an assets, an administrative, a management and a technical-accounting autonomy, reorganising themselves into organizations with legal personality. At the same time, Legislative Decree 502/92 determined that the new Local Health Organizations (ASLs), would correspond territorially to the provinces, in this way aggregating the smaller USLs.

By turning the USLs into organizations, a managerial system comes about where the general director is hired with a private law contract. He stays in office for five years and has ample decision-making power. No longer is he a political organ, rather a technician who must be in possession of precise requirements

concerning professionalism and competency. In this way does the system purely based upon the Management Committee and the Assembly cease.

Another substantial change concerns hospitals. The possibility of becoming autonomous Hospital Organizations with a legal personality is recognised to the biggest ones. Those of smaller dimensions, however, remain under the aegis of the USL organizations, therefore without their own autonomy.

As for planning, on a central level, the National Health Plan becomes a tool of the government which, for the first time, is used in the period 1994-1996. It has to establish minimum levels of assistance which every Region undertakes to guarantee, *"(...) considering the national socio-economic planning and the objectives of health protection which have been pointed out at a national level"*[1]. At local level, the Regional Health Plans are maintained.

The new legislative system therefore leads to the progressive reinforcing of the position of the Regions, allotting them the legislative function of determining the general principles of organisation, namely those of defining territorial competence of USL organizations, of identifying the hospitals to turn into Hospital Organizations (AOs), of disciplining relationships between Local Health Centre Organizations (AUSLs or ASLs) and AOs, as well as between public and private structures.

As far as the new organizations are concerned, the reform here examined, after having furnished them with technical, management, accounting, administrative and assets autonomy, has differentiated them into two typologies:

1. Local Health Organizations (hereafter either AUSLs or ASLs), having both a function of direct production and indirect provision of health-related services, and financed on a per head basis, with reference to the population weighted on the basis of different assistance needs, needs whose levels of satisfaction are fixed by the National Health Plan;

2. Hospital Organizations and University Hospital Organizations (hereafter AOs), having – as far as assistance is concerned – the function of production of hospital services and financed on the basis of the recognition of

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[1] Article 1 subsection 10 D.Lgs (Legislative decree) 502/92.

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specific fees for services provided.

Such organisation of the health system had (should have had) to allow:

1. the AUSLs/ASLs to concentrate on their own role of subject called to answer to the health needs of a body of people who insist upon a certain territorial area, by way of identifying organisational methods which opportunely balance the purchase of medical assistance and the direct production of adequate quality services, respecting the assigned resources;

2. the AOs to concentrate on those variables that greater relate to the function of production, by pursuing an elevated qualitative level of medical assistance provided, in respect of the lowest production cost possible.

In such a way, this should have given rise to a competition system between producers, which nevertheless had to be administered, in order to avoid eventual distortions both on equity and on the respect for expenditure rate (Taroni, 1996).

The Regions thus see themselves entrusted with the responsibility of having to make the public health organizations, which they control, search for opportune finance and economic balancing conditions.

Jointly with the normative provisions contained within the reform regarding economic and real accounting, financial accounts and analytic accounting, this all has led to adopting principles of balance statements and communication of accounting information, as well as to adopting management tools which are substantially analogous to those provided for private organizations.

Finally, this process has led some health organizations (but in certain cases, whole Regions) to the decision of adopting tools of social accounting, sometimes directly borrowing them from those models conceived for private, *for-profit* organizations.

3   Social responsibility and health care

Given that in the Italian context, "social responsibility" cannot be considered as an option for public subjects, rather it consists of a "morphological presupposi-

tion", to ask oneself on how the issues of social responsibility impact within the public health sector requires some thought, both of a general nature and a more precise one, in order to better picture the theme as well as its own specificnesses.

In general terms, repeating the words of Borgonovi (Borgonovi, 2005 and 2006), we may observe that corporate social responsibility in public health organizations may be tapered onto many, differing levels.

An initial stage consists in maintaining continual political updating, both as far as staff education and training and technology are concerned.

A second stage, instead, refers to the correct and efficient use of resources; while remembering how the research for economic efficiency does not necessarily contrast the values of respect for the individual and recognition of his/her dignity.

This may also be intended as a way to give content to the principle of social responsibility, in that we thus can answer certain, precise health needs using a lesser quantity of resources, making other resources available that can then be destined to other potential users.

A third stage may be identified in the search for quality for the recipients of services. Today, the system is based on a sequence that starts from scientific demonstration of efficiency in certain interventions, which then moves on to the technical and professional quality of interventions concerning health protection, to the organization quality of processes of service supplying, and which finally arrive at patient satisfaction. Certainly, that which should be aimed at is a model that starts from real needs and expectations of the patients, to whom an overall answer should be provided: only in this way this dimension of social responsibility is qualified[2].

A fourth level then concerns the way in which the relationship between demand and offer is managed. Certainly, interventions of rationalisation of offer structures express an evident orientation towards social responsibility, besides

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[2] The making human of assistance, the search of an organisation which allows for effectively realising it, for example defining times and production standard practices/aims that consider the "relationship" element as well, are expressions of social responsibility in so much as they take effects produced on other subjects by the way these health organizations appear into account". E. Borgonovi, La responsabilità sociale in sanità, Mecosan N° 56/2005, pag.6.

just answering the criteria of economic rationality[3].

A fifth level can refer to the financing policies of the system. Regardless, indeed, of the characteristics of the various systems of financing, there is always a common problem, that is the difficulty in sustaining the growing health-protection expenditure. A sixth level may then refer to the capacity to involve and make various subjects participate in the definition of health protection policies as well as in the fundamental decisions of management. Health protection is a complex issue that requires the coming together of many different rational dimensions. Adopting a logic directed towards social responsibility implies avoiding models and unilateral health-policy definition processes, for this reason the involvement of the various interest bearers becomes of fundamental importance. Everything, in actual fact, comes about with the help of an appropriate external information system, which must precede the decision phase. Next to this then, internal information must be strengthened, thereby consolidating an identity, a sense of belonging and of accepting responsibility.

A seventh level can be traced back to the method of interpretation and application of the laws of privacy, of informed consensus concerning the case of risk treatment, of adherence to experimentation. Concerning this very end, there may be excessive bureaucratic use, till we arrive at the total avoidance of responsibility. On the contrary, however, these tools might be used to spread the culture of the importance of experimenting among patients. An eighth level of social responsibility is part of those schemes that may be termed more 'traditional', aimed at environmental protection against the disposal of harmful and dangerous waste. The protection of health ever more requires the use of treatments which generate toxic waste. Issues which can be traced back to the containment of costs cannot reduce, in this sense, the attention of whoever

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[3] "Avoiding the creation of demand for useless and unnecessary medical assistance, closing and reconverting structures for patients with acute illnesses, which are not any more justified by modern care methodologies, realising structures for long term in-patients or terminally-ill patients (in order to undergo pain therapy) and adopting measures which respond to functionality logic even if they produce the loss of political support fall within that which can be defined culture of social responsibility of those who adopt policies and manage offer structures". E. Borgonovi, La responsabilità sociale in sanità, Mecosan N° 56/2005, pag.6.

wants to be socially responsible.

From these proposed thoughts, we can easily deduce rather clearly how social responsibility in the health sector cannot be only interpreted as an effect of evolution compared to the accepted logic developed in organizations. Within the framework of "recontextualising", we must necessarily include careful reflection on the aspects previously analysed. From this point of view, therefore, even the accounting tools which are adopted, of course starting from the social report, should not uncritically repeat the models which were born and conceived for the enterprises.

4   Methodology

As has likely previously emerged, the contribution that we intend to offer with this paper is based upon a case study and it has the main aim of illustrating an innovative instrument directed towards supporting the system of dynamic relations which exist between the public health organizations and their main "institutional" interlocutors.

The choice of following a single case study is justified by the fact that the experience is, at the moment, the most significant and complex undertaken in Italy and, therefore, the case offers us the chance to analyse a contextual and contemporary phenomenon (Yin, 2003).

At the same time, that which we may deduce from the analysis of this case, may end up being useful as an indicator to be able to explore the phenomenon of "social accounting" in new "clothes", offering elements for reflection through which to approach study of similar situations (Robson, 2002, pag. 59; Sauders et al., 2002, pag. 96; Yin, 2003, pag.41).

The gathering together of data and analysis of them has been, in the case study we are dealing with, essentially qualitative in nature, in that the scope of the study was that of describing the features and status of the project (Yin, 2003; Gilliam, 2000).

In the following pages, the aims and particularities of the "mission statement" project of the Emilia-Romagna Region are outlined, with the precise

intent to collect values in terms of relationships with institutional interlocutors – Regional Authority and territorial social and health Conferences – which the same project intends to achieve.

Data has mainly been extracted by analysing the official documents produced by the Regional Authority itself and interfacing them with the direct experience matured by one of the authors in conceiving and producing the project itself[4].

5   The Emilia-Romagna Region "Mission statement" project: aims and particularities

With regional law N° 29 of December 2004, the Emilia-Romagna Regional Authority foresees that its public health organizations annually draw up the mission statement as part of their financial statements for the accounting period.

From examination of the guidelines adopted for this purpose by the Regional authority[5], it emerges that the aims attributed to this type of document are, at the same time, wider in scope and more focussed compared to those that normally characterise social reports:

1. wider, in as much as the intention of the Regional authority is to make health organizations draw up tools that are able to not only "illustrate the results obtained from the institutional action carried on by the organization", but also (and perhaps, in the first place) "support the system of relationships between the Organization and its main institutional interlocutors: Regional Authority and social and health territorial Conference, in an active and dynamic way"[6];

2. more focussed, in as much as "among the many interlocutors possible who are interested in the activity of a health organization, the mission state-

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[4]Marco Tieghi assisted the Regione Emilia-Romagna as chief scientific advisor of the project.

[5]Cfr. the ASR REGIONE EMILIA-ROMAGNA, Dossier 107-2005 Il bilancio di mission per il governo della Sanità dell'Emilia-Romagna, May 2005.

[6]Cfr. the ASR REGIONE EMILIA-ROMAGNA, Dossier 107-2005 Il bilancio di missione (. . .) op. cit. p. 9.

ment identifies: both Regional authority and social and health territorial Conferences as main reference subjects"[7].

It is also interesting to underline that *"The mission statement takes on the form of a tool by which it is periodically possible, for such interlocutors, to verify the progressive achievement of established aims in the relative planning operation".* Therefore, on the basis of indications included in the discussed guidelines, *"The final representation of the institutional results within the context of the mission statement, becomes an element to assume as a reference point for the next phase of planning and programming".*
In other words, through the "mission statement" project the Emilia-Romagna Region wished to equip its health organizations with an instrument by means of which they can:

1. relate in a structured way with the other main subjects which within the regional context bear institutional responsibility in things concerning health, holding them account for the degree of achievement of aims attributed to them;

2. consent, by this method, the control by the Regional authority and social and health territorial Conferences (CTSSs) of results achieved compared to those proposed initially and – consequently – the reactivation of processes of planning and programming both external and internal to the organization;

3. in some way illustrate their own institutional action to other external/internal subjects, too (services sector, mixed committees, trade union organisations, professionals responsible for the clinic government, etc).

In such a way, the financial statements of the public health organizations of Emilia-Romagna take the shape not only of tools of accountability, but also (or perhaps, especially because) of instruments directed towards supporting the mechanisms of governance within the regional health system.

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[7] Ibidem.

Ultimately, therefore, the documents here examined vary from social reports, above called upon, for more than one significant aspect:

1. they are not drawn up by the organization on a voluntary basis, rather in compliance with an imposed normative obligation[8];

2. they are not just conceived as instruments of accountability, but above all instruments of governance;

3. consequently, even though they are "public", and therefore potentially accessible by all those who have an interest in the outcome of the activities carried out by the organization, they were designed to support the system of existing relations between three subjects that have precise institutional tasks: the Regional authority, the CTSSs and the organization;

4. therefore, they are not documents of a "divulging" nature, really they are rather technical instruments, which contain an ample crop of information, among which are numerous indicators, through which we try to "fully" understand the organization profile as well as the results of its activity, with regards to a given reference context and to its "system" and local objectives which are attributed to it;

5. in such a way, a constraint of connection between mission statement (a document which contains data, values and information in a final balance-type nature) and tools of planning and programming, both externally and internally to the organization.

   Now, let's see the general characteristics of the mission statement model adopted by the Emilia-Romagna Region.

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[8] On this subject, we must observe that the decision taken by the Regione Emilia-Romagna was strongly innovative, in that, with only the exclusion of the provisions contained in the D. Lgs: 153/1999 in relation to the disciplining of foundation of a banking nature, it is precisely with the L. R. (T.N. 'regional law') 29/2004 that in Italy an obligation was introduced to add a tool – which could be traced back to those ones of "social accountability" – to the traditional financial statements for the accounting period.

In drawing up the guidelines, the working group who developed the project tried to elaborate a model of a mission statement which:

1. is conceived as a yearly document: logically, temporally and functionally coordinated with the traditional financial statements for the accounting period, of which it must constitute the complement in the form of institutional report;

2. must possess, nevertheless, autonomous usability and readability, in the sense that from the information contained therein, it has to be possible to form a judgement regarding institutional performance achieved, also in relation to the asset, economic and financial situation of the organization;

3. must be an "open document", such as to allow on the one hand, respect of a predefined standard information constraint and on the other, (being a corporate document) acceptance of every other type of information held to be useful for the purpose of better illustrating the institutional performance achieved by the organization;

4. tries to summarise the completeness and selectivity of information, in such a way as to allow an overall appreciation of the institutional action of the organization, all this without useless weights for the pretension of providing detailed information concerning all institutional aspects of management. Development of those particular institutional matters is also envisaged which, when compared with policy-making indications and strategic objectives, are to be considered particularly critical in their relationships with the regional level as well as the local one;

5. must be a technical document that can be read, in the sense that it has to know how to mediate the dual need of providing rigorous information on a technical level, all the while assuming the most opportune forms of representation, since these remain more easily understandable even to those who are not experts;

6. must propose itself as a bridge spanning past, present and future of the organization, fulfilling, within the context of planning, programming and

control processes, a role of "zip-fastener" document between what has been, what is and what will become of corporate management.

The adopted document is made up of seven parts, preceded by a presentation and followed by the conclusions of the General Director and is thus articulated: Presentation of the general director;

1. Reference context;

2. Organization profile;

3. Institutional objectives and corporate strategies;

4. Working conditions, staff competencies and organisation efficiency;

5. Relation systems and communication tools;

6. Research & Development (R&D);

7. Specific objectives of particular institutional importance;

General director's conclusions.
The first three sections are to be taken as being strongly interconnected, in as much as they intend illustrating, in a sequential manner:

1. the "backdrop" against which the organization operates, furnishing certain elements and information aimed at delineating the same in term of catchment area, environment, demographic dynamics, socio-economic conditions, epidemiological situation, lifestyles and safety standards;

2. the organization's "profile" – we could call it: its "identity card" – traced considering the conditions of economic, financial and asset sustainability, considering its economic and cultural impact on the surrounding area as well as its Essential Levels of Assistance;

3. institutional objectives of the organization and the strategies adopted in order to achieve them, defining them according to certain perspectives

which reflect general principles of particular importance: the centrality of the citizen, participation of local authorities in health programming, the universal and equal access, quality of assistance and management efficiency.

At the end of the day, the information that emerges from the third section should reflect, from a dynamic point of view, the organization aims pursued and the connected strategic options exercised by the organization, to be evaluated in the light of a given operating context and of conditions which altogether sum up the profile of the organization.

Where such a philosophy was adequately "implemented" in the operational drawing up of the document, this could reasonably be said to be "complete" and enough to permit a reading of organization operations from an institutional point of view.

The project group has, however, decided that also certain specific deeper studies should expressly be included.

Sections four, five and six are, therefore, to be understood as proper "areas" of deeper studies which are specifically dedicated to development of themes of a greater level of strategic importance for a public health organization, such as those respectively connected to the staff, communication and R&D.

The seventh and final section, however, was envisaged in order to be able to treat topics held to be of particular institutional importance either by the organization, on the basis of its specific nature, or by the local CTSS or by the Regional authority. Themes, therefore, that may partially be particular to each organization and partially common to all; that may be repeated over time or else developed in monographic form in the year when the aspect dealt with has shown itself to be particularly important. Ultimately, this section represents a sort of "noticeboard" of varying content, aimed at allowing making the structure and information content of the overall document flexible.

6   Conclusion

From that which has, till here, been outlined, it seems obvious that the Emilia-Romagna Region experience is intensely innovative and – in a certain way – may be considered to be "pioneering".

   At the moment, a study on the "impacts" induced by the introduction of the tool in the relations system internal and external to the organizations still seems premature (as was previously advanced, it was however envisaged and both its "profiles" and methodology have been defined). Nevertheless, certain potentially critical aspects have come to the surface already and it is upon these aspects that we need to intervene for the purpose of aiding the passage from the experimental phase to the operating phase in the drawing up of and use of the tool.

Particularly, aspects which deserve special attention are coming to the fore regarding:

1. a certain heterogeneous quality in the degree of "interiorisation" of the tool by individual organizations;

2. the attitude of the territorial social and health Conferences;

3. co-ordination issues of the mission statement both with the tools of internal planning, programming and control as well as with processes of planning and programming external to the organization.

   Regarding the first aspect, we preliminarily need to observe that it is to, in some way, be considered as physiological, when confronted with a decision to adopt the tool which – even from a concerted point of view – has nevertheless been taken at the regional and not at organization level.

   In other words, the duty to adopt the tool, introduced by L. R. (T.N. 'regional law') 29/2004, was inserted onto single organization situations characterised by a specific varied sensitivity, given that the whole group of them was constituted by organizations that had already voluntarily experimented (among the first in Italy) various formats of social reporting, as well as by organizations

that had already autonomously decided to, in any case, provide themselves with these tools, and also, finally, by yet other organizations that rather had not noticed such a need.

It appears, therefore, interesting to explore the different processes of activation and development of the project within the individual organizations, starting from the options exercised by their general directorships.

The second aspect is of utmost importance.

As has been previously outlined in detail, the mission statement was conceived as a tool aimed at favouring processes of institutional interaction between individual organizations and respective CTSSs.

It is, therefore, of fundamental importance that a virtuous dialectic process is triggered off, one which, by way of an inevitable tool refinement/re-calibration process, brings the mission statement to become "the" institutional accounting method, by means of which the organization faces its own Conference.

That which must instead be avoided at all costs, is that an attitude of a ritual nature prevails, where the organization "performs its duty" ordered by the Regional Authority, the CTSS formally acknowledges it, but then in the actual interaction that comes out of the different institutional roles specifically attributed to these subjects, the document remains, in effect, ignored.

Presently, it is hard to delineate even an initial and provisional framework which can be said to have a summarising nature. The experimentation operated by individual organizations in this regard has been too recent, fragmented and innovative.

Nevertheless, certain important aspects are coming to the fore. Particularly, an element that has to be evaluated with extreme care is constituted by the technical complexity as well as the weighty nature of the initial documents.

In this sense, there have been some remarks and opportunely some organizations, among the five pilot ones, have already taken steps in order to review/adapt, even radically at times, their second document, on the basis of observations formulated by their CTSS when they submitted their first mission statement.

When all the ASLs have prepared and submitted at least their second doc-

ument, in agreement with the organizations themselves, we may proceed to a systematic recognition of the "answers" expressed by the different CTSSs, in such a way as to allow tracing out a sketch for an overall situation framework at regional level, so that the regional authority can have the elements at its disposal which are necessary to evaluate whether the objectives assigned to the project are being, in effect, achieved or whether, instead, it is opportune to prepare corrective or support actions.

The third aspect is that of the potentially more important, mid- to long-term implications.

The drawing up of the initial mission statement by the organizations and the related need for the "accounting" for objectives indicated by the Region and the CTSSs is already highlighting the issue of the auditing, the rationalisation and the co-ordination of the planning and programming tools both internal and external to the organization.

Concerning this point, we have already underlined how adopting a tool like the mission statement may not lead to a simple "juxtaposition" of the same to the overall organization information system. The need to fully integrate it with the other tools that make up the organization information system comes, consequently, to light.

Besides, it has already been pointed out how in the planning out followed by the Emilia-Romagna Regional Authority, the clear reference to the need, on the part of the organization, of having to account, first of all, to their own interlocutors, for the degree of achievement of the aims, which have been attributed by them, necessarily implies the need to face the issue of co-ordination between procedures and planning and programming tools employed by the various institutional players – Regional Authority, CTSSs and Organizations – which have specific roles to play regarding the "government", the accomplishment and evaluation of choices relative to the regional health system.

The organizations are already, actually, noticing these needs. It is, therefore, opportune that a greater integration is searched for between the various planning and programming tools, by way of which objectives are identified and strategies, tendencies and policies in the health field are defined at the various levels.

Wherever possible, it would then be extremely important that the institutional objectives assigned to organizations can easily be traced back to the accounting logic of these objectives themselves which is envisaged in the mission statement.

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CILJEVI DRUŠTVENOG RAČUNOVODSTVA U TALIJANSKIM ORGANIZACIJAMA JAVNOG ZDRAVSTVA

Sažetak

Posljednjih godina, unutar talijanskih javnih organizacija, značajan trag ostavljaju upravljački i informacijski alati. U privatnim su tvrtkama zasigurno korišteni već niz godina gdje njihovu pojavu možemo opravdati potrebom za zadovoljavanjem komunikacijskih potreba koja je definitivno usmjerena na društveno polje.

Javnozdravstvene organizacije su dio prije spomenutih organizacija a broj subjekata koji su odlučili ili su bili „prisiljeni" primijeniti društveni izvještaj – ili tomu slične alate – je zaista zamjetan.

Cilj ovog rada je analizirati projekt „izjava o misiji" proveden u regiji Emilia Romagna radi utvrđivanja kako se ponaša, ne samo kao računovodstveni alat već i (možda prvenstveno) kao alat čiji je cilj podržati mehanizme uprave unutar regionalnog sustava zdravstva.

Ključne riječi: javnozdravstvena organizacija, odgovornost i upravljanje, izjava o misiji, društveni izvještaj