Turhan Korkmaz[*]
Emrah İ. Çevik[**]
Elif Birkan[***]
Nesrin Özataç[****]

UDK 65.011.2:622.012>:339.172(73 New York)
Original scientific paper
Izvorni znanstveni rad

TESTING CAPM USING MARKOV SWITCHING MODEL: THE CASE OF COAL FIRMS

ABSTRACT

In this study, the relation between the coal firms that are traded in New York Stock Exchange and S&P500 index is analyzed. The return of the coal firms and the market return are analyzed by using traditional CAPM and two-state Markov regime switching CAPM (MS-CAPM). According to the Likelihood Ratio test, two-state regime MS-CAPM gives better results and indicates a non-linear relation between return and risk. It is found that beta shows variability in regard to low and high volatile periods making linear CAPM to provide deviated results.[1]

JEL: G12, C32

Keywords: *Coal Firms, CAPM, Markov Switching Model*

1. INTRODUCTION

The Capital Asset Pricing Model (CAPM) has an important place in finance theory for pricing an individual asset with respect to its expected return and risk. It is also possible to make comparison between its price and expected return that should be for an asset of certain risk. The CAPM assumes that there is a linear relationship between expected returns and risk, and determines the risk-return trade-off accordingly. However, studies in the literature in recent years indicate that the expected return of an asset and the relationship between the degrees of risk is not always linear, and show that it changes over time. Many studies present that beta, which is a measure of systematic risk, is significantly different when the market prices fluctuate.

It is certain that energy is the most important necessity of human life and there is an increasing relation between the level of development and amount of energy consumed in a country. Coal, which has the greatest importance among the energy sources, is the primary factor for the industrial revolution in the world (Yılmaz and Uslu, 2007). Developing countries use about 55% of the world's coal and this share is expected to grow to 65% over the next 15 years (Balat and Ayar, 2004). World primary energy demands grows by 1.6% per year on average in 2006-2030 and demand for coal rises more than demand for any other fuel in absolute terms. World demand for coal advances by 2% a year on average, its share in global energy demand climbing from 26% in 2006 to 29% in 2030. Some 85% of the increase

[*] Zonguldak Karaelmas University, Department of Management, 67100 Incivez / Zonguldak, Turkey, Tel/fax: 0 372 257 6927, E-mail: korktur@yahoo.com
[**] Zonguldak Karaelmas University, Department of Management, 67100 Incivez / Zonguldak, Turkey, Tel/fax: 0 372 257 6927, E-mail:emrahic@yahoo.com
[***] Zonguldak Karaelmas University, Department of Management, 67100 Incivez / Zonguldak, Turkey, Tel/fax: 0 372 257 6927, E-mail: elif.birkan@hotmail.com
[****] Eastern Mediterranean University, Faculty of Business and Economics, North Cyprus, Tel/fax: 90 392 630 2120, E-mail: nesrin.ozatac@emu.edu.tr

[1] Paper received 21 October 2009.

in global coal consumption comes from the power sector in China and India (World Energy Outlook 2008). Recently, tremendous volatility in the price of oil and natural gas and increasing coal demand reveal the importance of coal as alternative energy resources in the world. Increasing importance of coal brings coal mining companies in the foreground all over the world.

This study aims to investigate the relationship between the expected return and the degree of risk using non-linear CAPM model for the coal producing companies whose shares are traded in the U.S. equity markets. The main reason using the non-linear CAPM model is to investigate the differences of systematic risks of coal mining companies in the period of high and low market volatility. Systematic risks are measured using two-state Markov Switching Model for the coal producing companies in the period of high and low volatility.

2. LITERATURE REVIEW

In literature, there are many studies on testing CAPM using Markov switching model but there is a paucity of studies basing the analysis on coal firms.

Alexander et al. (1982) conduct a study to investigate both theoretically and empirically the appropriateness of describing the systematic risk of mutual funds with a different model of non-stationary-a first-order Markov process using the data consisting of the monthly returns for 67 mutual funds over the period January 1965 through December 1973. It will be shown that even if fund managers do not actively engage in timing decisions, the systematic risk of mutual funds theoretically can be modeled as being non-stationary. In particular, it is shown that the betas of such funds can be modeled as first-order Markov processes. Fridman (1994) finds out the high volatility state β can be more than double the size of the more stable state β, hence making it a higher risk state, and the duration of stay in the high risk state is typically shorter than the one for the low risk state for three oil industry corporation securities by means of two state Markov regime switching model.

Huang (2000) examines time varying CAPM for the Microsoft Corporation using monthly stock returns. He shows that the data from the low-risk state is consistent with the CAPM whereas the data from the high-risk state is not. Huang (2001) investigates that the data generating process of β can be well characterized by a regime-switching model for Taiwan Stock Market. The evidence shows that in the relatively high-risk state data are consistent with the CAPM, but they are inconsistent with the CAPM in the low-risk regime.

Fearnley (2002) tests a conditional multivariate international capital asset pricing model for US, Japanese and European stocks and government bonds. His findings indicated that the price of market risk is statistically significant, and the international CAPM risk premiums are validated, although currency risk premiums are not statistically significant. Huang (2003) incorporates two specific features in the test of CAPM. The first one is to allow the systematic risk β to come from two different regimes to capture the instability found in the previous studies. The second one is to consider the censoring effect caused by the implementation of price limit regulation. His findings suggest that β's are unstable over time and the data may be consistent with CAPM in one regime but inconsistent in the other regime.

Hess (2003) compares competing Markov regime-switching model specifications and reported that for the Swiss security market index monthly returns, the market movement is optimally tracked by time-varying first and second moments, including a memory effect. Galagedera and Shami (2003) examine time varying CAPM for thirty the securities in the Dow Jones index. Their results indicate very strong evidence volatility switching behavior in a sample of returns in the S&P 500 index. In three of the thirty securities in the Dow Jones index, the estimated slope in the market model show strong switching behavior.

Ishijima et al. (2004) use TSE REIT (Tokyo Stock Exchange Real Estate Investment Trust) Index to derive an asset pricing model based on a growth optimal portfolio in a market. In an asset pricing model they employ a regime switching model, describing two equations, an observation equation which governs asset prices and a state equation which assumes that regimes conform to a first-order Markov processes. By dividing the analysis into two cases – the case where regime is taken into account and the case where it is not- it is shown that taking regime into account is better for estimating the risk premium of J-REITs.

Shami and Galagedera (2004) relate the security returns in the 30 securities in the Dow Jones index to regime shifts in the market portfolio (S&P 500) volatility. They find that there is strong volatility switching behavior with high-volatility regime being more persistent than the low-volatility regime. Galagedera and Fuff (2005) investigate whether the risk-return relation varies, depending on changing market volatility and up/down market conditions. Three market regimes based on the level of conditional volatility of market returns are specified - "low", "neutral" and "high". For a set of U.S. industry sector indices using a cross-sectional regression, they find that the beta risk premium in the three market volatility regimes is priced. These significant results are uncovered only in the pricing model that accommodates up/down market conditions.

Huang and Cheng (2005) estimate and test for the Sharpe-Linter CAPM by allowing structural changes in betas. Their approach applies explicitly to the Sharpe-Linter CAPM using book-to-book market (BM) -and size- decile portfolios from July 1926 to December 2003, with a total of 930 monthly observations. Their study concludes that (1) there exists at least one break for all the portfolios under consideration, (2) the estimated break dates are quite similar for some of the portfolios, indicating the possible existence of a common break using multivariate time series, (3) the CAPM can be consistent with the data in some regimes but many appear to be inconsistent with the data in some other regimes. This particularly appealing feature has been completely ruled out under the conventional single-equation framework.

Gu (2005) develops regime-switching versions of the CAPM and the Fama French three-factor model, allowing both factor loadings and predictable risk premiums to switch across regimes. He finds that betas of value stocks increase significantly during bear market episodes. However, it is still rejected that the book-to-market premium is equal to zero for both the regime-switching conditional CAPM and the Fama-French model, even in the presence of regimes.

Tiwari (2006) develops a Bayesian framework for choosing a portfolio of mutual funds in the presence of regime switching in the stock market returns. He considers a two-state Markov regime switching model in order to capture the dynamics of stock market returns for the period 1962 to 2004. He finds that the existence of "bull" and "bear" regimes in market returns significantly impacts investor fund choices and ignoring the regimes imposes large utility costs. Wilson and Featherstone (2006) analyze the stock returns and market return for 21 food and agribusiness firms estimated in a threshold switching-regression framework. Their results indicate that risk parameters differ for alternative regimes and are not constant over time. Accounting for periods of temporary disequilibrium leads to notably more stable risk measurement estimates.

Hwang et al. (2007) propose generalized stochastic volatility models with Markov regime changing state equations (SVMRS) to investigate the important properties of volatility in stock returns, specifically high persistence and smoothness using S&P 500 daily index returns. According to their study, persistent short regimes are more likely to occur when volatility is low, while far less persistence is likely to be observed in high volatility regimes. Comparison with different classes of volatility supports the SVMRS as an appropriate proxy volatility measure. Their results indicate that volatility could be far more difficult to estimate

and forecast than is generally believed. Chen and Huang (2007) examine the relation between stock returns and the World Index for four Pacific Rim economies, i.e. that of Taiwan, Hong Kong, South Korea and Malaysia. When the constant international capital asset pricing model (ICAPM) and the regime-switching ICAPM are considered, the evidence shows that the estimated beta coefficients from the constant ICAPM model underestimates systemic risk under the high-volatility regime, but overestimates systemic risk under the low-volatility regime.

Liow and Zhu (2007) focus on how the presence of regimes affects portfolio composition by means of regime switching asset allocation model for the six major real estate security markets (USA, UK, Japan, Australia, Hong Kong and Singapore). They conclude that optimal real estate portfolio in the bear market regime is very different from that in the bull market regime. The out-of-sample tests reveal that the regime-switching model outperforms the non-regime dependent model, the world real estate portfolio and equally-weighted portfolio from risk-adjusted performance perspective. Li (2007) uses Markov-switching model to identify the volatility state of G7 (Canada, France, Germany, Italy, Japan, the UK and USA) stock markets. His empirical results are consistent with the two following notions. First, the situation of both the individual and world stock markets during high volatility states will be associated with the minimum benefit of risk-reduction from international diversification and a maximum cross-market correlation. Second, by incorporating the character of state-varying correlation into the establishment of an international portfolio, it can be created a more efficient investment strategy with less risk, or greater return for a given risk.

3. CAPITAL ASSET PRICING MODEL

The CAPM, as first proposed by Sharpe (1964) and Lintner (1965a, b), is central to financial theory. The CAPM was developed, at least in part, to explain the differences in risk premiums across assets. Inherent to the CAPM, these differences are the results of variations in the riskiness of the returns on assets. The model asserts that the correct assessment of riskiness is its measure – known as 'beta' – and that the risk premium per unit of riskiness is the same across all assets. Given the risk free rate and the beta of an asset, the CAPM predicts the expected risk premiums for that asset (Chen and Huang, 2007).

The CAPM assumes the marketplace compensates investors for taking systemic risk but not for taking a specific risk. For this simple reason that a specific risk can be diversified away. When an investor holds a market portfolio, each individual asset in that portfolio entails a specific risk, but through diversification, the investor's net exposure is just the systemic risk of the market portfolio. Systematic risk can be measured using beta coefficients. Based on the CAPM, the expected return on a stock equals the risk-free rate plus the portfolio's beta multiplied by the expected excess returns on the market portfolio (Chen and Huang, 2007).

CAPM model can be written as:

$$R_{it} - R_{ft} = \alpha_i + \beta_i \left(R_{it} - R_{ft} \right) + \varepsilon_{it} \tag{1}$$

where i = 1, 2, …, n and t = 1, 2, …, T. The returns on asset i, the market portfolio and the risk free-rate at time t are denoted by R_{it}, R_{mt} and R_{ft}, respectively. The error term ε_{it} is assumed to be iid N $(0, \sigma^2)$.

While the theory maintains a linear and stable relationship between return and risk, there is overwhelming evidence documenting significant time variation in market betas. One of the reasons, argued by Jagannathan and Wang (1996), might be due to the relative risk of a firm's cash flow varying over the business cycle. During a recession, the financial leverage of those firms in relatively poor shape may increase sharply compared with other firms, causing

their stock betas to rise. As a result, the risk measure betas are expected to depend on the nature of the information available at any given time and can vary over time (Huang, 2003).

To assess the validity of the test, one important question is the stability of the measure of systematic risk, i.e. β. Nonetheless, empirical investigations such as Blume (1971), Levy (1971), Fabozzi and Francis (1977) and Chen (1982) generally found that the betas tended to be volatile over time and challenged the assumption of constant beta coefficient (Huang, 2000).

To overcome nonlinearity in CAPM model Huang (2000, 2001, and 2003) and Chen and Huang (2007) use a two state, first order Markov switching model. In this study, we consider three different models to obtain systematic risk of coal firms in the U.S.A. First, we consider that Model I (linear regression based-model with constant alpha and beta) following by:

Model I: $r_{it} = \alpha_i + \beta_i r_{mt} + \varepsilon_{it}$ (2)

where $r_{it} = R_{it} - R_{ft}$ and $r_{mt} = R_{mt} - R_{ft}$ indicates excess return on asset and on the market portfolio at time t. In Model I, alfa and beta are assumed constants. However, in the literature, it has been reported that beta is not constant and it is switching according to low and high volatility regime. Thus, we consider that Model II allows beta to come from low and high volatility regime following by:

Model II: $r_t = \alpha_i + \beta_{s_t} r_{mt} + \varepsilon_t$ (3)

where $\varepsilon_t \sim$ iid N (0, σ^2) and the unobserved state variable, s_t, evolves according to the first order Markov-switching process described in Hamilton (1994):

$$\begin{aligned} &P\left[s_t = 1 | s_{t-1} = 1\right] = p \\ &P\left[s_t = 0 | s_{t-1} = 1\right] = 1 - p \\ &P\left[s_t = 0 | s_{t-1} = 0\right] = q \\ &P\left[s_t = 1 | s_{t-1} = 0\right] = 1 - q \\ &0 < p < 1 \quad 0 < q < 1 \end{aligned} \tag{4}$$

where p and q are the fixed transition probabilities of being in low or high volatility regime, respectively.

Finally, in Model III, we consider alpha and beta are not constant and they are switching across two different regimes.

Model III: $r_t = \alpha_{s_t} + \beta_{s_t} r_{mt} + \varepsilon_t$ (5)

where $\varepsilon_t \sim$ iid N (0, σ^2) and the unobserved state variable, s_t, evolves according to the first order Markov-switching process. As there are many studies in literature that deal with the procedures that use Makov-switching model in estimation, we prefer not to give detailed information about this. Hamilton's (1994) and Krolzig's (1997) studies are being considered as good references for Markow Switching Model.

We consider three different empirical models in this study and we use likelihood ratio (LR) test to select the most appropriate model. The Likelihood Ratio (LR) test can be based on the statistic (Krolzig, 1997):

$$LR = 2\left[\ln L(\lambda) - \ln L(\lambda_r)\right] \tag{6}$$

where λ denotes the unconstrained maximum likelihood estimator and λ_r the restricted maximum likelihood estimator. Under the null, LR has an asymptotic χ^2 distribution with r degrees of freedom.

4. DATA AND EMPIRICAL RESULTS

In this study, the monthly price series of the 21 coal firms traded in U.S. stock markets covering the period of January 2000 and January 2009 are used. As market values, S&P 500 index and as risk-free interest rate, monthly government bonds' interest rates are used as variables. The data that the prices of the securities of the firms and S&P 500 index are taken from www.finance.yahoo.com web-site and the monthly government interest rate is taken from Kenneth W. French's web-site. The coal firms and the codes are given in Table 1.

Table 1

The Coal Firms Used in the Study and its Codes

Code	Firms	Code	Firms
ATI	ALLEGHENY TECHNOLOGIES INC.	NANX	NANOPHASE TECHNOLOGIES CORP.
ACI	ARCH COAL INC.	RTI	RTI INTERNATIONAL METALS INC.
ARLP	ALLIANCE RESOURCE PARTNERS LP	SFEG	SANTA FE GOLD CORPORATION
BHP	BHP BILLITON LTD.	SWC	STILLWATER MINING CO.
BW	BRUSH ENGINEERED MATERIALS INC.	TIE	TITANIUM METALS CORP.
CCJ	CAMECO CORP.	USEG	US ENERGY CORP.
CCRE	CAN-CAL RESOURCES LTD.	USU	USEC INC.
CNX	CONSOL ENERGY INC.	WLT	WALTER INDUSTRIES INC.
BOOM	DYNAMIC MATERIALS CORP.	WLB	WESTMORELAND COAL CO.
MEE	MASSEY ENERGY CO.	YZC	YANZHOU COAL MINING CO. LTD.
MFN	MINEFINDERS CORP. LTD.		

S&P 500 index and the return of the firms' descriptive statistics are given in Table 2. According to the results in Table 2, the lowest monthly return in the period and the highest deviation belong to CCRE coal firm. According to the kurtosis value, the characteristic of the whole coal firms returns' distribution is observed as fat tail. Jarque-Bera normality test statistics indicate that coal firms' returns do not have a normal distribution except ACI, BW, SFEG and WLB.

Table 2

Descriptive Statistics on Security Returns

	N	Mean	Std. Deviation	Skewness	Kurtosis	Jarque-Bera	
S&P500	109	-0.418	4.474	-0.859	4.731	27.022	[0.000]
ACI	109	1.188	16.441	-0.287	3.772	4.201	[0.122]
ARLP	109	2.052	8.450	-1.140	7.286	107.039	[0.000]
ATI	109	0.398	17.290	-0.099	4.246	7.230	[0.027]
BHP	109	1.540	9.335	-0.553	3.869	8.979	[0.011]
BOOM	109	3.251	23.024	2.308	14.714	719.976	[0.000]
BW	109	-0.191	15.976	-0.302	3.451	2.580	[0.275]
CCJ	109	1.991	12.133	-0.605	3.263	6.967	[0.031]

CCRE	109	-1.811	33.646	0.933	4.692	28.830	[0.000]
CNX	109	1.957	14.829	-0.725	3.720	11.898	[0.003]
MEE	109	0.412	18.234	-0.540	4.231	12.182	[0.002]
MFN	109	2.135	15.885	0.283	4.792	16.030	[0.000]
NANX	109	-1.410	22.451	0.519	3.980	9.253	[0.010]
RTI	109	0.658	14.034	-0.572	4.219	12.684	[0.002]
SFEG	109	-0.427	29.041	0.404	3.551	4.351	[0.114]
SWC	109	-1.629	19.866	0.049	4.238	7.007	[0.030]
TIE	109	1.954	22.034	-1.376	10.340	279.096	[0.000]
USEG	109	-0.636	17.107	0.832	4.798	27.260	[0.000]
USU	109	0.092	15.242	-0.392	3.852	6.084	[0.048]
WLB	109	1.146	15.623	-0.237	3.245	1.291	[0.524]
WLT	109	1.301	16.477	-1.474	8.557	179.694	[0.000]
YZC	109	1.629	14.779	-0.654	5.225	30.270	[0.000]

The correlation of the security returns and S&P 500 index are given in Table 3. According to the results given in Table 3, the companies' returns except CCRE, MFN and SFEG, and the market returns (S&P 500) move parallel and also they are significantly correlated. Moreover, the returns of CCRE, MFN and SFEG companies move independently compared to other companies' returns.

Table 3 Correlation among the Returns of the Coal Firms

	S&P500	ACI	ARLP	ATI	BHP	BOOM	BW	CCJ	CCRE	CNX	MEE	MFN	NANX	RTI	SFEG	SWC	TIE	USEG	USU	WLB	WLT	YZC
S&P500	1.000																					
ACI	0.268*	1.000																				
ARLP	0.283*	0.554*	1.000																			
ATI	0.521*	0.324*	0.414*	1.000																		
BHP	0.527*	0.416*	0.418*	0.421*	1.000																	
BOOM	0.287*	0.281*	0.263*	0.298*	0.326*	1.000																
BW	0.553*	0.302*	0.302*	0.553*	0.424*	0.349*	1.000															
CCJ	0.405*	0.527*	0.480*	0.479*	0.551*	0.289*	0.422*	1.000														
CCRE	0.074	-0.089	-0.042	-0.008	0.030	-0.052	-0.049	-0.065	1.000													
CNX	0.365*	0.715*	0.509*	0.440*	0.476*	0.221*	0.335*	0.565*	-0.032	1.000												
MEE	0.427*	0.726*	0.662*	0.463*	0.439*	0.251*	0.324*	0.531*	0.017	0.747*	1.000											
MFN	0.089	0.117	0.119	0.138	0.196*	0.098	0.135	0.179	0.293*	0.166	0.084	1.000										
NANX	0.484*	0.104	0.102	0.183	0.211*	0.111	0.339*	0.067	0.069	0.151	0.104	-0.074	1.000									
RTI	0.463*	0.469*	0.433*	0.609*	0.424*	0.241*	0.463*	0.409*	-0.084	0.446*	0.463*	0.175	0.206*	1.000								
SFEG	0.075	0.009	-0.009	0.225*	-0.001	0.007	0.016	0.025	0.126	0.029	-0.024	-0.017	0.085	0.121	1.000							
SWC	0.459*	0.358*	0.262*	0.503*	0.366*	0.156	0.438*	0.473*	-0.024	0.410*	0.366*	0.115	0.326*	0.348*	0.227*	1.000						
TIE	0.412*	0.267*	0.244*	0.397*	0.405*	0.229*	0.489*	0.271*	-0.067	0.349*	0.286*	-0.010	0.244*	0.411*	-0.042	0.297*	1.000					
USEG	0.224*	0.338*	0.223*	0.301*	0.152	0.409*	0.251*	0.310*	-0.015	0.207*	0.308*	0.110	0.125	0.304*	0.031	0.288*	0.064	1.000				
USU	0.377*	0.330*	0.305*	0.423*	0.346*	0.314*	0.381*	0.428*	0.054	0.300*	0.396*	0.075	0.102	0.376*	0.066	0.259*	0.286*	0.326*	1.000			
WLB	0.293*	0.482*	0.417*	0.258*	0.297*	0.173	0.335*	0.375*	0.115	0.378*	0.480*	0.174	0.184	0.226*	0.036	0.268*	0.155	0.358*	0.371*	1.000		
WLT	0.363*	0.418*	0.545*	0.382*	0.323*	0.349*	0.269*	0.352*	-0.085	0.391*	0.536*	0.198*	0.158	0.419*	0.094	0.256*	0.183	0.278*	0.193*	0.274*	1.000	
YZC	0.403*	0.380*	0.379*	0.471*	0.590*	0.178	0.376*	0.487*	-0.048	0.446*	0.389*	0.431*	0.062	0.487*	0.068	0.221*	0.160	0.084	0.368*	0.259*	0.356*	1.000

* indicates significance at %1 level.

Using the Coal Firms' return series and the risk-free interest rate, the excess return series are formed and it is aimed to investigate whether they are stationary or not by using PP test which is proposed by Phillips and Perron (1988) and KPSS unit root test which is proposed by Kviatkowski et. al (1992). According to the unit root test results which are given in Table 4, all the variables that are used in models are observed as stationary.

Table 4

Unit Root Test Results

Variable	PP	KPSS	Variable	PP	KPSS
RM	-8.737*	0.215*	**MFN**	-10.216*	0.392*
ACI	-8.441*	0.237*	**NANX**	-11.538*	0.280*
ARLP	-10.528*	0.383*	**RTI**	-10.235*	0.323*
ATI	-9.488*	0.205*	**SFEG**	-6.986*	0.158*
BHP	-10.091*	0.162*	**SWC**	-9.640*	0.075*
BOOM	-11.715*	0.139*	**TIE**	-9.584*	0.177*
BW	-10.023*	0.122*	**USEG**	-10.778*	0.143*
CCJ	-8.977*	0.381*	**USU**	-9.400*	0.155*
CCRE	-13.701*	0.136*	**WLB**	-9.457*	0.369*
CNX	-9.723*	0.156*	**WLT**	-8.536*	0.083*
MEE	-8.989*	0.117*	**YZC**	-8.915*	0.108*

Unit root tests are examined with constant term model. * indicates that null hypothesis of unit root is rejected at 1% significance level.

In this study, as there are three different models that are taken into consideration, the most suitable model should be investigated. For this reason, three models are formed for all the firms and LR test is used to select the best model. The results of the LR test are given in Table 5. The $H_i|H_j$ notation in Table 5, shows that in LR test Model i is tested against Model j. As a result, if test statistics are greater than critical values than null hypothesis is rejected and superior model is selected as Model j. According to these results, Model I, linear model shows a low performance and null hypothesis is being rejected. This result proves that the beta as a measure of systematic risk shows a variability during high and low volatility periods. Alpha is also tested with LR test whether it shows a meaningful difference in both regimes. Consequently, Model II and Model III provided better results. Not only beta that is calculated for BHP, BW, MFN, RTI and WLB but also alpha showed variability during low and high volatility periods. For this reason, Model III is found as the best suitable model for these companies; however, for the rest of the companies Model II gives better results.

Table 5

Likelihood Ratio Test Results

Firm	$H_1\|H_2$	$H_1\|H_3$	$H_2\|H_3$	Firm	$H_1\|H_2$	$H_1\|H_3$	$H_2\|H_3$
ACI	19.072*	21.588*	2.516	**NANX**	16.372*	16.798*	0.426
ARLP	14.886*	15.282*	0.396	**RTI**	5.38	16.54*	11.16*
ATI	15.962*	16.044*	0.082	**SFEG**	31.546*	21.26*	-10.286
BHP	5.196	15.488*	10.292*	**SWC**	12.416*	12.438*	0.022
BOOM	55.662*	58.698*	3.036	**TIE**	29.82*	30.79*	0.97
BW	22.462*	28.426*	5.964*	**USEG**	12.796*	16.432*	3.636
CCJ	11.014*	8.102*	-2.912	**USU**	17.838*	18.194*	0.356
CCRE	21.186*	16.024*	-5.162	**WLB**	6.718*	11.754*	5.036*
CNX	11.178*	8.862*	-2.316	**WLT**	22.674*	22.988*	0.314
MEE	12.362*	11.806*	-0.556	**YZC**	19.608*	19.82*	0.212
MFN	7.344*	15.416*	8.072*				

H_1 represents Model I, H_2 represents Model II and H_3 represents Model III. * indicates that null hypothesis is rejected at 5% significance level.

The results of MS-CAPM model are given in Table 6. According to the results in Table 6, beta parameter, the systematic risk measure shows different results in low and high volatile periods. Low and high volatile periods are decided according to the standard error of regression. When the standard error is low, the period is named as low volatility, and when the standard error is high, the period is named as high volatility.[2]

Firstly, if we are to interpret the results of low volatile period; the beta parameter of the securities of ACI, BOOM, CNX, NANX, RTI, SWC, USEG, USU, and WLB is greater than one and statistically significant at 5% level. This result indicates that the firms during the low volatility periods are riskier. This provides a chance to the investors of such securities to have higher returns. The beta parameter of ATI and BHP firms which is less than one and statistically significant shows that the securities of such firms are less risky. Whereas, during the low volatile period, the beta parameters of the securities of CCJ, CCRE, MFN are less than zero and statistically significant indicating that the returns of the securities move in the opposite direction to the market return. During the low volatile period, the beta parameter of ARLP, MEE, SFEG and YZC firms is not found statistically significant. This result indicates that during the low volatile period it has no relation with the market return. The betas of CCJ, CCRE and MFN firms are negative and statistically significant showing that during the low volatile period, the return of the securities move in the opposite direction to the market.

According to the results during the high volatile period; the beta parameter of the securities of ATI, BHP, BW, CCJ, CCRE, MEE, RTI, WLT and YZC is found greater than one. This result shows that during the high volatile periods the systematic risk is higher. The beta parameter of ARLP and MFN firms is less than one and statistically significant indicating that during the high volatile period, the systematic risk is lower. Finally, the beta parameters of ACI, CNX, NANX, SFEG, SWC, TIE, USEG, USU and WLB are not found statistically significant showing that such firms' returns during high volatile period move independently from the market return. There is a considerable difference between the results of the linear CAPM and MS-CAPM model. If we investigate the coal firms' returns and the market returns with the linear CAPM, then β was going to be estimated from the MS-CAPM model. This result can be misleading and the risk can be higher than (or lower) the market making a firm to have lower (or higher) risk than the market. For this reason, when the CAPM and firms' risk level is investigated the existence of the non-linear relation should be taken into consideration.

[2] The normality test, heteroscedasticity and autocorrelation tests are done with the error terms taken from the MS-CAPM and at %1 significance level for the model results no diagnostic error is observed. These test results are available on request from the authors.

Table 6

MS-CAPM Results

	α_{low}	α_{high}	β_{low}	β_{high}	σ_{low}	σ_{high}	LogL	p_1/q_1	p_2/q_2
ACI	1.748 (1.189)	-	3.010* (0.601)	-0.444 (0.861)	8.762	12.284	-428.743	0.443	0.705
ARLP	2.490* (0.692)	-	0.352 (0.268)	0.902* (0.585)	6.100	13.244	-375.264	0.950	0.795
ATI	1.202 (1.197)	-	0.946* (0.335)	4.205* (1.201)	8.697	17.603	-439.426	0.668	0.488
BHP	9.776* (1.220)	-2.496* (1.111)	0.938* (0.161)	1.440* (0.163)	3.793	5.318	-371.515	0.227	0.548
BOOM	1.071 (1.367)	-	1.248* (0.305)	1.131 (2.781)	12.502	49.212	-464.468	0.973	0.805
BW	3.253* (1.005)	-0.820 (2.217)	2.206* (0.215)	1.843* (0.512)	5.310	16.903	-422.227	0.020	0.216
CCJ	2.284* (0.820)	-	-0.532** (0.292)	1.583* (0.311)	5.904	9.026	-393.300	0.818	0.928
CCRE	-4.260* (0.535)	-	-11.798* (0.087)	1.416* (0.679)	1.001	30.641	-526.477	0.133	0.952
CNX	2.546* (1.213)	-	2.556* (0.389)	-0.066 (0.580)	9.288	15.143	-435.339	0.878	0.863
MEE	1.109 (1.592)	-	-1.059 (0.722)	3.115* (0.561)	9.610	15.581	-453.225	0.328	0.642
MFN	21.269* (4.081)	0.686 (1.438)	-5.426* (1.001)	0.579** (0.309)	9.341	13.765	-447.485	0.651	0.969
NANX	-0.705 (1.558)	-	3.731* (0.515)	1.339 (0.871)	12.310	26.501	-471.450	0.905	0.834
RTI	13.541* (0.527)	1.029 (1.139)	7.008* (0.097)	1.187* (0.251)	0.932	11.371	-420.681	0.375	0.972
SFEG	-0.522 (0.845)	-	0.177 (0.174)	0.210 (1.023)	6.840	18.730	-402.542	0.964	0.895
SWC	-0.690 (1.486)	-	2.125* (0.387)	1.221 (2.329)	12.934	31.330	-461.720	0.807	0.107
TIE	4.043* (1.526)	-	1.627* (0.361)	3.763 (2.377)	13.980	46.155	-466.509	0.942	0.457
USEG	-1.156 (1.384)	-	1.174* (0.344)	-2.912 (2.870)	13.077	28.374	-448.899	0.918	0.020
USU	1.156 (1.047)	-	1.516* (0.242)	0.990 (0.812)	7.955	20.418	-433.221	0.864	0.758
WLB	-1.897 (2.126)	6.744* (3.146)	2.209* (0.489)	-0.393 (0.527)	12.233	13.378	-442.954	0.839	0.762
WLT	2.510* (1.143)	-	1.570* (0.590)	1.275** (0.700)	8.001	22.407	-440.028	0.865	0.779
YZC	2.577* (1.173)	-	0.099 (0.348)	3.322* (0.468)	11.015	11.954	-427.749	0.943	0.902

* indicates significance level at 5%. The values in parenthesis show the standard errors. σ_{low} shows the standard error of regression during the low volatile period, σ_{high} shows the standard error of regression during high volatile period. p_1/q_1 shows the probability of low volatile period after low volatile period, p_2/q_2 shows the probability of high volatility period after high volatility period. LogL represents the log likelihood function.

The relation between the returns of the coal firms that are derived from MS-CAPM and market return is also summarized in Table 7.

Table 7
The Relation between Coal Firms and the Market during Low and High Volatility

Firms	Low Volatility				High Volatility			
	Risky	Low Risk	No Relation with the Market	Opposite to the Market	Risky	Low Risk	No Relation with the Market	Opposite to the Market
ACI	●						●	
ARLP			●			●		
ATI		●			●			
BHP		●			●			
BOOM	●						●	
BW	●				●			
CCJ				●	●			
CCRE				●	●			
CNX	●						●	
MEE			●		●			
MFN				●		●		
NANX	●						●	
RTI	●				●			
SFEG			●				●	
SWC	●						●	
TIE	●						●	
USEG	●						●	
USU	●						●	
WLB	●						●	
WLT	●				●			
YZC			●		●			

Results obtained from MS-CAPM are important three aspects. First of all, we conclude that betas of coal companies are not stable through time and changes related to volatility of stock return. This result indicates that linear CAPM doesn't describe excess return of the coal companies. Secondly, investors who want to invest in coal companies should consider time-varying beta to optimize their portfolios because beta obtained from linear CAPM is found between betas obtained from MS-CAPM. Finally, investors and academicians should use nonlinear models to forecast stock return of coal companies because likelihood ratio test results indicate that nonlinear models capture better behaviors of stock return of coal companies than linear models.

However, these results bring with questions that why the betas of coal companies are time-varying and why the coal companies behave differently from each others. Therefore some studies in the literature try to answer these questions. The first interpretation of these

questions suggested by Stattman (1980), Rosenberg et al. (1985), and Fama and French (1992) emphasizes the book-to-market anomalies in which average returns on stocks with high ratios of book value to market value are higher than those with low ratios of book value to market value. It is expected related to finance theory because companies grow and invest new projects through time and these lead to change risk profile of companies. Therefore, book-to-market values of companies cause to change their betas over 10 or 20 years horizon even in short periods.

The second interpretation proposed by Banz (1981) emphasizes the size effect that the average returns on stocks of small firms are higher than the average returns on stocks of large firms. The third interpretation argued by Jegadeesh and Titman (1999) is the momentum effect that stocks with higher returns in previous 12 months (winning stocks) tend to have higher future returns than stocks with lower returns in the previous 12 months (losing stocks). In this context, Tai (2003), Ang and Chen (2007), In and Kim (2007) and Abdymomunov and Morley (2009) determine book-to-market, the size effect and the momentum effect anomalies in the stock markets. In addition to these, Ang and Liu (2004) argued that discounting cash-flows of firms lead to change market risk premiums, risk-free rates and betas over time.

Also, it is well known that changes in the oil price have significant effect on stock returns of energy companies and any shocks in the oil price lead to change betas of energy companies over time. Faff and Brailsford (1999), Sadorsky (2001), Trück (2008) and Boyer and Fillon (2007) determine that changes in the oil price effect positively and significantly to stock returns of energy companies.

5. CONCLUSION

CAPM which measures the relationship between securities' return and the market return has a significant place in finance theory. In CAPM, the systematic risk of the securities is measured with beta parameter and with the value of the parameter; the risk level of the securities can be interpreted accordingly. In traditional finance theory, the return of the securities and the market return relation are assumed as linear and when the return of the securities increase than systematic risk also increases. In recent years, with the development of the behavioral finance theory, the return and risk relation is proved not to be linear at all times and with the effect of the anomalies in the market, this relation is found in opposite direction. On the other hand, with the development in nonlinear time series analysis, in lots of studies, beta shows variability in high and low volatile periods. Especially when the return of the securities and the risk are taken as linear, the beta parameter can be misleading. For this reason, this study investigates the risk level of the securities of coal firms that are traded in U.S. securities markets with the linear and nonlinear models. According to the results, the relation between the return of the firms and the market return is found as non-linear. In the study, two non-linear models are used. The first one is the CAPM where alpha is constant and beta is a variable. In the second non-linear model, alpha and beta parameters are assumed to be variable in high and low volatile periods. According to the findings, the first model gave better results and only BHP, BW, MFN, RTI and WLB fit better to the second model.

To summarize the results from the MS-CAPM, it can be noted that in low and high volatile periods BW, RTI and WLT firms have higher systematic risk. ACI, BOOM, CNX, NANX, SWC, TIE, USEG, USU and WLB firms in the periods of low volatile period have higher systematic risk whereas, ATI, BHP, CCJ, CCRE, MEE and YZE firms have low systematic risk during low volatile periods. ARLP firm in both periods, MEE, SFEG and YZC firms, and the return of the MFN firms during high volatile period is observed as unrelated. Finally, the return of the securities of CCJ, CCRE and MFN and the market return move completely in the opposite direction during low volatility period.

REFERENCES

Abdymomunov, A. and Morley, J. C. (2009). "Time-variation of CAPM betas across market volatility regime for book-to-market and momentum portfolios", *http://artsci.wustl.edu/~morley/am.pdf*, (Access Date: May 01, 2010).

Alexander, G. J., Benson, P. G. and Eger, C. E. (1982). "Timing decisions and the behavior of mutual fund systematic risk", *Journal of Financial and Quantitative Analysis*, 17: 579-602.

Ang, A. and Chen, J. (2007). "CAPM over the long run: 1926-2001", *Journal of Empirical Finance*, 14: 1-40.

Ang, A. and Liu, J. (2004). "How to discount cashflows with time-varying expected returns", *Journal of Finance*, 59: 2745-2783.

Balat, M. and Ayar, G. (2004). "Turkey's coal reserves, potential trends and pollution problems of Turkey", *Energy Exploration & Exploitation*, 22: 71-81.

Banz, R.W. (1981). "The relation between return and market value of common stocks", *Journal of Financial Economics*, 9: 3-18.

Blume, M. E. (1971). "On the assessment of risk", *Journal of Finance*, 26: 1-10.

Boyer, M. and Filion, D. (2007). "Common and fundamental factors in stock returns of Canadian oil and gas companies", *Energy Economics*, 29: 428-453.

Chen, S. N. (1982). "An examination of risk-return relationship in bull and bear markets using time-varying security betas", *Journal of Financial and Quantitative Analysis*, 17: 265-286.

Chen, S.-W. and Huang, N.-C. (2007). "Estimates of the ICAPM with regime-switching betas: evidence form four pacific rim economies", *Applied Financial Economics*, 17: 313-327.

Fabozzi, F. J. and Francis, J. C. (1977). "Stability tests for alphas and betas over bull and bear market conditions", *Journal of Finance*, 32: 1093-1099.

Faff, R. and Brailsford, T. (1999). "Oil price risk and the Australian stock market", *Journal of Energy Finance and Development*, 4: 69-87.

Fama, E. F. and French, K.R. (1992). "The cross-section of expected stock returns", *Journal of Finance*, 47: 427-465.

Fearnley, T. A. (2002). "Tests of an international capital asset pricing model with stocks and government bonds and regime switching prices of risk and intercepts", Graduate Institute of International Studies and International Center for Financial Asset Management and Engineering (FAME), *Research Paper*, No. 97, Available at: http://papers.ssrn.com/sol3/papers.cfm?abstract_id=477485.

Fridman, M. (1994). "A two state capital asset pricing model", *IMA Preprint Series*, No. 1221.

Galagedera, D. U.A. and Fuff, R. (2005). "Modeling the risk and return relation conditional on market volatility and market conditions", *International Journal of Theoretical and Applied Finance*, 8: 75–95.

Galagedera, D. U.A. and Shami, R. (2003). "Association between Markov regime-switching market volatility and beta risk: evidence from Dow Jones industrial securities", *Monash Econometrics and Business Statistics Working Paper* No. 20/03, Monash University, Department of Econometrics and Business Statistics.

Gu, L. (2005). "Asymmetric Risk Loadings in the Cross Section of Stock Returns", *Colombia University Job Market Paper*, Available at: http://papers.ssrn.com/sol3/papers .cfm?abstract_id=676845

Hamilton, J. D. (1994). *Time Series Analysis*. Princeton University Press, New Jersey.

Hess, M. K. (2003). "What drives Markov regime-switching behavior of stock markets? The Swiss case", *International Review of Financial Analysis*, 12: 527-543.

http://finance.yahoo.com (Access Date: January 5, 2009).

http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/ (Access Date: January 5, 2009).

Huang, H.-C. (2000). "Tests of regimes-switching CAPM", *Applied Financial Economics*, 10: 573-578.
Huang, H.-C. (2001). "Tests of CAPM with nonstationary Beta", *International Journal of Finance and Economics*, 6: 255-268.
Huang, H.-C. (2003). "Tests of regime-switching CAPM under price limits", *International Review of Economics and Finance*, 12: 305-326.
Huang, H.-C. and Cheng, W.-H. (2005). "Tests of the CAPM under structural changes", *International Economic Journal*, 19: 523-541.
Hwang, S., Satchell, S. E. and Pereira, P. L. V. (2007). "How persistent is stock return volatility? An answer with Markov regime switching stochastic volatility models", *Journal of Business Finance & Accounting*, 34: 1002–1024.
In, F. and Kim, S. (2007). "A note on the relationship between Fama-French risk factors and innovations of ICAPM state variables", *Finance Research Letters*, 4: 165-171.
Ishijima, H., Takano, E. and Taniyama, T. (2004). "The growth of optimal asset pricing model under regime switching: with an application to J-REITs", *Daiwa International Workshop on Financial Engineering* No.15710120.
Jagannathan, R. and Wang, Z. (1996). "The conditional CAPM and the cross-section of expected returns", *Journal of Finance*, 51: 3–54.
Jegadeesh, N. and Titman, S. (1999). "Profitability of momentum strategies: An evaluation of alternative explanations", *Working Paper*, *University of Texas at Austin*.
Krolzig, H.-M. (1997). *Markov-Switching Vector Autoregressions Modelling, Statistical Inference, and Application to Business Cycle Analysis*. Springer, Berlin.
Kwiatkowski, D., Phillips, P.C.B., Schmidt, P. and Shin, Y. (1992). "Testing for the null hypothesis of stationarity against the alternative of a unit root", *Journal of Econometrics*, 54: 159–178.
Levy, R. A. (1971). "On the short-term stationarity of beta coefficients", *Financial Analysts Journal*, 27: 55-62.
Li, M.-Y. L. (2007). "Volatility states and international diversification of international stock markets", *Applied Economics*, 39: 1867–1876.
Lintner, J. (1965a). "The valuation of risk assets and the selection of risky investments in stock portfolios and capital budgets", *Review of Economics and Statistics*, 47: 13–47.
Lintner, J. (1965b). "Security prices, risk and maximal gains from diversification", *Journal of Finance*, 20: 587–616.
Liow, K. H. and Zhu, H. (2007). "Regime switching and asset allocation", *Journal of Property Investment & Finance*, 25: 274-288.
Phillips, P.C.B. and Perron, P. (1988). "Testing for a unit root in time series regression", *Biometrika*, 75: 335–346.
Rosenberg, B., Reid, K. and Lanstein, R. (1985). "Persuasive evidence of market inefficiency", *Journal of Portfolio Management*, 11: 9-17.
Sadorsky, P. (2001). "Risk factors in stock returns of Canadian oil and gas companies", *Energy Economics*, 23: 17–28.
Shami, R. and Galagedera, D. U. A. (2004). "Beta risk and regime shift in market volatility", *Economic Society Australasian Meetings* 126, Available at: http://papers.ssrn .com/sol3/papers.cfm?abstract_id=612022
Sharpe, W. F. (1964). "Capital asset prices: A theory of market equilibrium under conditions of risk", *Journal of Finance*, 19: 425–442.
Stattman, D. (1980). "Book values and stock returns", *The Chicago MBA: a Journal of Selected Papers*, 4: 5-45.
Tai, C. S. (2003). "Are Fama-French and momentum factors really priced?", *Journal of Multinational Financial Management*, 13: 359-384.

Tiwari, A. (2006). "Investing in mutual funds with regime switching". Available at: http://www.biz.uiowa.edu/faculty/atiwari/InvestinginMFunds.pdf.
Trück, S. (2008). "Oil price dynamics and returns of renewable energy companies", *http://www.firn.net.au/resources/pdfs-papers-slides/Trueck_RD_2008.pdf*, (Access Date: May 01, 2010)
Wilson, C. A. and Featherstone, A. M. (2006). "Adjusting the CAPM for threshold effects: An application to food and agribusiness stocks", *Purdue University Staff Paper* No. 06-08.
World Energy Outlook (2008). http://www.worldenergyoutlook.org/docs/weo2008/WEO2008_es_english.pdf, (Access Date: May 15, 2009)
Yılmaz, A. O. and Uslu, T. (2007). "The role of in energy production-consumption and sustainable development of Turkey", *Energy Policy*, 35: 1117-1128.

TESTIRANJE MODELA PROCJENJIVANJA KAPITALNE IMOVINE (CAPM) KORISTEĆI MARKOVLJEV KOMUTACIJSKI MODEL: SLUČAJ RUDARSKIH PODUZEĆA

SAŽETAK

Ovo istraživanje analizira vezu između rudarskih poduzeća prisutnih na njujorškoj burzi i S&P500 indeksa. Zarada rudarskih poduzeća i tržišna zarada analiziraju se tradicionalnim CAPM modelom i komutacijskim CAPM modelom Markovljevog režima dva stanja. Sudeći po testu omjera vjerojatnosti, MS-CAPM režim dva stanja daje bolje rezultate i ukazuje na nelinearni odnos između zarade i rizika. Zaključeno je da beta pokazuje varijabilnost u odnosu na periode niske i visoke volatilnosti zbog čega linearni CAPM prikazuje devijantne rezultate.

***Ključne riječi**: Rudarska poduzeća, CAPM, Markovljev komutacijski model*

Marko Paliaga
Zoran Franjić
Željko Strunje

UDK 711.42:339.138
Preliminary paper
Prethodno priopćenje

METHODOLOGY OF VALUATION OF CITIES' BRANDS

SUMMARY

A growing number of articles and literature in Croatia and worldwide deals with the issue of applying marketing and branding concepts to cities and countries or places in a wider sense (a city denoting an urbanized, organized and functionally shaped place with all belonging contents and functions). From the perspective of physical planning and urban development, literature is focused on macro perspective of a place, on efficient social and economic functioning of an area in conformity with objectives set by a particular social and political community. From the perspective of marketing and branding theory, literature is more focused on marketing and branding nations and less on the segment of cities and small towns. This particularly refers to Croatian and foreign literature and scientific works in terms of modelling the methodology for the valuation of city brand. There are but a few concrete researches in this particular field, and hence this paper examines and researches reasons for branding cities and tries to set the theoretical framework for measuring – valuating the city brand. Financially, it is very important to be able to assess the extent to which marketing, budget and economic efforts invested in the creation of the brand have contributed to the newly created value of the city.[1]

Key words: *city branding, brand valuation, development of local economy*

1. WHY BRAND A CITY AND WHAT ARE THE FUNCTIONS OF BRANDING?

The American Marketing Association (AMA) defines brand as a name, term, symbol or design, or their combination, with the intention of identifying merchandise or services of a sole vendor or a group of vendors and differentiating them from those of competitors (AMA, 2009), which is also the most frequent view of the notion of brand or trademark. Brand may also be defined as a name that makes it possible for any given product or producer to be unique among similar or same products or producers (Radawiecka, 2009). Brands have become the main communicators in the market. A strong brand simplifies consumer's behaviour and decision-making and reduces the risk inherent in choosing or buying; it establishes quality and high expectations. Strong brands also create strong thoughts and emotions in the customer's awareness (Kuhn and Alpert, 2009.) Brand is a product, service or organization considered in relation to its name, identity and reputation (Anholt, 2007). Branding is the process of creating, planning and communicating the name and identity aimed at managing one's own image and reputation (Anholt, 2007.) The identity of a trademark or brand is the main concept of a product, service or city. Commercially, the first aspects we notice of an identity are the logo, colours, slogans, packaging and design. Brand image is the perception of trademark/brand in the customer's consciousness or reputation of a city, product and service in the customer's consciousness. A lot depends on the image of the trademark. City branding was the main topic of authors such as Cheratony, Levy, Munson, McWiliam and Spivey (Andia, 2005.). Most authors study city branding from the standpoint of identity and functionality (Andia, 2005), which is the key of branding. Branding for purposes of mere

[1] Paper received 13 October 2009.

change of visual identity, promotion of mere slogan and presentation of logotype is not a branding process and creation of city brand.

Why has city branding become increasingly popular and important? According to authors Cheratony and Virgo (2006), branding helps cities attract tourists, funds or residents in the increasingly competitive environment. Furthermore, authors are convinced that a strong city brand shall have less difficulty in overcoming hard times such as economic crisis. The main premise of city branding is creating added value for an organization - city with a brand through adequate brand management (Tschirhart, 2009). According to the author Qingjun Wu (2008), city brand for the city of Rizhao in China has become the biggest intangible asset of the city. Anholt (2007) maintains that people evaluate cities and places, choose them, like or dislike them based on stereotypes and clichés. If you do not have time to read a book, you judge it by its cover. It is very difficult for a city or a country to convince their prospect visitors or investors that their perceptions are unfounded. And this is the fundamental task of city branding. Therefore, it has become more obvious that today's countries and cities increasingly compete with other cities worldwide in terms of investments, attracting larger numbers of tourists and the best possible placement of their export products. Their greatest concern is to attract as many as possible suitable investors, to secure the best possible image to secure long-term local and national development of economy. The process of branding cities and countries is not simple and it takes quite a long time. Such long duration is the result of the need to change the image of the city or country by constructing infrastructure projects and creating attractions - recognizable features and forms. Country or city branding is not a promotional campaign. Results become visible only after a couple of years, and only after ten or fifteen years may it be stated and concluded whether the process has been successful. Branding and creating a city brand is a prolonged part of strategy of city marketing. Marketing or urban marketing has to teach city administration how to listen to its stakeholders, how to recognize its wishes and needs and wishes and needs of all its stakeholders and how to behave as competitors. City branding is an addition to the process. Branding has to secure loyalty of stakeholders and attractiveness, recognition of a branded city. Cities have a certain truth to themselves. The truth is actually the core that accumulates all marketing and branding efforts.

Functions of city branding are considered based on the aspect of communication, perception, creation of personality and new value. From the aspect of communication, brands are continued communicators (Hankison, 2004). This is very important for cities and for the city branding process. The role of city brand as communicator is to secure a continued process geared at constant construction of one's own brand identity and its communication to the public. A city brand will make the overall city identity measurable, tangible and communicating (Aronczyk, 2009). As subjects of perception, brands affect customers' feelings, emotions and requests. For this reason, the image of the brand is defined as images, notions or feelings the customer has acquired or keeps acquiring about a product, while the identity of a brand is something an organization or a mayor would want his/her citizens to think about his/her city-brand. Identity is something we want to communicate, and perception or images are impressions the buyers have acquired about us. Finally, city branding constructs city’s personality and uniqueness. In such a manner, we create interdependent relationships with customers. These relationships are particularly connected with customers’ attempt to create their own image through wearing, consuming or using somebody else’s particular image. The relationship is constructed through a positive experience a customer-visitor when contacting a city brand.

2. CITY BRAND AS GENERATOR OF NEW VALUE AND FINANCIAL BENEFITS

After a series of mergers of renowned companies in the 1970s and 1980s, brands started to be perceived as part of corporate assets that have to be maintained and invested in. This concept later led to the creation of the notion of brand equity. From the perspective of financiers and accountants, brand equity is exclusively considered as financial asset. From the marketers' standpoint, brand equity is considered an indicator of future business activities through brand loyalty, distribution and recognition of the brand in the following years. Such standpoints have produced a need to develop brand management that will manage a trademark, particularly its identity (brand identity). Moreover, brands also contribute to the creation of added value for customers. There is a positive correlation between the brand and customer loyalty. For the customer, the brand acts as risk reducer in terms of quality, design and other values. The more customers trust a brand and the more loyal they are, it reduces the risk of purchasing in terms of all features of the product, because they know exactly what they get from a brand. Valuation of the brand of a company is particularly important in acquisitions or mergers, when one company is taken over by another, or when two companies merge, when the brand is licensed to a third company or when a company collects or wants to collect capital in the market and in terms of total brand management. For some companies, brands are actually their most important company assets. Brands like Google, Coca Cola or Mercedes Benz are almost sole guarantees of business success. These brands are worth more than total tangible company assets. Philip Morris spent 12.9 billion dollars in 1989 on the brand Kraft, 6 times the total company assets. Successful brands have loyal customers, guaranteed sales and foreseeable growth, which directly reflects on overall company income, its book and market value. Similar is true for cities. Successful city brands are magnets for tourists, new residents or prospect investors. Suddenly everyone wants to be a part of a successful city. Cities like Sidney, Barcelona or Manchester that mainly owe their new identity to large sports manifestations have actually increased their value by constructing their overall worldwide recognition, which made them famous, desirable and trendy. With the Winter Olympic Games, Turin attracted a large number of investors and renowned brands. These cities witnessed a surge in the prices of real estate, they became more interesting for both investors and tourists. These cities, having branded themselves, have created prerequisites for future city revenues after a particular event or manifestation. The following section presents and studies a possible model of valuation of city brand and its influence on the local economy and budget.

3. DEVELOPMENT OF MEASURABLE INDICATORS AS PROOFS OF POSITIVE OR NEGATIVE INFLUENCE OF BRANDING ON THE DEVELOPMENT AND ASSETS OF CITY BRAND

Value of each property, be it tangible or intangible, may be assessed. From stakeholders' perspective, brand value equals the financial return, or the profit it generates over a particular period of time, and the shareholders may divide it in the form of dividend. From the perspective of cities, it is not possible to apply such an exact approach. However, generally looking, the value of a city brand should reflect on the total development and progress of a community, a larger number of tourists, strengthening of local economy, growth of GDP, growth of foreign investments, growth of employment and similar. In short, a city brand should initially increase the value of the assets of all stakeholders' over a particular period of time and increase prospects of their business activities. Brand valuation is defined as the calculation of future incomes from the brand over a particular period of time – lifespan converted to present value (Forbes, 2006.)

Methodology of valorisation of trademarks is based on the premise that brands are actually long-term assets and that they will generate future income for their owners-companies over a particular economic life. The stronger the connection between customers and the brand, the more probable is a longer period of generating future income. In other words, brand valuation in companies can be performed using the following methods.

There are numerous methods used in the estimate and calculation of brand value in companies (Laboy 2009; Radawiecka 2009; Antić and Pancić 2008). The following are some of the most widely used brand valuation methods:

a) Method of calculation of net present value –the method that refers to presupposed life of brand through discounting net cash flow and discount factor and it is one of the widely used methods. It is based on the estimate of future income and net profit from a brand and on their conversion to present value using a chosen discount factor.

NCV = ∑(Annual income from brand n – Annual expense from brand n)/(1+p/100)^n - (Initially invested amount in the development of brand)

Brand is successful and cost-efficient and it generates newly created value for a company if NCV > 0, it borders cost-efficiency when NCV = 0, and it is unprofitable – unsuccessful when NCV<0

b) ***Book value versus market value***- method that tries to provide brand valuation by subtracting book value from market value. Book value comprises the value of overall assets minus company liabilities and intangible assets. Market value of a company is estimated based on market capitalization or value of all shares. There is a series of problems related to this method, and one of the most evident is the difficulty to estimate the brand of a given product in relation to the brand of the company. In other words, it is difficult to calculate the value of detergent Tide for the company Proctor & Gamble when we know that the market trades only with shares of the company, and not with shares of Tide. This method may be expressed in the following way:

Bv =M (market value) – B (book value)

where Bv = brand value, m stands for market value and b denotes book value.

c) ***Premium price–*** for some products, it is possible to provide brand valuation using this method. It is calculated provided that increased value of a branded product is actually the difference between its price and the average price of similar non-branded products multiplied by the number of sold units over a particular lifespan-period. The principal shortcoming of this method is the difficulty to find comparable generic products that are not brands whose quality and properties resemble those of branded products. This calculation is expressed in the following way:

Bv = (P brand –N generic) x S sales

where Bv means brand value, p is the price of branded product, n being the average price of similar non-branded products, and S stands for average number of sold products in the past

year. (Note: a more extensive analysis is available in the work of Fernandez, 2001., Damodaran model)

d) ***Relief from Royalty*** – this method is based on the premise that particular companies, if they do not have their own brand or a similar brand, may produce on the basis of a licence granted by another producer. Companies pay royalty for the licence, or a commission expressed as percentage from sales or total income. To obtain brand valuation, it is necessary, as in the case of net present value, to estimate sales in an expected period of time-lifespan of a brand, to calculate royalty from total amounts over a particular period and to discount and convert them to present value.

e) ***Present value of performed investments and estimate of necessary investments in advertising to realize the current level of brand recognition*** (Fernandez, 2001) - are methods based on the estimate and calculation of performed investments in overall marketing efforts geared at achieving the present level of brand recognition. These methods are based on past available book values and amounts, so that the value of a brand can be estimated in relation to the book value of company assets based on performed investments.

Naturally, there is a series of other methods used in assessing the value and influence of a brand on the value of company assets (Anholt city brand index 2007 βrandβeta® indeks, Safron European brand barometer). However, when using any of these methods, we must be aware of the risk and the role they have in assessing future income and market trends considering the fact that they are predominantly based on projections and estimates of future trends of particular market flows and sales. When assessing the value and influence of a brand on company assets, it is always advisable to take into consideration several methods so that their combination will produce middle indicators.

Undoubtedly, the influence of brand and marketing concepts on cities is much more complex than with companies where incomes are clearly defined. In the first place, a city brand comprises a much wider range of services and incomes some of which are quite cost-driven (such as culture and social sensitivity), so that they cannot be considered in the majority of the above listed methods. As opposed to these methods, one of the most renowned world experts in country and city branding, Simon Anholt (2003;2009), the author of the research "City Brands Index", provides the annual valuation of city-brands based on a particular methodology. Index and overall methodology proceed from research and analysis of the manner in which people react to city brands. The basic premise is that people react to such brands in the absolutely same manner in which they react to all other trademarks (*www.nation**brand**index.com*). Research of city brands has been carried out on the large sample of 17,502 persons and it includes valuations for 60 cities, based on 6 dimensions, export, city administration management, cultural and historical heritage of a city and its preservation, kindness of citizens, tourism and attracting new citizens, or desirability to live in a city. In fact, this methodology is not based on the model of expenses, but on the model of satisfaction and valuation by users of services-citizens or by all stakeholders in contact with the city. A similar method and identical parameters of valuation have also been used in assessing the value of nations (Anholt, 2005.) This method is rather demanding and complex. Together with the above listed methods, Roger Sinclair (2004) presented the result of his five-year research in his work dealing with the elaboration of methodology of calculating the value of brand for nations using the example of South Africa. Like the model proposed herein, his model is partially based on financial premises (income), tourism and export, or the premise that export incomes of a country actually mostly depend on recognizability, image or brand of

a country. Further estimates in the model are performed by means of the Delphi Method and other estimates of future trends aimed at constructing future estimated incomes based on present conditions, and they are converted to present value by means of discount factor. Using data available in international statistics, Sinclair (2004.) basically proves that the existing data may be used in the estimate of brand recognition of each country in the world economy, and the resulting number may be used in the valuation of marketing efforts invested in construction of the brand. Nevertheless, the objective of this work is to apply one of the cost approach methods of city brand valuation, which has been insufficiently researched both in Croatia and abroad (estimate of value based on measurable influences without researching the above mentioned stakeholders' opinion). For this reason, we have tried to introduce a combination and the premise that growth of local development of city economy through three measurable components, namely export, foreign investments and tourism, contributes to recognition and increase of value of total assets of a city and its stakeholders. The more visited and known the city, the more expensive it becomes. The value of real estate grows for the simple reason that a large number of visitors generate a larger demand for scarce assets available for sale. Foreign investors, because of their employees, financial possibilities of a city, its openness for collaboration and marketing concept, may and want to invest and encourage investments in the growth and development of a successful city. Everybody wants to be a part of success. When we create a city as a brand, we create a successful story. Success and recognition create extra newly created value for all the citizens of a city brand, a new value of overall local development.

To be able to use one of the above explained methodologies for estimating brand value, we have tried to provide basic premises for the estimate and financial calculation of selected incomes generated by a city as a result of its branding. This means that we have to be able to estimate the particular share of income the city acquires thanks to the application of a given methodology. This income is considered a part of new city value expressed financially that has a positive effect on the development of local economy and the consequent growth and development of a city, its assets and GDP. Income the city generates that is mostly related to its image and perception and the communication of trademark is undoubtedly income from city exports, annual amount of foreign investments and annual income from tourism. In Croatia, the city of Rovinj is known for its tobacco industry, export potential of the city and its famous slogan "Greetings from Rovinj", and it is also renowned as a tourist destination with a beautiful old town. Similar is true for the cities of Dubrovnik and Varaždin. The city of Varaždin is known in Croatia as the city of culture and baroque and for some trade export brands that increase its recognition and value through its export potential, namely textile brands Varteks, Di Caprio and Levis. The following model and valuation could serve as a starting point and framework for the beginning of research. It is presented in the below table and in the proposal of calculation.

Table 1

Available income of city economy for city brand valuation

CITY INCOME IN THE PAST PERIOD	**year n-3**	**year n-2**	**year n-1**	**year n**	**average for n years**
1. INCOME FROM TOURISM IN THE CITY					
Estimate of total tourist turnover of the city					
2. INCOME FROM FOREIGN INVESTMENTS					
Estimate of direct cash flow from foreign investments in the city					
3. TOTAL EXPORT					
total city export (expressed in HRK)					
A = TOTAL INCOME FROM CITY BRAND (1+2+3)					
BUDGET EXPENSES OF THE CITY IN THE PAST PERIOD					
City communal expense directly related to tourism and city arrangement					
Total import of goods and services in the city					
Total investments of domestic companies out of administrative city borders					
B = TOTAL EXPENSES RELATED TO CITY BRANDING					
NET INCOME FROM BRAND = A – B					

Source: authors

The above data and valuations and calculations proposed herein based on past and available data should be used in the valuation of future income and expenses and discounted, converted to their present value using the net present value method with the choice of a particular discount factor. Discount factor should be within the range of interest given on city securities in Croatia or within the range of average interest on received city credits for the construction of infrastructure facilities or institutions (such as city sports hall, theatre or similar). All above listed data or table requirements have to be independently calculated and estimated for every city. Tourist turnover data for Croatian cities may be acquired from the city tourist board, and average expenses can be obtained from the Croatian Institute for Tourism or through polls/estimates of tourist companies in the city area. Direct foreign investments can be estimated using the data of tax authorities competent for the city area. The same is true for export data. These data are also statistically updated at the tax administration. A simple comparison and eventual subtraction should produce the amount we can claim to be directly

related to the creation of a city brand. Consequently, "net income" from the brand is inserted in the following formula:

NCV = ∑(Expected annual income from city brand n – Expected annual expenses from city brand n)/(1+p/100)^n - (Initial invested amount in the development of city brand, if available)

The resulting value or net present value converted to present value of money will represent finances the city as total entity generates from selected criteria we have defined as parts of city brand. The calculation can simply be made using table calculators type Excel. The selected income is basic positive engine of overall development of local economy and we can correlate it to existence or inexistence of city brand.

In the future, we wish to test the model based on indicators presented herein on several Croatian cities, which will lead to conclusions about its representative quality and its usefulness.

4. FINAL CONSIDERATIONS

Brands are part of our everyday life, created as a consequence of growing competitiveness and globalisation. City brand represents and comprises all its cultural, social, economic, tourist and town planning assets. In today's economy marked by crammed markets, fast marketing, "media jam" and deluge of information, brands have become the principal and the most important distinguishing features of particular products, services, organizations, as well as recognition of particular countries and regions.

City branding process refers to managerial processes that endow any given city with a unique identity and image, presents cities with a possibility of being clearly and positively identified and thus different and recognizable from competitors. Compared to classical products and services, branding geographical areas and tourist destinations (cities, regions, countries, etc) is a process whereby a region actively creates its identity with the objective of as quality as possible positioning in the domestic and international market as desirable destinations for tourism, trade, investments, and similar. Naturally, stakeholders choose both with their emotions, their hearts, but also with their minds.

The preliminary model presented herein is aimed at presenting one possible valuation and calculation of city brand value using net present value or discounted cash flow. Income for cash flow and expenses have been chosen based on authors' experience and the availability of data. All required entry data for proposed model may be gathered from city administrative and tax authorities at the local level. Our wish was to indicate possible calculations of the value of city brand through a unique methodology applied from business marketing and business branding, considering that a study of existing literature indicated a lack of any elaborate methodology or proposal of elaboration of methodology used in city brand valuation. The only serious approach was given in the article by Roger Sinclair. However, it refers to methodology of valuation of country brand based on a wider research of competitiveness of nations and their comparison. The methodology we have presented based on its simplicity already indicates in this work a direct connection of particular parts of city income and city brand and their possible influence in the future period either as fall or increase depending on the success of city branding process. Further authors' research is

necessary in order to prove whether our hypotheses and measurements and calculations we have proposed are representative and useful and to prove their positive influence on the local development and growth of the city.

REFERENCE

"Brand Valuation", Interbrand , 2004, www.marketingritson.com, *16.09.2009*

Andia Alfredo "Branding the Generic City" Monu-Magazine on urbanism, number 7, www.monu.org/monu7/**Branding**.pdf, *20.09.2001*

American Marketing Association brand definition, http://marketing.about.com/cs/brandmktg/a/whatisbranding.htm

Anholt Simon, http://www.simonanholt.com/, *16.09.2009*

Anholt, Simon: "Branding places and nations", *Brands and Branding*, Profile Books, London, pp.213-26. , 2003

Anholt, Simon: "How does the world see America", Anholt GMI Nation Brands Index, 2005, www.**nationbrandindex**.com, *19.09.2009*

Cheratony Leslie, Ben Virgo: "Delphic brand visioning to align stakeholder buy in to the City of Birmingham Brand", Palgrave Macmilian, Brand management, vol. 13, no 16, 2006

Partly according to: Aronczyk Melissa: "How to do things with brands: uses of national identity", Canadian Journal of Communication, vol. 34, 2009., pp. 291-296.

Fernandez Pablo: "Valuation of brands and intellectual capita", IESE Business School, 2001, www.stern.nyu.edu, *17.09.2009*

Forbes Thayne: "Brand Valuation, an ROI measurement tool", ADmap, World advertising research, number 3, 2006

Hankison, Graham: "Relational work on brands: towards a conceptual model of place brands", Henry Stuart Publications, Journal of Vacation marketing, vol. 10, No. 2, 2004, pp 109-121.

Kuhn Kerry, Alpert Frank: "Applying Kellers Brand equity model and B2B context-limitations and empirical test", Griffith University, 2009

Laboy Pedro:" The Importance of Measuring Brand Value and Brand Equity", COO, Tocquigny , www.tocquigny.com, *16.09.2009*

Radawiecka, Ewa: "METHODS OF BRAND VALUE VALUATION", Zeszyty naukowe, Instytutu Ekonomii i zarazadzania, www.ieiz.tu.koszalin.pl, *17.09.2009*

Sinclair Roger: "A brand valuation methodology for nations", Henry Stuart Publications, Place branding, vol. 1, pp. 74-79, 2004

Safron European City Brand Barometer, www.**city**mayors.com, *08.08.2009*

Tatjana Antić, Ladislav Antić, Mladen Pancić: "Brand Valuation", Faculty of Economics in Osijek, Interdisciplinary Management Research IV, 2008., pp. 198-216.

The Anholt city brand index, "How the world views its cities", 2007, www.business.nsw.gov.au/.../**anholt_citybrand**index2007_general.pdf, 16.09.2009

Tschirhart, Mary: "Identity management and the branding of cities", Campbell Public Affairs Institute, Syracuse University, 2009

Wu Qingjun: "The scheme of Rizhao city brand", Operation and Management College, International Business Research, vol 1, number 3, 2008., www.ccsnet.org/journal.html, 17.09.2009

βrandβeta® indeks, "Adding brand value", http://www.brandfinance.com, 17.09.2009

METODOLOGIJA OCJENE VRIJEDNOSTI GRADSKIH BRENDOVA

Sažetak

Sve veći broj članaka i literature u Hrvatskoj i svijetu bavi se pitanjem primjene marketinga i koncepta brenda na gradove i zemlje ili mjesta u širem smislu (grad koji je urbanizirano, organizirano i funkcionalno oblikovano mjesto sa svim pripadajućim sadržajima i funkcijama). Sa stajališta prostornog planiranja i urbanog razvoja, literatura je usredotočena na makro perspektivu mjesta, na efikasno socijalno i ekonomsko funkcioniranje područja u skladu s ciljevima određene društvene i političke zajednice. Sa stajališta teorije marketinga i brendiranja, literatura je više fokusirana na marketing i brendiranje nacija a manje na segment gradova i gradića. To se posebno odnosi na hrvatsku i stranu literaturu i znanstvene radove u pogledu kreiranja metodologije za ocjenu vrijednosti gradskog brenda. Postoji samo nekoliko konkretnih istraživanja na ovom specifičnom polju a ovaj rad istražuje razloge za brendiranje gradova te pokušava postaviti teoretski okvir za procjenu gradskog brenda. Sa stajališta financija, vrlo je važno procijeniti u kojoj su mjeri marketing, budžet i ekonomski napori uloženi u stvaranje brenda doprinijeli novostvorenoj vrijednosti grada.

Ključne riječi: *brendiranje grada, ocjena brenda, razvoj lokalnog gospodarstva*

Marija Bušelić[1]

UDK 314.5:314.87>(497.5)
Review
Pregledni rad

FAMILY STRUCTURE AND DEMOGRAPHIC PICTURE IN THE REPUBLIC OF CROATIA

ABSTRACT

The analyses of population movements in the Republic of Croatia are characterized by depopulation features, which have been especially prominent since 1991. Natural and mechanical population movements contribute to total depopulation. Natural depopulation is mostly caused by diminution in the number of marriages, divorce increment as well as marriages without children. An empirical research on students' population has been applied in our work in order to identify their attitudes towards marriage, family and children.

The results point to students' positive attitudes and the fact that these attitudes reflect their family structure and their provenience (urban, rural). They associate their positive attitudes with the later entry into marriage as a consequence of social and economic factors.[2]

Key words: *family, marriage, depopulation, population*

1. INTRODUCTION

The last decade of the 20th century was characterized by enhanced changes in nuptiality and divortiality rates as well as natural population growth rates in the majority of the European Union member states. The underlined unfavourable phenomena in demographic movements in the developed countries are also visible in demographic movements in the Republic of Croatia. The mentioned trends result in a late entry into marriage, smaller number of children, giving birth at an older age and divorcing more often. Most of this changes sprang up from the development of the economic structure and socio-economic processes. The consequence was higher participation of women in the labour market, which was enabled by enhanced job and employment accessibility, change of propensity and attitude towards women, higher integration in the educational process and the growth of women's real wages. Therefore, women became more independent of the material existence, which was visible in the decrease of the birth rate and high divorce rate.

The highlighted changes contributed to natural depopulation which will certainly affect future demographic movements.

The purpose of this paper is to research when these important changes in nuptiality and divortiality rates as well as natural population growth rates in the Republic of Croatia occurred and how they have influenced country's demographic picture.

In demographic literature, it is well known that factors, which affect changes and birth rates, affect also the number of marriages. Because of today's situation and the future Croatian demographic picture forecast, the purpose of this work is to identify young population's (working and natural reproduction age) opinions and attitudes to marriage,

[1] University Juraj Dobrila of Pula Department of Economics and Tourism «Dr. Mijo Mirković»

[2] Paper received 13 October 2009.

family and children. To meet this aim an anonymous survey among the student population of the University of Juraj Dobrila in Pula will be conducted .

2. FAMILY STRUCTURE

Families are a constituent part of the economic structure of the population that have an important impact on the social and economic development and that is why it is important to research the structure of the family. The economic structure of the population could be related to their economic activity, occupation, occupational rank and features of the settlement or to active population and workforce that has to be grouped according to mentioned features and see the source of their income. This paper will borrow definitions from the official statistics since the Croatian historiography does not contain any notions related to the family structure. For the purpose of this paper the analysis will include a number of marriages and divorces and their features, a number of children in families, a number of children in single parent families and a number of children of divorced parents.

The family structure varies from society to society. The smallest family community is known as the nuclear family and it consists of a father and a mother and their underage children (Gelo,J.,Akrap, A., Čipin, I., pg. 151, 2005).

There are several definitions of family: statistical, jurisdictional, institutional, social and other.

The most important for economists is the statistical definition used for population census. According to this definition family is a narrow family community including:

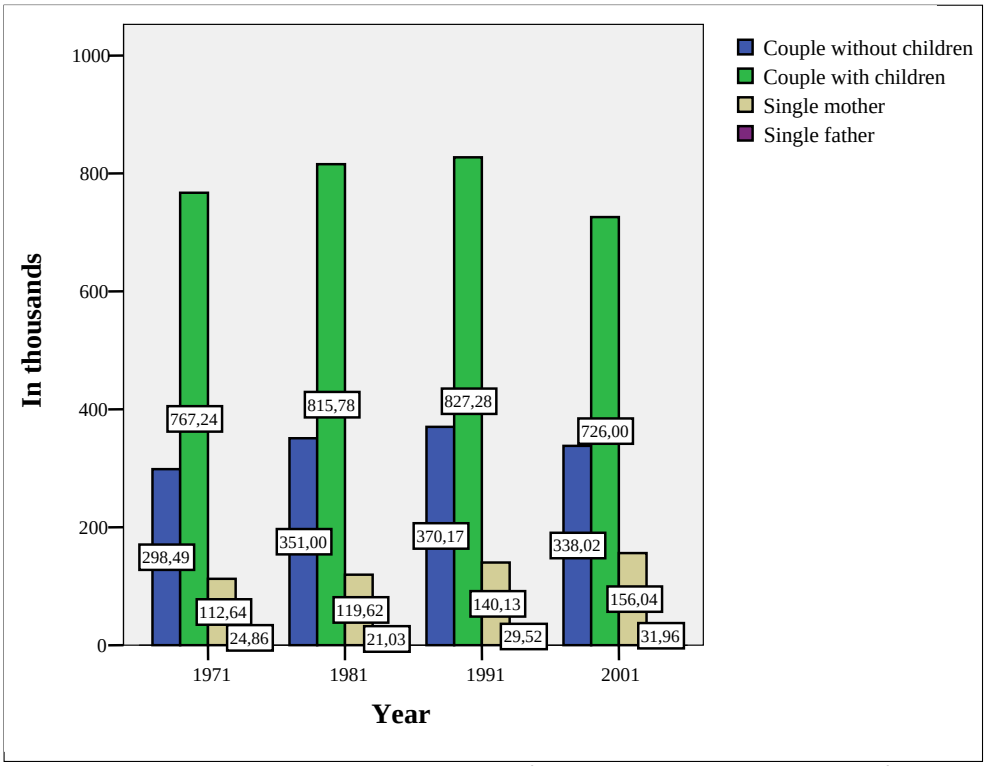
- parents(both or just one) and their children who are not married or
- a man and a woman without children or a man and a woman who cohabitate[3]

Marriage is the foundation of the family, although in modern society today it is more often the case of cohabitation and incomplete families. The relationship between partners acquires personal as well as social dimension. In spite of the increase in the divorce rate, alternative lifestyles and more children who are born outside marriage, family remains the central social institution. Because of its importance and its role, the family has to be considered in greater detail (Figure 1).

[3] Puljiz, V. (2002): "Hrvatska obiteljska politika u europskom konteksktu", Revija za socijalnu politiku, Vol. 9, No. 2, pg. 121

Figure 1

Family types according to population censuses



Source: Authors' interpretation according to the Republic of Croatia Statistic Yearbook, Republic of Croatia – Central Bureau of Statistics, Zagreb, 2007, pg 88

The total number of families in the Republic of Croatia augmented from 1.203.240 in 1971 to 1.307.423 in 1981 to 1.367.106 in 1991. According to the 2001 population census the number of families was reduced by 9,01% or 124.081, which can be explained by the reduction of included population or mechanical movements. Cohabitation is defined as the non official living together of a man and a woman. In our country more and more families consist of a single parent, man or woman, who lives with their child or more of them. The number of such families increased between 1971 and 2001. The rate of single parent families in 1971 amounted to 11,5%, in 1991 12,4% and 15,0% in 2001. In such families the rate of single mothers amounted to 83,0% and single fathers included 17,0% of single parents families. In the same period the number of marriages with no children rose from 24,8% in 1971 to 27,15 in 1991. The analysis of the number of children in families indicates that it reached the highest level in 1971, most probably as the result of the "baby-boom" generation. But since the 1971 population census the number of married couples with children has diminished.

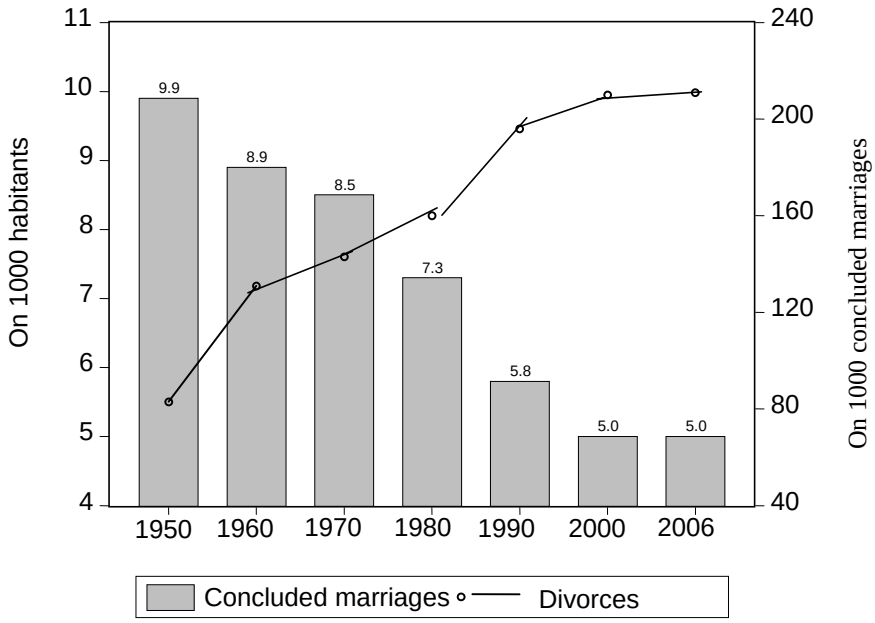
3. MARRIAGE AND ITS RELEVANT FEATURES

The foundation of marriage is the relationship between two individuals and the obligations and rights which arise from it. The way a marriage is concluded depends on an individual, community, culture, religion or society. There are two essential marriage types present in all societies: monogamy and polygamy. Polygamy has two varieties: polygamy and polyandry.[4] Polygamy is the type of marriage where a spouse can have more than one partner. Polyginy – a situation when a man has two ore more wives is more common. Polyandry is rarer. This term defines a marriage where a wife has two ore more partners. Monogamy, the marriage between a man and a woman, prevails in western societies and that is the case with the Republic of Croatia as well. Today marriage has two important functions: personal and social. There is a difference between personal and private connection between two people and family including a particular interest and social group. The development of society influences the change of the attitude towards marriage, therefore, the importance of marriage fades and the number of divorces and single mothers experiences a growth. On the other hand, long-term analysis of marriages concluded in Croatia during the 20th century confirmed that more than 90% of children where born in marriage. This is an important determinant of the birth-rate (Gelo,J., Akrap, A., Čipin, I., 2005, pg 174). The factors which influenced the reduction of concluded marriages through time are: developmental and non-demographic (wars, economic and political crises and related migrations).

A continuous fall of concluded marriages and the growth of divorce is evident considering a 50 year period in Croatia.(Picture 2)

Figure 2

Concluded marriages and divorces in the Republic of Croatia from year 1950 to 2006



Source: Author's interpretation according to the Report on Women and Men in Croatia 2008, Republic of Croatia – Central Bureau of Statistics, Zagreb, 2008, pg 15

[4] Fanuko,N. (1997): Sociologija, Školska knjiga, Zagreb, pg. 105

The number of concluded marriages in Croatia since 1950 is in diminution while at the same time the number of divorces is on a rise.. 37.995 marriages were concluded and 3.137 ended in divorce in Croatia in 1950. The number of concluded marriages in 2006 diminished by 42% in comparison to 1950, while the number of divorces rose by 33%.

Notwithstanding the important role that the family has in marriage, the number of divorces and children pertaining to one parent are on a rise which is illustrated by the index of divorces and the number of dependent children between 1960 and 2006 (Table 1).

Table 1

Divorces according to dependent children in the Republic of Croatia

	Divorces		Number of sustained children	Children pertaining to:			
	Total	With sustained children		Mother	Father	Mother and father	Other
1960	4 811	2 354	3 344	78,8	14,9	5,7	0,6
1970	5 333	2 821	3 888	79,2	14,7	4,8	1,2
1980	5 342	3 020	4 282	84,4	10,2	4,5	0,8
1990	5 466	3 363	4 998	83,8	11,5	3,5	1,2
2000	4 419	2 764	4 208	86	10,2	3,1	0,6
2006	4 651	1 614	4 067	83	10,5	4,8	1,7

Source: The Report on Women and men in Croatia 2008, Republic of Croatia – Central Bureau of Statistics, Zagreb, 2008, pg 15

In 1960 out of 4.811 divorces, 2.354 where couples with children. The number of divorces rose in 1990s and after that period it began to fall. In the year 2006 there where 4.651 divorced married couples, 1.614 had children. Although the number of divorces was slightly lower than in the sixties, the number of children in such marriages was smaller. It means that the marriage period was shorter and that couples whose marriage was doomed to failure and break-up did not consider enlarging their family. This condition is probably the result of fast and continuous changes in Croatian political and economic life. These changes along with the particular situation in Croatia, caused by the Civil War and its consequences (the economic crises, unemployment and residential issues) certainly contributed to changes in the family structure.

After the divorce, children are mostly assigned to the mother, and just a little percentage is assigned to the father. In 1960s 78,8% of children where assigned to their mother, while 14,9% where assigned to the father. In 1970s the situation significantly changed. In the eighties the percentage of children assigned to the mother was higher (84,4%) as a result of their economic independence gained by their rising number entering the labour market.

Divorces are structured on the basis of the index of national statistics in Table 3. They are based on legal divorce. Separations and cohabitation are not a part of the official statistics. The inclusion of children from this type of marriage would pose a difficulty and the real situation would be different from the official statistics.

3.1. COMPARATIVE ANALYSIS OF CONCLUDED MARRIAGES AND DIVORCES IN THE REPUBLIC OF CROATIA IN COMPARISON TO THE EUROPEAN UNION

Croatia is getting ready to enter the European Union. This fact includes several interventions in the economic and other fields. One of the relevant fields is demography and the correspondent demographic structure, as well as the situation and comparison of concluded marriages and divorces in Croatia and in the European Union between 1997 and 2006. The analysis for the European Union will be carried out for EU (27 countries) and the selected countries.

By researching and analyzing the EUROSTAT[5] indexes it was established that the rate of concluded marriage per 1000 inhabitants amounted to 5,40% in Croatia in 1997, which was higher than the average EU-27 rate amounting to 5,17%. In the European Union Sweden had the lowest rate of concluded marriages (3,65%), Slovenia (3,78%), Latvia (3,98%) and Estonia (3,99%), the highest rates were evidenced in Lichtenstein (12,55%) and Cyprus (10,71%). In Croatia this rate of concluded marriage remained around 5% throughout the observed period, while in the European Union the rate of concluded marriages was around 5% until the year 2000. In 2001 it fell and for the rest of the period, that is, until 2005 it amounted to around 4,8%. Slovenia had the lowest rate of concluded marriages throughout the observed period (in 2006 -3,17%) which was the lowest rate in the EU-27. In Sweden the rate of concluded marriages raised constantly in the observed period, from 3,65% (very low) in 1997 to 5,02% in 2006. This rate was above the EU-27 average, which was between the highest rate of 6,80% in 2006 in Cyprus and the Slovenian lowest rate of 3,17%. Besides Cyprus, other countries had this above average rate: Denmark (6,71%), Romania (6,79%), Latvia (6,39), Lithuania (6,26%), Malta (6,25%). We can conclude that in more than a half of the EU-27 countries, a total of 17, the rate of concluded marriages was between 4,13% (Italy) and 4,81% (Slovakia). In spite of negative demographic movements Croatia's rate was higher then the average European Union's rate of concluded marriages.

The same countries are analysed in the next sequence of concluded marriages and divorces between 1991 and 2006. The divorce rate throughout the whole period under consideration (1997 – 2006) in the Republic of Croatia was below the EU-27 and from 1997 to 2001 it was under 1% (0,8 – 0,9). In 2000 it rose to 1,0% and from 2001 to 2006 it constantly amounted to 1,1‰. In the EU-27 the rate was twice higher in comparison to the Croatian one and it amounted to 1,8‰. In 2003 it was kept below 2 (1,8 – 1,9) and after that it remained stable until the end of the period under consideration. This rate was almost twice higher than the one in the Republic of Croatia.

Ireland had the lowest divorce rate among the EU-27. At the beginning of the period under consideration its divorce rate is irrelevant (0,0%). From 1998 to 2005 it slightly rose and it was between 0,4 and 0,8‰. Italy as a catholic country where divorce was forbidden for a long time, this rate was also low and it was between 0,6 in 1997 to 0,8 in 2005. A low divorce rate, very close to the one recorded in the Republic of Croatia, was registered in Greece and Spain. Slovenia was also a country with a low divorce rate varying between 1,0‰ and 1,2‰ for the period under consideration. Estonia had the highest divorce among the EU-27 countries 3,8‰, but this rate decreased during the period under consideration and it was lower for one promille in 2006. However, Czech Republic had also a high divorce rate, 3,2‰, and it kept it during the whole period, unlike Estonia. The divorce analysis results show that at the beginning of the period, as well as at the end of it, 15 countries had a divorce rate higher than 2‰. It was between 2,1 and 2,8‰. Most of these countries kept the same divorce rate.

[5] EUROSTAT. Available on:http//epp.eurostat.ec.europa.eu

The trend of depopulation in the European Union can be confirmed trough this analysis by the stagnation rate and even by the smaller number of concluded marriages and the higher rate of divorces. This is the case with the Republic of Croatia as well. Regardless the fact that, this trend is less visible in Croatia than in the European Union, it has led to the same phenomenon – depopulation followed by population ageing and demographic implosion.

4. DEMOGRAPHIC PICTURE IN THE REPUBLIC OF CROATIA

In this chapter the paper studies and analyses the natural population growth in the Republic of Croatia, population migrations in the Republic of Croatia from 1971 until 2001 and the family and populations policies.

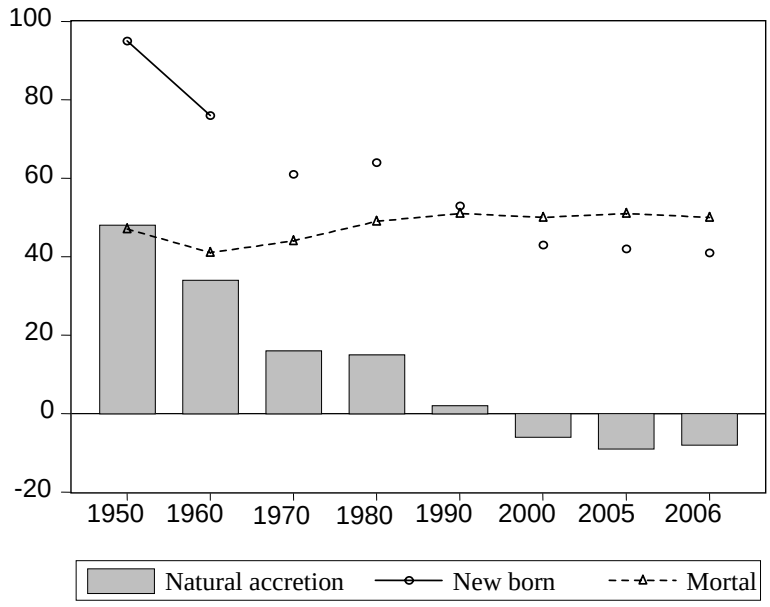
4.1. NATURAL POPULATION GROWTH IN THE REPUBLIC OF CROATIA

Because of negative trends in the fields of marriage and divorce, it is necessary to analyse the natural population growth as well in order to understand better the Croatian demographic picture. Therefore, in this chapter the paper deals with the reproductive function of the family. It deals with population's biological reproduction, which in modern society mainly takes place within a family. New birth in a family means new members of society.

Figure 3 shows the natural population growth in the Republic of Croatia from 1950 until 2006.

Figure 3

Natural population growth in the Republic of Croatia from 1950 until 2006



Source: Author's interpretation pursuant to the Report on Women and men in Croatia 2008, Republic of Croatia – Central Bureau of Statistics, Zagreb, 2008, pg 13

There were 95.174 newborn children in 1950 and this number has been reduced to half until today amounting to 41.446. There are more new born male children in our country, but more male population dies, so the number of men and women is almost equal. The number of deaths has decreased in comparison to 1950, but in the sixties it rose and in 2006 it amounted to 50.378. The alterations in the natural population growth emerged on the surface on account of all these indicators. In 1950 the trend was positive amounting to 48.094 and since then it has a tendency to fall. Table 3 indicates that the negative natural population growth is not a result of a higher mortality rate but of the low birth rate in the Republic of Croatia. The mortality rate does not oscillate much throughout the period under consideration while the birth rate has been significantly and constantly decreasing.

The biggest changes of the natural population growth in the Republic of Croatia occurred during 1990s and they still continue. The result is the negative natural population growth .

4.2. POPULATION MOVEMENT IN THE REPUBLIC OF CROATIA IN THE PERIOD FROM 1970 UNTIL 2001

In order to integrate the so far explored indicators the aim of this chapter is to analyse population's age and sex structure for the purpose of better understanding the Croatian demographic picture.

The population age, besides the demographic importance (fertility, connubiality, mortality), is a very important category which with its structure takes a very important place in understanding of the functioning of a society . Analysing the total population movement according to the population census carried out in 1971 compared to 1961 it is clear that the increase of the population is negligible. (4.159.696 / 4.169.887)[6]. There was a change in the age group of the population structure between the ages of 25 and 49. There was an increase by 50,40% or 118.998 of inhabitants compared to 1971. This was certainly a consequence of the "baby-boom. Results indicate better health condition of the population and life prolongation in the over 60 age group . According to the 1991 population census the highest decrease in population was in the age group 0 – 4 . However, the total population number had grown in comparison to 1981 by 2,45% or 107.910 inhabitants. Obviously this was the result of life prolongation. What is specific for that period is the fact that this was the first time after the war that male and female population was equalised, which should have resulted in the creation of better conditions for the family formation. The 2001 population census was on the one hand expected and on the other hand astonishing. Furthermore, it indicated the first reduction in the second half of the 20th century, it also indicated a high reduction by 6,5% or 294.630 inhabitants in the Croatian population. The reduction was present in all age groups as a consequence of the war which emerged to the surface troughout the whole census period from year 1991 to 2001. These unfavourable consequences will continue even in the forthcoming periods as indicated by the population movement forecast for the Republic of Croatia.

4.3. FAMILY AND POPULATION POLICIES

In many European countries a stimulating pro-birth population policy containing pro-birth measures has been trying to stop further birth-rate reduction. . With these measures parents are stimulated to enlarge their families in accordance to their wishes and possibilities. Stimulating effects have already shown positive results at the beginning of the nineties

[6] Statistic Yearbook 1998, DZSRH, Zagreb, December 1998 and 2002, November 2002, the source refers to all the absolute total in the text

(Hungary, Czech Republic, Slovakia, Bulgaria). The first effect was further birth-rate reduction. The second effect was a slight birth-rate growth in Scandinavian countries. The latter is a matter of an absolute children support policy, which encourages free decision making regarding the number of children, the freedom of choosing the time between birth and responsible parenting, further it refers to indirect birth-rate augmentation, with reference to special policies (residential policy, fiscal and credit policy, policy for creating and expanding the infrastructure for helping working women with children, adequate labour legislation especially for women working time, etc.). In order to rejuvenate and achieve a numeric growth of population the Croatian Parliament adopted the National Population Policy on 24 December 2006.

Family policy is a unique and systematic frameset of measures in favour of the family; first of all for families with children, and the population policy is focused on goals related to population movement and structure.[7] Family and population policies are interconnected and they mainly coincide. The most important measures of the family policy, and therefore of population policy as well, are as following: child allowance, tax relieves, family services, paid maternity and parental leave. The main components of the family policy are money transfers, allowances and relieves mostly aimed at bigger families with children. Therefore, we can say that family policy is an important component of the population policy.

The majority of the measures mentioned in the document are still not implemented, so it is necessary to institutionalise a family support system. Measures such as children allowance, pro-birth income for the third and fourth child and the additional child allowance from the local and regional administration units depend on the number of children and the family income.

According to the Health Insurance Act the employed woman is entitled to salary remuneration: during her sick leave because of pregnancy complications and temporary inability to work on account of pregnancy, during the obligatory maternity leave, during the maternity leave raging from six months until a child turns 1, within the adoptive parent leave and within the breast feeding intermission. An unemployed mother, a mother attending a regular education or an unemployed mother who receives an invalid pension for professional disability has also the right to receive the maternity allowance until a child is one year old. Exceptionally, a mother of twins, triples or more children is entitled to a three year maternity leave. The father of a child is entitled to a paid leave for the birth of a child pursuant to the collective agreement or an internal book of regulations. The father has also the right to use parental leave, in case the mother is employed and she wants to go back to work after her maternity leave.

According to the Retirement Insurance Act, during the maternity leave, the Croatian Institute for Health Insurance pays the pension contribution. The child's father has the right to use the parental leave if the mother returned to work after the obligatory period of six months of maternity leave or exceptionally after 42 days after the birth – in that case the father can use one year parental leave , or respectively three years, providing that he is employed or if the child's mother has died, has abandoned the child or in any other case in which she is not able to take care of the child. In these cases the father does not have to be employed.

Population and family policies measures need to be studied and its effects need to be analysed on regular basis in order to identify their results.

[7] Damjanić, Z. (2007): Stavovi studentica Ekonomskog fakulteta u Zagrebu prema djeci i obiteljskoj politici, Ekonomski fakultet Sveučilišta u Zagrebu, Zagreb, pg 81

5. RESEARCH RESULTS ANALYSIS

The research is based on survey's data. The survey consisted of 13 questions and every question had at least three offered answers. The conducted research is preliminary and should be a substantiating document for future research at a regional level. The survey was held at the University of Juraj Dobrila, at the Department for Economics and Tourism "Dr. Mijo Mirkovic" in Pula among undergraduate students. The sample included 273 students, 11 questionnaires where invalid, so the data analysis was carried out on the basis of 262 questionnaires. The survey was held in May 2009. The goal of this research was to identify students' attitude towards marriage and children in context of a low birth-rate in the Republic of Croatia.

5.1. RESPONDENTS' BASIC SOCIAL AND ECONOMIC FEATURES

The survey was carried out among undergraduate students aged between 19 and 22 years old. 71,55% of students included in the research are female and 28,45% are male. The majority grew up in villages or smaller towns, while the rest grew up in larger cities. The biggest percentage of respondents is from Istria, so it is understandable that most of them live with their parents because they are students. However, significant number of respondents live in rented apartments because more and more students from different parts of Croatia come to Pula and the majority of them is religious.

5.2. SURVEY'S RESULTS

Relative results related to marriage and birth-rate according to respondents' sex are shown in Table 1 as enclosed..

Research results indicate the following:

- Most of the students live in families consisting of four members and their parents are not divorced. In the future they would like to get married, they would like a religious ceremony and they would like to have two children. Female students would like to marry between the ages of 25 and 30, while male student would like to do it a little bit later between the ages of 27 and 30. Regarding their provenience and religiousness, the high percentage of respondents who grew up in villages or smaller towns and consider themselves religious live in families consisting of five members, while the respondents who grew up in a city mostly live in families consisting of three members. A high percentage of divorced or temporarily separated parents are the parents of respondents who grew up in larger cities and who do not consider themselves religious. The reason to this might be the fact that church does not approve divorce, while on the other hand the smaller number of divorces of respondents' parents who grew up in villages might be a consequence of the traditional way of living in the rural areas which does not approve divorce. A very small percentage of respondents who do not want to get married grew up in larger cities. The rest of the respondents who grew up in larger cities would like to marry and respondents who consider themselves religious would like to marry, between the ages of 27 and 30, while respondents who grew up in villages and smaller cities would like to do it between the ages of 25 and 27. Non- religious respondents would also like to marry between the ages of 27 and 30 and later.. Although the majority of respondents would like to have a religious ceremony a higher percentage of non religious persons prefers a civil one.
- If moving was a condition for concluding a marriage, male and female students would do it only if it meant moving to a big city, larger than the one they presently live in.

After marriage male student would keep their surname, and female students would take their husbands' surname. This indicates that the Republic of Croatia is a traditional country that preserves old customs. Concerning giving birth male students would like to have their first child between the ages of 27 and 30, while female students would like to have their first child between the ages of 25 and 30. Regarding their provenience and religiousness, students who grew up in villages and smaller cities and consider themselves religious would like to have their first child between the ages of 25 and 27, while respondents who grew up in a city and do not consider themselves religious persons would like to have their first child later between the ages of 27 and 30. Although most of the respondents expressed their wish to have two children, there is a high percentage of those who would like to have three children contrary to non-religious persons. The majority of students think that in the Republic of Croatia, taking into consideration the average wages and state support, it is sufficient to have two children. A very small number of students think that it is possible to have three children in the Republic of Croatia, while all the respondents think that a Croatian family should not include four or more children. In case of pregnancy female students would keep the baby regardless if their partners would like to marry or not and take responsibility for the baby. This is the proof that women have become economically independent, that they do not depend on men so much any more, because they know that they are able to take care of the child as well as of his or her education and provide for the expenses during his or her growing up. In case of their partners' pregnancy male students would marry her and suggest her to have the baby. It seems that the plausibility of myths about the irresponsibility of men has broken down in the 21st century confirming that they are ready to be relied upon and provide a financial support for their partner in such a situation. There is a very small percentage of female students would choose to have an abortion in such a situation as well as male students who would suggest to their partners to do so. A higher percentage of non religious respondents are in favour of abortion, and this is because the church and the Christian religion do not approve abortion.

- Attitudes towards children and family policy do not differ so much regardless respondents' sex, background and religiousness. The majority of respondents do not consider marriage an old-fashioned institution and think that quarrelling about housekeeping is not a good reason to end marriage and they find career less important than marriage and having children. Before getting married and having children they want to resolve their financial independence and residential issues, but they consider cohabitation before marriage a good test for marriage life. Most of them think that children and marriage do not slow down career and that they should not have children because of society's expectations and they enjoy children's company. They also think that frequent quarrelling between partners is not a reason for divorce. Most of them think that it is easier to live with their parents and they postpone taking responsibilities, but on the other hand, they do not agree with the statement that life is difficult even without getting married and having children. Regarding the distribution of sex most of the male students think that marriage and children require sacrifice and female students do not agree with this statement.

6. CONCLUSION

This work contains a comparative analysis of family structure and population movements as well as the analysis of survey data.

Comparative analysis has confirmed a cause-consequence relation between family structure and population movement. In fact, the falling rate of concluded marriages, the growth of divorce rate and marriages without children are surely the consequence of birth-rate diminution. Birth-rate diminution in the nineties had an impact on 2001 population decrease. This decrease in comparison to 1991 amounted to 6,6 % or 295.218 inhabitants. The influence of this reduction was evident in 2003 when the natural depopulation reached its peak amounting to 107.954 inhabitants, which was the consequence of the increased mortality rate.

In spite of such a natural depopulation and lower level of the economic development Croatia has reached economically developed countries of Western Europe.

It should be remembered that factors affecting birth-rate (biological, social, economic, cultural, religious and psychological) also affect the family structure. In case of Croatia, one must take into consideration the civil war and the effect of aggression. The unfavourable Croatian population's movement tendencies highlighted in this paper led to the unbalanced young and elderly population structure.

Demographists with good reason announce an even more unfavourable depopulation in the Republic of Croatia. Its negative implications are already felt on the labour market.

Developed European countries reduced this problem by means of immigration of the population during the 20th century, contrary to this Croatia was characterised by the emigration process.

This negative demographic process cannot be stopped without a positive migration balance. To reach such a balance, it is necessary to create clear immigration policy of high quality preferably based on the regional development policy. Because of the negative movement of the Croatian population a preliminary survey on student population's attitudes regarding marriage, family and children has been carried out in the second part of this paper.

High percentage of research results indicate students' positive attitudes which are an outcome of their family situation, the place of their residence (city, village) and their religion.

Besides the already mentioned positive attitudes towards marriage, children and family it is worth to note their inclination to marry at a later age, because they associate the achievement of their attitudes with employment, finding a place to live, settling family and business relations. The results of the empirical research point out that marriages and birth-rate are related to economic and social factors, while the psychological factors are not so significant.

In order to achieve a greater number of marriages and higher birth-rate in the Republic of Croatia, according to the research results, it is indispensable to achieve higher levels of the economic growth rate, which is unfortunately possible only in the long-term on account of the present business situation..

REFERENCES

Akrap, A. i Čipin, I. (2006): Socijalitetni sterilitet u Hrvatskoj – zašto smo neoženjeni i neudane, Ministarstvo obitelji, branitelja i međugeneracijske solidarnosti, Zagreb

Bogunović, A., Crkvenac, M., Družić I. idr. (1998): Hrvatsko gospodarstvo, Ekonomski fakultet Sveučilišta u Zagrebu i Politička kultura, Zagreb

Damjanić, Z. (2007): Stavovi studentica Ekonomskog fakulteta u Zagrebu prema djeci i obiteljskoj politici, Ekonomski fakultet Sveučilišta u Zagrebu, Zagreb

Državni zavod za statistiku Republike Hrvatske (2000): Priopćenje prirodnog kretanja stanovništva, dostupno na: http:// www.dzs.hr

Državni zavod za statistiku Republike Hrvatske (2008): Statistički ljetopis Republike Hrvatske, dostupno na: http://www.dzs.hr/Hrv_Eng/ljetopis/2008/PDF/00-sadrzaj.pdf

Državni zavod za statistiku Republike Hrvatske(2008): Žene i muškarci u Republici Hrvatskoj, dostupno na:
http://www.dzs.hr/Hrv_Eng/menandwomen/men_and_women_2008.pdf
Fanuko, N. (1997), Sociologija, Školska knjiga, Zagreb
Gelo, J., Akrap, A., Čipin, I. (2005.): Temeljne značajke demografskog razvoja Hrvatske (bilanca 20. stoljeća), Ministarstvo obitelji, branitelja i međugeneracijske solidarnosti, Zagreb
Haralambos, M.i Holborn, M. (2002): Sociologija, (Zagreb: Golden marketing)
Kuvačić, I. (2004): Uvod u sociologiju, Golden marketing, Zagreb
Obiteljski zakon, N.N. br. 116/03, dostupno na:
http://narodnenovine.nn.hr/clanci/sluzbeni/306171.html
Puljiz, V. (1999), "Profili obiteljske politike", Revija za socijalnu politiku, 6 (1): 21-33
Puljiz, V. (2002), "Hrvatska obiteljska politika u europskom kontekstu", Revija za socijalnu politiku, 9 (2): 117-137
Wertheimer-Baletić, A. (1999): Stanovništvo i razvoj, Mate, Zagreb
Žepić, B. (2007), Sociologija, Hrvatska sveučilišna naklada, Zagreb

Table 1. Supplement
Research results on marriage and birth-rate among students grouped according to their sex

QUESTION	ANSWERS	SEX in %	
		M	F
		%	
1. How many children did your mother give birth to?	1	15,15	9,64
	2	66,67	60,24
	3	15,15	26,51
	4	3,03	2,41
	Five and more	0	1,20
2. Are your parents divorced or were they divorced?	Yes	3,03	12,05
	No	96,97	87,95
3. Would you like to get married one day?	Yes	90,91	98,80
	No	9,09	1,20
4. What is the appropriate age to enter marriage?	20-23	3,33	1,22
	23-25	3,33	9,76
	25-27	16,67	39,02
	27-30	43,33	39,02
	More than 30	33,33	10,98
5. What kind of ceremony would you like to have?	Religious	56,67	65,85
	Civil	16,67	13,41
	Either way	26,67	20,73
6. After the marriage you would:	Keep your surname	96,67	9,76
	Take husband's / wife's surname	0	51,22
	Keep your own and take your husband's / wife's surname	3,33	39,02
7. Would you be ready to change your permanent	Only if it means moving to a bigger city	50	42,68

address at your partner's request?	Only if it means moving to a village	0	7,32
	I live in a city and I do not want to move	23,33	23,17
	I live in a village and I do not want to move	10	18,29
	I do not want to live in a city	3,33	0
	I do not want to live in a village	10	6,10
	I would move anyway	3,33	2,44
8. Would you like to have children in the future?	Yes	93,94	97,59
	No	6,06	2,41
9. How many children would you like to have?	1	12,90	13,58
	2	54,83	64,20
	3	22,58	20,99
	4	3,23	1,23
	Five and more	3,23	0
	I do not know	3,23	0
10. What is the appropriate age to have children?	20-23	0	1,23
	23-25	6,45	12,35
	25-27	19,35	40,74
	27-30	48,39	40,74
	More than 30	25,81	4,94
11.Concerning the average wage and state support in the Republic of Croatia, what is the ideal number of children for a family?	0	12,18	2,41
	1	36,36	36,15
	2	39,39	54,22
	3	12,12	7,23
	4 and more	0	0
12. What would you do in case of unwanted pregnancy ? (question for female respondents only)	Give birth	/	69,88
	Give birth if the partner wants to get married	/	1,20
	Give birth although the partner does not want to get married but wants to take part in its raising	/	0
	Give birth if I have enough financial resources to provide for the baby	/	13,25
	I would give the child for adoption	/	0
	Abort the pregnancy	/	12,05
	I do not know	/	3,61
13. If your partner accidentally gets pregnant, what would you do? (question for male respondents only)	Advise her to give birth and marry her	57,58	/
	Advise her to give birth and would not marry her and take my responsibilities	12,12	/

	Advise her to give birth and take my responsibility in regard to the child but would not marry her	3,03	/
	Advise her to give birth if I do not have the obligation to pay the alimony	3,03	/
	Advise her to give the child for adoption	0	/
	Advise her to abort the pregnancy	12,12	/
	I would not consider it my problem	0	/
	I would not know what to do	12,12	/

Source: Survey, Authors elaboration, November 2008

OBITELJSKA STRUKTURA I DEMOGRAFSKA SLIKA U REPUBLICI HRVATSKOJ

SAŽETAK

Analiza kretanja stanovništva u Republici Hrvatskoj obilježena je depopulacijskim značajkama. One su napose došle do izražaja u razdoblju od 1991. do danas. Ukupnoj je depopulaciji pridonijelo prirodno i mehaničko kretanje stanovništva. Prirodna depopulacija najvećim je dijelom uzrokovana smanjenjem broja sklopljenih brakova, porastom broja razvedenih brakova kao i brakova bez djece. Zbog navedenih negativnih pojava u radu je provedeno empirijsko istraživanje na populaciji studenata zbog utvrđivanja njihovih stavova o braku, obitelji i djeci.

Rezultati istraživanja ukazuju na pozitivne stavove studenata i činjenicu da ti stavovi odražavaju njihovu obiteljsku strukturu i prostor iz kojeg dolaze (grad, selo). Svoje pozitivne stavove vezuju uz kasniju dob stupanja u brak koja je najvećim djelom uvjetovana društveno-gospodarskim čimbenicima.

Ključne riječi: *obitelj, brak, depopulacija,stanovništvo*

Fadzlan Sufian[1]

UDK 336.71(595)
Original scientific paper
Izvorni znanstveni rad

ASSESSING THE IMPACT OF FINANCIAL SECTOR RESTRUCTURING ON BANK PERFORMANCE IN A SMALL DEVELOPING ECONOMY

ABSTRACT

The present paper examines the impact of mergers and acquisitions on the technical efficiency of the Malaysian banking sector. The analysis consists of three stages. Firstly, by using the Data Envelopment Analysis (DEA) approach, we calculate the technical, pure technical, and scale efficiency of individual banks during the period 1997-2003. Secondly, we examine changes in the efficiency of the Malaysian banking sector during the pre and post merger periods by using a series of parametric and non-parametric univariate tests. Finally, we employ the multivariate regression analysis to examine factors that influence the efficiency of Malaysian banks. Although the merger program was unpopular, perceived by the market as impractical, and controversial, the empirical findings from this study suggest that the merger program among the Malaysian domestic commercial banks was driven by economic reasons.[2]

JEL Classification: *G21; D24*

Keywords: *Mergers and Acquisitions, Data Envelopment Analysis, Multivariate Regression Analysis, Malaysia*

1. INTRODUCTION

Against the backdrop of the Asian financial crisis in 1997, many Asian countries have undergone massive reforms in their financial sector. Consolidation of domestic banking institutions in these countries is an essential concomitant of this strategy. In the case of Malaysia, the proposed major restructuring plan for the banking sector was announced by the central bank of Malaysia, Bank Negara Malaysia (BNM) on July 1999. Among the main objective of the merger program was to create bigger and stronger domestic banks that are able to withstand competition from the foreign banks when the financial sector is liberalized under the World Trade Organization (WTO) agreement.

The central bank of Malaysia has always encouraged the domestic banking institutions to merge. For example, in 1994 a two-tier banking system was introduced as an incentive to promote mergers, especially among the small domestic banking institutions. Under the two-tier systems, the highly capitalized banks (with the tier-1 status) are allowed to offer a wide range of financial products and services. However, the move was unsuccessful in getting the desired results, as there were only a few mergers among the Malaysian financial institutions

[1] Department of Economics, Faculty of Economics and Management, Universiti Putra Malaysia.
Mailing address: Khazanah Research and Investment Strategy, Khazanah Nasional Berhad, Level 35, Tower 2, Petronas Twin Towers Kuala Lumpur City Centre, 50088 Kuala Lumpur, Malaysia.

2 Paper received 17 February 2009.

took place to take the advantage of the tier-1 banking group status[3]. The smaller banks with the tier-2 status had instead augmented their capital to graduate to tier-1 status. Furthermore, to secure sufficient return on capital, several tier-2 banks have also been lending aggressively.

The merger program for the domestic banking institutions, initiated in 1999 was concluded in 2000. Approval was granted for the formation of 10 anchor banking groups. The 10 anchor banks are: Malayan Banking Berhad, RHB Bank Berhad, Public Bank Berhad, Bumiputra-Commerce Bank Berhad, Multi-Purpose Bank Berhad, Hong Leong Bank Berhad, Perwira Affin Bank Berhad, Arab-Malaysian Bank Berhad, Southern Bank Berhad, and EON Bank Berhad.

The ten anchor banks emerged having complied with all the requirements of anchor bank status, such as minimum capitalization, total asset size, and other prudential requirements. Each bank had minimum shareholders' fund of 2 billion Ringgit and asset base of at least 25 billion Ringgit. With the formation of these 10 banking groups, the number of domestic banking institutions was substantially reduced to 29 banking institutions consisting of 10 commercial banks, 10 finance companies, and 9 merchant banks. Table 1 summarizes the post merger banking institutions.

Table 1

Malaysian Banks Mergers and Acquisitions As At 30 June 2000

Anchor Banks	Banks Acquired	Anchor Banks Total Assets as at 30 June '00 RM billion	Post-Merger Assets RM billion	% of System Assets
Maybank	The Pacific Bank	127	150	24.0
Bumiputra-Commerce Bank	N.A.	63	67	10.7
RHB Bank	N.A.	51	56	9.0
Public Bank	Hock Hua Bank	43	50	8.0
Arab-Malaysian Bank[1]	N.A.	11	39	6.2
Hong Leong Bank	Wah Tat Bank	29	35	5.6
Multi-Purpose Bank	Sabah Bank	9	14	2.2
Affin Bank[2]	BSN Commercial Bank	15	30	4.8
Southern Bank	Ban Hin Lee Bank	24	25	4.0
EON Bank	Oriental Bank	14	25	4.0

[1] The merger between Utama Banking group, comprising Bank Utama and Utama Merchant Bank with Arab-Malaysian banking group did not proceed due to a disagreement over the ultimate control of the merged entity initially

[2] Another merger that failed to materialize was that of Multi-Purpose Bank and MBf Finance due to Multi-Purpose Bank's minority shareholders balking at the price involved. The Arab-Malaysian Banking Group however acquired MBf Finance from Danaharta. Source: Bank Negara Malaysia

3 There were three mergers instituted during the earlier part of the 1990s: DCB Bank with Kwong Yik Bank, DCB Finance with Kwong Yik Finance, and United Overseas Bank with Chung Khiaw Bank, which resulted in both DCB Bank and Kwong Yik Bank granted the tier-1 institutions status.

The proposed major restructuring plan for the banking sector caught many by surprise. The merger program was very unpopular, perceived by the market as impractical and provoked serious criticisms (Chin and Jomo, 2001). Among the controversial issues are some very small banks have to take over larger banks[4] while in some cases the size of the anchor banks would not necessarily be much larger than before the merger[5]. Furthermore, Chong, Liu and Tan (2006) argued that the merger program was not driven by economic reasons. Their results show that the merger program destroys shareholders wealth in aggregate, while the acquiring banks tend to gain at the expense of the target banks.

In light of Chong, Liu and Tan (2006) argument, it is interesting to examine the impact of the Malaysian mergers and acquisitions program on the efficiency of the banks involved. In essence, the paper attempts to answer two important fundamental questions: 1) What is the impact of the mergers and acquisitions program on the efficiency of the banks involved post merger, and 2) Did a more (less) efficient bank become the acquirer (target)?

To do so, we follow a three-stage procedure. Firstly, by using the Data Envelopment Analysis (DEA) approach, we calculate the technical, pure technical, and scale efficiency of individual banks during the pre and post merger periods. Secondly, by using a series of parametric and non-parametric univariate tests we examine changes in the efficiency of the Malaysian banking sector during the pre and post merger periods. Finally, we employ the multivariate Tobit regression analysis to examine factors that influence the efficiency of Malaysian banks during the pre and post merger periods.

The paper is structured as follows: the next section reviews the main literatures in regard to bank mergers and acquisitions. Section 3 outlines the approaches to the measurement of efficiency change as well as the method for the estimation of the determinants of bank efficiency. Section 4 discusses the results, and finally, Section 5 provides some concluding remarks.

2. REVIEW OF THE RELATED LITERATURES

The empirical literature analyzing the effects of mergers and acquisitions on bank performance follows two major approaches. The first major approach follows the event study type methodology, often based on changes in stock prices around the period of the announcement of the merger (e.g. Cybo-Ottone and Murgia, 2000; Houston, James and Ryngaert, 2001; Scholtens and de Wit, 2004; Cornett, McNutt and Tehranian, 2006; Campa and Hernando, 2006; Campa and Hernando, 2008; Crouzille, Lepetit and Bautista, 2008; Altunbas and Marques, 2008; Petmezas, 2009). These studies typically try to ascertain whether the announcement of a bank merger creates shareholder value, normally in the form of cumulated abnormal stock market returns for the shareholders of the target, the bidder, or the combined entity.

The second strand of literature analyzes the impact of mergers and acquisitions on bank efficiency. These studies typically examine the productive efficiency indicators, such as cost, profit, and/or technical efficiency (e.g. Kohers, Huang and Kohers, 2000; Hahn, 2007; Koetter, 2008; Rezitis, 2008; Al-Sharkas, Hassan and Lawrence, 2008). The empirical evidence from the U.S. and Europe have generally suggest that the acquiring banks are relatively more cost efficient and more profitable than the target banks (e.g. Berger and

4 For example, Perwira Affin Bank and Multi Purpose Bank were required to acquire banks that are many times their size, which leads to accusations of unfairness.

5 For example Southern Bank will still remain many times smaller than the pre-merger size of Malaysia's largest bank, Maybank. This raised concern that the bank may not survive the effects financial market liberalization.

Humphrey, 1992; Pilloff and Santomero, 1997; Peristiani, 1997; Focarelli, Panetta and Salleo, 2002).

In regard to the frontier efficiency techniques, two main approaches are commonly used to assess the impact of mergers and acquisitions on bank efficiency, namely the parametric and non-parametric approaches. The parametric approach on one hand comprises of three major approaches namely the Stochastic Frontier Approach (SFA), the Distribution Free Approach (DFA), and the Thick Frontier Approach (TFA). On the other hand, Data Envelopment Analysis (DEA) and Free Disposal Hull (FDH) are non-parametric approaches. While both techniques require the specification of a cost or production function or frontier, the former involves the specification and econometric estimation of a statistical or parametric function/frontier, the non-parametric approach provides a piecewise linear frontier by enveloping the observed data points.

The DEA method has been widely applied in the empirical estimation of financial institutions, health care, and education sectors' efficiency worldwide. Notwithstanding, the technique has increasingly been the preferred method to investigate the impact of mergers and acquisitions on bank efficiency, in particular if the sample size is small. Previous studies undertaken to analyze a small number of mergers and acquisitions includes among others Avkiran (1999), Liu and Tripe (2002), and Sufian and Majid (2007).

Avkiran (1999) employed DEA and financial ratios to a small sample of 16 to 19 Australian banks during the period of 1986-1995, studied the effects of four mergers on efficiency and the benefits to public. He adopted the intermediation approach and two DEA models. He reported that the acquiring banks were more efficient than the target banks. He also found that the acquiring banks do not always maintain their pre-merger efficiency, but that, during the deregulated period, technical efficiency, employees' productivity and return on assets (ROA) improved. There were mixed evidence from the four cases on the extent to which the benefits of efficiency gains from mergers were passed on to the public.

Liu and Tripe (2002) analyzed a small sample of 7 to 14 banks employed accounting ratios and two DEA models to explore the efficiency of 6 bank mergers in New Zealand between 1989 and 1998. They found that the acquiring banks to be generally larger than their targets, although they were not consistently more efficient. They found that five of the six merged banks had efficiency gains based on the financial ratios, while another only achieved a slight improvement in operating expenses to average total income. Based on the DEA analysis, they found that only some banks were more efficient than the target banks pre-merger. The results suggest that four banks had obvious efficiency gains post-merger. However, they could not decisively conclude on possible benefits of the mergers on public benefits.

Using a small sample size of 6 banks, Sufian and Majid (2007) employed Data Envelopment Analysis (DEA) to examine the effects of mergers and acquisitions on the Singapore domestic banking groups' efficiency. They applied a variant of the intermediation approach to two models to detect for any efficiency gains (loss) resulting from the mergers and acquisitions. The results from both models suggest that the merger has resulted in higher mean overall efficiency of Singapore banking groups post-merger. They do not find evidence of more efficient acquirers compared to the targets, as the findings from both models suggest that both the targets are more efficient relative to the acquirers. The empirical results further support the hypothesis that the acquiring banks' mean overall efficiency improved post-merger resulting from the merger with a more efficient bank.

3. ESTIMATION METHODOLOGY

3.1 DATA ENVELOPMENT ANALYSIS (DEA)[6]

A non-parametric Data Envelopment Analysis (DEA) is employed with variable return to scale (VRS) assumption to measure input-oriented technical efficiency of Malaysian banks. DEA involves constructing a non-parametric production frontier based on the actual input-output observations in the sample relative to which efficiency of each firm in the sample is measured (Coelli, 1996). The term DEA was first introduced by Charnes, Cooper and Rhodes (1978), (hereafter CCR), to measure the efficiency of each Decision Making Units (DMUs), that is obtained as a maximum of a ratio of weighted outputs to weighted inputs. This denotes that the more the output produced from given inputs, the more efficient is the production. The weights for the ratio are determined by a restriction that the similar ratios for every DMU have to be less than or equal to unity. This definition of efficiency measure allows multiple outputs and inputs without requiring pre-assigned weights. Multiple inputs and outputs are reduced to single 'virtual' input and single 'virtual' output by optimal weights. The efficiency measure is then a function of multipliers of the 'virtual' input-output combination.

The analysis under DEA is concerned with understanding how each DMU is performing relative to others, the causes of inefficiency, and how a DMU can improve its performance to become efficient. In that sense, DEA calculates the relative efficiency of each unit in relation to all other units by using the actual observed values for the inputs and outputs of each DMU. It also identifies, for inefficient DMUs, the sources and level of inefficiency for each of the inputs and outputs.

Let us give a short description of the DEA. Assume that there is data on K inputs and M outputs for each N bank. For ith bank these are represented by the vectors x_i and y_i respectively. Let us call the K x N input matrix – X and the M x N output matrix – Y. To measure the efficiency for each bank we calculate a ratio of all inputs, such as $(u'y_i/v'x_i)$ where u is an M x 1 vector of output weights and v is a K x 1 vector of input weights. To select optimal weights we specify the following mathematical programming problem:

$$\begin{aligned} &\min_{u,v} (u'y_i / v'x_i), \\ &u'y_i / v'x_i \leq 1, \quad j = 1, 2, \ldots, N, \\ &u, v \geq 0 \end{aligned} \tag{1}$$

The above formulation has a problem of infinite solutions and therefore we impose the constraint $v'x_i = 1$, which leads to:

$$\begin{aligned} &\min_{\mu,\varphi} (\mu'y_i), \\ &\varphi'x_i = 1 \\ &\mu'y_i - \varphi'x_j \leq 0 \quad j = 1, 2, \ldots, N, \\ &\mu, \varphi \geq 0 \end{aligned} \tag{2}$$

where we change notation from u and v to μ and φ, respectively, in order to reflect transformations. Using the duality in linear programming, an equivalent envelopment form of this problem can be derived:

[6] The routine to perform the DEA analysis is written on the DEAP 2.1 software program developed by Coelli (1996).

$$\begin{aligned} &\min_{\theta,\lambda} \theta, \\ &y_i + Y\lambda \geq 0 \\ &\theta x_i - X\lambda \geq 0 \\ &\lambda \geq 0 \end{aligned} \qquad (3)$$

where θ is a scalar representing the value of the efficiency score for the *i*th DMU which will range between 0 and 1. λ is a vector of *N* x 1 constants. The linear programming has to be solved N times, once for each DMU in the sample. In order to calculate efficiency under the assumption of VRS, the convexity constraint ($N1'\lambda = 1$) will be added to ensure that an inefficient bank is only compared against banks of similar size, and therefore provides the basis for measuring economies of scale within the DEA concept. The convexity constraint determines how closely the production frontier envelops the observed input-output combinations and is not imposed in the constant returns to scale (CRS) case.

The estimation with these two assumptions allows the technical efficiency (TE) to be broken down into two collectively exhaustive components: pure technical efficiency (PTE) and scale efficiency (SE) i.e. TE = PTE x SE. The former relates to the capability of managers to utilize banks given resources, whereas the latter refers to exploiting scale economies by operating at a point where the production frontier exhibits CRS.

3.2 MULTIVARIATE TOBIT REGRESSION ANALYSIS[7]

As defined in equations 1 to 3, the DEA score falls between the interval 0 and 1 ($0 < h^* \leq 1$) making the dependent variable a limited dependent variable. Following among others Das and Ghosh (2006) and Pasiouras (2008), the second stage regressions in this study are estimated by using a Tobit regression model. The standard Tobit model can be defined as follows for observation (bank) i:

$$\begin{aligned} &y_i^* = \beta' x_i + \varepsilon_i \\ &y_i = y_i^* \quad \text{if} \quad y_i^* \geq 0 \\ &\text{and } y_i = 0, \text{ otherwise} \end{aligned} \qquad (4)$$

where x_i is a vector of explanatory variables and β is the set of parameters to be estimated. $\varepsilon_i \sim N(0, \sigma^2)$ denotes the error term. y_i^* is a latent variable and y_i is the efficiency score obtained from the DEA model[8].

By using the efficiency scores as the dependent variables, we estimate the following model:

$$\gamma_{jt} = \beta_0 + \beta_1 \Sigma Characteristics + \zeta_2 \Sigma Econ + \varepsilon_{jt} \qquad (5)$$

---

7 The Tobit regression model is performed by using the econometric software EViews 6.0.

8 The likelihood function (L) is maximized to solve β and σ based on 191 observations (banks) of y_i and x_i is $L = \prod_{y_i=0}(1-F)\prod_{y_i>0}\frac{1}{(2\Pi\sigma^2)^{1/2}} \times e^{-[1/(2\sigma^2)](y^i-\beta x_i)^2}$ where, $F_i = \int_{-\infty}^{\beta x_i/\sigma} \frac{1}{(2\Pi)^{1/2}} e^{-t^2/2} dt$

The first product is over the observations for which the banks are 100 percent efficient (y = 0) and the second product is over the observations for which banks are inefficient (y >0). F_i is the distribution function of the standard normal evaluated at $\beta x_i/\sigma$.

where, γ_{jt} is the technical efficiency of the *j*th bank in period *t* obtained from the DEA model, *Characteristics* is a set of bank specific traits variables and *Econ* is a vector of economic and market conditions.

3.3 DATA AND CONSTRUCTION OF VARIABLES

We use annual bank level data of all Malaysian commercial banks covering the period 1997-2003. The variables are collected from published balance sheet information in annual reports of each individual bank, while the macroeconomic variable is sourced from various issues of Bank Negara Malaysia's annual reports. The total number of commercial banks operating in Malaysia varied from 33 banks in 1997 to 22 banks in 2003 due to entry and exit of banks during the past decade. This gives us a total of 191 bank year observations. The sample represents the whole gamut of the industry's total assets.

As in most recent studies, (e.g. Isik and Hassan, 2002; Pasiouras, 2008), we adopt the intermediation approach. Accordingly, three inputs and three output variables are chosen. The input vectors used are (X1) Total Deposits, (X2) Capital, and (X3) Labour, while, (Y1) Total Loans, (Y2) Investments, and (Y3) Non-Interest Income are the output vectors. The summary of data used to construct the efficiency frontiers are presented in Table 2.

Table 2
Descriptive Statistics for Inputs and Outputs, Input Prices (in million of RM)

	Y1	Y2	Y3	X1	X2	X3
Min	53,411.00	205.00	14.00	131,352.00	1,248.00	1,898.00
Mean	12,335.73	3,767,524.55	180,873.30	888,037.68	184,255.20	152,612.30
Max	109,070.50	36,423.40	1,800,718.00	137,864.10	1,417,961.00	1,419,973.00
S.D	5,790.82	2,346,414.05	80,638.77	6,551.73	61,636.41	78,243.08

Notes: Y1: Loans (includes loans to customers and other banks), Y2: Investments (includes dealing and investment securities), Y3: Non-Interest Income (defined as fee income and other non-interest income, which among others consist of commission, service charges and fees, guarantee fees, and foreign exchange profits), X1: Total Deposits (includes deposits from customers and other banks), X2: Capital (measured by the book value of property, plant, and equipment), X3: Personnel Expenses (inclusive of total expenditures on employees such as salaries, employee benefits and reserve for retirement pay)[9].

Source: Banks annual reports and authors own calculations

The bank specific variables included in the second stage multivariate regression models are, LNDEPO (log of total deposits), LOANS/TA (total loans divided by total assets), LNTA (log of total assets), LLP/TL (loans loss provisions divided by total loans), NII/TA (non-interest income divided by total assets), NIE/TA (total overhead expenses divided by total assets), and EQASS (book value of stockholders' equity as a fraction of total assets). To measure the relationship between economic and market specific factors and bank efficiency, LNGDP (natural logarithm of gross domestic products), PRE_MER (binary variable that takes a value of 1 for the pre merger years, 0 otherwise), POST_MER (binary variable that takes a value of 1 for the post merger years, 0 otherwise), and CR_3 (concentration in terms of assets of the three largest banks) are used. The independent variables and their hypothesized relationship with efficiency are detailed in Table 3.

9 As data on the number of employees are not readily made available, personnel expenses have been used as a proxy measure.

Table 3

Descriptive of the Variables Used in the Regression Models

Variable	Description	Hypothesized Relationship with Efficiency
	Bank Characteristics	
LNDEPO	Natural logarithm of total deposits	+/-
LOANS/TA	Total loans over total assets	+/-
LNTA	Natural logarithm of total assets	+/-
LLP/TL	Loan loss provisions over total loans	-
NII/TA	Non-interest income over total assets	+
NIE/TA	Non-interest expense over total assets	-
EQASS	Total book value of shareholders equity over total assets	+/-
DUMACQ	Binary variable that takes a value of 1, if a bank is an acquiring bank, 0 otherwise.	+/
CON_GRP	Binary variable that takes a value of 1, if a bank does not involve in any merger during the years, 0 otherwise.	+/
	Economic/ Market Conditions	
LNGDP	Natural logarithm of gross domestic products	+/-
CR_3	Proxy for the concentration in terms of assets of the three largest banks.	+/-
PRE-MER	Binary variable that takes a value of 1 for the pre merger years, 0 otherwise.	+/
POST_MER	Binary variable that takes a value of 1 for the post merger years, 0 otherwise.	+/

Source: Authors own calculations

Our data cover the registered M&As that took place in the Malaysian banking sector during the year 2000. To be included in the sample, both the target and the acquiring banks must not have been involved in any other merger in the three years prior to the merger. In

addition to the banks that were involved in M&As during the study period, we have also included 19 other domestic and foreign banks that have not been involved in any M&As during the years as a control group in the analysis. In the spirit of maintaining homogeneity, only commercial banks that make commercial loans and accept deposits from the public are included in the analysis. Therefore, Investment Banks, Finance Companies, and Islamic banks are excluded from the sample. In the study population, there were seven major M&As that fit into our sample which were analyzed:

Case 1: Affin Bank Berhad acquisition of BSN Commercial Bank Berhad.

Case 2: Alliance Bank Berhad acquisition of Sabah Bank Berhad.

Case 3: EON Bank Berhad acquisition of Oriental Bank Berhad.

Case 4: Hong Leong Bank Berhad acquisition of Wah Tat Bank Berhad.

Case 5: Maybank Berhad acquisition of The Pacific Bank Berhad.

Case 6: Public Bank Berhad acquisition of Hock Hua Bank Berhad.

Case 7: Southern Bank Berhad acquisition of Bank Hin Lee Bank Berhad.

It is observed from Table 4 that the acquiring banks are relatively larger and have a bigger share of market for deposits. The differences in the mean are statistically significantly different from zero at the 1% level for both the parametric and non-parametric tests. The acquiring banks also seem to generate a higher proportion of income from non-interest sources and are better capitalized. On the other hand, the target banks seem to have relatively higher loans intensity, higher proportions of provisions for loans losses, and relatively high operating costs.

Table 4

Summary of Parametric and Non-Parametric Tests

	Test Groups					
	Parametric Test		Non-Parametric Test			
Individual Tests	*t*-test		Mann-Whitney [Wilcoxon Rank-Sum] test		Kruskall-Wallis Equality of Populations test	
Hypotheses			$Median_{Acquirer} = Median_{Target}$			
Test Statistics	*t* (Prb > *t*)		*z* (Prb > *z*)		χ^2 (Prb > χ^2)	
	Mean	*t*	Mean Rank	*z*	Mean Rank	χ^2
LNDEPO						
Acquirer	16.6180	-	29.57	-4.264***	29.57	18.181***
Target	15.2299	5.109***	13.43		13.43	
LOANS/TA						
Acquirer	0.6412	0.931	21.76	-0.138	21.76	0.019
Target	0.6593		21.24		21.24	
LNTA						
Acquirer	16.8221	-	29.81	-4.390***	29.81	19.269***
Target	15.4104	5.136***	13.19		13.19	
LLP/TL						
Acquirer	0.221	0.991	23.67	-1.145	23.67	1.310
Target	0.384		19.33		19.33	
NII/TA						
Acquirer	0.081	-1.294	23.95	-1.296	23.95	1.679
Target	0.071		19.05		19.05	
NIE/TA						
Acquirer	0.153	1.488	19.07	-1.283	19.07	1.646
Target	0.175		23.93		23.93	
EQASS						
Acquirer	0.828	-0.367	22.05	-0.289	22.05	0.084
Target	0.791		20.92		20.92	

Note: Test methodology follows among others, Aly, Grabowski, Pasurka and Rangan (1990), Elyasiani and Mehdian (1992), and Isik and Hassan (2002).

***, **, * indicates significant at the 0.01%, 0.05%, and 0.10% levels respectively.

Source: Authors own calculations

4. EMPIRICAL RESULTS

In the spirit of Rhoades (1998), we develop a [-3, 3] event window to investigate the effects of M&As on Malaysian bank efficiency. The choice of the event window is motivated by Rhoades (1998, p. 278), who pointed out that there has been unanimous agreement among the experts that about half of any efficiency gains should be apparent after one year and all gains should be realized within three years after the merger. The whole period (i.e. 1997-2003) is divided into three sub-periods: 1997-1999 refers to the pre-merger period, 2000 is considered as the merger year, and 2001-2003 represents the post merger period. During all periods the targets and acquirers' mean technical efficiency along with its decomposition of pure technical and scale efficiency scores are compared. This could help shed some light on the sources of inefficiency of the Malaysian banking sector in general, as well as to differentiate between the targets' and acquirers' efficiency scores. To allow inefficiency to vary over time, following Isik and Hassan (2002) among others, the efficiency frontiers are constructed for each year by solving the linear programming (LP) problems rather than constructing a single multi-year frontier.

4.1 DID THE MERGERS AND ACQUISITIONS RESULT IN A MORE EFFICIENT BANKING SECTOR?

Table 5 illustrates the TE estimates, along with its decomposition into PTE and SE. It is apparent that during the pre merger period, Malaysian banks have exhibited a mean TE of 57.4%. The results imply that during the pre merger period Malaysian banks could have produced the same amount of outputs with only 57.4% of the amount of inputs used. In other word, Malaysian banks could have reduced their inputs by 42.6% and still could have produced the same amount of outputs. The decomposition of the TE into its mutually exhaustive components of PTE and SE suggest that during the pre merger period, Malaysian banks' inefficiency were largely due to scale (34.4%) rather than pure technical (13.1%). The empirical findings imply that during the pre merger period, Malaysian banks have been managerially efficient in controlling their operating costs but were operating at a relatively non-optimal scale of operations.

Table 5

Summary of Mean Efficiency Levels of Malaysian Banks

Bank	ABB	Pre Merger*			During Merger**			Post Merger***		
		TE	PTE	SE	TE	PTE	SE	TE	PTE	SE
Affin Bank	AFF	0.533	0.903	0.585	0.836	0.897	0.932	0.853	0.926	0.921
Alliance Bank	ALB	0.539	0.925	0.579				0.888	0.949	0.936
Arab Malaysian Bank	AMB	0.855	1.000	0.855	1.000	1.000	1.000	0.871	1.000	0.871
Ban Hin Lee Bank	BHL	0.413	0.791	0.523						
Bumiputra-Commerce Bank	BCB	0.741	1.000	0.741	0.831	1.000	0.831	0.873	1.000	0.873
Bank Utama	BUB	0.411	0.874	0.467	0.923	0.926	0.997	1.000	1.000	1.000
BSN Commercial Bank	BSN	0.591	0.859	0.687						
EON Bank	EON	0.517	0.934	0.556	0.874	1.000	0.874	0.842	0.980	0.858
Hock Hua Bank (Sabah)	HHS	0.281	0.425	0.668						
Hock Hua Bank	HHB	0.355	0.740	0.473						
Hong Leong Bank	HLB	0.462	0.911	0.507	0.754	0.911	0.827	0.786	0.989	0.793
Maybank	MBB	0.519	1.000	0.519	0.870	1.000	0.870	0.907	1.000	0.907
Oriental Bank	OBB	0.450	0.808	0.553						
Phileo Allied Bank	PAB	0.609	0.719	0.842						
Public Bank	PBB	0.428	0.903	0.474	0.755	1.000	0.755	0.822	0.955	0.865
RHB Bank	RHB	0.617	1.000	0.617	0.944	1.000	0.944	0.930	1.000	0.930
Sabah Bank	SBH	0.378	0.607	0.636						
Southern Bank	SBB	0.492	0.951	0.516	0.880	0.999	0.882	0.942	0.968	0.972
Pacific Bank	PAC	0.423	0.769	0.548						
Wah Tat Bank	WTB	0.309	0.542	0.548						
ABN-Amro Bank	ABN	0.580	0.719	0.841	0.791	0.826	0.958	0.942	0.942	1.000
Bangkok Bank	BBB	0.453	0.875	0.549	0.586	1.000	0.586	0.969	0.986	0.983
Bank of America	BOA	0.536	0.700	0.731	0.957	0.964	0.993	0.826	0.834	0.991

Bank of Nova Scotia	BNS	1.000	1.000	1.000	1.000	1.000	1.000	0.831	1.000	0.831
Bank of Tokyo	BOT	0.903	1.000	0.903	1.000	1.000	1.000	1.000	1.000	1.000
Citibank	CIT	0.628	0.922	0.677	0.949	1.000	0.949	1.000	1.000	1.000
Deutsche Bank	DEU	0.877	0.967	0.900	1.000	1.000	1.000	0.971	1.000	0.971
Hongkong Bank	HBB	0.475	0.957	0.491	0.665	1.000	0.665	1.000	1.000	1.000
JP Morgan Chase	JPM	1.000	1.000	1.000	1.000	1.000	1.000	0.843	0.983	0.858
OCBC Bank	OCB	0.593	0.991	0.598	0.914	0.948	0.964	0.805	0.985	0.813
OUB Bank	OUB	0.825	1.000	0.825	1.000	1.000	1.000	0.916	1.000	0.916
Standard Chartered Bank	SCB	0.549	1.000	0.549	0.955	1.000	0.955	0.909	1.000	0.909
UOB Bank	UOB	0.609	0.893	0.682	0.870	0.956	0.910	0.916	0.918	0.998
Mean		**0.574**	**0.869**	**0.656**	**0.885**	**0.971**	**0.911**	**0.902**	**0.976**	**0.925**

* 1997-1999; ** 2000; *** 2001-2003

TE – Technical Efficiency; PTE – Pure Technical Efficiency; SE – Scale Efficiency.

Source: Authors own calculations

The empirical findings clearly suggest that the merger has resulted in the improvement of Malaysian banks' TE during the post merger period. It is apparent from Table 5 that the Malaysian banks have exhibited mean TE of 90.2% during the post merger period, higher than the 57.4% recorded during the pre merger period. It is also interesting to note that with the exception of two foreign banks, all Malaysian banks have exhibited a higher mean TE during the post merger period. A closer look at the decomposition of TE into its PTE and SE components reveals that the improvement in TE during the post merger period was mainly attributed to the improvement in SE.

The results seem to suggest that the consolidation has resulted in a more managerially efficient banking system as banks expand in size. A plausible reason could be due to the advantage that the large banks have to attract a larger chunk of deposits and loans, which in turn command larger interest rate spreads. Additionally, large banks may offer more services and in the process derive substantial non-interest income from commissions, fees, and other treasury activities (Sufian and Majid, 2007). The large banks extensive branch networks and large depositor base may also attract cheaper source of funds (Randhawa and Lim, 2005).

To examine the difference in the efficiency of the Malaysian banking sector between the two periods i.e. before and after the mergers, we perform a series of parametric (*t*-test) and non-parametric (Mann-Whitney [Wilcoxon] and Kruskal-Wallis) tests. The results are presented in Table 6. The results from the parametric *t*-test support the findings that the Malaysian banking sector has exhibited a higher mean TE post merger (0.57555 < 0.89896) and is statistically significant at the 1% level (*p*-value = 0.000). The decomposition of the TE changes into its PTE and SE components suggest that the improvement in the Malaysian banking sector's TE post merger was mainly attributed to a higher SE (0.65814 < 0.92259) and is statistically significant at the 1% level. Likewise, the Malaysian banking sector has also exhibited a higher PTE during the post merger period (0.86778 < 0.97497) and is significant at the 1% level (*p*-value = 0.000). It is observed from Table 6 that the results from the

parametric *t*-test are further confirmed by the non-parametric Mann-Whitney [Wilcoxon] and Kruskal-Wallis tests. Thus, we conclude that the Malaysian banking sector has exhibited a higher TE during the post merger period mainly attributed to the improvements in SE.

Table 6

Summary of Parametric and Non-Parametric Tests

	Test Groups					
	Parametric Test		Non-Parametric Test			
Individual Tests	*t*-test		Mann-Whitney [Wilcoxon Rank-Sum] test		Kruskall-Wallis Equality of Populations test	
Hypotheses			$Median_{Pre\ Merger} = Median_{Post\ Merger}$			
Test Statistics	*t* (Prb > *t*)		*z* (Prb > *z*)		χ^2 (Prb > χ^2)	
	Mean	*t*	Mean Rank	*z*	Mean Rank	χ^2
Technical Efficiency (TE)	0.57555	-	58.64	-8.013***	58.64	64.203***
Pre Merger	0.89896	11.261***	119.14		119.14	
Post Merger						
Pure Technical Efficiency (PTE)	0.86778	-4.989***	69.16	-5.098***	69.16	25.988***
Pre Merger	0.97497		104.56		104.56	
Post Merger						
Scale Efficiency (SE)	0.65814	-	59.69	-7.688***	59.69	59.109***
Pre Merger	0.92259	10.564***	117.69		117.69	
Post Merger						

Note: Test methodology follows among others, Aly, Grabowski, Pasurka and Rangan (1990), Elyasiani and Mehdian (1992), and Isik and Hassan (2002).

***, **, * indicates significant at the 0.01%, 0.05%, and 0.10% levels respectively.

Source: Authors own calculations

4.2 Are the Acquirers the More Efficient Banks?

We now turn to the assessment of how the mergers and consolidation process affects the mean TE of the involved banks. First, we analyze the pre merger performance of the banks concerned. Theoretically, the more efficient banks should acquire the less efficient ones. A more efficient bank is assumed to be well organized and has a more capable management. The idea is that since there is room for improvement concerning the performance of the less efficient bank, a takeover by a more efficient bank will lead to a

transfer of the better management quality to the inefficient bank. This will in turn lead to a more efficient and better performing merged unit. In order to see whether indeed it is the case that banks that are more efficient acquire the inefficient ones, we calculate the difference in the technical efficiency between the acquiring and the target banks. This efficiency difference is measured as the mean TE of the acquiring banks minus the mean TE of the target banks for the last observation period before consolidation.

Table 7
Summary of Mean Efficiency Levels of Targets and Acquirers Banks

Bank	Target/Acquirer	Acquirer More Efficient Than Target	Pre Merger		
			TE	PTE	SE
			AFF + BSN		
Affin Bank	ACQUIRER	**NO**	0.533	0.903	0.585
BSN Commercial Bank	TARGET		0.591	0.859	0.687
			ALB + SBH		
Alliance Bank	ACQUIRER	**YES**	0.539	0.925	0.579
Sabah Bank	TARGET		0.378	0.607	0.636
			EON + OBB		
EON Bank	ACQUIRER	**YES**	0.517	0.934	0.556
Oriental Bank	TARGET		0.450	0.808	0.553
			HLB + WTB		
Hong Leong Bank	ACQUIRER	**YES**	0.462	0.911	0.507
Wah Tat Bank	TARGET		0.309	0.542	0.548
			MBB + PAC		
Maybank	ACQUIRER	**YES**	0.519	1.000	0.519
Pacific Bank	TARGET		0.423	0.769	0.548
			PBB + HHB		
Public Bank	ACQUIRER	**YES**	0.428	0.903	0.474
Hock Hua Bank	TARGET		0.355	0.740	0.473
			SBB + BHL		
Southern Bank	ACQUIRER	**YES**	0.492	0.951	0.516
Bank Hin Lee Bank	TARGET		0.413	0.791	0.523

TE – Technical Efficiency; PTE – Pure Technical Efficiency; SE – Scale Efficiency.

The font in bold indicate banking group that is relatively more efficient.

Source: Authors own calculations

It is clear from Table 7 that during the pre merger period, the acquirers were relatively more technically efficient compared to the targets in six out of the seven merger cases analyzed. With the exception of the merger between AFF (acquirer) and BSN (target), all the acquirers have exhibited a higher TE levels compared to the target banks. It is clear from

Table 7 that during the pre merger period BSN's mean TE of 59.1% is higher compared to AFF's mean TE level of 53.3%.

In the next step, we again perform a series of parametric (*t*-test) and non-parametric (Mann-Whitney [Wilcoxon] and Kruskal-Wallis) tests to verify whether the difference between the acquirers' and targets' efficiencies. The results are presented in Table 8. The result seems to suggest that the acquirers were more technically efficient (0.49890 > 0.41676) and is statistically significant at the 5% level (*p*-value = 0.014), mainly attributed to higher PTE (0.93252 > 0.73143) and is statistically significant at the 1% level (*p*-value = 0.000). On the other hand, the target banks seem to be more scale efficient compared to the acquiring banks (0.53452 < 0.56671) although is not statistically significant at any conventional levels. The *t*-test results are further confirmed by the results derived from the Mann-Whitney [Wilcoxon] and Kruskal-Wallis tests. We therefore can conclude that the acquiring banks were more technically efficient compared to the target banks mainly attributed to a higher PTE.

Table 8

Summary of Parametric and Non-Parametric Tests

	Test Groups					
	Parametric Test		Non-Parametric Test			
Individual Tests	*t*-test		Mann-Whitney [Wilcoxon Rank-Sum] test		Kruskall-Wallis Equality of Populations test	
Hypotheses			$Median_{Acquirer} = Median_{Target}$			
Test Statistics	*t* (Prb > *t*)		*z* (Prb > *z*)		χ^2 (Prb > χ^2)	
	Mean	*t*	Mean Rank	*z*	Mean Rank	χ^2
Technical Efficiency (TE)						
Acquirer	0.49890	-2.569**	17.07	-2.340**	17.07	5.475**
Target	0.41676		25.93		25.93	
Pure Technical Efficiency (PTE)						
Acquirer	0.93252	-	12.48	-4.778***	12.48	22.834***
Target	0.73143	5.800***	30.52		30.52	
Scale Efficiency (SE)						
Acquirer	0.53452	1.160	24.40	-1.535	24.40	2.356
Target	0.56671		18.60		18.60	

Note: Test methodology follows among others, Aly, Grabowski, Pasurka and Rangan (1990), Elyasiani and Mehdian (1992), and Isik and Hassan (2002).

***, **, * indicates significant at the 0.01%, 0.05%, and 0.10% levels respectively.

Source: Authors own calculations

4.3 The Determinants of Bank Efficiency

Regression results focusing on the relationship between bank efficiency and the explanatory variables are presented in Table 9. The equations are based on 191 bank year observations during the period 1997-2003. Saxonhouse (1976) pointed out that heteroscedasticity can emerge when estimated parameters are used as dependent variables in the second stage analysis. Thus, following Hauner (2005) and Pasiouras (2008) among others, QML (Huber/White) standard errors and covariates are calculated. Several general comments regarding the test results are warranted. The model performs reasonably well in at least two respects. For one, results for most variables remain stable across the various regressions tested. Secondly, the findings suggest that all explanatory variables have the expected signs and in most cases are statistically different from zero.

In models 2 and 3 regressions when we add the other group of variables to the baseline specification that include the bank specific attribute variables, the coefficients of the baseline variables stay mostly the same: they keep the same sign, the same order of magnitude, they remain significant as they were so in the baseline regression model (albeit sometimes at different levels), and with few exceptions, do not become significant if they were not in the baseline regression model. Therefore, for models 2 and 3 regressions, we will only discuss the results of the new variables added to the baseline specification.

Table 9

Multivariate Tobit Regression Analysis

$$\gamma_{jt} = \alpha + \beta_1 \text{LNDEPO} + \beta_2 \text{LOANS/TA} + \beta_3 \text{LNTA} + \beta_4 \text{LLP/TL} + \beta_5 \text{NII/TA} + \beta_6 \text{NIE/TA} + \beta_7 \text{EQASS} + \zeta_8 \text{LNGDP} + \zeta_9 \text{CR\_3} + \zeta_{10} \text{PRE\_MER} + \zeta_{11} \text{POST\_MER} + \varepsilon_j$$

The dependent variable is bank's technical efficiency scores derived from the DEA. LNDEPO is a measure of bank's market share calculated as a natural logarithm of total deposits. LOANS/TA is a measure of loans intensity calculated as the ratio of total loans to total bank assets. LNTA is a proxy measure of bank size measured as the natural logarithm of total bank assets. LLP/TL is a proxy measure of risk calculated as the ratio of total loan loss provisions divided by total loans. NIE/TA is a measure of bank management quality calculated as total non-interest expenses divided by total assets. NII/TA is a measure of bank's diversification towards non-interest income, calculated as total non-interest income divided by total assets. EQASS is a measure of capitalization measured by banks' total shareholders equity divided by total assets. LNGDP is natural logarithm of gross domestic product. CR_3 is the 3 bank concentration ratio. PRE_MER is a binary variable that takes a value of 1 for the pre merger years, 0 otherwise. POST_MER is binary variable that takes a value of 1 for the post merger years, 0 otherwise.

Values in parentheses are *z*-statistics

***, **, and * indicate significance at 1, 5, and 10% levels.

	Model 1	**Model 2**	**Model 3**
CONSTANT	-12.07107***	4.113445**	3.586330
	(-8.519629)	(1.997860)	(1.560172)
Bank Characteristics			
LNDEPO	-0.213410***	-0.250925***	-0.252137***
	(-3.531557)	(-4.104366)	(-4.244993)
LOANS/TA	0.398846***	0.382714***	0.363745***
	(3.678475)	(4.220306)	(3.521629)
LNTA	0.233922***	0.253146***	0.260590***
	(3.628733)	(3.895242)	(4.067355)
LLP/TL	0.386265	-0.006068	0.231259
	(1.131903)	(-0.019931)	(0.725165)
NII/TA	12.63603***	11.15732***	11.21229***
	(6.382575)	(5.022878)	(5.002308)
NIE/TA	-9.048737***	-10.50992***	-9.750526***
	(-3.234440)	(-3.992717)	(-3.503848)
EQASS	0.420112***	0.033549	0.082439
	(2.621180)	(0.241566)	(0.576965)
Economic/ Market Conditions			
LNGDP	0.912747***	-0.331009*	-0.681946***
	(6.267161)	(-1.829567)	(-2.881078)
CR_3	0.049198***	0.002485	0.090216***
	(4.955759)	(0.235493)	(8.152025)
PRE_MER		-0.373957***	
		(-9.832471)	
POST_MER			0.293684***
			(9.347191)
Log likelihood	79.53888	122.5838	109.2452
R^2	0.545655	0.692528	0.666944
Adj. R^2	0.520413	0.710329	0.646477
No. of Observations	191	191	191

Source: Authors own calculations

The proxy for network embeddedness, LNDEPO reveals a negative relationship and is statistically significant at the 1% level, suggesting that the more technically efficient banks are associated with banks with a smaller branch networks. On the other hand, LOANS/TA reveals a positive relationship and is statistically significant at the 1% level. The findings imply that banks with higher loans-to-asset ratios tend to have higher technical efficiency scores. Thus, bank loans seem to be more highly valued than alternative bank outputs i.e. investments and securities. Likewise, LNTA shows positive coefficients suggesting that the larger the bank, the more efficient the bank will be, purely because of the economies of scale arguments. Hauner (2005) offers two potential explanations for which size could have a positive impact on bank efficiency. First, if it relates to market power, large banks should pay

less for their inputs. Second, there may be increasing returns to scale through the allocation of fixed costs (e.g. research or risk management) over a higher volume of services or from efficiency gains from a specialized workforce. Thus, assuming that the average cost curve for Malaysian banks is U-shaped, the recent growth policies of the small and medium Malaysian banks seem to be consistent with cost minimization.

The coefficient of NII/TA has consistently exhibit strong positive and significant relationship with TE. The elasticity and TE with respect to NII/TA is quite high and is statistically significant at the 1% level. The results imply that banks tend to become more efficient as they increase their income from non-interest sources. The results seem to suggest that NIE/TA has consistently exhibit negative relationship with bank efficiency and is statistically significant at the 1% level. The finding is in consonance with the *bad management* hypothesis of Berger and DeYoung (1997). Low measure of cost efficiency is a signal of poor senior management practices, which apply to input-usage and day-to-day operations. Clearly, efficient cost management is a prerequisite for the improved efficiency of the Malaysian banking system i.e. the high elasticity of technical efficiency to this variable denotes that banks have much to gain if they improve their managerial practices.

EQASS exhibits positive relationship with bank technical efficiency in the baseline regression model. The empirical findings seem to suggest that the more technically efficient banks, *ceteris paribus*, use less leverage (more equity) compared to their peers. The findings may also imply that the more efficient banks are involved in riskier operations and in the process tend to hold more equity, voluntarily or involuntarily, i.e. the reason may be due to deliberate efforts by banks to increase the safety cushions. However, the coefficient of the variable loses its explanatory power when we control for the pre and post merger periods.

During the period under study, the empirical findings seem to suggest that macroeconomic conditions (LNGDP) exhibit a positive relationship with technical efficiency. Again, when we control for the pre and post merger periods, the coefficient of the variable is no longer statistically significant in the regression models. The three-bank concentration ratio (CR_3) entered the baseline regression model with a positive sign. Similarly, the coefficient of the variable is positive in regression model 3, but is not statistically significant at any conventional levels in regression model 2. The empirical findings suggest that market concentration has a positive influence on technical efficiency during the post merger period. The binary variable PRE_MER entered the regression model with a negative sign suggesting Malaysian banks have been relatively inefficient during the pre merger period. On the other hand, the coefficient of the binary variable POST_MER has a positive sign and is statistically significant at the 1% level suggesting that the Malaysian banking sector has been relatively more technically efficient during the post merger period.

5. CONCLUSIONS

Applying a non-parametric frontier approach Data Envelopment Analysis (DEA), the paper attempts to investigate the effects of mergers and acquisitions on the efficiency of Malaysian banks. The sample period is divided into three sub-periods, i.e. pre merger, during merger and post merger periods, to compare the differences in Malaysian banks' mean technical, pure technical and scale efficiency levels during all periods.

The results from DEA suggest that Malaysian banks have exhibited technical efficiency level of 57.4%. We find that during the post merger period, Malaysian banks have exhibited higher mean technical efficiency levels compared to the pre merger period. Similar to the pre merger period, the empirical results seem to suggest that scale inefficiency outweighs pure technical inefficiency in the Malaysian banking sector during the post merger

period. The empirical findings suggest that the acquirers are relatively more efficient compared to the targets in six out of the seven merger cases analyzed.

The results from the multivariate regression analysis suggest that LNDEPO has a negative relationship with technical efficiency, implying that the more efficient banks are associated with banks with smaller branch networks. On the other hand, LOANS/TA reveals a positive relationship implying that banks with higher loans-to-asset ratios tend to have higher technical efficiency scores. LNTA shows positive coefficients suggesting that the larger the bank, the more efficient the bank will be, purely because of the economies of scale arguments. The coefficient of NII/TA has consistently exhibits strong positive and significant relationship with TE. The results imply that banks tend to become more efficient as they increase their income from non-interest sources.

The findings seem to suggest that NIE/TA consistently exhibit negative relationship with bank efficiency levels. The finding is in consonance with Berger and DeYoung's (1997) *bad management* hypothesis. Clearly, efficient cost management is a prerequisite for the improved efficiency of the Malaysian banking system. EQASS exhibits positive relationship with bank technical efficiency suggesting that the more technically efficient banks, *ceteris paribus*, use less leverage (more equity). The findings may also imply that the more technically efficient banks are involved in riskier operations and in the process tend to hold more equity, voluntarily or involuntarily. However, when we control for the pre and post merger periods, the variable is no longer significant in the regression models. The empirical findings suggest that market concentration has positive influence on the Malaysian banking sector's technical efficiency during the post merger period. The results seem to suggest that Malaysian banks were relatively more technically efficient during the post merger compared to the pre merger period.

The empirical findings of this study have considerable policy relevance. First, in view of the increasing competition resulting from the more liberalized banking sector, the continued success of the Malaysian financial sector depends on its efficiency and competitiveness. Therefore, bank managements as well as the policymakers will be more inclined to find ways to obtain the optimal utilization of capacities as well as making the best use of their resources, so that these resources are not wasted during the production of banking products and services. From the regulatory perspective, the performance of the banks will be based on their efficiency and productivity. Thus, the policy direction will be directed towards enhancing the resilience and efficiency of the financial institutions with the aim of intensifying the robustness and stability of the financial system (Bank Negara Malaysia, 2005).

Secondly, during the pre merger period most of the banks in Malaysia were relatively small by global standards. Within the context of the Malaysian banking sector, earlier studies have found that the small financial institutions are at disadvantage in terms of technological advancements compared to their large counterparts (see among others Sufian, 2008). Thus, the relatively larger institutions post merger could have better capability to invest in the state of the art technologies. To this end, the role of technology advancement is particularly important given that banks with relatively more advanced technologies may have added advantage compared to their peers. Consolidation among the small banking institutions may also enable them to better withstand macroeconomic shocks like the Asian financial crisis. Furthermore, from economies of scale perspectives, the merger program could have entailed the small Malaysian banks to better reap the benefits of economies of scale.

Thirdly, the empirical findings from this study clearly suggest that the merger program has resulted in a relatively more efficient Malaysian banking sector during the post merger period. With the exception of two foreign banks, the results suggest that all Malaysian banks have exhibited a higher efficiency levels during the post merger period. All banks that were

involved in the merger program have also demonstrated their abilities to reap merger synergies, thus exhibits higher efficiency levels during the post merger compared to the pre merger period. Thus, it could also be argued that the merger program has been successful in eliminating the redundancies in the banking system.

Finally, although the merger program was unpopular, perceived by the market as impractical, and controversial, the empirical findings from this study clearly reject the notion that the merger program among the Malaysian domestic commercial banks was not driven by economic reasons. Furthermore, the results from this study also suggest that the selection of the anchor banks is supported by the economies of scale reasons.

REFERENCES

Al-Sharkas, A., Hassan, M.K. and Lawrence, S., (2008), "The Impact of Mergers and Acquisitions on the Efficiency of the U.S. Banking Industry: Further Evidence", *Journal of Business, Finance and Accounting*, 35 (1-2): 50-70.

Altunbas, Y. and Marques, D., (2008), "Mergers and Acquisitions and Bank Performance in Europe: The Role of Strategic Similarities", *Journal of Economics and Business*, 60 (3): 204-222.

Aly, H.Y., Grabowski, R., Pasurka, C. and Rangan, N., (1990), "Technical, Scale and Allocative Efficiencies in U.S. Banking: An Empirical Investigation", *Review of Economics and Statistics*, 72 (2): 211-218.

Avkiran, N.K., (1999), "The Evidence on Efficiency Gains: The Role of Mergers and the Benefits to the Public", *Journal of Banking and Finance*, 23 (7): 991-1013.

Bank Negara Malaysia (2005), Annual Report. Kuala Lumpur: Bank Negara Malaysia Press.

Berger, A.N. and DeYoung, R., (1997), "Problem Loans and Cost Efficiency in Commercial Banks", *Journal of Banking and Finance*, 21 (6): 849-870.

Berger, A.N. and Humphrey, D.B., (1992), "The Megamergers in Banking and the Use of Cost Efficiency as an Antitrust Device", *Antitrust Bulletin*, 37 (Fall): 187-229.

Campa, J.M. and Hernando, I., (2006), "M&As Performance in the European Financial Industry", *Journal of Banking and Finance*, 30 (12): 3367-3392

Campa, J.M. and Hernando, I., (2008), "The Reaction by Industry Insiders to M&As in the European Financial Industry", *Journal of Financial Services Research*, 33 (2): 127-146.

Charnes, A., Cooper, W.W. and Rhodes, E., (1978), "Measuring the Efficiency of Decision Making Units", *European Journal of Operational Research*, 2 (6): 429-444.

Chin, K.F. and Jomo, K.S., (2001), *Financial Liberalization and System Vulnerability*, in Jomo, K.S. (ed.), Malaysian Eclipse: Economic Crisis and Recovery. New York: Zed Books Ltd.

Chong, B.S., Liu, M.H., and Tan, K.H., (2006), "The Wealth Effect of Forced Bank Mergers and Cronyism", *Journal of Banking and Finance*, 30 (11): 3215-3323.

Coelli, T., (1996), "A Guide to DEAP Version 2.1: A Data Envelopment Analysis (Computer Program)", Working Paper, University of New England.

Cornett, M.M., McNutt, J.J. and Tehranian, H., (2006), "Performance Changes around Bank Mergers: Revenue Enhancements versus Cost Reductions", *Journal of Money, Credit and Banking*, 38 (4): 1013-1050.

Crouzille, C., Lepetit, L. and Bautista, C., (2008), "How Did the Asian Stock Markets React to Bank Mergers after the 1997 Asian Financial Crisis", *Pacific Economic Review*, 13 (2): 171-182.

Cybo-Ottone, A. and Murgia, M., (2000), "Mergers and Shareholders Wealth in European Banking", *Journal of Banking and Finance*, 24 (6): 831-859.

Das, A. and Ghosh, S., (2006), "Financial Deregulation and Efficiency: An Empirical Analysis of Indian Banks During the Post Reform Period", *Review of Financial Economics*, 15 (3): 193-221.
Elyasiani, E. and Mehdian, S., (1992), "Productive Efficiency Performance of Minority and Non-Minority Owned Banks: A Non-Parametric Approach", *Journal of Banking and Finance*, 16 (5): 933-948.
Focarelli, D., Panetta, F. and Salleo, C., (2002), "Why Do Banks Merge?" *Journal of Money, Credit and Banking*, 34 (4): 1047-1066.
Hahn, F. R., (2007), "Domestic Mergers in the Austrian Banking Sector: A Performance Analysis", *Applied Financial Economics*, 17 (3): 185-196.
Hauner, D., (2005), "Explaining Efficiency Differences Among Large German and Austrian Banks", *Applied Economics*, 37 (9): 969-980.
Houston, J.F., James, C.M. and Ryngaert, M.D., (2001), "Where Do Merger Gains Come From? Bank Mergers from the Perspective of Insiders and Outsiders", *Journal of Financial Economics*, 60 (2-3): 285-331.
Isik, I. and Hassan, M.K., (2002), "Technical, Scale and Allocative Efficiencies of Turkish Banking Industry", *Journal of Banking and Finance*, 26 (4): 719-766.
Koetter, M., (2008), "An Assessment of Bank Merger Success in Germany", *German Economic Review*, 9 (2): 232–264.
Kohers, T., Huang, M.H. and Kohers, N., (2000), "Market Perception of Efficiency in Bank Holding Company Mergers: the Roles of the DEA and SFA Models in Capturing Merger Potential", *Review of Financial Economics*, 9 (2): 101-120.
Liu, B. and Tripe, D., (2002), "New Zealand Bank Mergers and Efficiency Gains", *Journal of Asia Pacific Business*, 4 (4): 61-81.
Pasiouras, F., (2008), "Estimating the Technical and Scale Efficiency of Greek Commercial Banks: The Impact of Credit Risk, Off-Balance Sheet Activities, and International Operations", *Research in International Business and Finance*, 22 (3): 301-318.
Peristiani, J., (1997), "Do Mergers Improve the X-Efficiency and Scale Efficiency of U.S. Banks? Evidence from the 1980s," *Journal of Money Credit and Banking*, 29 (3): 326-337.
Petmezas, D., (2009), "What Drives Acquisitions? Market Valuations and Bidder Performance", *Journal of Multinational Financial Management*, 19 (1): 54-74.
Piloff, S.J. and Santomero, A.M., (1997), "The Value Effect of Bank Mergers and Acquisitions", Working Paper, Wharton Financial Institution.
Randhawa, D.S. and Lim, G.H., (2005), "Competition, Liberalization and Efficiency: Evidence From a Two Stage Banking Models on Banks in Hong Kong and Singapore", *Managerial Finance*, 31 (1): 52-77.
Rezitis, A.N., (2008), "Efficiency and Productivity Effects of Bank Mergers: Evidence from the Greek Banking Industry", *Economic Modelling*, 25 (2): 236-254.
Rhoades, S.A., (1998), "The Efficiency Effects of Bank Mergers: An Overview of Case Studies of Nine Mergers", *Journal of Banking and Finance*, 22 (3): 273-291.
Saxonhouse, G.R., (1976), "Estimated Parameters as Dependent Variables," *American Economic Review*, 66 (1): 178-183.
Scholtens, B. and de Wit, R., (2004), "Announcement Effects of Bank Mergers in Europe and the U.S.", *Research in International Business and Finance*, 18 (2): 217-228.
Sufian, F. and Majid, M.Z.A., (2007), "Deregulation, Consolidation and Banks Efficiency in Singapore: Evidence from Event Study Window Approach and Tobit Analysis," *International Review of Economics*, 54 (2): 261-283.
Sufian, F., (2008), "Revenue Shifts and Non-Bank Financial Institutions' Productivity: Evidence from Malaysia", *Studies in Economics and Finance*, 25 (2): 76-92.

PROCJENA UTJECAJA RESTRUKTURIRANJA FINANCIJSKOG SEKTORA NA PERFORMANSE BANAKA U MALOM GOSPODARSTVU U RAZVOJU

SAŽETAK

Rad istražuje utjecaj spajanja i akvizicija na tehničku efikasnost malezijskog bankarskog sektora. Analiza se sastoji od tri faze. Koristeći DEA (Analiza omeđenih podataka) pristup, najprije smo izračunali čisto tehničku i efikasnost s obzirom na opseg djelovanja pojedinih banaka u periodu 1997.-2003. Nakon toga, istražili smo promjene u efikasnosti malezijskog bankarskog sektora tijekom perioda prije i poslije spajanja koristeći niz parametarskih i neparametrijskih univarijatnih testova. Na kraju smo primijenili multivarijatnu regresijsku analizu kako bismo ispitali čimbenike koji utječu na efikasnost malezijskih banaka. Iako je program spajanja bio nepopularan i od strane tržišta shvaćen kao nepraktičan i kontroverzan, empirijski nalazi ovog istraživanja pokazuju da je program spajanja domaćih malezijskih banaka potaknut ekonomskim razlozima.

Ključne riječi: *Spajanja i akvizicije, analiza omeđenih podataka, multivarijatna regresijska analiza, Malezija*

Amorino Poropat[1]

UDK 711.142:711.4
Original scientific paper
Izvorni znanstveni rad

LAND PLOT – A MATRIX OF PLANNING SCRIPT

ABSTRACT

The goal of this work is to establish the structural rules of planning for quality of life of inhabitants. The aim of the research is to establish a division between land plots and the associated structure of general terms into a hierarchy of four levels of units of use and a matrix of symbols for their classification. The research methodology includes an analysis of relevant literature on the characteristics of fractals and the author's experience in preparing, developing and implementing spatial planning plans. A structure of general terms and symbols for spatial planning has been established with four levels along with the application of hierarchy of use for three groups of land plots and their classification. In this way the hierarchy of land plots is equally relevant for administrators and professionals and is a rule which must be respected.[2]

Key words: *hierarchy, matrix, land plot, plot, planning script, structure.*

1. INTRODUCTION

A significant contribution on the construction of space is based on the characteristics of 'fractals,' outlines of the areas zoned for construction in a settlement. By definition, a fractal is a rough or fragmented geometric shape that can be subdivided into parts, each of which is (at least approximately) a smaller copy of the whole (Thomas, et al. 2008). Fractals have been used for more than four decades for the description of outlines and surfaces and have generated a large number of papers in various scientific disciplines (geology, biology, landscape analysis, architecture, physics, remote sensing, etc.) including landscape analysis (see e.g. Milne, 1991 and McGarigal and Marks, 1995). More about fractals can be found further on in relevant works. In essence, the characteristics of fractals are the subject of scientific research especially with respect to their time-period, structure, hierarchy, function, identification and problems associated with them.

Research on time period of a fractal includes a view of growth in city areas in intervals over a longer period of time.[1] (Abercrombie, 1945; Doxiadis, 1968; Gallion and Eisner 1950, 1975). Research into the structure of fractals includes an elaboration of the characteristics of cities using different approaches. Important approaches are area type, model and use. Area type can be further divided into: poly-nuclear, container, patchwork, centre & sub-centre and fingers, while their characteristics can be further divided into: structure of living, transport system, green structure, commerce and mall location (Borsdorf and Zembri, 2004). Eminent authors (2004) note these models: Linear City, Satellite City, Central Place City, Prodution City, Market City, Real-Estate City, Funger City, Cluster or Corridor City, Regional City, Expansion City, Dispersed City, Fractal City, Information City, Network City and Global City. Nadalje prikazi Idealized Models of Urban Growth and Form (Morris, 1979; Arlinghaus and Nysteun,1990). Further views: Idealized Models of Urban Growth and Form (Morris, 1979; Arlinghaus and Nysteun, 1990). A structure of use and size has been established as

[1] Ph. D. in Technical science, field Architecture and Urban Planning. Senior research fellow at the Institute for Agriculture and Tourism, Poreč, Croatia, e-mail: amorino@iptpo.hr

[2] Paper received 20 June 2009.

have the associated relationships between city areas at the general urban plan level (Marinović-Uzelac, 1989). The hierarchy is based on the view of characteristics of a city reminiscent of a tree or bodily organ. These are traffic systems (Keeble, 1959) and social groups (Abercrombie, 1945), the ideal system of social cities (Hovard, 1898, 1965; Kostof, 1991), the hierarchy of central places and hexagonal geometry and the lattice of central places (Christaller, 1933, 1966), regionalisation and nodal rules (Šimunović, 1996) and city development in the form of the growth of the human lung (Nelson and Manchester, 1988). Functional structure is the application of mathematical equations on the view of a certain fractal characteristic. These views are: Models of Urban Structure and Multinomial logit Model (Hensher and Johnson, 1981; Ben Aktiva and Lerman, 1985, Wrigley, 1985). Models Measurement (Lagarias, 2007), and A Classification using fractal indices (Thomas, 2008). For identification purposes, this implies the structure of land plot terms in four units of use. In order from smallest to largest, these land plots are: Planning parcel, Planning block, Planning zone and Planning area (Poropat, 2010). Using previous fractal research, we can describe the identity of the characteristics of cities and spaces by which individual ranges and numerical measurement data are defined.

General concepts for range are: wider to narrower, larger to smaller, denser to sparser, higher to lower or vice-versa, while those for data are: History, design, growth rates, government policies, size, amount and height as well as functions, drawings, area shape or volume, etc. Modalities of characteristics are new understandings or the results of research which in essence are reminiscent of a tree, funnel or ring, etc. As a result, important research in the state of cities and their characteristics are a consequence of the problem. Problematically, there are millions of settlements in the world none of which are identical. The causes are sociological problems in cities for which planning rules for quality of life are lacking. Of the relevant sociological research some approaches and facts from urban sociology are set apart. According to Ognjen Čaldarević there are a number of approaches to urban planning: traditional, adaptable, stakeholder, tactical, structural, systematic and representational. Above this, approaches are directed towards planning goals and the way in which space is constructed with the policies of the relevant authorities predominating. The facts are that "The failures of urban planning throughout the world, the dissatisfaction of inhabitants with new settlements, unachieved realisation – ideal micro-regions-, neighbourhoods or individual –solutions- very quickly gave rise to the amassing of a large amount of literature[2] on the many aspects of this failure." (Čaldarević, 1985). Competent authorities often change and supplement the terminology of spatial plans without defining units of use (Poropat et al., 2006). "We study space as if it were a shell in which social processes are fossilised, materialised and become categories of our every-day lives which will outlive us and which for later generations be telling of us and of our times. This is only cause for the constitution of rules at the spatial planning level. The subjects of the research are elements of planning and the objects of observation are land plots in the function of rules for spatial planning. Relevant works in international literature have been analysed and the empirical method or our own experience have been used in the preparation, development and implementation in spatial planning plans. The expected scientific contribution is in the constitution of a matrix of planning script. Research on consequences and sociological causes in the development of cities is scientifically inexhaustible. At the same time the facts stated which result in rules are difficult to implement on the existing state in cities. Basic research on the causes of the problems is lacking and would form a basis for the development of settlements and other space. The reason for this is largely in spatial plans which primarily create space under the influence of political authorities. The application of scientifically-found characteristics for planning new cities is questionable because rules for hierarchy and

structure of units of use are missing. For this reason we put for the following hypothesis for our research:

The land plot and its use in division, hierarchy, structure and classification of symbols can conditionally be elaborated into a matrix of planning script.

2. PURPOSE

The word 'purpose' is the technical word usually used, but it is not sufficiently clear and shall be examined through its definition, hierarchy and facts.

2.1. DEFINITION

The purpose of the space / area is a planned system of space use, more specifically the use of buildings, areas and land surfaces as determined the appropriate zoning document. The basic purpose of the space/area is the planned use of the space/area as determined for one function (settlement, farming, forest, transportation, economy, sport, recreation, etc.), within which purposes or activities exclusively arising from the needs of the basic purpose can be planned. The main purpose is the planned use of the space/area for a number of different functions, one of which is dominant (The Act, 2007, num. 76; 2009, num. 38). Conceptually, the purpose is legalized in a way that equates the space and area for which it differentiates the primary and most often purpose, but does not consider the properties, characteristics, gender or genus of the purpose.

Above this, words whose concepts must be made more precise using different wording are included in purpose. These are words or parts of sentences: a planned system of spatial use, the corresponding document, the function, the second purpose, content and the difference between space and area! Purpose is an essential element of construction conditions on land parcels zoned for building.[3] In order to clarify, purpose is the identity of something for terms of use or the use of which is commonly utilized in the development of spatial planning documents. In addition, the concept behind the word *purpose* is very general. It can be used for movable property and real estate. An example of movable property. There is a stack of wheat in stock. From this stack of wheat two bags will be filled. One purpose for the bags will be seed while the other purpose of the bags will be used for processing and food. Properties are land and buildings[4] whose purpose for a specific use are conditionally shaped and set by planners in spatial plans. In this respect, the purpose should be specified so that it points to the person that creates or shapes. As a rule, the purpose is created and shaped by the spatial planner. The intent is precisely defined if we say – the planner's intent! Why not "planning" intent? If we say planning intent, this excludes the creator's intentions, which means it can be anyone regardless of his expertise. Planning purposes are the current legalized practice for the professional basis of these documents that are: "provide(d) by competent state administration bodies and bodies of local and district (regional) government to conduct the professional work of spatial planning, as well as legal entities founded and registered to prepare these documents and licensed architects who independently conduct professional work in spatial planning." (The Act, 2007, 2009, article 23, section 2). The cited decree highlights that there are many entities which can create these documents, and consequently control the purpose (dictate). In practice, legal entities are most often those who create purpose, and behind them one usually finds incompetence and politically motivated decisions which benefit those in power rather than benefiting the local population and their quality of life. The responsible plan developer is therefore marginalized to the level of a technical

drafter from whom obedience and responsibility in completing tasks is expected; at the same time he is expected to bear the legal penalties that arise from mistakes made by others. In addition, the absence of written consent for the term "compliance" is not defined by law. (The Act, 2007, num.76; 2009: article 305-308).[5]

2.2. HIERARCHY

The concept of hierarchy can point to the example of spatial units and individual knowledge. "The cadastre rules" include a classification and registry of spatial units, of which the types are especially emphasised. These types are: administrative spatial units, spatial units of local self-government, spatial units of neighbourhood-level government, judicial spatial units, cadastre spatial units, statistical spatial units, address spatial units, spatial units of conservation and protected areas. Prominent types and classification of spatial units are reminiscent of the scope of land plots from which you can determine the hierarchy of administration, governance, power, domination, etc. See the sketch of enumeration districts. (Regulations, 2008, num. 142). In the literature we can also find the hierarchy of the movement of people from the city to home within an urban district. It is a polycentric view of more urban centres and their effect on where people gravitate (Thomson, 2002, 59-72).

In our case hierarchy[6] is the rule of subordination and superiority in land plots in their identity of aligned or related purposes. Concerted use (compliance) is the rule for two or more identities which have the same comparative properties of a part or whole. Identity is the image or information on the characteristics which serve to differentiate one person or thing from any other person or thing. Harmonized data can be at the level of parts of different spatial planning documents, like numerical measures for: user, quantity, size, ratio, capacity, and land pollution of the associated land plot in the hierarchy of similar purposes.

Users of space are: people (resident, employee, guest, family, team, group), the dead (corpses), animals and poultry (conditional on their numbers), wild game, etc., vehicles (car, truck, boat, etc.), plants (fruit trees, grains, etc.); fish, etc.

Amounts in numbers: population (permanent and temporary) - employees (workers), the unemployed, guests, retirees, children, students, convicts, the sick, soldiers and peasants; animals - livestock and poultry, fish; and real estate - parking lots, moorings, land plots, buildings, functional units etc.

Sizes as measured: length, width, height, area and volume.

Ratios as they are used in area: proportions for the use of closed and open spaces: (basic and supplemental) /also elements of planning open spaces (leisure, road access)/, the proportion of elements (the use of surface areas or functional units) and includes grounds, the structure of relations at the planning area level; then the coefficients (the ratio of the surface floor-plan area of building to the land plot as well as the relationship of the gross area of the building and the area of the plot of land), degree (the ratio of volume the of buildings and land surfaces, and density (the ratio of quantities and units of the ground surface – land plot, acres, or km^2), and the yield ratio or the amount of fruits and unit area, the catch (the ratio of the amount of fish and aquatic unit area) and the scale of maps, classification, etc.

Capacity in relation to the quantity and unit of time: yield, drainage, power, consumption, transport and communications. For example: infrastructure cables (the amount water sources, waste water drainage, available electrical power), fuel consumption (oil, gas, uranium), as well as traffic on through roads (roads, streets, railway, etc.), water surfaces (shipping lines, etc.), air (air routes, etc.) and links in the transmission of sound frequencies, letters and pictures, as well as the corresponding connections: telephone, telegram, internet, radio and television, and finally the level of waves allowed (sound, vibration, soil and radiation) etc.

Environmental pollution (air, water, ground) for the allowed properties (physical, chemical, radioactive and bacteriological) in relation to the unit of operation (^{o}C, pH, mg / l, microcurie / ml, germs / ml, ha, etc.). This includes standards for landfill sites, waste, toxins and radiation. Conceptual, the spatial planning document is a complete study plan, bound (file), validated and made public as a whole that is much different than other document covering the "smaller" or "wider" area.[7] Spatial and associated urban plans and strategic documents as a whole have different textual and graphic content regardless of some parts which can be adjusted. They differ in the structure of their contents, glossary, scope, meaning, etc. Compliance can be applied only to specific parts or provisions of physical planning documents when the regulation clearly defines the content and meaning of data that is in harmony. Therefore, compliance cannot be applied to synchronize the planning documents as a whole. The regulation should more closely define the data as parts of the physical planning documents and must be mutually consistent.

2.3. FACTS

A spatial planner should be the creator of the elements of planning in the application of professional rules and science "in accordance with spatial planning and construction standards that Croatia has yet to devise."[8] This lack of norms points to the facts that support traffic overload, over-capacity, uneven development, irrational infrastructural burden, substantial unemployment, profiteering and others. These facts at the beginning of the 21st century substantially confirm the state we see in modern medium and large sized cities.

Conceptually, the planning purpose is the identity of the purpose of real estate which is encompassed by land plots documented in spatial plans and represent the terms for their use or what they are already used for.

3. THE PLOT

What is the plot? A parcel in the field is a surface or belt of a certain area of land! It refers to the generic term that is synonymous with a building land plot and includes other planned land areas. A land parcel or plot [9] on paper is a geometrical figure which constitutes a particular area, and is used as a rule in cadastral maps and the preparation of physical planning documents. In addition to these properties, they also determine the division of land plots and belts, the identity matrix and defining features as well as examples and differences.

3.1. PROPERTIES OF PLOTS

According to the use of land or crops on the land, cadastre regulations define that: THE PLOT is characteristically a cadastre parcel. For the purposes of land preparation, a "unique PARCEL" has been defined by studies which include many cadastre parcels consolidated into one entity in such a way that they create one plot of jointly-owned land (Poropat et al. 2000; Poropat, 2002; Poropat, A. Ružić, P. 2003, 479-489). The plot characteristically includes size in two dimensions (length and width), including the intent and shape of neighbouring land surfaces. Land use identifies a product for different uses, and most recently has become a means to digitally record data. New technologies create new products and change the environment with artificially created values, from buildings to new organisms (Poropat and Ružić, 1999, 215-225). To master the products at the planning level is to create a database as the foundation with the possibility of simulating the optimal development of formed land plots since the technological development in the past one hundred years has significantly compromised and distorted the natural balance.[10]

How are we to balance current and future spatial development? One way is to create an information system that integrates a whole unit of space with many data about its nature and where land plots are particularly highlighted (Poropat, 2002). The digital processing of plots (cadastre parcels) are all the more emphasised in spatial planning (Elfick, 1991, 107-114, 2009). This can also be the digital processing of topographic data (Filho De Figueeiredo, Carvalho and Gattass, 1995).

Land plots in the planning area are of public interest and their importance can be compared to:

- A letter of the alphabet on paper or "a letter as the everyday name of a symbol of some writing system, usually alphabetic. In science the preferred term is grapheme";[11]
- A note as the means to record music onto paper;[12]
- Prominent spots in the raised writing system (Braille) used by the blind;[13]
- Numbers on paper to describe amounts;[14]
- Units of measurement on paper to describe size;[15] etc.

3.2. SURFACES AND BELTS

A land plot can be a surface or belt by its linear or geometric appearance. A surface includes the area of the geometric appearance of the land (square, rectangular, trapezoid and circular, etc.) with size, length and width being approximately equal or unequal to a certain size ratio (1:2 or more). Size ratios are adjusted to accept the building and land around it and for forming the remaining surfaces or areas which are not long and narrow in the function of public transport.

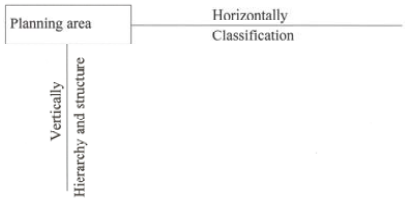
In spatial planning, a land plot belt is reminiscent of something narrow and long. These are land areas used for the public transport of goods and live animals on a belt or corridor road, railway, river etc. Notable land plots are surfaces which lead to destination plots (building plots, agricultural and other non-communal plots). In the preparation of detailed development plans, as a rule roads are made in the form of drafts in the scope of one unidentified parcel (Adli Imam Zakaria EL, 2006, 192-209), as well as the rest of the plot's surface. The structure of roads has been dealt with by several authors, of which three are relevant to this work: German architect Dieter Prinz differentiates roads according to transportation tasks: the area for pedestrians (pedestrian areas), hiking and biking trails; roadway-pedestrian through roads, access roads; collector roads, converging residential areas: traffic roads (roadway traffic), main traffic roads, motorways, city highways, state highways and junctions (Prinz, 2006, 99-104). Professor Dr. M. Mihail of the Faculty of Engineering at the University of Belgrade determined the planning characteristics for roads. These are primary and local networks. The primary network includes city highways (GA – connecting distanced areas of the city), main city roads (GM – connecting various urban facilities) and city traffic (GS – connecting residential areas and the city centre). The local network includes collector roads (SU – serving city entities) and access roads (PU – serving individual locations) (Maletin, 2005, 54-81). Similarly, roads are covered within the structure of the land plot: the main street – a plot of land set aside for through traffic and its links to street plots; collector street – a plot of roadway which links buildings (building plots) and other street plots, as well as paths with various purposes – plots of roadways intended for cyclists, horseback riders, pedestrians, etc. (Poropat, 2004, 281-293). Based on these insights we can define the structure of roadways which includes the four levels of land plots. City traffic (GS) can be replaced with the term "local" as used in the Guidelines (1998, 2004), then the plot for the collector road can be divided into primary and secondary as defined in the author's published article.

3.3. THE MATRIX FOR PLANNING SYMBOLS

The starting point for making a matrix of planning symbols is the primary scheme of the planning areas. The scheme includes the elaboration of the chosen area in two perpendicular directions, one direction is vertical and includes a hierarchy of structural levels and modalities and the second is horizontal and establishes the terms for the classified plots (fig. 1).

Figure 1

The primary scheme of the planning area



Source: author

The matrix of planning symbols is a graphical representation of the hierarchy of purposes and displays the identification signs of the plots.

3.3.1. THE HIERARCHY OF PURPOSE

To view the general terms of purpose, a graphic interpretation for the hierarchy of purpose and shaped characteristics of surfaces and belts was formed in the structure of plot classification levels. These our four levels of plot planning in which the first level (I) analyses the smallest unit and detailed purpose and the fourth level (IV) analyses the largest unit and global purpose. In forming the surfaces and belts the order is from the largest to the smallest shape-unit in such a way that the level of planning is recognised in identifying the hierarchy of four different terms from the largest to the smallest related unit. Universal terms in the hierarchical identification of plots are: Planning Area, Planning Zone, Planning Block and Planning Parcel, while those for the identification of belt plots are: Main, Local, Collector and Access. The shapes of the surface plots and their related belts can be regular, irregular or a combination of these with the condition that the surface is a homogeneous whole (Fig. 2).

Level IV

Planning areas are parts of territory within the smallest unit of the territorial organization of local government. These are larger areas of land or conditionally plots that make up the surface within which it is possible to identify and develop a global purpose over a longer time period: settlements, plant life (forests) and agriculture, barren land, barren mountainous terrain, water, protection and others.

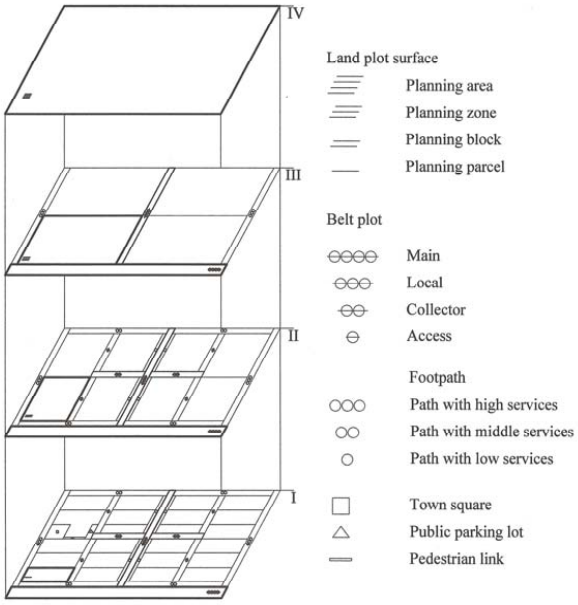
Level III

This planning zone is formed by the division of surface plots within the planning area. It is the result of several related or similar purposes. In our matrix these are four planning zones and three belt plots of which one is local and two are footpaths with high services. Prominent zones are joined by the main plot of the belt. It is a new image that establishes the rules for use and conversion of part of the surface into belts so that roadways and footpaths are separated.

Level II

The planning a block was created by the division of land surfaces within a planning zone. It came about from several related purposes as those in the third surface level. On the matrix in our example the level of one plot surface in the planning zone came out of plots for two block surfaces and four additional belt plots of which two were footpaths with medium services, one collector and one footpath with low services. In this configuration the plots are joined by a belt from the third level. The basic number of belt plots is defined on the second plan level.

Figure 2
The Hierarchy of purposes



Source: author

Level I

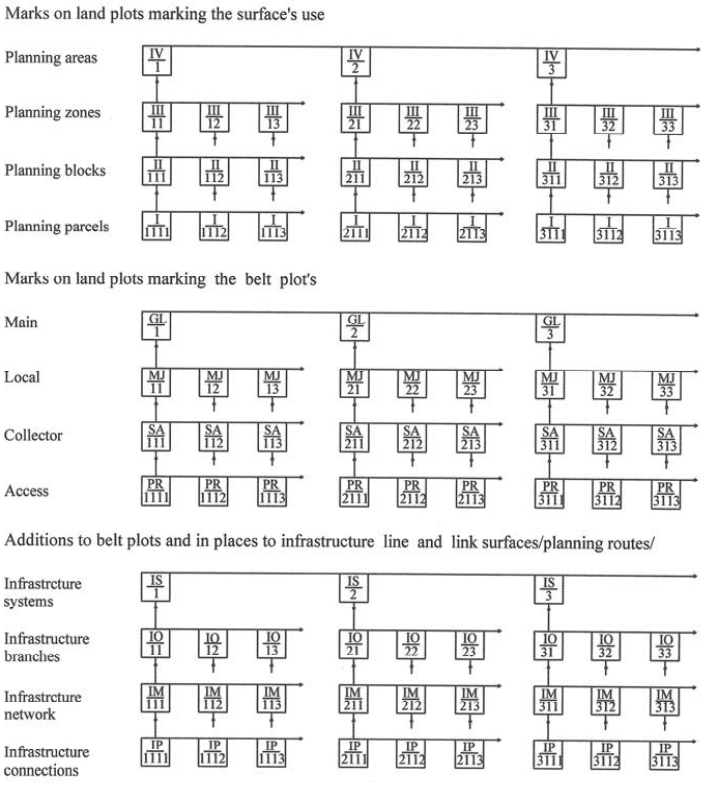
The planning parcel is formed by the division of land in the planning block. It can be a number of plot surfaces or a planning parcel within the plot of the planning block. It is given as a view and additional belt plots which form a town square plot, public parking lot and their pedestrian links and in some places a small park. The remaining plot belts from the second level are joined in the first planning level.

3.3.2. IDENTIFICATION DESIGNATION FOR PLOTS

A matrix of three groups of identification symbols which symbolise planning characters has been determined (fig. 3). At the level of territorial local government around the world, planning areas should be classified and individually modelled and then identified hierarchically in four levels. In particular, a matrix should be established for the identification of the purpose of the surface, belt as well as the identification of terms of planning routes. The first group symbolizes the identification of surfaces in four hierarchical levels of land plots. This means that the territory of the lowest form of local government (fourth level) should be divided into several planning areas (plots) in terms of their purpose so that they can be globally differentiated as well as differentiated amongst themselves. This is not an act of division but is merely a condition for the globalisation of the field (plot) for long-term projections of population development as well as economic and social activities for the balanced and quality of life of the local residents. Long-term development projections should take into account the rationalization and reservation of space and surfaces on Earth for the development and life of future generations. The prerequisite for this is the scientific analysis of the conditions for the identification of terms of the planning area and its modalities.

Figure 3

Matrix of indicators



Souce: author

Plot surfaces and belts are generally organised for the elaboration of the terms purpose, classification and categorisation. The development of terms for purpose is joined by plot elements and features. The given land's elements are loaded from the cadastral-geodetic database with regard to cadastral parcels and include properties for: producing land, barren land (construction), buildings and especially barren land and water, while the land plot characteristics are the users of space, quantity, size, proportions, capacity, pollution, and protection[16] anywhere, especially in spatial standards.[17] Additions to belt plots and in places surfaces are infrastructure lines and links (underground or above-ground) as planning routes. Plots which contain planning routes are in addition to their primary use also "servicing" and the same rules for use apply for use if the land is privately owned. The first group of features symbolize the identification of the surface into four hierarchical levels of land plots.

In the hierarchy one term surface purpose is followed by a related division. At each level surfaces are classified (sorted) into different terms of purpose. At the fourth level of the surface purpose we find lots IV/1, IV/2, IV/3.... Similarly, they are also divided in terms of their purpose at other levels.

In the hierarchy of superiority to the inferior, planning area (IV/1), is divided into several planning zones (III/11, III/12...), then the individual planning zone (III/11) into a number of planning blocks (II/111, II/112...) and the individual planning block (II/111) into a number of planning parcels (I/1111, I/1112...). Appropriate related division also applies to the hierarchy of other terms of purpose in the planning area (IV/2, IV/3 ...), belt plot use (GL/1, GL/2 ...) and planning relationships (IS/1, IS/2...).

For more information see the examples.

In our classification,

- Planning the area of a settlement - a small town needs additional symbols for the following data: amount, capacity and pollution in long-term development projections (more than 20 years).
- Planning residential zones need additional symbols for the following data (as elaborated from level IV): amount, capacity, pollution and size and height of the area as well as ratios of density in projections of medium-term development (10-20 years)
- Planning block groups of family homes need additional symbols for the following data (as elaborated from level III): amount of users and amount of functional units, the size of the area and height as well as plot division density in a projection of short-term development (5-10 years);.
- Planning parcels for family homes need additional symbols for the following precise data: size, amount of users, the ratios for the range of development and utilization, the capacity of connections, functional units and types of parcels. The period for land preparation up to five years.

Special symbols generally determine the properties of essential information for certain purposes. They are the basis for certain elaboration, so they differ, however in places they corroborate depending on the identity of the purpose. At the surface level, the use of special appropriate symbols is related to the hierarchy of other terms of purpose. This must especially be elaborated after defining the other planning areas which are not residential.

The second group of features symbolise the identification of belts as well as the first group of four hierarchical levels of plots. In order for the global surfaces to be brought to life, they need a global link or element of linking, flow tissue.

Elements of flow tissue are classified belt plots at the fourth level, within which the main transit traffic takes place. In the present circumstances, transit traffic is intended for main roads (roads, streets), the main railway (railway, subway) and the main water routes (shipping lines), etc. Fourth-level land plot belts are parts of the planning area which are

elaborated at the third level of use. The former principle of use also classifies main belts which are then elaborated at the lower levels in a similar manner.

The third level takes the main belts and elaborates local traffic for linking parts of settlements or other uses within individual planning areas and in parts of the surface. These are local street traffic, footpaths, larger services, local railway lines (trams), local water, forest and other pathways.

The second level practically takes over the third and fourth levels of the resulting belts and creates collector belts in the development of the planning zone. These are collector belt plots for roadway to pedestrian traffic: collector and access roads, footpaths with middle services, collector, footpaths with low services. A network of these basic belts exists at the second level.

The first level takes up the network of all the basic belts. In developing the plots for the planning block, additional belts are intended for public parking, town squares and their pedestrian links and in places small parks. By classifying belts above their different terms of use, special symbols for the size of the width and amount of traffic vehicles as well as the capacity for flow join the original symbols.

The third group of marks symbolizes additions or infrastructure inserts on the belt plot and in places the surface plot. These additions are generally planning route lines and connections. Four levels of planning routes are hierarchically defined on the same principle as belts. Each plot level is accompanied by corresponding levels of infrastructure lines and links which are classified according to their terms and meaning. Infrastructure lines and links with associated purposes are developed at the necessary plot level depending on their meaning and hierarchy as compared to infrastructure systems, branches, networks all the way to connections.

Additions are classified in the same manner as the other groups of symbols above the different terms of identification, and special symbols for amount, capacity (power, flow, wires, sewage) etc. are included.

Examples

Term for the use of land plot surfaces: IV / 1 = village – mid-sized town; III/12 = hospitality and tourism; II/121 = “group of villas”, II/122 =“group of hotels”, II/123 = “group of boarding houses”; I/1211 = tourist villa-****: separate I/1221 = hotel - ****: separate, I/1231 = boarding house ***: singly joined.

Terms for the use of belt plots:	Terms for the use of planning routes
GL / 1 = main roads - alleys;	IS / 1 = main water supply line,
MJ/11 = local roads;	IO/11 = water supply line branch;
SA/111 = collector roads;	IM/111 = water supply line network;
PR/1111 = access roads.	IP/1111 = water supply line connection.

Source: author

3.4. CRITICAL REVIEW

The symbols for planning areas that have been used to date are planning symbols with respect to textual terms and graphic symbols. The prominent symbols are used for the creation of various plan levels. Individual terms are repeated in up to seven spatial planning

levels (Poropat, 2010). The differences included in this work are the organisation of the hierarchy and general terms of use as well as the associated markings and elements of plots. Without this hierarchy there is no government, no administration, no management. Planning without a hierarchy of purpose is a deficit in our profession and estranges spatial planners while the deficit strengthens administrative government to tailor space according to its own measures without responsibility for the consequences of this type of management. Individual spatial solutions which are not the product of accepted spatial standards are replaced by the power of the individual in the hierarchy of administrative government. This is demonstrated in a number of relevant examples, such as the cases of "Detaljni plan uređenja" (DPU), "Cvjetni trg", "Rogoznica" and others.

The procedure to pass the detailed urban plan for Saladink Sv. Martin is at a standstill even though it has been being prepared since 2003.[18] The reason for this is that the highest administrative government conditions the measures of capacity and consolidation of plots so that it exceeds the size of the land owned by a significant number of owners and these owners are forced to sell. The consolidation of all these estates for the sale of real estate is largely unachievable. The majority of owners insist on family estates on which their families will work for the entire year and will include the highest accommodation category. This is a great contribution to the quality of the development of manufacturing jobs, with less money for the administrative apparatus of the state government. A similar situation is present in other land uses, such as residential, sport etc.

With the introduction of a hierarchy of planning purposes the preconditions for balanced and sustained development of the area have been created, thus reducing the power of administrative authorities to think of locations and sizes backed by the hierarchy of authority and power of the individual which has consequences on the hospitality industry, the short time span of capacity use (only in the summer), questionable productivity for unknown big business capital and unforeseeable consequences for the survival of native inhabitants and the fertility of the land of their ancestors.

There are cases where the competent administrative authorities destroy buildings then seek to legalise most of the illegal construction through spatial plans (Rogoznica).[19] This infiltration of bid solutions with large content among traditional architecture (Cvjetni trg in Zagreb) has been accepted by the competent authorities. This has resulted in protests and unrest among the population regarding the "destruction of Cvjetni trg" and the immense traffic pressure for the wider area which will result.[20]

This state in space is the result of regulations which are flawed, superficial and give great authority to the administration and little space for the profession to plan the wider spatial area for long-term aspects such as quality, rationality and spatial standards. In other countries we find "slums" (a devastation of space – abandoned settlements) but also measures for spatial standards for the scaling of settlements, which have yet to be devised in Croatia.

By introducing plot matrices the conditions have been formed for the development of a planning script. The structure of general terms and features for spatial planning have been confirmed with the use of a hierarchy of use for three groups of plots and their classification. In this way the hierarchy of plots is equally valid for administrative bodies and the profession and represents a rule which must be respected by users. What do we get with this? First, the foundation for the quality of the work of spatial planning is created. In addition, the rationalisation and balanced development of space is guaranteed. Furthermore, greater prosperity and less state concerns and most importantly, the passage and application of spatial standards as a condition for the quality of life in a healthy environment.

4. CONCLUSIONS

At the international literature level a significant scientific contribution was directed to studying fractals or outlines of areas zoned for construction. The scientific contributions are facts on the state of cities with regard to their time, structure, hierarchy, function, identification as well as their problems. Relevant research on the state of cities and their characteristics are a consequence of the problem, while the causes are sociological problems for which planning rules for quality of life are lacking.

The basis for proper spatial planning is the constitution of units of use and their application in the development of spatial planning plans. The application, creation and shaping of units of use as well as solutions to sociological problems and responsibility for the state of cities belong to the Spatial Planner. This is a prerequisite for the quality of life of inhabitants where the policies of the relevant authorities will give incentive and not be intrusive and irresponsible.

Planning intent is a unit or identity of use of real estate in the scope of a land plot which is documented in spatial planning plans and represents conditions of use or the manner in which they are used.

Matrices of surface and belt lots and their adjoining planning infrastructure routes have been confirmed in the hierarchy of general terms of use. This is a picture of the generalisation in terms of planning in theoretical and practical conditions as well as experience and new scientific knowledge, which confirms the hypothesis stated in the introduction.

With the introduction of a matrix of plots the conditions for the preparation of a planning script have been formed. The organisation of general terms and marks for spatial planning have been determined with four levels with the application of a hierarchy of use for three groups of plots and their classification. In this way the hierarchy of plots is equally valid for government and professionals and forms a rule which must be respected by users.

REFERENCES

Abercrombie, P. (1945) *Greater London Plan 1944*, HMSO, London.

Anić, V.(1998), *Rječnik hrvatskoga jezika*, Novi Liber, Zagreb, pp.290, 732.

Arlinghaus, S. (1985) Fractal take a central place, *Geogr. Ann.* B, 67 (2),pp 83-88.

Arlinghaus, S.L. and Nysteun, J.D. (1990) Geometry of boundary exchanges, *The Geoographical Review, 80*, 21-31.

Bajagić, S. i sur. (1990), *GIZIS za Istru I faza*, Urbis-72, Pula, p.36.

Batty, M. and Longley, P. (1994) *FRACTAL CITIES, A Geometry of Form and Function*, Academic Press, London, San Diego, New York, Boston, Sydney, Tokyo, Toronto.

Ben Activa, M. and Lerman, S.R. (1985) *Discrete Choice Analysis: Applications to Travel Demand*, The MIT Press, Cambridge, MA.

Benguigui, L. Czamaski, D. Marinov, M. and Portugali, Y. (2000) When and where is a city fractal?, *Environ. Plann.* B 27 (4), PP 507-519.

Borsdorf, A. Zembri, P. (2004) *Structures*, COST Action 10.

Christaller, W. (1933, 1966) Central Places in Southern Germany, Prentice Hall, Englewood Cliffs, NJ.

Čaldarević, O. (1985) *Urbana sociologija, Socijalna teorija i urbano planiranje*, Globus, Zagreb.

Čaldarević, O. (1989) *Društvena dioba prostora, Sociološko društvo Hrvatske, Zagreb.*

Doxiadis, C.A. (1968) Ekistics: *An Introductionto the Science of Human Settlements*, Hutchinson, London.

Elfick, M.H. (1991), "Management of Cadastral Dana in a Land Information System", *Proceedings Conference Sydney*, pages, pp.107-114.

Elfick, M.H. (2009), A Cadastral Geometry Management System, Dept. Civil Engineering and Surveying University of Newcastle, Australia. http://www.geodata.com.au/downloads/CAD_P11.pdf

Filho, W.C. De Figueiredo, L.H. Carvalho, P.C. end Gattass, M.(1995), A topological dana structure for hierarchical planar subdivisions, http://www.cs.uwaterloo.ca/research/tr/1995/53/CS-95-53.pdf

Frankhauser, P. (1994) La fractalité des structures urbaines, *Collection Villes*, Anthropos, Paris.

Gallion, A.B. and Eisner, S. (1950,1975) *The Urban Pattern: City Planning and Design*, Van Nostrand Reinhold Company, New York.

Hensher, D.A. and Johnson, L.W. (1981) *Applied Discrete-Choice Modelling*, Croom Helm, London.

Howard, E. (1898, 1965) *To-Morrow; A Peaceful Path Reform*, Swan Sonnenschein, London, republished (1965) *Garden Cities of ToMorrow*, The MIT Press, Cambrige, MA.

Karlovac, M.(2008): *Teorija planiranja održivog turističkog proizvoda*, Školska knjiga, Zagreb.

Keeble, L. (1959) *Principles and Practice of Town and Country Planning*, The Estates Gazette, London.

Kostof, S. (1991) *The City Shaped: Urban Patterns and Meanings Throughout History*, Little, Brown and Company, Boston, MA.

Lagarias, A. (2007) Fractal Analysis of the Urbanization at the Outskirts of the City. Models, Measurement and Explanation, *Cybergo. European Journal of Geoography [En ligne] Systèmes, Modélisation, Géostatistiques, document 391*.

Lin, F.T. (2000), GIS-based information flow in a land-use zoning review process, *Landscape and Urban Planning*, Volume 52, Issue 1, 5 Novenber, pp.21-32.

Longley, P. and Mesev, V. (2000) On the measurement and generalisation of urban form, *Environ. Planning*, A 32 (3), pp 471-488.

Longley, P. and Mesev, V. (2002) Measurement of density gradiens and space-filling in urban systems, *Pap. Reg. Sci.* 81, pp 1-28.

MacLennan, M. Fotheringham, S. Batty, M. Longley,P. (1991) Fractal Geometry and Spatial Phenomena: A Bibliography. NCGIA Report.

Maletin, M. (2005), *Planiranje i projektovanje saobraćajnica u gradovima*, Oriont art, Beograd, pp.54-81, 145.-151.

Marinović-Uzelac, A. (1989) *Teorija namjene površina u urbanizmu*, Tehnička knjiga, Zagreb.

McGarigal, K. Marks, B.J. (1995) FRAGSTATS: Spatial Pattern Analysis Program for Quantifying Landscape Structure, Gen. Tech. Report PNW-GTR-351, USDA Forest Service, Pacific Northwest Research Station, Portland, OR.

Milne, B.T. (1991) Lessons from applying fractal models to landscapa patterns, In: M.G. Turner and R.H. Gardner, *Editors, Quantitative Methods in Landscape Ecology*, Springer-Verlag, New York, pp 199-235.

Morris, A.E.J. (1979) *History of Urban Form: Before the Industrial Revolutions*, Longmans Scientific and Technical, London.

Nelson, T.R. and Manchester, D. K. (1988) Modeling of lung morphogenesis using fractal geometry, *IEEE Transitions on Medical Imaging, 7*, 321-327.

Poropat, A. (2000), Prilog pojmovnom i metodološkom pristupu mjerama kućišta - rezultati istraživanja, International Congress, *Energy and the environment 2000*, Opatija: pp.291-307.

Poropat, A. (2002), Prostorni činitelji izgrađivanja parcele obiteljskih građevina na primjeru zapadne obale Istre. *Disertacija*, Sveučilište u Zagrebu, Arhitektonski fakultet.

Poropat, A. (2003), Prostorni činitelji izgrađivanja parcele obiteljskih građevina na primjeru zapadne obale Istre. // *Prostor, Znanstveni časopis za arhitekturu i urbanizam.* 11[2003] (2003), 2[26], pp. 227-227.

Poropat, A. (2004), Identifikacija parcele prometnica u naselju, *International Congress, Energy and the environment, 27-29 listopada 2004*, Opatija, pp.281-293

Poropat, A. Brščić, K.. Velčić, E.. (2006), The Hierarchy of Plans of Physical Planning in the Republic of Croatia and EU , *International Congress, Energy and the environment 2006*, Opatija, pp.139-152.

Poropat, A. Ružić, P. (1999), Tehnološki napredak i turizam // *Hrvatski turizam na pragu XXI. stoljeća - Knjiga odabranih radova* /, Poreč : Tipomat, pp.215-225.

Poropat, A. Šehanović, J. Bušelić, M. Ružić, P. Bratović, i. Krajnović, A. (2000), *Studija područja Saladinka-Sveti Martin (Okvirne mogućnosti*), Institut za poljoprivredu i turizam Poreč.

Poropat, A.; Ružić, P. (2003), Famework Possibilities for the Area Development of Saladinka- sv. Martin tourist zone / case study/. // *Hotellink*. **1** (2003), pp. 479-489.

Prelog, M. (1957), Poreč grad i spomenici, Kolaričev narodni uni verzitet, Beograd, pp.191.-200.

Poropat, A. (2010), Land Plot – a Matrix of Planning Script, Ekonomska istraživanja, Vol. 23, No.1.

Prinz, D. (2006), *Urbanizam, Svezak 1. – Urbanističko planiranje*, Golden marketing – Tehnička knjiga, Zagreb, pp.30, 99-104).

Schweitzer, F. and Steinbrick, J. (1998) Estimation of megacity growth: simple rules versus complex phenomena, *Appl. Geogr.* 18 (1), pp 69-81.

Shen, G. (2002) Fractal dimension and fractal growth of urbanized areas, *Int. J. Geogr. Inf. Sci.* 16 (5) pp 437-519.

Svirčić-Gotovac, A. Zlatar, J. (2008), *Sociology and Space*, Vol.46 No.1 (179), pp.53-76.

Šimunović, I. (1996) *Grad u regiji ili regionalni grad*, Logos, Split.

Thomas, I. Frankhauser, P. and Biernacki, C. (2008) The morphology of built-up landscapes in Wallonia (Belgium): A Classification using fractal indices, *Landscape and Urban Planning*, Volume 84, Issue 2, 6 February 2008, pp 99-115.

Thomson, C. W. (2002), Urban open space in the 21st century, *Landscape and Urban Planning*, Volume 60, Issue 2, 30 July, pp.59-72.

Wentz, F. (2001) A Shape definition for geographic applications based on edge elongation and perforation, *Geogr. Anal*. 32 (2), pp 95-112.

White, R. and Engelen, G. (1993) Cellular automata and fractal urban form: a cellular modelling approach to the evolution of evolution of urban-land use patterns, *Environ. Plann.* A 25, pp 1175-1199.

Wrigley, N. (1985) *Categorical Dana Analysis for Geographers and Environmental Scientists*, Longmans Technical and Scientific, London.

Zakaria El Adli Imam, K. (2006), Role of urban greenway systems in planning residencial communities: a case study from Egypt, *Landscape and Urban Planning*, Volume 76, Issues 1- 4, 30 april, pp.192-209.

*** (2006), Odluka o usklađenju plana uređenja Dragonera s Uredbom o uređenju i zaštiti zaštićenog obalnog područja mora, *S.N. Grada Vodnjana*, 3/06.

*** (1998-2004), Pravilnik o sadržaju, mjerilima kartografskih prikaza, obveznim prostornim pokazateljima i standardu elaborata prostornih planova, *N.N.* 106/98, 39/04, 45/04, 163/04 ; http://www.mzopu.hr/default.aspx?id=3712

*** (1999), Odluka o donošenju Programa prostornog uređenja R. Hrvatske, *N.N* 50.

*** (2000-2008), Pravilnik o registru prostornih jedinica, *N.N. 75/00, 37/08.*

*** (2008), Pravilnik o sadržaju i obliku katastarskog operata katastra nekretnina, *N.N.* 142: http://narodne-novine.nn.hr/default.aspx

*** (1983.-1986.), Pravilnik o mjerama zaštite od elementarnih nepogoda i ratnih opasnosti u prostornom planiranju i uređivanju prostora – redakcijski pročišćeni tekst *N.N.* 29/83, 36/85 i 42/86

*** (2007,2009), Zakon o prostornom uređenju i gradnji**,** *N.N.* 76/07 i 38/09.

*** (1996-2009), Zakon o vlasništvu i drugim stvarnim pravima, *N.N*, 91/96, 73/00, 114/01, 79/06, 141/06, 146/08, 38/09.

Boris Marović*
Vladimir Njegomir**
Rado Maksimović***

UDK 336.7:368
338.124.2:368
Review
Pregledni rad

THE IMPLICATIONS OF THE FINANCIAL CRISIS TO THE INSURANCE INDUSTRY – GLOBAL AND REGIONAL PERSPECTIVE

ABSTRACT

This paper analyses the impact of global financial crisis on individual functional operations and resulting insurance industry's relationships with regulators, rating agencies, insureds, reinsurers and capital market investors in order to determine current insurance industry position and to derive a conclusion on necessary measures that have to be taken by insurance companies. The research results indicate that global financial crisis has negative impact on all aspects of insurance companies' business and suggest the need to focus on core business activities and the necessity of further improvement of holistic risk and capital management of global and regional insurers with the aim to overcome problems imposed by financial crisis.[1]

***Key words**: financial crisis, recession, insurance, reinsurance, risk management*

I. INTRODUCTION

The cyclical movements, represented in expansions and contractions, in the economy are typical for market economies[1], and one of the most important lesson of the financial history is that sooner or later every bubble bursts (Ferguson, 2008). The contractions in the economy are usually refered to as crisis. The issues of crisis are studied even in XIX century by Marx, who pointed out that the existence of crisis in the capitalism is conditioned by the inability of producers to sell goods in determined time, which then cause the inability of the realisation of the whole series of payments (Marks, 1978) and in XX century by Keynes whose key point was that effective market demand represents the central problem of modern capitalism (Kejnz, 1956). These thesis have become once more evident with the realisation of the current financial crisis.

The root of current financial crisis is housing market bubble that was created by excesive expansion of banks' credit activities during 2004 and 2005 in the U.S. Led by the opportunities of achieving higher interest rates while speculating on the posibility that they will be able to monetise their receivables in the case of credit default, by the sale of underlying real estates, in addition to usual mortgage credits, banks provided subprime mortgage lending.[2] The expansion of subprime mortgage credits was financed by excessive use of securitisation[3] while the newly created securities were collateralised by these credits. Therefore, the securitisation enabled the transfer of credit default risk to financial market investors. The problem arised when the housing market bubble burst creating a situation

* PhD, Department of Industrial Engineering and Management, Faculty of Technical Sciences, University of Novi Sad, Novi Sad, e-mail: marovicb@nspoint.net
** MSc in economics, currently at PhD studies at Department of Industrial Engineering and Management, submajor Engineering and Insurance Management, Faculty of Technical Sciences, University of Novi Sad, Novi Sad, e-mail: njega@eunet.rs
*** PhD, Department of Industrial Engineering and Management, Faculty of Technical Sciences, University of Novi Sad, Novi Sad, e-mail: rado@iis.ns.ac.yu
[1] Paper received 19 March 2009.

where banks were not able to compensate even a half of subprime mortgage related debt. The resulting liquidity crisis of the banking industry in the U.S. had been transformed into the financial crisis in the U.S. and later, due to the increased interconnectedness imposed by globalisation, it transformed into global financial crisis. The subsequent loss of confidence in the financial system and the reduction of banks' credit activities provoked the decline of share prices, consumer and investment consumption, which resulted with the global recession in 2008. The reduction in economic growth provided an impetus for monetary and fiscal intervention and increased regulation, measures similar to those taken during the Great Depression of 1930's (Dobb, 1961). The horizon promises continued turbulence as OECD's predicions for first six months of 2009 are that the contraction of economic activities will continue in all OECD member countries as well as in China, India, Brazil and Russia (OECD, 2009).

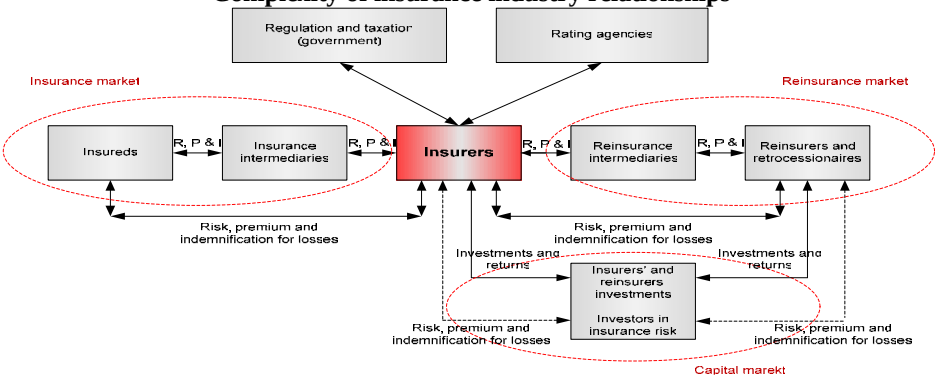
The direct impact of the financial crisis on the insurance industry was less prominent than it was on the banking industry. According to the IMF estimates total losses of writedowns on U.S. loans and securities for the banking industry will be between $725 and $820 billion while for the insurance industry they will be between $160 and $250 billion (Global Financial Stability Report, 2008, 15). However, the financial crisis and subsequent recession imposed substantial changes to the institutional and business landscape in which insurance industry operates. Having taken into the consideration the fact that effects of global financial crisis has started to be felt in the regional economies with a certain delay, compared to when they first had been felt in developed western economies, the analysis of its impacts on global insurance companies' business operations and gained experience is critically important for regional insurers. Thus, the aim of this paper is to determine the short and long-term impact of global financial crisis on different business activities of global as well as regional insurance companies' and to derive conclusions for desirable future development and measures that are needed to be taken to accomplish it in each segment of their business.

II. THE COMPLEXITY OF INSURANCE INDUSTRY RELATIONSHIPS

Insurance is one of the key mechanisms of the risk management.[4] As insurance is based on spreading of losses incurred by a few over the entire group of isureds, insurance companies may be regarded as institutionalised pools of insurable risks, which primarily role is to put together risks of many insureds, collect premiums and indemnify those insureds that suffer a financial loss from a loss event defined in an insurance policy. In order to minimise their excessive exposures to insurance risks, those that are above their retention levels, insurance companies transfer all or part of underwritten risks to reinsurance and/or, by using innovative risk transfer mechanisms, to capital markets' investors. Additionally, on the basis of financial resources obtained by collecting premiums for underwritten risks, insurance companies are one of the major institutional investors. The rationale behind their investment operations is the need to achieve additional income and increase ability for indemnification of losses. In addition to participants with whom insurance companies have direct relationships at insurance, reinsurance and capital markets, important influence on insurance companies have government, which determines the regulatory framework for their business operations, and rating agencies, which assessments of credit and financial strength of insurance companies determine their business success at insurance, reinsurance and capital markets. The complexity of relationships, which stem from their business activities, between insurance companies and many different institutions and individuals is shown in figure 1.

Figure 1

Complexity of insurance industry relationships



Note: R, P & I are abbreviations for risk, premiums and indemnification for losses flows

Although the insurance risks are the main focus of insurance companies' risk management, aforementioned relationships are the source of numerous other risks[5] to which insurance companies are faced with. Although the literature mentions additional risk types such as liquidity risk (Christoffersen, 2003 and Gallati, 2003), media risk (Esch, Kieffer, and Lopez**,** 2005), legal, regulatory, accounting and tax risk (Jorion, 2003), the total insurers' exposure to risks consists of insurance risks (risks that are on the liability side of balance sheet), market and credit risks (risks that are on the assets side of balance sheet), operational and reputational risks. Having considered many different business activities and resulting relationships we argue that the impact of global financial crisis to the insurance industry is complex by its nature as it could have the potential to simultaneously affects all of different risk types to which insurance companies are exposed to. Thus, assessment of the impact of global financial crisis to insurance industry requires the analysis of its impact on the developments in insurers' regulation, ratings, underwriting, investments and risk transfer operations.

III. THE FINANCIAL CRISIS AND THE ROLE OF GOVERNMENT AND RATING AGENCIES

Public confidence in insurance industry is of crucial importance as, by paying premiums, insureds actually are buying promises of future payments that are conditional on the occurrence of the predefined loss events. The role of government is to regulate (to set the rules that will govern insurance companies operations) and supervise (to oversee insurance companies with the aim to ensure that established rules are obeyed) the insurance industry in order to protect public confidence in it. Although the degree of government interference in the insurance market functioning varies between countries, its role is universally the same – customer protection. With that aim governments determine access to the market, compulsory insurance purchases, competition rules, regulate and supervise solvency and directly intervene in the case of insurers that are in financial troubles. Additionally, the public confidence, especially in the case of commercial insurance buyers, is conditional on independent rating grades, summary information about insurers financial strength (Harrington and Niehaus, 2004 120), provided by rating agencies. If the estimate of insurer's financial strength is reflected in lower rating grade the insurance buyers are informed that there is greater probability of insolvency of that insurer than of insurer who has higher solvency rating. Having considered their importance, it is obvious that any deficiencies in the functioning of rating agencies and

government regulation and supervision has tramendous impact on public confidence and thus on the functioning of the insurance industry.

As the present crisis resulted from the complex interaction of market failures, global financial and monetary imbalances, inappropriate regulation, weak supervision and poor macro-prudential oversight (Larosiere, et al, 2009, 14) it is obvious that the financial crisis has revealed shortages in the functioning of government regulation and supervision. The most obvious example of this failure and failure of the rating agencies is the financially most troubled insurer American International Group (AIG). Althought the company has achieved positive financial results in the underwriting business, due to its excessive exposures to subprime mortgages that resulted from credit default swaps[6] business of its financial products division and its negative investment results, it declared a loss of $13 billion in August 2008. In order to protect public confidence and avoid potential increase for already present systemic financial risk the government intervened firstly by providing credit line of $85 billion in return for 79.9% share in AIG, factualy nationalising the company, and later by providing additional $37.8 billion. Although the insurance business was well regulated and supervised, the credit default swap business was not supervised, the company reinvested cash collateral[7] and rating agencies have not downgraded its rating until 15th September, when it became obvious that the company is in financial troubles.

This financial crisis has clearly showed that neither government regulation nor rating agencies have in a timely manner anticipated the potential problems, which implies the need for a change in order to prevent problems reccuring in the future. The history shows that market failures are inevitably followed by the change in regulation and supervision.[8] In the UK, Germany and the U.S. governments have already announced their intentions to change current regulation and supervision. However, it must be noted that the financial crisis have proved the adequacy of the regulation of underwriting activities of insurance industry but emphasised the failure of the entirety of their supervision. Because the causes of insurers' and reinsurers' failures were in the field of non-insurance operations and with these operations related entities[9], the change in governments' oversight of the insurance industry must be focused on previously, until the financial crisis, non-regulated constituent entities. Also, having considered the fact that different constituent entities operate in different regulatory and supervisory regimes, financial crisis has emphasised the already existent need for more cross-border cooperation. Problems with credit default swaps indicate the need for more transparency of innovative financial products. Additionally, although we consider the direct governments' intervention was necessary it should be implemented only as a short-term measure in order to stabilise the market, but on a long-term basis it is counterproductive as there is always the danger of favourising one company over another. The unenviable experience of former socialist countries speaks in favour of this. However, we argue that support for holistic approach in insurers' risk management, which contradicts to managing risks in sylos, is of critical importance and that special emphasis in the field of regulation and supervision changes should be given to this issue. The holistic approach to risk management of insurance companies, which individually measures each of the risks to which insurance companies are faced with (insurance, market, credit, operational and reputational risks) but also consider them in integration in order to determine the aggregate capital needed for total risk exposure, need to be embeded into day-to-day operations and not operationally but strategically focused.

Some of the mentioned issues have already been tackled. For example, the new framework for the supervision of the insurance companies in Europe called Solvency II,

which is intended to be implemented by 2012, will introduce a holistic approach in regulation and supervision of insurance companies operations, improve group supervision with cross-border cooperation at Euorpean level and will emphasise the role of internal risk and capital management models. Also, International Association of Insurance Supervisors enacted the Standard in order to facilitate regulatory and supervisory impetus for enterprise risk management in insurance companies.[10]

Due to revealed failures in the ratings, it is reasonable to expect that rating agencies will determine new set of rules and increase the capital requirements as insurance industry is faced with more risks than they previously envisaged. They need to be more regulated and supervised in order to provide really independent, timely and reliable information about insurers' financial strength. Additionally, as in the case of regulation and supervision, the rating agency criteria used have to provide impetus for enterprise risk management.[11]

IV. THE IMPACT OF FINANCIAL CRISIS ON THE UNDERWRITING

In the area of underwriting, which is the core function of insurance industry, the strongest impact of financial crisis has been in the field of credit insurance. For example, in Europe credit insurers on average increased their premiums up to 30% for renewal business and up to 60% for new business (Serra and Harris, 2009). However, the most affected were monoline bond insurers with total losses estimated to be around $50 billion (Hess, Karl and Wong, 2008, 6). Bond insurance is a financial guarantee insurance that has been used since 1970's in order to provide the default guarantee primarily for bonds issued by municipalities. Later this type of insurance has started to be used for asset-backed securities. The essence of this type of insurance is the fact that in the case of issuer's credit default the insurer will settle obligations of the issuer, and usually the insurer gives unconditional and irrevocable guarantee that interest and principal will be paid on time and in full in the event of a default (AFGI, 2009). Monoline bond insurers, usually referred to as monolines, were among insurers that had the highest rating given by the rating agencies and by providing financial guarantees they were actually selling their rating, as rating that municipalities got from bond insurers were usually their sole rating. Thus, by providing bond insurance to issuers of municipal bonds and asset-backed securities monolines actually enabled them to collect capital cheaper than they would be able to without bond insurance, as its existence was a clear signal to investors that even high-risk subprime securities are secured enough to be repacked with investment grade ratings. This type of insurance functioned well until the housing market crisis that caused many issuers' credit defaults and subsequent losses to bond insurers. Finally, rating agencies downgraded the ratings of these insurers, producing the additional negative impact on investors in the securities related to subprime mortgages, and increased capital requirements, which means that now monoline insurers need to have more capital in order to obtain the same rating. The summary effect is the limitation in the availability of bond insurance in the U.S. The basic lesson of such a strong impact of the financial crisis on monoline bond insurers is the deficiency in the business model of specialised insurance companies that are not able to adequately diversify risks due to their concentration on only one type of insurance. Additionally, it testify the shortages of heavy relying on loss modeling of individual securities as the models applied by monolines had not been able to predict the crisis on the subprime mortgage market.

Having considered a large number of subprime-related lawsuits[13], the financial crisis will have a significant long-term negative impact on directors and officers liability insurance (D&O) and errors and omissions professional liability insurance (E&O). D&O liability

insurance provides financial protection for the directors and officers and the corporation if the directors and officers are sued for mismanagement of the company's affairs and E&O professional liability insurance provides protection against loss incurred by a client because of negligent acts, errors, or omissions by the insured (Rejda, 2005, 325). Financial crisis has caused many losses and it is obvious that those who have suffered losses (such as investors in banks, other companies or securities related to subprime mortgages; banks or other companies themselves as well as their employees) can become plaintiffs. This could trigger insurers' obligations to provide indemnifications for losses that are covered under D&O and E&O insurance policies. For example, it is reasonable to expect lawsuits against banks or funds by their investors who can state reasons such as inadequate information on financial results, wrongful investment portfolio management or inadequate information on total risk exposures, as possible causes for indemnification of losses. It is too early to estimate the total exposure of insurance industry to these type of losses, as D&O and E&O liability insurance policies are usually issued on a claims-made basis, which means that the exact amount of claims may be known only after the reporting period, which is usually several months or a year after the coverage period of the policy. However, on the basis of the data generated by MSCAd database of the Advisen company, the possible total losses of the insurance industry from claims related to D&O and E&O liability insurance could reach $12.3 billion, of which losses related to D&O liability insurance are estimated to be in a range between $4.4 billion and $7.4 billion (Bradford, 2008a) while losses related to E&O liability insurance are estimated to be in a range between $2.4 billion and $4.9 billion (Bradford, 2008b). If these losses realise, they will have considerable impact on these segments of insurance market and will lead to limitation of available capacity for underwriting, incrase in premiums and tightening of underwriting conditions (more exclusions).

The impact of financial crisis on other insurance types is determined by reduction in total economic activity. This impact we should analyse in the context of income elasticity of insurance demand, which shows the percentage change in demand for insurance that results from a given percentage change in income. Studies (Hussels, Ward and Zurbreuegg, 2005 and Enz, 2000) has shown that the level of income directly influence the insurance demand and if other determinants of insurance demand are constant, the higher level of income will result with the higher insurance demand and vice versa. The fact that insurance industry is the most developed in developed economies testifies goes in favour to this conclusion. Also, income elasticity of insurance demand itself varies with the level of income as income elasticity in developing countries is the highest while it is much lower in developed and undeveloped countries. (Enz, 2000). Thus, the current economic recession can have more severe impact on the insurance industry in developing countries.

Having considered the income elasticity of insurance demand and the fact that growth of global life and non-life insurance premiums in 2008 was negative (Hess, Karl and Wong, 2008), we argue that financial crisis and subsequent economic recession will have a considerable negative effect on insurance demand in the future. The decrease of insurance demand will be especially pronaunced in life insurance, particularly unit-linked life insurance that are essentially investment products, as in the time of economic volatility and decreasing investment returns people are less prone for long-term commitments. Additionally, the decrease in demand for life insurance will not impact only new but also the existing business, as it is reasonable to expect an increase of life insurance contracts' lapses. Finaly, although the financial crisis will generally have negative impact on underwriting activities it could also provide opportunities for those types of insurance that show less elasticity to income, such as health, energy or agriculture insurance.

V. INSURANCE INDUSTRY INVESTMENT RESULTS AMID FINANCIAL CRISIS

Insurance industry's investments always need to be balanced in terms of the ratio between expected return and risk. The risk associated with investments has three major constituents: the price risk, or the risk of losses caused by decrease in the market value of assets held in insurers' investment portfolios, the risk of default, which is usually very low as insurers typically invest in highly secure investment-grade securities, and interest rate risk, which depends on the movement of interest rates (when interest rates increase, the value of fixed income securities decline (Harrington and Niehaus, 2004, 93)). Insurers' investment results have historically been positive and provided additional income that insurers used in order to offset negative results in underwriting operations, to offer more competitive premiums to insureds and higher profits to investors. However, the situation changed with the financial crisis, which caused significant capital market turbulences.[14] Investment results of insurance companies are negatively influenced by the decrease in values of shares that is caused by excessive liquidation of capital market positions, which are the result of diminished investors' confidence due to the present economic recession. Additionally, many central banks have significantly lowered the interest rates.[15] Although, the decrease of interest rates have positive impact on fixed income securities already present in the investment portfolios of insurers, it will have negative impact on future investment income. However, the financial crisis has provoked the paradigm shift in regard to the risk of default as it turned out that the strongest negative impact on insurers' investments had writedowns of investments related to subprime mortgages.

The impact of financial crisis on investment activities of insurance companies vary between individual companies. For example, Swiss Re had reported a net group loss of CHF 0.9 billion primariliy because of the decrease of net investment income of 29%, net realised investment losses of CHF 4.7 billion and net unrealised losses of CHF 5.5 billion, generated due to equity and alternative investments (Swiss Re's Annual Report for 2008). In contrast to Swiss Re, the leading reinsurers in the U.S. have reported investment income of $3 billion (Reinsurance Underwriting Report, 2008) a slightly lower than in 2007 when they reported $3.3 billion (Reinsurance Underwriting Report, 2007), primarily due to the conservative investment portfolios. Additionally, the financial crisis had different impact on investment results depending on the type of insurance. Life insurers' investment results are generally under more powerful negative impact of the financial crisis than non-life insurers' as they have invested in riskier investments in order to achieve higher investment returns. The rationale behind such structure of life insurers' investments is the need to be more competitive not only in relation to other life insurers but also in relation to banks, pension and investment funds. The importance of investment results is especially emhasised in the case of life insurers who provide unit-linked policies, life insurance products associated with investments into funds, as the key incentive for buyers of such products is profit making.

Having considered the impact of the financial crisis on insurers' investment activities it is obvious that it had greater impact on those insurers and reinsurers who experimented with high-risk investments, atypical for insurance industry, such as investments in asset-backed securities, non-rated shares and hedge funds. This emphasise the need for more conservative investments with more balanced ratio of risk and return and better allignment with insurers' liabilities. However, we argue that metamorphosis of the financial crisis into economic recession will have increasingly devastating impact on insurers' investment results due to

strong negative impact to capital, real estate and exhange rate markets and incrasingly reduced possibility for investment risk diversification due to the global nature of the crisis.

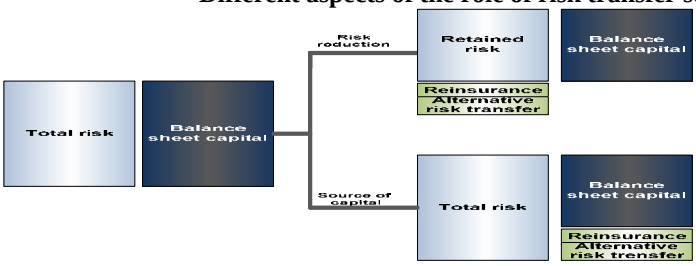
VI. THE EXPECTED EFFECT OF FINANCIAL CRISIS ON INSURANCE RISK TRANSFER

In managing underwritten risks insurers use risk retention and risk transfer. Although different, these methods are not mutually exclusive and are almost always used together. However, if the extent of use of risk retention is greater, the extent of use of risk transfer will be smaller, and vice versa. The basic aim is to achieve the optimal balance between costs and benefits of different insurance risk management methods. The amount of risks that can be retained within insurers' balance sheet is limited with the amount of balance sheet capital that is available for risk coverage, which implies that the greater the balance sheet capital the greater the risk retention would be. The financial crisis had limited the risk retention levels by decreasing the balance sheet capital.[16] However, the balance sheet capital that is needed for risk retention can be increased by issuing of shares or debt to capital market investors. Historically, in the presence of high prices of risk transfer, insurers utilised additional equity and debt capital provided by capital market investors as a support for greater levels of risk retention. However, the present financial crisis, which reduced the available capital of capital market investors and negatively influenced the business confidence, have limited insurers' access to this additional capital. Additionally, the insurers' financial problems imposed by financial crisis impact on their underwriting and investment activities have prompted rating agencies to downgrade their ratings, thus increasing the cost of additional debt and equity capital.[17]

Risk transfer solutions basically provide the reduction in the total retained amount of underwritten risks by their wider dispersion (Marović, 2001). However, they also serve as a substitute for insurers' balance sheet capital because, by reducing total underwritten risk, they reduce the total insurer's liability and thus contribute to reduction in total balance sheet capital that insurers have to hold in order to provide coverage for underwritten risks and protect required solvency level (see figure 2). Having considered the financial crisis impact on the increase of liabilities on underwritten risks and the decrease on investment returns and the availability and cost of additional debt and equity capital, it is obvious that risk transfer, as off-balance sheet substitute for "real" capital, becomes increasingly prominent in current economic conditions.

Figure 2

Different aspects of the role of risk transfer solutions



Insurers use risk transfer to reinsurance and/or capital markets as complementary solutions in order to reduce exposures to underwritten risks that exceeds their risk retention limits. Traditionally, insurers used reinsurance as the only solution for wider spreading of

underwritten risks. However, during the late 1990's, because of increased frequency and severity of loss events that caused the limitation of reinsurance capacity and high reinsurance prices, insurers started using alternative risk transfer solutions that transfer insurance risks to capital markets. The same situation is very likely to happen in the aftermath of the financial crisis as it contributed to shareholders equity decrease, by 10.1% on average in the first nine months of 2008 (Guy Carpenter, 2008), across the reinsurance industry. Having considered that financial crisis negatively influenced the amount of reinsurers' available capital and that it also, as in the case of insurers, limits reinsurers' access to addtional debt and equity capital, it is obvious that financial crisis has similar impact on reinsurance companies. As a consequence of financial crisis impact, reinsurers will need to protect their scarce capital by increasing profitability through higher pricing or limited underwriting. In either case it is reasonable to expect that insurers will, as they did after hurricane seasone of 2005, increase the demand for utilisation of alternative risk transfer instruments. Also, their growth will be urged by investors who will be increasingly interested to invest in these instruments, which provide direct investments in insurance risk and thus diversification of total investment risk, as there is absence of correlation between insurance and other risks in investment portfolios (Heike and Kiernan, 2008) and because during financial crisis these instruments provided relativelly higher returns than corporate bonds with the same rating (Ozzizmir, 2008).

VII. THE REGIONAL INFLUENCE OF FINANCIAL CRISIS

Because of the globalisation, the financial crisis that originated in the U.S. has quickly transferred to developed and later to developing countries in Europe, including economies in the region of South East Europe. The direct impact of the financial crisis to the economies in the region is most visible in the reduction in value of stock market indexes of all stock exchanges in the region in 2008.[18] However, the direct impact of the financial crisis impact on regional economies has not been as severe as it has been in developed and some developing countries, such as Hungary. The regional financial industry is stable primarily because of the more stringent regulation and supervision of financial services, which had facilitated a significantly lower impact of financial crisis. In a banking industry, for example, in 2008 only Moldova had higher ratio of bank regulatory capital to risk-weighted assets than Serbia, while Serbia had highest ratio of bank capital to assets in the world (Global Financial Stability Report, 2008). In insurance industry, for example, Croatian Financial Services Supervisory Agency reduced the highest interest rate in the calculation of mathematical provision from 4.5% in 2006 to 3.3% for 2009 (Ordinance amending the Ordinance on minimum standards, methods of calculating and guidelines for calculating technical provisions in insurance, 2008), which aim is to prompt insurers to have even more conservative investments. Additionally, regional central banks, especially in Serbia and Croatia, have achieved to preserve banks' stability by increasing their reserve requirements. However, we are of the opinion that greater transparency of regional financial markets in relation to those in developed economies, due to the absence of innovative financial market instruments, such as asset-backed securities, had the most profound effect on significant reduction of the financial crisis impact on banks, insurance companies and other financial institutions.

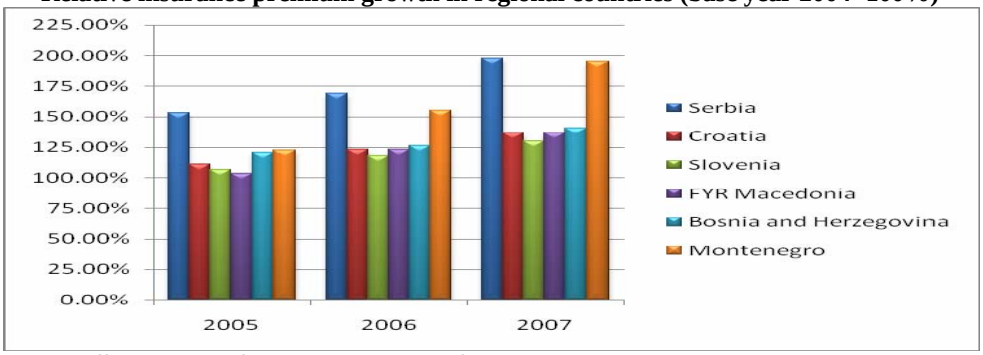
Although the direct impact of the financial crisis has been limited so far, the indirect impact will be more pronounced. It has already negatively influenced the volume of foreign direct investments[19] and will also reduce banks' ability to lend abroad, thus reducing their credit potential. Also, it caused the economic recession that has been already felt in regional economies. In addition to the reduction in the growth of the real GDP in all regional countries, except FYR Macedonia,[20] the economic recession, which inevitably reduces regional

companies' export possibilities to developed countries but also within the region, will further deepen the balance of payment deficit, already present in all regional countries except Slovenia. Having considered the fact that the key for economic stability and sustainable economic growth of regional economies, especially financial services industry, is in the stabilisation and continuous improvement of business and consumer confidence, regional governments and central banks have taken fiscal and monetary measures in this regard. For example, the government guarantees for deposits in banks in Serbia and Croatia have been increased to €50000 and HRK 400000 respectively. In addition, measures that will facilitate the consumer and investment demand for domestic products are needed, but regional governments have to avoid to implement measures that will lead to foreign trade protectionism as economic nationalism can provide only short-term benefits but always has long-term negative impact, as is demonstrated by the example of the Great Depression in 1930's, when protectionism measures deepen the crisis (Dobb, 1961).

Growth rates of insurance premiums on average in all regional countries have been much higher than in the developed economies (Straib and Bevere, 2008) in the period before the financial crisis (see graph 1). Although the final data on insurance premiums for 2008 are still absent, because of undeveloped insurance lines such as directors and officers liability insurance, bond insurance and errors and omissions liability insurance, that are at the forefront of the financial crisis impact in the developed countries, we assume that the same trend of growth, marked in previous years, have continued in 2008. Such trends in premium growth rates have made the regional insurance industry more resilient to the first wave of financial crisis impacts.

Graph 1

Relative insurance premium growth in regional countries (base year 2004=100%)



Source: Different sources of insurance markets' data for regional countries

The investment results of insurance companies are usually higher if wider range of financial instruments is present at capital markets, as insurers have more investment possibilities at their disposal for optimal portfolio structure designing. However, the impact of the financial crisis on the investment returns of regional insurance companies have been relatively smaller than in the case of insurers in developed countries exactly because of the absence of wider range of financial market instruments. In fact, the primary reason for smaller impact on investment returns on regional insurance companies has been the absence of innovative financial instruments. Additionally, the undeveloped capital markets and the absence of securitisation have prevented insurers from engagement in complex financial arrangements. This had an important influence on the preservation of the stability of regional insurance industry as insurers' engagement with innovative financial arrangements, such as

credit default swaps, was the crucial cause of their problems in developed countries, as the example of AIG clearly demonstrates. Therefore, the financial crisis has directly influenced regional insurers only through the impact of the decreased stock market indexes on insurers' results on investments in shares and investment funds. However, having considered the fact that national insurance laws have limited insurers' investments in shares and that high risk assets represented only small amount of the total insurers' investments[21] it is obvious that even the decline of stock market indexes will have limited effect on regional insurers.

The direct impact of the financial crisis on regional insurance industry has been limited so far. However, as in the case of global insurers, the economic recession has the potential to seriously destabilise the insurance industry by its direct impact on the future decrease in insurance demand, especially in the field of life insurance, and by its impact on investment returns because of further decrease in the value of stock market indexes. Additionally, the access to additional debt and equity capital will be limited, because of limited available capital at regional capital markets, and expensive, because of falling insurers' shares prices. Although such development could potentially trigger solvency problems they also represent the opportunity of regional leaders, such as Triglav, Sava, Croatia or Dunav insurance company to further expand their regional presence by way of relatively cheap acquisitions. Finally, as regional insurers are dependent on the global reinsurance capacity and premiums, the explained most probable increase in reinsurance premiums on a global level will have negative influence on regional insurers' profitability, which accompanied with inflationary pressures can trigger premiums increases.

VIII. CONCLUSION

The analysis of the impact of the financial crisis to the insurance industry has demonstrated the complexity of insurers' exposures to risks and multiplying influence to their overall solvency position. The research has shown that financial crisis and economic recession simultaneously influenced the decrease in the value of assets and an increase in the value of liabilities because it had strong negative impact on all insurers' business activities - underwriting, investments and risk transfer. Because insurers' capital is defined as the difference between the market value of assets and the market value of liabilities and serves as a cushion against the insolvency risk, it is obvious that financial crisis had multiplying effect on capital reduction and thus the increase of insolvency risk of insurance companies. As the decrease in the capital leads to reduced perceived value of insurers among potential insureds and investors, the capital depletion influenced the decrease of insurers' share prices and, in combination with overall economic slowdown, the decrease in insurance demand. Such developments implies that it is reasonable to expect that insurers will intensify efforts to improve their capital position by consolidation and premium rates' increases, especially for those insurance classes that have been severely hit by the crisis, such as credit, D&O and E&O liability insurance. Additionally, as combined ratio, the measure of insurers profitability, is determined by premiums, claims and expenses, and because only claims are not directly manageable by insurers, we argue that in order to increase profitability and thus solvency position, in addition to premium increases, insurers should decrease expenses through efficiency improvement.

Although the overall impact of the financial crisis to the insurance industry was negative, the research results indicate that it has not been the same for all insurance companies. The crisis had strongest negative impact to those insurers who were engaged with innovative financial products, who were specialised and thus not well diversified and who had

aggressive investment policies that produced investment portfolios with a considerable share of riskier assets, atypical to insurance industry's traditional assets. This clearly demonstrates that insurance companies' risk management practices had failed to identify overall risk exposures. Also, the overall insurance industry results show that the industry generated underwriting profit. These findings suggest that insurance companies should focus on their core business activities, on underwriting of insurable risks, as that is what they know the best, and that their investments should be more conservative and balanced with corresponding liabilities. Also, insurers should focus to the improvement of holistic approach to risk and capital management that could provide them with the ability to identify, in a timely manner, all potential treats to their solvency position, thus making them more resilient to similar shocks in the future, with the ultimate aim of insureds and shareholders protection. This will require greater managers' responsibility for identification, measurement, monitoring and treatment of all identified risks in conformity with defined risk tolerance, greater emphasis to accumulations of risk exposures, precise definition of maximal total limits for individual losses and greater transparency in reporting overall risk exposures.

NOTES

1. During the 1960-2007 period 21 OECD countries experienced 122 recessions, 112 credit contraction episodes, 114 episodes of house price declines, 234 episodes of equity price declines and their various overlaps. (Claessens, Kose, and Terrones, 2008)
2. Subprime mortgages exposed banks to higher credit risks as they were provided without any participation of debtor, without banks' insight into credit capability of debtors and even without any insight into debtors' income but with significantly higher interest rates.
3. Securitisation is the process by which an asset (or asset pool) is sold for cash, which in turn is raised by the sale of securities whose cash flows are collateralised by the principal and interest income on the original asset pool. (Culp, C.L., 2006)
4. Other forms include risk avoidance, loss prevention and reduction, retention and non-insurance transfers.
5. In this context we consider the most comprehensive definition of risk according to which "the risk is the combination of the probability of an event and its consequences". (ISO/IEC Guide 73, 2002)
6. Credit default swap is a bilateral contract on a par value of a specified reference asset, with a protection buyer that pays a periodic fixed fee or a one-off premium to protection seller (guarantor), in return for which the seller will make a payment on the occurrence of a specified credit event. (Choudhry, 2006)
7. By lending assets, which are hold in order to meet long-term liabilities, for short periods in return for cash collateral insurers provide short-term liquidity. This practice is not considered controversial in the US. However, AIG reinvested that cash collateral in order to generate extra returns and by that exposed policyholders to liquidity risk, especially because the company reinvested its collateral in the residential mortgage-backed securities.
8. For example, the Sarbanes Oxley was enacted after the financial scandals of Enron and WorldCom.
9. For example, AIG's financial products unit.
10. The Standard states that supervisors should review insurers' risk management processes and financial conditions and if necessary drive them to strengthen it, including solvency assessment and capital management processes. Source: Standard on Enterprise Risk Management for Capital Adequacy and Solvency Purposes, International Association of Insurance Supervisors, October 2008, Basel

11. For example, in 2007 rating agency Standard and Poor's embedded estimates of the degree of the enterprise risk management implementation in its ratings criteria.
12. Although the word "monolines" can also be applied to other specialised, insurers engaged in only one type of insurance business.
13. In just the first nine months of 2008, the number of subprime mortgage and related cases filed (448) significantly exceeded the total for all of 2007 (294). (Nielsen, Paczosa and Schoeffler, 2008).
14. Capital market indexes tramandously decreased in 2008. For example, during the third week of September 2008 FTSE 100 decreased for 3.7%, CAC decreased for 3.3%, DAX decreased for 2.5% and Dow Jones decreased for 504 basis points.
15. For example, the Bank of England lowered the official bank rate in March 2009 to 0.5%, the historical minimum since the bank's foundation in 1694.
16. In the first eight months of 2008 non-life insurers have lost 10% to 15% while life insurers have lost 15% to 20% of their shareholder equity (Hess, Karl and Wong, 2008).
17. If the rating is downgraded the insurance company will appear riskier to investors and they will consequently demand a higher return on their investments in securities issued by insurance company.
18. For example, in the period between 1.1.2008 till 1.1.2009, index of most liquid shares of the Belgrade stock exchange – Belex 15 decreased in value by around 78%, Zagreb's stock exchange index – CROBEX decreased in value by around 67% and Slovenian stock market index – SBI 20 decreased by around 70%.
19. For example, the volume of foreign direct investments in 2008 in relation to 2007 in Croatia was reduced by more than 12% while in Bosnia and Herzegovina it was reduce by more than 68% (Transition Report, 2008).
20. In 2008 in relation to 2007, the real GDP growth decreased from 6.8% to 4.3% in Slovenia, from 5.6% to 3.5% in Croatia, from 6.8% to 6.0% in Bosnia and Herzegovina, from 10.3% to 7.0% in Montenegro and from 7.5% to 7.0% in Serbia, while in FYR Macedonia it slightly increased from 5.1% to 5.3% (Transition Report, 2008).
21. For example, in the third quarter of 2008 the participation of shares in investment portfolios of Serbian insurance companies was 11% while the participation of insurers' investments in investment funds in Croatia in 2007 was 11.2%

REFERENCES

AFGI, (2009), Association of Financial Guaranty Insurers website http://www.afgi.org/whoweare.htm
AIG's Annual Report for 2007, American International Group, New York, NY, 2008
Bradford, D., (2008a), "The Subprime Mortgage Meltdown, the Global Credit Crisis and the D&O Market", Special Report, Advisen Ltd, New York
Bradford, D., (2008b), "The Crisis in the Subprime Mortgage Market and the Global Credit Markets: The Impact on E&O Insurers", Special Report, Advisen Ltd, New York
Choudhry, M., (2006), *The Credit Default Swap Basis*, (New York: Bloomberg Press)
Christoffersen, P. F., (2003), *Elements of Financial Risk Management*, (San Diego: Academic Press, An imprint of Elsevier Science)
Claessens, S., Kose, M.A. and Terrones, M.E., (2008), "What Happens During Recessions, Crunches and Busts?", Working Paper Series, International Monetary Fund, New York
Culp, C.L., (2006), *Structured Finance and Insurance*, (New Jersey: John Willey & Sons, Inc)
Dobb, M., (1961), *Studije o razvoju kapitalizma*, (Zagreb: Naprijed)

Enz, R., (2000), "The S-Curve Relations Between Per-capita Income and Insurance Penetration", Geneva Papers on Risk and Insurance: Issues and Practice, 25 (3): 396-406

Esch, Louis, Kieffer, Robert and Lopez, Thierry, (2005), *Asset and Risk Management: Risk Oriented Finance*, (West Sussex: John Willey & Sons Ltd)

Ferguson, N., (2008), *The Ascent of Money: A Financial History of the World*, (New York: The Penguin Press)

For insurance markets of regional countries sources used encompass:

For Bosnia and Herzegovina – Filipović, Zlatan, (2008), "Bosna i Hercegovina – pregled tržišta osiguranja u 2007 godini." Paper presented at the annual meeting of SorS, Sarajevo.

For Croatia – Udruženje osiguravatelja, (2009) Hrvatska gospodarska komora. http://hgk.biznet.hr/hgk/tekst.php?a=b&page=tekst&id=921 (accessed March 10, 2009)

For Macedonia – Popovski, Jonče, (2008), "Makedonija – pregled tržišta osiguranja u 2007 godini", Paper presented at the annual meeting of SorS, Sarajevo.

For Montenegro – Šaban, Boris, (2008), "Crna Gora – pregled tržišta osiguranja u 2007 godini" Paper presented at the annual meeting of SorS, Sarajevo.

For Serbia – Podaci o poslovanju društava za osiguranje, (2009) Narodna banka Srbije. http://www.nbs.rs/export/internet/cirilica/60/60_2/index.html (acessed March 10, 2009)

For Slovenia – Statistični podatki. (2009) Slovensko Zavarovalno Združenje.http://www.zav-zdruzenje.si/statistika.htm (accessed March 10, 2009)

Gallati, R. R., (2003), *Risk Management and Capital Adequacy*, (New York: McGraw-Hill Professional)

Global Financial Stability Report, (2008), *Financial Stress and Deleveraging: Macrofinancial Implications and Policy*, (Washington, International Monetary Fund)

Guy Carpenter (2008), Chart: Change in Equity: First Nine Months of 2008 - http://www.gccapitalideas.com/2008/11/14/chart-change-in-equity-first-nine-months-of-2008

Harrington, S.E. and Niehaus, G.R., (2004), *Risk Management and Insurance*, (New York: McGraw-Hill/Irwin)

Heike, D. and Kiernan, J., (2002), "Improving Portfolio Performance with Catastrophe Bonds", in: Lane, M. (ed), *Alternative Risk Strategies*, (London: Risk Waters Group), pp. 545-556

Hess, T., Karl, K., and Wong, C., (2008), "Global insurance review 2008 and outlook 2009: Weathering the storm", Special Report, Swiss Re, Zurich

Hussels, S., Ward, D and Zurbruegg, R., (2005), "Stimulating the Demand for Insurance", Risk Management and Insurance Review, 8 (2): 257-278

ISO/IEC Guide 73, (2002), Risk management. Vocabulary. Guidelines for use in standards, International Organization for Standardization, Geneva

Jorion, P., (2003), *Financial Risk Manager Handbook*, (Hoboken: John Wiley & Sons)

Kejnz, J.M., (1956), *Opšta teorija zaposlenosti, kamate i novca*, (Beograd: Kultura)

Larosiere, de J., et al, (2009), *Report*, The High-Level Group on Financial Supervision in the EU, Brussels

Marks, K., (1978), *Teorije o višku vrednosti II deo (četvrti tom "Kapitala")*, (Beograd: Prosveta)

Marović, B., (2001), *Osiguranje i špedicija*, (Novi Sad: Stylos)

Narodna banka Srbije, (2008), "Izveštaj o poslovima nadzora nad obavljanjem delatnosti osiguranja u III tromesečju 2008. godine", - http://www.nbs.rs/export/internet/cirilica/60/60_6/index.html

Nielsen, J., Paczosa, S., and Schoeffler, W., (2008), "Subprime Mortgage and Related Litigation, Third Quarter 2008 Update: Breaking New Ground", Navigant Consulting, Inc., Chicago
OECD, (2009), "Composite Leading Indicators signal deep slowdown in OECD area and major non-OECD member economies", OECD - http://www.oecd.org/dataoecd/33/21/41968144.pdf
Ordinance amending the Ordinance on minimum standards, methods of calculating and guidelines for calculating technical provisions in insurance, (2008), Official Gazette of the Republic of Croatia, no. 112
Ozizmir, D., (2008), An Overview of Securitisation for Capital Efficiency, Rendez-vous de Septembre, Monte Carlo, - http://www.rvs-monte-carlo.com/docs/conf/presentation_dan_ozizmir_2008.pdf
Reinsurance Underwriting Report, (2007), Six Months Ended June 30, 2007, Reinsurance Association of America, Washington
Reinsurance Underwriting Report, (2008), Six Months Ended June 30, 2008, Reinsurance Association of America, Washington
Rejda, G.E., (2005), *Principles of Risk Management and Insurance*, (New Jersey: Pearson Education, Inc)
Serra, B. and Harris, S., (2009), "European Credit Insurance: What Can We Expect In 2009?", Moody's Investor Service
Standard on Enterprise Risk Management for Capital Adequacy and Solvency Purposes, International Association of Insurance Supervisors, October 2008, Basel
Straib, D. and Bevere, L., (2008), "World insurance in 2007: emerging markets leading the way", Swiss Re, Zurich
Swiss Re's Annual Report for 2008, Swiss Reinsurance Company, Zurich, 2009
Transition Report, (2008), Growth in Transition, EBRD, London

POSLJEDICE FINANCIJSKE KRIZE NA INDUSTRIJU OSIGURANJA – GLOBALNA I REGIONALNA PERSPEKTIVA

SAŽETAK

U radu se analizira utjecaj svjetske financijske krize na pojedinačne funkcionalne operacije i iz njih proizlazeće međuzavisnosti industrije osiguranja sa regulatorima, rejting agencijama, osiguranicima, reosiguravateljima i investitorima na tržištu kapitala u cilju determiniranja sadašnje pozicije industrije osiguranja te na bazi toga donošenja zaključka o neophodnim mjerama koje osiguravajuće kompanije trebaju poduzeti. Rezultati istraživanja ukazuju da svjetska financijska kriza ima negativnog utjecaja na sve aspekte poslovanja osiguravajućih kompanija i sugeriraju potrebu fokusiranja na izvorne poslovne aktivnosti i neophodnost daljeg unapređenja holističkog upravljanja rizikom i kapitalom globalnih i regionalnih osiguravatelja u cilju svladavanja financijskom krizom nametnutih problema.

***Ključne riječi**: financijska kriza, recesija, osiguranje, reosiguranje, upravljanje rizikom*

Ali Acaravci*

UDK 338.24:621.31>:330.55(560)
Original scientific paper
Izvorni znanstveni rad

THE CAUSAL RELATIONSHIP BETWEEN ELECTRICITY CONSUMPTION AND GDP IN TURKEY: EVIDENCE FROM ARDL BOUNDS TESTING APPROACH

ABSTRACT

This paper investigates the long-run and causal relationship between electricity consumption and economic growth in Turkey by using the ARDL cointegration test and Granger causality models. It employs annual data covering the period of 1977–2006. The ARDL cointegration test yields evidence of a long-run relationship between electricity consumption per capita and real GDP per capita. The results from the Granger causality models indicate that there is an evidence of unidirectional causality running from the electricity consumption to economic growth in the long-run. The overall results confirm the "Growth hypothesis" for Turkey. This implies that, energy conservation policies, such as rationing electricity consumption, are likely to have an adverse effect on real GDP of Turkey.†

JEL classification: *C32, C52, Q43*
Keywords: *Electricity consumption, Economic growth, ARDL bounds testing*

I. INTRODUCTION

In Turkey, the higher demand for electricity is growing rapidly due to the technical, social and economic development. Its electricity demand tends to increase by a rapid average of %7.5 per year. In Turkey, electricity generation came from three main sources: natural gas by %48.17, coal by %28.98, and hydroelectric by %16.77 in 2008 (www.enerji.gov.tr). Both Figure 1 and differences between two growth rates in Table 1 also show that (i) both the electric power consumption per capita (kWh) and real GDP per capita (constant 2000 US$) are smoothly increasing, but (ii) electricity consumption per capita grows faster than GDP per capita.

On the other hand, energy prices have allegedly been a significant factor especially for the energy importing countries like Turkey. To make a well designing electricity policy, it is very important to ascertain empirically whether there is a long-run causal link between electricity consumption and economic growth and the way of causality.

* Faculty of Economics and Administrative Sciences, Mustafa Kemal University, Antakya-Hatay, Turkey.
Tel: +903262455845, Fax:+903262455854, E-mail: acaravci@hotmail.com
† Paper received 8 October 2009.

Figure 1

The log of electric power consumption per capita, kWh (LnELEC) and real GDP per capita, constant 2000 US$ (LnGDP).

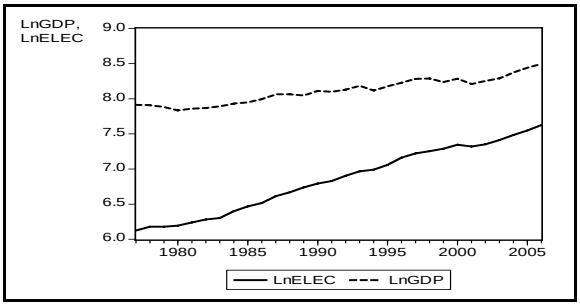


Table 1

The average growth rates of electricity consumption per capita and real GDP per capita

Variables	1977-1981	1982-1986	1987-1991	1992-1996	1997-2001	2002-2006
g_{ELEC}	2.28	4.68	4.29	5.16	1.95	5.49
g_{GDP}	-1.11	2.52	0.72	1.97	-1.45	4.82
$g_{ELEC} - g_{GDP}$	3.39	2.16	3.57	3.18	3.40	0.67

Notes: g_{ELEC} and g_{GDP} are the average growth rates of electricity consumption per capita (kWh) and real GDP per capita (constant 2000 US$), respectively.

Over the last three decades, the relationship between energy consumption and economic growth has been widely discussed in this literature. Since the seminal work of Kraft and Kraft (1978), different studies have focused on different countries, time periods, and have used different proxy variables for energy consumption and income, but the direction of the causality relationship has been mixed. The directions and its policy implications of causal relationship between electricity consumption and economic growth have been generally tested by using following four hypothesize within the literature (See Jumbe, 2004): (i) G*rowth hypothesis* (Causality running from electricity consumption to economic growth): This suggests that electricity consumption plays an important role in economic growth (Altinay and Karagol, 2005; Shiu and Lam, 2004). (ii) C*onservation hypothesis* (Causality running from economic growth to electricity consumption): This indicates that a country is not dependent on energy for growth and development and then electricity conservation policies will have little or no effect on economic growth. (Ghosh, 2002). (iii) *Feedback hypothesis* (two-way causality between electricity consumption and economic growth): This shows that electricity consumption and economic growth complement each other (Jumbe, 2004; Yoo, 2006). (iv) N*eutrality hypothesis* (No causal relationship between electricity consumption and real GDP): This means that neither conservative nor expansive policies in relation to electricity consumption have any effect on economic growth.

The empirical result for energy consumption - economic growth nexus is supported neutrality hypothesis, while there is an evidence of growth hypothesis for electricity consumption - economic growth nexus in the previous studies about Turkey (see Table 2 and Table 3). As it can be seen in these tables, almost all types of causality are found in these

studies. In other words, the empirical results of energy-growth and electricity-growth nexus studies for Turkey are mixed and contradictory.

Table 2
Summary of empirical studies on energy consumption –growth xexus for Turkey

Authors	Period	Variables	Methodology	Conclusion
Soytas et al. (2001)	1960-1995	Energy consumption; GDP	Granger causality; VEC; JJ cointegration.	$EC \rightarrow GDP$
Soytas and Sari (2003)	1950-1992	Energy consumption; GDP	Granger causality; VEC; JJ cointegration.	$EC \rightarrow GDP$
Altinay and Karagol (2004)	1950-2000	Energy consumption; GDP	Hsiao causality; Zivot–Andrews structural break test	$EC \neq GDP$
Lise and Monfort (2007)	1970-2003	Energy consumption; GDP	Granger causality; VEC; JJ cointegration.	$GDP \rightarrow ELC$
Jobert and Karanfil (2007)	1960-2003	Energy consumption; GDP	Granger causality; VAR.	$EC \neq GDP$
Erdal *et al.* (2008)	1970-2006	Energy consumption; GDP	Granger causality; VEC; JJ cointegration.	$EC \leftrightarrow GDP$
Halicioglu (2009)	1960-2005	Carbon emissions; Energy consumption; GDP; Foreign Trade	Granger causality ARDL cointegration.	$EC \neq GDP$
Soytas and Sari (2009)	1960-2000	Energy consumption; carbon emissions; Labor; gross fixed capital investment; GDP	TY causality.	$EC \neq GDP$

Notes: $\rightarrow$, $\leftrightarrow$ and $\neq$ represent unidirectional causality, bidirectional causality, and no causality, respectively. Abbreviations are defined as follows: VAR= vector autoregressive model, VEC= vector error correction model, JJ= Johansen–Juselius, TY= Toda–Yamamoto, ARDL= autoregressive distributed lag, EC= energy consumption, ELC= electricity consumption, GDP= real gross domestic product.

Table 3
Summary of empirical studies on electricity consumption–growth nexus for Turkey

Authors	Period	Variables	Methodology	Conclusion
Murry and Nan (1996)	1950-1970	Electricity consumption; GDP	Granger-causality; VAR	$ELC \rightarrow GDP$
Altinay and Karagol (2005)	1950-2000	Electricity consumption; GDP	Granger-causality; Dolado–Lutkepohl causality.	$ELC \rightarrow GDP$
Halicioglu (2007)	1968-2005	Residential electricity consumption; GDP, residential electricity price; the urbanization rate	Granger causality ARDL cointegration.	$GDP \rightarrow ELC$
Narayan and Prasad (2008)	1960-2002	Electricity consumption; GDP	Bootstrapped Granger-causality	$ELC \neq GDP$
Soytas and Sari (2007)	1968-2002	Industry electricity consumption, value added-Manufacturing; Manufacturing employment; manufacturing real fixed investment	Granger-causality; VEC; JJ cointegration.	$IELC \rightarrow MVA$

Notes: $\rightarrow$ and $\neq$ represent unidirectional causality and no causality, respectively. Abbreviations are defined as follows: VAR= vector autoregressive model, VEC= vector error correction model, JJ= Johansen–Juselius, ARDL= autoregressive distributed lag, EC= energy consumption, ELC= electricity consumption, GDP= real gross domestic product, IELC= industrial electricity consumption, MVA= manufacturing value added.

These contractionary results are also confirmed in the study of Payne (2010) and Ozturk (2010). According to Payne (2010), the results for the specific countries surveyed show that 31.15% supported the neutrality hypothesis; 27.87% the conservation hypothesis; 22.95% the growth hypothesis; and 18.03% the feedback hypothesis. This survey also indicates that the empirical results have yielded mixed results in terms of the four hypotheses (neutrality, conservation, growth, and feedback) and electricity consumption - economic growth nexus is an unresolved issue. In empirical literature on energy consumption - economic growth or electricity consumption - economic growth, it can be seen that most of the studies are using only GDP and energy or electricity consumption variables in their models (See Payne, 2010; Table 1 for details). In other words, bivariate models were used in many of these empirical studies. Thus, we also prefer to apply bivariate model to compare and evaluate our results. To design an appropriate electricity policy, we investigate the long-run and causal relationships between the electricity consumption per capita and real GDP per capita by using recently developed autoregressive distributed lag (hereafter ARDL) bounds testing approach of cointegration by Pesaran and Shin (1999) and Pesaran *et al.* (2001), and error-correction based Granger causality models for Turkey. The rest of the paper is organized as follows. The next section presents the methodology and data. The third section reports the empirical results. The last section concludes the paper.

2. METHODOLOGY AND DATA

Following the empirical literature, the long-run relationship between the real GDP and the electricity consumption may be expressed as:

$$GDP_t = \alpha + \beta ELC_t + \varepsilon_t \quad (1)$$

where GDP and ELC are real GDP per capita (constant 2000 US$) and electric power consumption (kWh per capita), respectively and ε_t is the error term. The annual Turkish time series data are taken for 1977-2006 from the World Development Indicators (WDI) online database. All variables are employed with their natural logarithms. The long-run and causal relationships between real GDP per capita and the electricity consumption per capita in Turkey will be performed in two steps. Firstly, we will test the long run relationships among the variables by using the ARDL bounds testing approach of cointegration. Secondly, we test causal relationships by using the error-correction based causality models.

2.1. Autoregressive Distributed Lag (ARDL) Cointegration Analysis

The ARDL bounds testing approach of cointegration is developed by Pesaran and Shin (1999) and Pesaran *et al.* (2001). Due to the low power and other problems associated with other test methods, the ARDL approach to cointegration has become popular in recent years. The ARDL cointegration approach has numerous advantages in comparison with other cointegration methods such as Engle and Granger (1987), Johansen (1988), and Johansen and Juselius (1990) procedures: (i) The ARDL procedure can be applied whether the regressors are I(1) and/or I(0), while Johansen cointegration techniques require that all the variables in the system be of equal order of integration. This means that the ARDL can be applied irrespective of whether underlying regressors are purely I(0), purely I(1) or mutually co-integrated and thus no need for unit root pre-testing. (ii) While the Johansen cointegration techniques require large data samples for validity, the ARDL procedure is statistically more significant approach to determine the cointegration relation in small samples. (iii) The ARDL

procedure allows that the variables may have different optimal lags, while it is impossible with conventional cointegration procedures. (iv) The ARDL technique generally provides unbiased estimates of the long-run model and valid t-statistics even when some of the regressors are endogenous (see Harris and Sollis, 2003). (v) The ARDL procedure employs only a single reduced form equation, while the conventional cointegration procedures estimate the long-run relationships within a context of system equations.

The ARDL model for the standard log-linear functional specification of long-run relationship between electricity consumption and real GDP may follows as:

$$\Delta GDP_t = \alpha_1 + \sum_{i=1}^{p1} \phi_{1i} \Delta GDP_{t-i} + \sum_{j=0}^{q1} \beta_{1j} \Delta ELC_{t-j} + \delta_1 GDP_{t-1} + \delta_2 ELC_{t-1} + \varepsilon_{1t} \qquad (2)$$

where ε_{1t} and Δ are the white noise term and the first difference operator, respectively. An appropriate lag selection based on a criterion such as Akaike Information Criterion (AIC) and Schwarz Bayesian Criterion (SBC). The bounds testing procedure is based on the joint F-statistic or Wald statistic that is tested the null of no cointegration, $H_0 : \delta_r = 0$, against the alternative of $H_1 : \delta_r \neq 0$, $r = 1, 2$. Two sets of critical values that are reported in Pesaran et al. (2001) provide critical value bounds for all classifications of the regressors into purely I(1), purely I(0) or mutually cointegrated. If the calculated *F*-statistics lies above the upper level of the band, the null is rejected, indicating cointegration. If the calculated *F*-statistics is below the upper critical value, we cannot reject the null hypothesis of no cointegration. Finally, if it lies between the bounds, a conclusive inference cannot be made without knowing the order of integration of the underlying regressors. Recently, Narayan (2005) argues that exiting critical values, because they are based on large sample sizes, cannot be used for small sample sizes. Narayan (2005) regenerated the set of critical values for the limited data ranging from 30–80 observations by using the Pesaran et al. (2001)'s GAUSS code. With the limited annual time series Turkish data on electricity consumption and income, this study employs the critical values of Narayan (2005) for the bounds F-test rather than Pesaran *et al.* (2001).

If there is evidence between long-run relationships (cointegration) of the variables, the following long-run and short-run models that are employed:

$$GDP_t = \alpha_2 + \sum_{i=1}^{p2} \phi_{2i} GDP_{t-i} + \sum_{j=0}^{q2} \beta_{2j} ELC_{t-j} + \varepsilon_{2t} \qquad (3)$$

$$\Delta GDP_t = \alpha_3 + \sum_{i=1}^{p3} \phi_{3i} \Delta GDP_{t-i} + \sum_{j=0}^{q3} \beta_{3j} \Delta ELC_{t-j} + \psi ECT_{t-1} + \varepsilon_{3t} \qquad (4)$$

where ψ is the coefficient of error correction term (hereafter *ECT*). It shows how quickly variables converge to equilibrium and it should have a statistically significant coefficient with a negative sign.

2.2. Causality Analysis

ARDL cointegration method tests whether the existence or absence of long-run relationships between the electricity consumption per capita and the real GDP per capita. It doesn't indicate the direction of causality. We use the two-step procedure from the Engle and Granger (1987) model to examine the causal relationship between the electricity consumption per capita and real GDP per capita. Once estimating the long-run model in Equation (3) in order to obtain the estimated residuals, the next step is to estimate error-correction based Granger causality models. As opposed to the conventional Granger causality method, the error-correction based causality test allows for the inclusion of the lagged error-correction term derived from the cointegration equation (See Narayan and Smyth, 2008; and Odhiambo, 2007, 2009):

$$\Delta GDP_t = \alpha_4 + \sum_{i=1}^{p4} \beta_{4j} \Delta GDP_{t-i} + \sum_{j=0}^{q4} \phi_{4i} \Delta ELC_{t-j} + \psi_1 ECT_{t-1} + \varepsilon_{4t} \quad (5.a)$$

$$\Delta ELC_t = \alpha_5 + \sum_{i=0}^{p5} \beta_{5j} \Delta GDP_{t-i} + \sum_{j=1}^{q5} \phi_{5i} \Delta ELC_{t-j} + \psi_2 ECT_{t-1} + \varepsilon_{5t} \quad (5.b)$$

Residual terms, ε_{4t} and ε_{5t}, are independently and normally distributed with zero mean and constant variance. An appropriate lag selection is based on a criterion such as AIC and SBC. Rejecting the null hypotheses indicate that ELC does Granger cause GDP and GDP does Granger cause ELC, respectively. Using Equations (5.a) and (5.b), Granger causality can be examined in three ways: i) Short-run or weak Granger causalities are detected by testing $H_0 : \phi_{4i} = 0$ and $H_0 : \beta_{5j} = 0$ for all *i* and *j* in equations (5.a) and (5.b), respectively. ii) Another possible source of causation is the *ECT* in equations. Thus, long-run causalities are examined by testing $H_0 : \psi_1 = 0$ and $H_0 : \psi_2 = 0$ for equations (5.a) and (5.b). iii) Strong Granger causalities are detected by testing $H_0 : \phi_{4i} = \psi_1 = 0$ and $H_0 : \beta_{5j} = \psi_2 = 0$ for all *i* and *j* in equations (5.a) and (5.b), respectively (Lee and Chang, 2008).

3. EMPIRICAL RESULTS

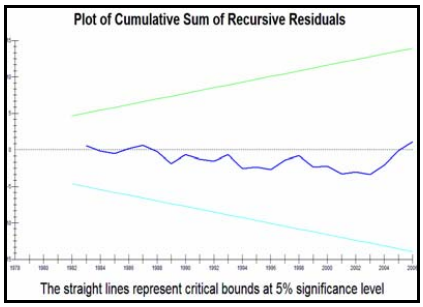
According to Pesaran and Shin (1999), the SBC is generally used in preference to other criteria because it tends to define more parsimonious specifications. With the limited observations, this study used the SIC to select an appropriate lag for the ARDL model. Table 4 presents the estimated ARDL (1,1) model that has passed several diagnostic tests that indicate no evidence of serial correlation and heteroscedasticity. Besides this, the ADF unit root test for the residuals revealed that they are stationary.

In addition, due to the structural changes in the Turkish economy it is likely that macroeconomic series may be subject to one or multiple structural breaks. In addition, . For this purpose, the stability of the short-run and long-run coefficients is checked through the cumulative sum (CUSUM) and cumulative sum of squares (CUSUMSQ) tests proposed by Brown *et al.* (1975). Unlike Chow test, requires break point(s) to be specified, the CUSUM and CUSUMQ tests are quite general tests for structural change in that they do not require a prior determination of where the structural break takes place. Figure 2 presents the plot of CUSUM and CUSUMSQ test statistics that fall inside the critical bounds of 5% significance. This implies that the estimated parameters are stable over the period of 1977–2006.

The bounds *F*–test for cointegration test yields evidence of a long-run relationship between electricity consumption per capita and real GDP per capita at 5% significance level in Turkey. The estimated log-linear long-run coefficient of the electricity consumption per capita is about 0.40 and positive. This coefficient implies the elasticity of electricity consumption and an increase in electricity consumption per capita will raise the real GDP per capita at the 40%. The estimated *ECT* is also negative (-0.405) and statistically significant at 1% confidence level. *ECT* indicates that any deviation from the long-run equilibrium of between variables is corrected about 41% for each period and takes about 2.5 periods to return the long-run equilibrium level.

Figure 2

Plot of Cusum of Squares and Cusum test



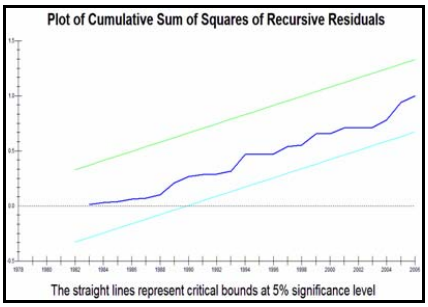


Table 4

Estimated coefficients

Variables	**Short-Run**	**Long-Run**
GDP(-1)	0.5946 [0.000]	
ELC	1.0181 [0.000]	0.4022 [0.000]
ELC(-1)	- 0.8550 [0.000]	
Constant	2.1386 [0.014]	5.2754 [0.000]

R^2	0.9810	NORM	1.464 [0.481]	*ECM*	-0.405 [0.009]
Adj. R^2	0.9787	LM	2.246 [0.134]	ADF	-6.391 (-4.513)
SEE	0.0267	HET	0.980 [0.322]	F	4.720

Notes:

SEE is the standard error of the regression.

NORM is a test for normality of residuals with a χ^2 distribution with two degrees of freedom.

LM is the Lagrange multiplier test for serial correlation with a χ^2 distribution with four degrees of freedom.

HET is test for heteroskedasticity with a χ^2 distribution with only one degree of freedom.

ECM is the estimated coefficient of error correction term.

p-values for the estimated coefficients and statistics are in [ ].

ADF is unit root test statistics for residuals and its 5% critical value is in ( ).

F is the ARDL cointegration test. The critical values for the lower *I*(0) and upper *I*(1) bounds are 4.090 and 4.663 for 5% significance level, respectively (Narayan, 2005, Appendix: Case II).

This study also explores causal relationship between the variables in terms of the three error-correction based Granger causality models. The overall results show that there is unidirectional causality running from the electricity consumption to economic growth in the long-run (see Table 5). This indicates that energy conservation policies, such as rationing electricity consumption, are likely to have an adverse effect on the real output growth of Turkey. Therefore, the energy growth policies regarding electricity consumption should be adapted in such a way that the development of this sector stimulates economic growth.

Table 5

Granger causality test results

The Null Hypotheses		**Short-run (or Weak) Granger Causality**
$\Delta\text{ELC} \rightarrow \Delta\text{GDP}$	$(H_0 : \phi_{4i} = 0)$	0.7737 (0.3791)
$\Delta GDP \rightarrow \Delta\text{ELC}$	$(H_0 : \beta_{5j} = 0)$	0.1540 (0.6948)
The Null Hypotheses		**Long-run Granger Causality**
$\text{ECT} \rightarrow \Delta GDP$	$(H_0 : \psi_1 = 0)$	3.4321 (0.0639)
$ECT \rightarrow \Delta\text{ELC}$	$(H_0 : \psi_2 = 0)$	0.0985 (0.7537)
The Null Hypotheses		**Strong Granger Causality**
$\Delta\text{ELC,ECT} \rightarrow \Delta\text{GDP}$	$H_0 : \phi_{4i} = \psi_1 = 0)$	3.8881 (0.1431)
$\Delta GDP, ECT \rightarrow \Delta\text{ELC}$	$H_0 : \beta_{5j} = \psi_2 = 0)$	0.1557 (0.9251)

Notes: The null hypothesis is that there is no causal relationship between variables.
Values in parentheses are p-values for Wald tests with a χ^2 distribution.
Δ is the first difference operator.

4. CONCLUDING REMARKS

The empirical result for energy-growth nexus is supported neutrality hypothesis, while there is an evidence of growth hypothesis for electricity consumption-growth nexus in the previous studies for Turkey. Since the question of whether electricity consumption causes economic growth or economic growth causes electricity consumption still is an unresolved issue, this paper may be considered as a complementary study to the previous studies for Turkey.

This paper explores the long-run and causal relationship issues between electricity consumption and economic growth in Turkey by using the ARDL cointegration test and Granger causality models. It employs annual data covering the period 1977–2006. The ARDL cointegration test yields evidence of a long-run relationship between electricity consumption per capita and real GDP per capita at 5% significance level. According to results from three kinds of Granger causality, the electricity consumption per capita causes real GDP per capita only in the long-run. But, there is no causal evidence from the real GDP per capita to electricity consumption per capita. In other words, "Growth hypothesis" is confirmed in Turkey. This suggests that electricity consumption plays an important role in economic growth and high electricity consumption tends to have high economic growth in the long-run, but not the reverse.

Therefore, energy conservation policies, such as rationing electricity consumption, may harm economic growth in Turkey in the long-run. In addition, any electricity consumption infrastructure shortage is likely to restrain the economic growth in Turkey. In order to avoid any adverse effect of electricity shortages on economy, the Ministry of Energy and Natural Resources of Turkey should continue to explore new resources and expand the electricity supply via hydroelectric power plants, thermal power plants and wind power plants to satisfy total demand for electricity. As a strategy toward higher long-run economic growth, Turkey should try to invest more on electricity supply infrastructure.

REFERENCES

Altınay, G. and Karagol, E., (2004), "Structural break, unit root, and the causality between energy consumption and GDP in Turkey", Energy Economics, 26, 985–994.
Altınay, G. and Karagol, E., (2005), "Electricity consumption and economic growth: evidence fromTurkey", Energy Economics, 27, 849–856.
Brown R.L., Durbin J. and Evans J.M., (1975), "Techniques for testing the consistency of regression relations over time", Journal of the Royal Statistical Society, 37, 149-192.
Engle, R.F. and Granger, C.W.J., (1987), "Co-integration and error correction: representation, estimation, and testing", Econometrica, 55, 251-276.
EIA, (2009). U.S. Energy Information Administration, Independent Statistics and Analysis, September 2009. Available at: http://www.eia.doe.gov/emeu/mer/pdf/pages/sec1_7.pdf.
Erdal, G., Erdal, H. and Esengun, K., (2008), "The causality between energy consumption and economic growth in Turkey", Energy Policy, 36, 3838-3842.
Ghosh, S., (2002), "Electricity consumption and economic growth in India", Energy Policy, 30, 125–129.
Halicioglu, F., (2007), "Residential electricity demand dynamics in Turkey", Energy Economics 29, 199–210.
Halicioglu, F., (2009), "An econometric study of CO_2 emissions, energy consumption, income and foreign trade in Turkey", Energy Policy, 37, 1156-1164.
Harris, R. and Sollis, R., (2003), *Applied Time Series Modelling and Forecasting*, (West Sussex: Wiley).
Jobert, T. and Karanfil, F., (2007), "Sectoral energy consumption by source and economic growth in Turkey", Energy Policy, 35, 5447-5456.
Johansen, S., (1988), "Statistical analysis of cointegration vectors", Journal of Economic Dynamics and Control, 12, 231-254.
Johansen, S. and Juselius, K., (1990), "Maximum likelihood estimation and inference on cointegration - with applications to the demand for money", Oxford Bulletin of Economics and Statistics, 52, 169-210.
Jumbe, C.B.L., (2004), "Cointegration and causality between electricity consumption and GDP: empirical evidence from Malawi", Energy Economics, 26, 61–68.
Kraft, J. and Kraft, A., (1978), "On the relationship between energy and GNP",Journal of Energy and Development, 3, 401– 403.
Lee, C.C. and Chang, C.P., (2008), "Energy consumption and economic growth in Asian economies: a more comprehensive analysis using panel data", Resource and Energy Economics, 30, 50–65.
Lise, W. and Monfort, K.V., (2007), "Energy consumption and GDP in Turkey: is there a Co-integration relationship?", Energy Economics, 29, 1166–1178.
Murray D.A. and Nan G.D., (1996), "A definition of the gross domestic product-electrification interrelationship", Journal of Energy Development, 19, 275–283.
Narayan, P.K., (2005), "The saving and investment nexus for China: evidence from cointegration tests", Applied Economics, 37, 1979–1990.
Narayan, P.K. and Smyth, R., (2008), "Energy consumption and real GDP in G7 countries: new evidence from panel cointegration with structural breaks", Energy Economics, 30, 2331–2341.
Narayan P.K. and Prasad A., (2008), "Electricity consumption-real GDP causality nexus: evidence from a bootstrapped causality test for 30 OECD countries", Energy Policy, 36, 910–918.
Odhiambo, N.M., (2007), "Supply-leading versus demand-following hypothesis: empirical evidence from three SSA countries", African Development Review, 19, 257–279.

Odhiambo, N.M., (2009), "Energy consumption and economic growth nexus in Tanzania: an ARDL bounds testing approach", Energy Policy, 37, 617-622.
Ozturk, I., (2010), "A literature survey on energy–growth nexus", Energy Policy, 38, 340-349.
Payne J.E. (2010), "A survey of the electricity consumption-growth literature", Applied Energy, 87, 723-731.
Pesaran H.M. and Shin, Y., (1999), "Autoregressive distributed lag modelling approach to cointegration analysis", in: S.Storm (Ed.) Econometrics and Economic Theory in the 20th Century: The Ragnar Frisch Centennial Symposium, chapter 11, Cambridge University Press.
Pesaran M.H., Shin, Y. and Smith, R.J., (2001), "Bounds testing approaches to the analysis of level relationships", Journal of Applied Econometrics, 16, 289–326.
Shiu, A. and Lam, P.L., (2004), "Electricity consumption and economic growth in China", Energy Policy, 32, 47–54.
Soytas, U., Sarı, R. and Ozdemir, O., (2001), "Energy consumption and GDP relation in Turkey: a cointegration and vector error correction analysis", Economies and Business in Transition: Facilitating Competitiveness and Change in the Global Environment Proceedings. Global Business and Technology Association, 838–844.
Soytas, U. and Sari, R., (2003), "Energy consumption and GDP: causality relationship in G7 countries and emerging markets", Energy Economics, 25, 33–37.
Soytas, U. and Sari R., (2007) "The relationship between energy and production: evidence from Turkish manufacturing industry", Energy Economics, 29, 1151–1165.
Soytas, U. and Sari R., (2009), "Energy consumption, economic growth, and carbon emissions: challenges faced by an EU candidate member", Ecological Economics 68, 1667-1675.
The Republic of Turkey, The Ministry of Energy and Natural Resources (2010). http://www.enerji.gov.tr/index.php?dil=en&sf=webpages&b=elektrik_EN&bn=219&hn=&nm=40717&id=40732
WDI, World Development Indicators online.
Yoo, S. H., (2006), "The causal relationship between electricity consumption and economic growth in the ASEAN countries", Energy Policy, 34, 3573-3582.

KAUZALNI ODNOS POTROŠNJE ELEKTRIČNE ENERGIJE I BDP-a U TURSKOJ: DOKAZI DOBIVENI GRANIČNIM TESTIRANJEM ARDL

SAŽETAK

Rad proučava dugoročne i kauzalne veze između potrošnje električne energije i gospodarskog rasta u Turskoj koristeći ARDL (autoregresijski model s distribuiranim vremenskim pomakom) kointegracijski test i Grangerov kauzalni model. Koriste se godišnji podaci za period od 1977. do 2006. ARDL kointegracijski test dokazuje dugoročnu vezu između potrošnje električne energije i stvarnog BDP-a po glavi stanovnika. Rezultati dobiveni Grangerovim modelima kauzalnosti ukazuju na jednosmjernu kauzalnost koja dugoročno vodi od potrošnje električne energije do gospodarskog rasta. Ukupni rezultati potvrđuju «hipotezu rasta» za Tursku. To znači da bi politika uštede energije, kao što je ograničenje potrošnje električne energije, vjerojatno imala negativni učinak na stvarni BDP Turske.

Ključne riječi: *Potrošnja električne energije, gospodarski rast, ARDL granični test*

PARCELA – MATRICA PLANERSKOG PISMA

SAŽETAK

Svrha ovog rada je utvrditi strukturna pravila planiranja za kvalitetu življenja stanovnika. Cilj istraživanja je utvrditi diobu parcela i pripadajuću strukturu općih termina u hijerarhiji od četiri razine jedinaca namjene, te matricu oznaka za njihove klasifikacije. Metodologija istraživanja obuhvaća analizu relevantne literature o svojstvima fractala, te iskustvo autora u pripremi, izradi i provedbi planova prostornog uređenja. Utvrđen je ustroj općih termina i oznaka za planiranje prostora na četiri razine uz primjenu hijerarhije namjene za tri skupine parcela i njihovih klasifikacija. Na taj način hijerarhija parcela vrijedi i za upravu i za struku podjednako, a za njihove korisnike pravilo koje se mora poštovati

Ključne riječi: *Hijerarhija, matrica, parcela, planersko pismo, struktura.*

Endnotes

1 The length of time includes various generations. One generation of inhabitants is equivalent to twenty years.

2 Please see the authors of the works and the list of their literature: Batty and Longley, 1994; Arlinghaus, 1985; Batty, 2005; Benguigui et al., 2000 L. Benguigui, D. Czamanski, M. Marinov and Y. Portugali, When and where is a city fractal?, Environ. Plann. B 27 (4) (2000), pp. 507–519. Full Text via CrossRef | View Record in Scopus | Cited By in Scopus (30)Benguigui et al., 2000; Frankhauser, 1994; Goodchild and Mark, 1987; Longley and Mesev, 2000; Longley and Mesev, 2002; MacLennan et al., 1991; Schweitzer and Steinbrick, 1998; Shen, 2002; Wentz, 2001; White and Engelen, 1993;http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.33.7130&rep=rep1&type=pdf.

3 The terms of construction are essentially are: "The Purpose, Size and Construction (Gross) Area of The Building With the Number of Functional Units" (The Act, 76/07, 38/09: article 106, section).

4 "The subject of property rights and other real rights can be any mobile (movable) or immovable property (real estate), except those who are not able to do so. Things in terms of this Act are physical parts of nature other than people that serve to be used by people. It is also considered that things are also all other things that are equivalent to them by law. Real estate is a parcel of the Earth's surface together with everything that is permanently connected to the surface or below it, if the law does not define it to be otherwise." (The Ownership and Actual Rights Act, 91/96, 73/00, 114/01, 79/06, 141/06, 146/08, 38/09).

5 See conditions: The Act, 76/07, 38/09, article 305-324.

6 Hierarchy is... a system of inferiority and superiority in institutions and various organizations, (Rječnik, 1998, 290).

7 Conceptually, planning documents for the wide rand narrower areas are questionable when they deal with the majority of fields on various planning levels (UPU and DPU) when the areas in the scope of the area are the same or the scope of the superior plan is narrower than that of the subordinate spatial plan which encompasses a wider area. There are great differences in the content of strategic documents (The spatial planning strategy and Spatial planning program of the Republic of Croatia) and spatial plans. It is more objective to use the term subordinate or superior spatial plan.

8 Introduction by Dr. Slavko Kulić, Ph.D. in the book Teorija planiranja održivog turističkog proizvoda (The theory of planning a sustainable tourism product) (Karlovac, 2008).

9 In the cases where the adjective 'construction' is added to a plot the third dimension (height), which can be above-ground, underground or a combination of these is also added. This is given the term building plot because it regulates design issues for construction on certain land.

10 This is evident in the transport of agro-pollution over long distances (acid rain, radiation, etc.), and soil, groundwater and sea (in recent years in mucilage) pollution. Some extreme conditions in space caused by long-term human effects have been noted, that is the manner in which natural resources are used so that socio-economic components of the system (political, cultural, demographic and economic) indicate the state of natural systems. These are evident in the natural, agricultural and urban-industrial types of ecosystems (Bajagić, S. et al.1990, 36).

11 See, http://hr.wikipedia.org/wiki/Slovo.

12 See, http://hr.wikipedia.org/wiki/Death_Note.

13 See, http://www.infoform.co.yu/graviranje/Brajevo_pismo.htm.

14 See, http://hr.wikipedia.org/wiki/Broj;

15 See, http://bs.wikipedia.org/wiki/Mjerna_jedinica

16 Protection should be implemented through special regulation and standard measures. These include: noise, radiation, environmental pollution, nature reserves, natural disasters, threat of war, health, safety, cultural monuments and others. Protection measures must be included in the development standards for spatial planning documents.

17 Spatial standards must be established scientifically. A possible definition which includes the development of the following is possible: the interdependence of optimal unit of measurement in the balanced function of life or existence of equilibrium of structural purposes: housing, labour, provision, rest, recreation, care, protection and education, collaborative transportation, communication and information for all age groups from conception to eternal rest. At the state-level in Croatia, there are different decrees for spatial standards in the Regulations 1983.-1986.

18 The final proposal of the DPU Saladinka St. Martin was made based on scientific studies (Poropat, et al. 2000) and the scientific articles (Poropat and Ružić, 2003), plans passed for the wider GUP area and the PPUG of the town of Poreč, which supports a small economy. Public media also support the highest political authorities in Croatia. Among others (purposes for existing buildings), the administrative brass of the relevant Ministry refused to give their consent to the said plan (letter of rejection from the Ministry dated 14 August 2008) because plots intended for hospitality-tourism must not have a capacity of less than 80 beds and the tourist resort must be one plot?

19 http://www.rogoznica.hr/dokumenti/Odluka%20o%20izradi%20PPU-a.doc.

20 http://hrcak.srce.hr/index.php?show=clanak&id_clanak_jezik=39351

Lorena Škuflić[1]
Danijela Rabar[2]
Sandra Šokčević[3]

UDK 330.368(497.5-3).
Original scientific paper
Izvorni znanstveni rad

ASSESSMENT OF THE EFFICIENCY OF CROATIAN COUNTIES USING DATA ENVELOPMENT ANALYSIS

ABSTRACT

Achieve high rates of economic growth is the government's task of any country because the future world order depends on the own ability to improve the living standards of its citizens. In Croatia, observed at the regional level, is present uneven economic growth according to the GDP per capita, while in line with the nominal growth rate economic development shows uniform movements. In recent years, Croatia has obtained a relatively high growth rates, but they were still below the average rate of other developing countries. Croatia did not follow the global development trends, and the reason for this lies primarily in the uneven economic growth by counties. Using data envelopment analysis, in this paper we determine efficient and inefficient counties, and which resources should be efficiently used to enhance regional production, and then also the total national production.[4]

Keywords: *economic growth, counties, efficiency, data envelopment analysis*

1. INTRODUCTION

Achieve high rates of economic growth is the government's task of any country because the future world order depends on the own ability to improve the living standards of its citizens. From the distant history to the present, many economists have tried to find answers on how to accelerate economic growth, or what are factors that allow some countries achieving higher rates of growth and leadership in the global rankings as measured by national production. Numerous studies have shown that the economic growth is a complex macroeconomic phenomenon, and therefore even today it can not be completely explained what determinants; in what measure and in what way contribute to the growth. The historical survey of theories of economic growth has shown that each theory pointed out one or more determinants which are key ones for the economic growth. Classical economists pointed out natural resources, namely land, and labor, neo-classicists capital and technology, and the new theory of growth stressed human potentials. Besides the mentioned determinants, the theories of growth give the key role in growth also to: innovations, research and development, international trade and export capacity, political and governmental factors, equipment investment, foreign direct investment etc. Therefore, government should design their economic policies to encourage: open markets of goods and service, promotion of liberal capital market, protection of private property rights, reasonable government spending, efficiency of the tax system, incentives for entrepreneurial activity, incentives for investment in human capital (active labor market policies) as well as macro-economic stability.

Considering the fact that economic growth is increase of the national production i.e. the quantity and value of manufactured products and services; economic growth can be identified with the production possibilities frontier. Specifically, a country that has moved its

[1] Ph.D. Associate Professor, University of Zagreb, School of economics and business, Trg J. F. Kennedyja 6, 10 000 Zagreb, Croatia, lskuflic@efzg.hr
[2] MSc, Assistant, Juraj Dobrila University of Pula, Preradovićeva 1, 52 100 Pula, Croatia, danijela.rabar@unipu.hr
[3] MSc, Lecturer, Manero Business College, Istarska 23/1, 52463 Višnjan-Poreč, Croatia, sokcevic@net.hr
[4] Paper received 6 January 2010.

production possibilities frontier has achieved a greater level of national production, which is possible using more resources and/or with technological progress. According to the economic theory, equilibrium is established at a point which is on production possibilities frontier (PPF), indicating an efficient economy; while point inside of the PPF means inefficient economy. In this paper we investigate the efficiency of Croatian counties with the goal to assess the efficiency of the development process in the entire country. We construct the production possibilities frontier with two outputs, gross domestic product per capita and gross wages per employee as indicators of achieved living standards of citizens and level of economic growth. Both outputs depend on several inputs, but in line with the theory and facts of insufficient availability of data, we take following inputs:

- Graduated students (Input 1) as indicator of human potential
- Foreign direct investment FDI (Input 2) as indicator of capital and technology
- Equipment investment (Input 3) as indicator of capital
- Exports (Input 4) as indicator of openness
- Active legal entities (Input 5) as indicator of entrepreneurship

Using data envelopment analysis (DEA) we tried to identify efficient and inefficient counties, and how the latter can increase efficiency, which in our case means to accelerate economic growth.

2. THE THEORETICAL FOUNDATION OF ECONOMIC GROWTH

Economic growth means increase in a level of production of one country or some region over a certain period of time. It includes only a positive change in the level of production of goods and services and could be analyzed like nominal growth defined as economic growth including inflation, or real growth which is nominal growth adjusted for inflation. Since the production depends on many factors such as number of inputs and technologies, economic growth is very complex economic phenomenon.

The theoretical foundation of economic growth can be studied from classical economist Smith. One of the biggest Adam Smith's contributions to the economic theory is the introduction of the term increasing returns into economy, based on division of labor, i.e. on specialization. Smith was aware that specialization is stronger in industrial production and, at the same time, very limited in agricultural production, that led to his theses that countries more oriented to industrial production become richer, whilst those oriented to agricultural production, are and remain poor. At the same time, Smith recognized also the importance of international exchange and free trade as engine of economic growth. Only free markets can lead to better country prosperity (Smith, 1776). He also stressed the importance of a stable legal framework in which business sector can operate. Based on the research of Smith, Ricardo deepened the theory of economic growth, formalized decreasing returns, but did not take into consideration innovation.

The following contributions to the theory of growth come from Harrod and Domar (Harrod, 1939; Domar, 1946) who, independently from one another, starting from different positions, came to the same conclusions. The Harrod-Domar model explains economic growth through savings. Savings should be equal investment, and investment leads to capital accumulation. Capital accumulation generates economic growth. This model suggests that the main variable to increase GDP is savings. Harrod-Domar model uses aggregate production function with fixed coefficients, assuming therefore constant returns. Its aggregate production function is linearly homogeneous in the stock of capital. It merges together the physical and human capital with the intellectual capital when the technical progress happens. Through technological progress is neutralized effect of diminishing returns. According to this model

high savings will finance a higher rate of technological progress resulting in faster growth process.

In the 50's of last century, the neo-classical theory of growth was created by Robert M. Solow (Nobel Prize winner in 1987). It is also called the neo-classical model of growth or Solow's growth model. The Solow model (Solow, 1956) emphasizes capital accumulation and exogenous rates of change in population and technological progress. Mentioned model predicts that all market-based economies will eventually reach the same constant growth rate if they have the same rate of technological progress and population growth. Moreover, the model assumes that the long-run rate of growth is out of the reach of policymakers but he stressed that combination of capital deepening & technological improvement explains major trends in economic growth.

New (endogenous) theories of growth are connected to the names of P. M. Romer, R. E. Lucas, E. Helpman and G. Grossmann, who start from the assumption that single decision-makers learn rationally not adaptively. That means that they do not change their behavior gradually, reacting to new information or different circumstances, but they learn new rules quickly and discontinuously. It is assumed that people in decision-making are turned towards future, expectations, not towards history, experience (Romer, 1986; Lucas, 1988). Romer observed that traditional theory failed to reconcile its predictions with the empirical observations that, over the long run, countries appear to have accelerating growth rates and, among countries, growth rates differ substantially. Endogenous growth theory says that government policy to increase capital or foster right kinds of investment in physical capital can permanently raise economic growth. Three main factors of economic growth are labor (increasing rate of population and participating rate of labor force, as well as the quality of labor force); capital (net and gross value of investment as well as quality of investment) and entrepreneurship (quality of entrepreneurs and entrepreneurial ability).

New Economic Geography (NEG) asserts that economic growth tends to be an unbalanced process favoring the initially advantaged economies (Krugman, 1991). According to this theory economic activity tends to concentrate in one region and also choose a location with a significant local demand generating a self-reinforcing process. Distribution of economic activity between regions can be explained by centripetal forces and centrifugal forces. The first include networks between firms, externalities and economies of scale while the second include negative externalities, transport costs and level of competitiveness. Consequently, NEG is mainly concerned with the location of economic activity, concentration and specialization rather that economic growth.

The economic growth is a complex macroeconomic phenomenon, and therefore even today it can not be completely explained what determinants, in what measure and in what way contribute to growth. The historical survey of theories of economic growth has shown that each of the said theories pointed out one or more determinants, which are key ones for the economic growth. Classicists pointed out natural resources and labor, neo-classicists capital and technology, and the new theory of growth stressed human potentials as well as entrepreneurship, while in recent theoretical approaches, economists distinguish location and development of cluster as main determinants of development process.

Besides the mentioned determinants, the theories of growth give the key role in growth also to: innovations, research and development, international trade and export capacity, political and governmental factors, equipment investment, foreign direct investment etc. Some of mentioned determinants we will also include in our research.

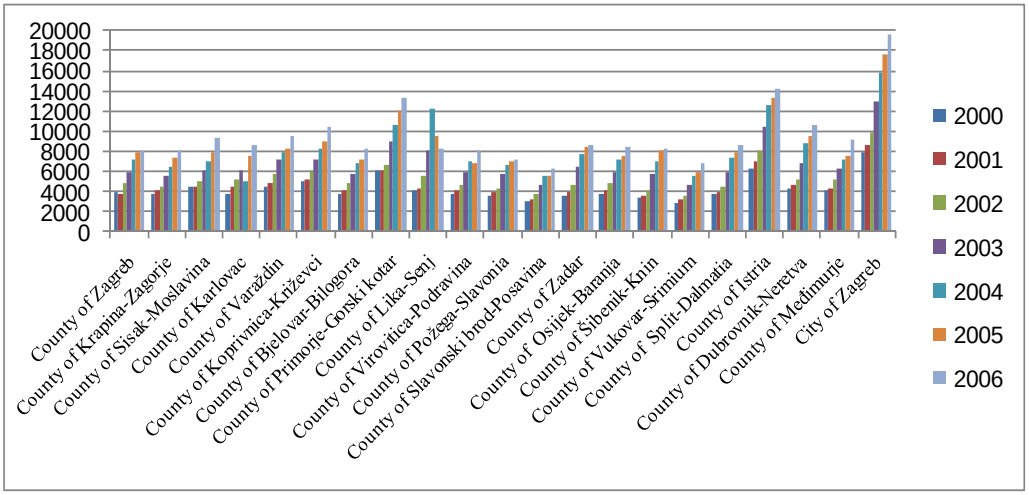
3. WHAT ARE THE MOST DEVELOPED COUNTIES IN CROATIA?

Global economic production grew 4 percent a year from 2000 to 2007, led by record growth in low- and middle-income economies. Developing economies averaged 6.5 percent annual growth of GDP from 2000 to 2007, and growth in every region was the highest in three decades. Europe and Central Asia and South Asia had their best decade in the most recent period (2000–07). East Asia and Pacific almost equaled their previous peak, reached before the 1997 crisis. For others the peak was in 1976 – before the oil price shocks of the late 1970s and the debt crisis of the 1980s (WDI, 2009). In light of the transition from planned to market economy, Croatia, like other transition economies faced with the transitional crisis whose bottom was reached somewhere between 1993 and 1995. Croatia has experienced a period of positive change in the economic field since 2000. In the period 2000-2007, Croatia grew 4.48 percent a year, while the reduction in 2008 (2.4%) caused the average rate fell to 4.24%. In accordance with the above, Croatia has grown more slowly than other developing countries in 21st century.

Despite the events on the world economic scene, the recession and the crisis that began in the USA spread to the rest of the world, the data showed that Croatia has its own weaknesses and limitations of economic growth (Škuflić, Šokčević, 2010). Specifically, relatively high growth rate of Croatian GDP was based on personal consumption and partly government spending that was financed by borrowing abroad generating a high level of external debt. At the end of 2008, Croatian external debt was 39 milliard of euro or 8,805 euro per capita; in terms of GDP it was 82% of GDP as well as 196% of export of goods and services. In 2009 external debt only increased and reached amount of 44 milliard of euro. Croatia used external debt to finance the development process, but unequally, and achieved economic growth rates and GDP levels varying by counties, which will be analyzed below. As at the regional level in Croatia the last available data are for 2006, in our paper we analyze the period 2000-2006.

Figure 1

GDP per capita of Croatian counties, 2000-2006 in US $

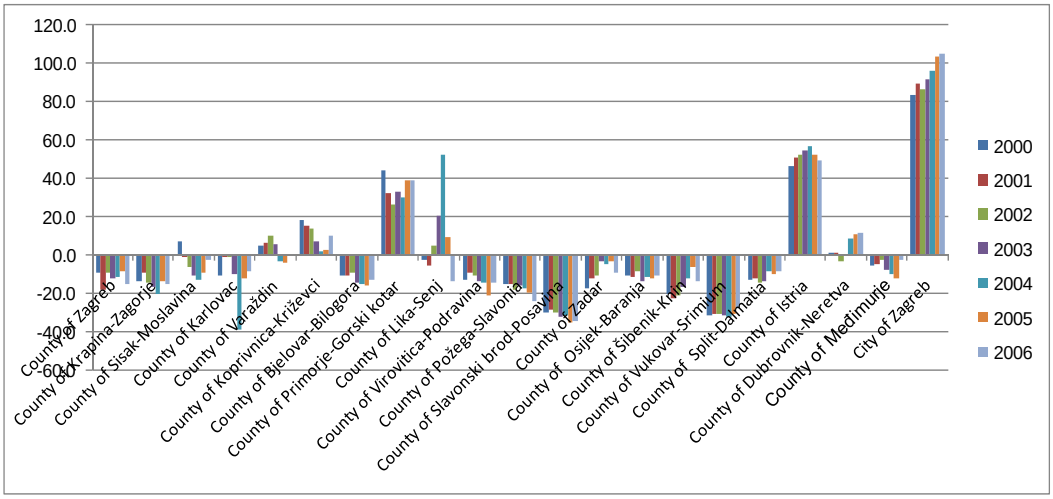


Source: Central Bureau of Statistics, www.dzs.hr

Figure 1 shows how varied the GDP per capita in the Croatian counties in the period since 2000 to 2006 year (expressed in U.S. dollars). It is obvious that the most developed

county is City of Zagreb with the highest GDP per capita. In that county, in all analyzed period, GDP per capita was between 7,840 USD (2000) to 19,523 USD (2006). The least developed county was Slavonski Brod-Posavina, which in 2006 had only 6,236 USD per capita, which is considerably lower than the average of all counties amounted to 9,532 USD in 2006. City of Zagreb represents the engine of development of the Croatian economy because its GDP per capita is more than twice of the Croatian average. According to the date from 2006, amongst the most developed counties can count those whose per capita GDP was higher than the Croatian average, and they were: Istria (14,267 US $), Primorje-Gorski kotar (13,242 US $), Dubrovnik-Neretva (10,636 US $) and Koprivnica-Križevci (10,515 US $). If we compare the county with the European average, the most developed City of Zagreb in 2006 reached 65% of EU average while the less developed Slavonski Brod-Posavina recorded only 20.8% of European average.

Figure 2
Croatian counties according to the achieved GDP per capita in relation to the average, 2000-2006

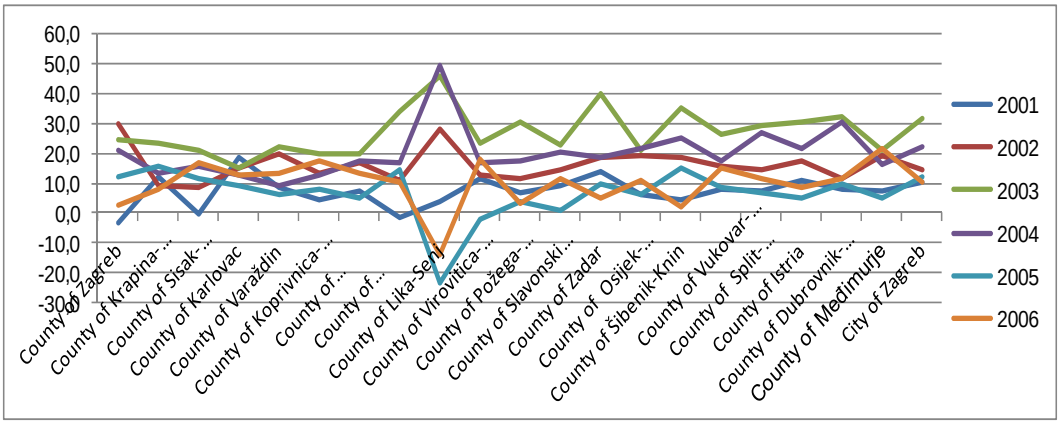


Source: Central Bureau of Statistics, www.dzs.hr

In 2000, the Croatian average GDP was 4,274 USD per capita. Above the average were the following counties: City of Zagreb, Dubrovnik-Neretva, Istria, Primorje-Gorski kotar, Koprivnica-Križevci. In 2001, the average Croatian GDP per capita amounted 4,581 US $, but the order of the counties was not significantly changed. In the line with figure 2 can be concluded that the most developed is City of Zagreb with a GDP of $ 13,210 per capita, followed by County of Istria. Another positive extreme (above the average of actual Croatian development level) are: Primorje-Gorski kotar, Varaždin, Koprivnica-Križevci, Dubrovnik-Neretva but also Lika-Senj. The reason why Lika-Senj is amongst seven most developed Croatian counties is a small number of people since it was taken GDP per capita as indicator of economic growth. At the same time, only that county reported higher fluctuations of the nominal growth rate of GDP which is evident by figure 3. The average growth rate of GDP was ranged between 0 to 30% per year, while the bottom and top are present in the Lika-Senj County.

Figure 3

The nominal growth rate of GDP in Croatian counties, 2000-2006



Source: Central Bureau of Statistics, www.dzs.hr

In line with the presented nominal growth rate can be concluded, at this stage of analysis, that the counties equally (effective or ineffective) used their resources, but the reason for the difference in the achieved development level should be in the unequal starting position. We try to confirm or reject our hypothesis using data envelopment analysis.

4. METHODS AND RESULTS

Data Envelopment Analysis (DEA) is a non-parametric linear programming-based technique used for evaluating the relative efficiency of homogenous operating entities / decision-making units (DMUs) on the basis of empirical data on their inputs and outputs. In only thirty years since it has been introduced (Charnes, Cooper and Rhodes, 1978), it has become a central technique in a wide range of productivity and efficiency analysis used when comparing organizations, companies, regions and countries. It was written more than four thousand scientific papers in the field (Emrouznejad, Parker and Tavares, 2008) and developed several models that differ in the choice of returns to scale (constant or variable), orientation toward inputs or outputs, etc.

Advantages over traditional methods of measuring efficiency are also the reason behind choosing this method for purposes of this analysis, and are reflected in the following:

- does not require knowledge of the explicit functional form linking inputs and outputs,
- handles simultaneously multiple inputs and multiple outputs where each of them can be expressed in different units of measure,
- does not require a priori determination of input and output weights, but they represent the variables which are chosen by the method in a manner that assigns the best set of weights to each evaluated DMU thus avoiding the subjective assessment of their importance and contributing to the objectivity of analysis,
- characterizes each DMU by a single result of relative efficiency,
- identifies the sources and amounts of inefficiency in each input and each output,
- proposes improvements to inefficient DMUs based on achieved results of efficient DMUs.

Efficiency assessment in the field of economic growth of Croatian counties using DEA has not been the subject of expert discussions or research which makes it even more interesting.

The Republic of Croatia is administratively divided into twenty counties and City of Zagreb which has status of the county. They represent 21 entities whose relative efficiency is evaluated on the basis of five inputs and two outputs. Inputs included into analysis are the number of graduated students and active legal entities, and the amounts of foreign direct investment (FDI), equipment investment and exports. Outputs are represented by gross domestic product (GDP) and gross wages. To make a comparison reliable, and bearing in mind great differences between counties in population and thus in the number of persons employed resulting in significant differences in all other listed indicators, the gross wages are given per person employed while all other variables are given per capita. All data were taken from the Central Bureau of Statistics (CBS) and the Croatian National Bank (CNB) and relate to the year 2006 as the last available at the Croatian regional level.

Initially collected data presented in appendix 1 needed to be scaled in order to meet DEA requirements for inputs to be exclusively positive and for their smaller amounts to be preferable. That is achieved by adding the same arbitrary number (600) to the amounts of FDI of all counties to make even worst results positive, and then taking the reciprocal of the data of all inputs. The relationships between the data derived by given procedures remained unchanged. The values of output variables are positive and larger amounts are preferable so we use them in their original form.

Thus derived data on inputs and outputs should be included for all the observed DMUs into a linear program that represents the selected DEA model. It derives an empirical efficient frontier (production possibilities frontier) bounding inputs from below and outputs from above, and measures the relative efficiency of each DMU. Since determined by the (best) existing DMUs, the efficient frontier represents an achievable goal that inefficient DMUs should gain on. The relative efficiency value lies between 0 and 1. DMUs identified as "best practice units" are given a rating of 1, whereas the degree of inefficiency of the rest is calculated on the basis of their distance from the efficient frontier and attributed to input excesses and/or output shortfalls which can be overcome by projecting on the efficient frontier.

Basic DEA models commonly used in applications are CCR[5] and BCC[6], named by initials of their authors.

CCR model is built on the assumption of constant and BCC model on the assumption of variable returns to scale activities. Therefore, knowing the characteristics of the production frontiers of the process to be analyzed is crucial for model type selection. As we could not determine that with certainty, the analysis was carried out under both assumptions. Because of similarity among the results obtained, CCR model is recommended.

In addition, the DEA model can be adjusted to the strategy chosen by management. If the aim is in reducing the input amounts by as much as possible while keeping at least the present output levels, the input-oriented model is used. If the aim is in maximizing the output levels under at most the present input consumption, the output-oriented model is used. Mentioned distinction between the input- and output-oriented model results in different courses and thus in different projection values of inefficient counties on the efficient frontier. Since economic growth is aimed at increasing both the selected outputs, the logical choice is output-oriented model that gives us the ability to explore to what extent we can improve outputs while not worsening the level of inputs used.

The output-oriented CCR model evaluates the efficiency of DMU0 by solving the following linear program (Cooper, Seiford and Tone, 2006)

[5] Charnes-Cooper-Rhodes model
[6] Banker-Charnes-Cooper model

$$\begin{aligned} & \min \ \eta = v_1 x_{10} + ... + v_m x_{m0} \\ \text{subject to} \quad & u_1 y_{10} + ... + u_s y_{s0} = 1 \\ & v_1 x_{1j} + ... + v_m x_{mj} - u_1 y_{1j} - ... - u_s y_{sj} \geq 0 \ \ (j = 1, ..., n) \\ & v_1, v_2, ..., v_m \geq 0 \\ & u_1, u_2, ..., u_s \geq 0 \end{aligned}$$

where n is the number of DMUs, m is the number of inputs, s is the number of outputs. Variables (v_i) ($i = 1, ..., m$) and (u_r) ($r = 1, ..., s$) represent input and output weights.

The dual envelopment form of this linear program is expressed as (Cooper, Seiford and Tone, 2006, 58)

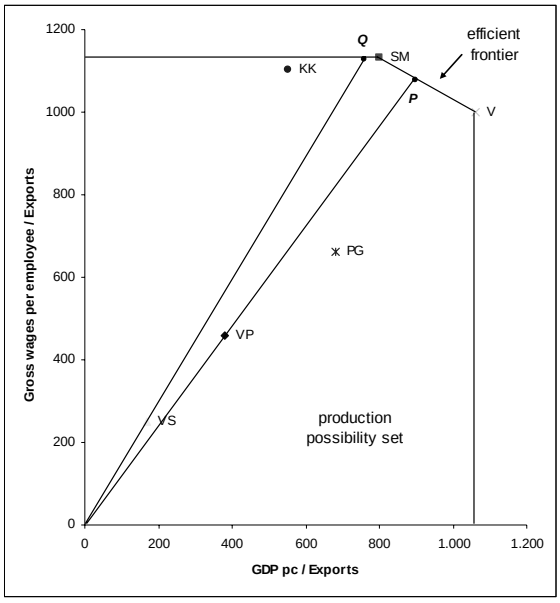
$$\begin{aligned} & \max \ \eta \\ \text{subject to} \quad & x_0 - X\mu \geq 0 \qquad (1) \\ & \eta y_0 - Y\mu \leq 0 \qquad (2) \\ & \mu \geq 0 \qquad (3) \end{aligned}$$

Condition (1) consists of m, condition (2) of s, and condition (3) of n constraints. In this case, $n = 21$, $m = 5$, $s = 2$. The optimal objective value η^* is the reciprocal of the efficiency result, and for inefficient DMU_0 also the output enlargement rate.

Efficient frontier of the output-oriented CCR model will be illustrated by the example of six counties in the model with one input (exports) and two outputs (gross domestic product and gross wages). In order to be able to plot it (figure 4), exports is unitized to 1 under the constant returns-to-scale assumption. Among selected counties, only Sisak-Moslavina (SM) and Varaždin (V) are efficient. Points P and Q represent projections of Virovitica-Podravina (VP) and Vukovar-Sirmium (VS) against the efficiency frontier. Positions of these projections show that both efficient counties are references to Virovitica-Podravina, while only Sisak-Moslavina is reference to Vukovar-Sirmium.

Figure 4

Production frontier of the CCR model



Source: Author's work

Inputs and outputs should be classified as controllable and non-controllable. Controllable are those which management can control and change, while non-controllable are given and can not be influenced by management. In this analysis we consider FDI as non-controllable output. This means that the constraint in condition (1) relating to FDI becomes equality while all remaining constraints and conditions do not change.

The assessment of Croatian counties relative efficiency was carried out using described DEA model based on empirical data computed by DEA-Solver-Pro software.

According to the analysis of the obtained results, average relative efficiency is 0.8492. This means that an average county, should only combine 84.92% of the currently available quantity of inputs and produce the same quantity of the currently produced outputs, if it wishes to reach the efficiency frontier. In other words, if it wishes to do business efficiently, should produce (1–0.8492)/0.8492 = 17.76% more output with the same input level. Minimum efficiency result is 0.5057 obtained by County of Vukovar-Sirmium. Seven more counties showed below average efficiency. Those are County of Slavonski Brod-Posavina (0.5065), Krapina-Zagorje (0.6177), Požega-Slavonia (0.6472), Osijek-Baranja (0.6545), Zadar (0.7012), Bjelovar-Bilogora (0.7603) and Virovitica-Podravina (0.7906).

Table 1 The reference set frequency

Efficient county	Frequency
County of Zagreb	6
County of Dubrovnik-Neretva	3
County of Sisak-Moslavina	1
County of Karlovac	3
County of Istria	10
County of Koprivnica-Križevci	12
County of Lika-Senj	0
City of Zagreb	3

Source: Author's calculations

Eight counties proved to be relatively efficient which makes 38% of the total number. It is known that counties that were rated efficient appear in reference sets of inefficient counties, and the frequency of occurrence can be considered an indication of whether they are a role model that other counties should achieve. Table 1 displays for every efficient county the frequency in reference sets of inefficient counties. County of Koprivnica-Križevci can be considered the most efficient as a reference for the most, as many as twelve inefficient counties.

Among a number of results are the projections of all counties against the efficiency frontier, i.e. the values of inputs and outputs that they should come up with to achieve relative efficiency. When it comes to efficient county, empirical data and their projections do not differ. Bearing in mind executed scaling of original data, differences between empirical and projected values in every input and output and their averages for all counties are displayed in table 2.

Table 2

Sources and amounts of inefficiency

Inefficient county	Input and output improvements					
	I1	**I3**	**I4**	**I5**	**O1**	**O2**
Krapina-Zagorje	8.18%	0.00%	0.00%	97.04%	61.89%	67.76%
Varaždin	33.20%	0.00%	0.00%	31.18%	6.51%	50.51%
Bjelovar-Bilogora	0.00%	60.85%	14.06%	0.00%	31.53%	115.23%
Primorje-Gorski kotar	0.00%	82.41%	0.00%	40.62%	0.11%	13.91%
Virovitica-Podravina	30.72%	0.00%	0.00%	30.46%	26.49%	101.21%
Požega-Slavonia	0.00%	7.80%	4.96%	21.27%	54.52%	110.07%
Slavonski Brod-Posavina	0.00%	63.68%	96.54%	23.87%	97.44%	97.44%
Zadar	0.00%	0.00%	14.64%	22.28%	42.62%	42.62%
Osijek-Baranja	0.00%	10.35%	24.85%	31.13%	52.79%	97.78%
Šibenik-Knin	0.00%	45.74%	53.30%	18.55%	16.07%	30.81%
Vukovar-Sirmium	0.00%	0.00%	26.54%	15.93%	97.73%	129.32%
Split-Dalmatia	0.00%	37.63%	0.00%	20.87%	2.26%	2.26%
Međimurje	17.72%	29.57%	0.00%	0.00%	14.64%	62.18%
Average per county	6.91%	26.00%	18.07%	27.17%	38.81%	70.85%

Source: Author's calculations

Significantly greater average influence of outputs rather then inputs is predetermined by selection of model orientation.

Gross wages per employee (O2) have far the strongest influence on inefficiency, almost twice stronger then gross domestic product per capita (O1). At the same time, the leading source of inefficiency among inputs are active legal entities (I5) with equipment investment (I3) very close behind it. Exports (I4) and graduated students (I1) have significantly lower impact on inefficiency, while FDI (I2) as non-controllable input does not change. The major modifications are needed in County of Varaždin (number of graduated students), Primorje-Gorski kotar (amount of equipment investment), Slavonski Brod-Posavina (amount of exports), Krapina-Zagorje (number of active legal entities), while Vukovar-Sirmium has relatively worst gross domestic product per capita and gross wages per employee. These facts indicate the need for deeper consideration of the causes of such devastating results and urgent measures to improve them.

Sources and amounts of relative inefficiency and the proposed improvements are extremely valuable information on which authorities can set goals that should be achieved and make decisions that will lead to them.

Since in described model gross wages per employee affect inefficiency significantly stronger than all the other inputs and outputs, we are interested to explore how their omission as output reflects the results of efficiency.

In new model with the same five inputs and gross domestic product per capita as the only output, the average relative efficiency decreased by 0.89% and now stands at 0.8416. Only three counties changed their relative efficiency amounts. In all three cases the amounts are reduced, and that is for 0.07% in County of Slavonski Brod-Posavina, 6.55% in Split-Dalmatia and 13.45% in Zadar whose efficiency amount is lowered to 0.6069. From this we can conclude that gross wages per employee favorably affect the amounts of efficiency of these counties which means that they are high comparing to average gross wages in other counties observed through selected inputs and outputs.

When it comes to amounts of (in)efficiency and number of efficient counties, the differences between models with and without gross wages per employee are not considerable. However, sources and amounts of inefficiency shown in table 3 are significantly different.

Table 3

Sources and amounts of inefficiency in the model without gross wages per employee

Inputs / Outputs	Average difference (%)	Most significant difference			
		County	Empirical value	Projection value	Difference (%)
I1	6.91%	Varaždin	303	403	33.20%
I2	0.00%	/	/	/	/
I3	41.94%	Split-Dalmatia	7,922.47	18,547.94	134.12%
I4	33.73%	Split-Dalmatia	9,423.83	29.947,14	217.78%
I5	39.99%	Zadar	1,836	4,075	121.90%
O1	41.08%	Vukovar-Sirmium	33,385	67,001	97.73%

Source: Author's calculations

Inefficiency is now most affected by equipment investment and little less by gross domestic product per capita and active legal entities which are followed by exports. Influence of graduated students on the efficiency results remained unchanged, while FDI is left uncontrollable and as such has no impact. The counties with major modifications needed, except for number of graduated students and gross domestic product per capita, have changed. Thus Split-Dalmatia has relatively worst amounts of equipment investment and exports, while Zadar has relatively worst number of active legal entities.

5. CONCLUDING REMARKS

Economic growth is always present issue in the scientific research as well as in political discussions. Economic theory has not reached consensus about the determinants of economic growth, but various theorists distinguish different factors. Relevance of some factor depends on the time and circumstances in which some economist operates. What we can say with certainty is that all countries want to achieve the higher growth rate and their paths in achieving this goal differ. In recent years, Croatia has obtained a relatively high growth rates, but they were still below the average rates of other developing countries. This is explained by the fact that Croatia belongs to countries with medium – high income, and according to the theory, level of economic growth and the growth rate are in inverse relationship. It can be concluded that Croatia did not follow the global development trends, and the reason for this lies primarily in the uneven economic growth by county.

Economic growth of Croatian counties was analyzed through the use of data envelopment analysis output-oriented CCR model on selected five inputs (number of graduate students and active legal entities, the amount of FDI, investment and exports) and two outputs (amount of gross domestic product and gross wages). FDI is classified as non-controllable input. It should be noted that we are dealing with relative efficiency which results are obtained by comparing all the counties exclusively on the basis of empirical values of their inputs and outputs.

Analysis revealed that eight counties are efficient. These are County of Istria, Dubrovnik-Neretva, Koprivnica-Križevci, Lika-Senj, Zagreb, Karlovac and Sisak-Moslavina and City of Zagreb. Using statistical and historical methods we get an almost identical result regarding the development level of counties in Croatia. For the remaining thirteen counties, we listed sources and amounts of inefficiency, i.e. inputs and outputs that cause inefficiency and their quantities that are used more (for inputs) and produced less (for outputs) then necessary compared with the efficient counties.

Among the thirteen inefficient counties, four are efficient in only one input while the other nine are efficient in just two inputs. In order to achieve efficiency, number of graduated students should be increased in four, exports in seven, equipment investment in eight and number of active legal entities in eleven counties. In comparison with efficient, all of thirteen inefficient counties could achieve higher gross domestic product per capita and higher gross wages per employee without affecting their input levels. Based on these results, guidelines for implementing necessary improvements to achieve efficiency are given. Those improvements are attainable because they are based on the results achieved by efficient counties, while mentioned guidelines provide support to the competent authorities, both at county and state-level decision-making.

BIBLIOGRAPHY

Central Bureau of Statistics, (2009), "Statistical Yearbook of the Republic of Croatia 2009"

Cooper, W. W., Seiford, L., Tone, K., (2006), *Introduction to Data Envelopment Analysis and Its Uses: With DEA-Solver Software and References*, (New York: Springer).

Domar, E., (1946), "Capital Expansion, Rate of Growth and Employment", *Econometrica*, (April 1946)

Emrouznejad, A., Parker, B. R., Tavares, G., (2008), "Evaluation of research in efficiency and productivity: A survey and analysis of the first 30 years of scholarly literature in DEA", *Journal of Socio-Economic Planning Sciences*, (42), 3: 151–157.

Harrod, R., (1939), "An Essay in Dynamic Theory", *Economic Journal*, (May 1939)

Krugman P., (1991), "Increasing returns and economic geography", *Journal of Political Economy*, 99

Lucas, R. E., (1988), "On the Mechanics of Economic Development", *Journal of Monetary Economics*, Vol. 22

Romer, P., (1986), "Increasing Returns and Long Run Growth", *Journal of Political Economy*, Vol. 94

Smith, A., (1776), *An Inquiry into the Nation and Cause of the Wealth of Nation*, **(**Glasgow Edition, Book IV).

Solow, R.M., (1956), "A Contribution to the Theory of Economic Growth", *The Quarterly Journal of Economics*, Vol. 70, No. 1 (February 1956), The MIT Press

Škuflić, L., Šokčević, S., (2010), "Determinants of the Economic Growth in Western Balkans Countries", *Fifth International Conference (ICES2010)* with the central theme "Economic Development Perspectives of SEE Region in Global Recession Context", in the process

World Bank, (2009), World Development Indicator, www.worldbank.org (15.03.2010.)

PROCJENA EFIKASNOSTI HRVATSKIH ŽUPANIJA PRIMJENOM ANALIZE OMEĐIVANJA PODATAKA

SAŽETAK

Postizanje visokih stopa gospodarskog rasta je zadaća vlade svake zemlje jer budući svjetski poredak ovisi o sposobnosti unapređenja životnog standarda građana svake zemlje. U Hrvatskoj je, gledano na regionalnoj razini, prisutan neravnomjeran gospodarski rast gledajući BDP per capita, dok prema nominalnoj stopi rasta gospodarski razvoj pokazuje ujednačena kretanja. U posljednjih nekoliko godina Hrvatska je ostvarila relativno visoke stope rasta, ali su one još uvijek ispod prosjeka stopa drugih zemalja u razvoju. Hrvatska nije slijedila globalne trendove razvoja, a razlog tome leži prije svega u neravnomjernom gospodarskom rastu županija. Primjenom analize omeđivanja podataka, u ovom smo radu utvrdili koje su županije efikasne, koje resurse neefikasne županije trebaju efikasnije koristiti za povećanje regionalne, a time i ukupne nacionalne proizvodnje.

Ključne riječi: ekonomski rast, županije, efikasnost, analiza omeđivanja podataka

Appendix 1 Initial data on inputs and outputs

County	Inputs					Outputs	
	I1	I2	I3	I4	I5	O1	O2
Zagreb	357	-565.49	5,152.25	4,225.65	2,016	39,724	61,625
Krapina-Zagorje	328	962.61	9,429.47	12,696.63	1,351	39,723	52,973
Sisak-Moslavina	336	155.85	3,571.04	17,105.25	1,319	46,675	66,126
Karlovac	403	-199.71	4,411.51	8,122.67	1,687	43,836	63,884
Varaždin	303	638.87	7,004.19	21,864.11	1,749	48,485	45,752
Koprivnica-Križevci	349	107.00	5,465.59	10,129.59	1,573	54,586	108,844
Bjelovar-Bilogora	307	-9.58	2,982.47	5,155.93	1,541	43,323	47,930
Primorje-Gorski kotar	461	3,726.15	11,721.21	10,151.39	3,275	66,993	65,233
Lika-Senj	297	-52.11	6,561.62	771.54	1,648	50,153	45,034
Virovitica-Podravina	275	64.27	5,695.97	9,200.51	1,293	41,255	49,908
Požega-Slavonia	331	17.64	3,962.20	7,512.96	1,185	35,912	45,914
Slavonski Brod-Posavina	304	63.23	2,393.08	3,630.49	1,068	30,513	52,871
Zadar	433	3,005.77	8,357.87	6,394.03	1,836	41,592	63,136
Osijek-Baranja	336	796.14	6,601.74	10,353.79	1,533	42,738	52,771
Šibenik-Knin	448	232.81	5,720.97	9,865.54	1,982	39,779	61,956
Vukovar-Sirmium	273	127.97	3,439.59	5,005.56	1,017	33,885	49,750
Split-Dalmatia	521	739.21	7,922.47	9,423.83	2,474	43,766	67,293
Istria	369	1,608.43	19,714.03	28,551.17	4,455	71,727	82,973
Dubrovnik-Neretva	637	2,012.74	10,377.19	1,619.37	2,811	53,522	60,900
Međimurje	350	394.80	6,322.50	13,746.80	2,322	44,662	52,453
City of Zagreb	633	18,922.83	56,623.23	28,499.41	4,610	104,039	96,386

I1 – graduated students (per 100.000 population), kuna
I2 – FDI (per capita), kuna
I3 – equipment investment (per capita), kuna
I4 – exports (per capita), kuna
I5 – active legal entities (per 100.000 population)
O1 – gross domestic product (per capita),
O2 – gross wages (per employee), kuna

Source: CBS (www.dzs.hr), CNB (www.hnb.hr) and author's calculations

Sandra Krtalić, Ph.D
Aleksandar Major, B. Sc.

UDK 355/359:339.9(100)>(73)
355/359:339.9(100)>(410)
355/359:339.9(100)>(497.5)
Review
Pregledni rad

MILITARY EXPENDITURES IN THE MAELSTROM OF THE GLOBALIZED WORLD

ABSTRACT

The concept of military expenditures is as old as the first antic civilizations. The military, as the first and only line of defense, has always had a great role in the expenditures of countries. Military expenditures changed through history, as has the very understanding of the armed forces which represented the military might of a country. Through the evolution of society many other priorities have emerged concerning state expenditures, but because of their focus on population defense, upholding peace and protecting the country borders as the first and primary forms of public goods, have the military expenditures kept their steadfastness through the entire human history.
The globalized world we live in today has changed all this, especially when speaking about insuring the safety of our country against foreign and domestic threats. The development of technology and the globalization itself have drastically changed the concept of waging war and as a result influenced the very structure and level of military expenditures. The level of technology is one of the best indicators of a countries development, but also of the power of its military force. Naturally, military might is very hard to sustain without equally adequate economical power since a developed economy and a strong industry is exactly what enables the development of defense potentials of a country and it's financing.[1]
Key words: *military expenditures, military spending, globalization, arms, USA, Great Britain, Croatia*

JEL classification: H5, H56

1. THE WORLDS GEOSTRATEGIC SITUATION

A whole and perfect understanding of the general international security state is the prerequisite for creating any national defense program. The international situation is in a constant state of flux primarily since it is determined by the economy and politics of each individual country, especially from the most developed ones. This means that it's very hard to estimate the future development of events and that the military force needs to be able to cope with every challenge modern warfare has to offer.

With the exception of the World Wars, the longest period of militarization has been the Cold War, from the late 40s until the end of the 80s of the last century. During this period the NATO alliance and the Warsaw Pact have invested greatly in their military which represented almost 85% of the total world military expenditures, reaching the highest point in the mid 80s of the last century with the sum of one trillion US dollars per year.[2] Along with huge spending on conventional weapons, the two superpowers were waging a constant race in

[1] Paper received 9 September 2009.
[2] Leger Sivard, R. (1987-1996). edition „World Military and Social Expenditure", World Priorities, Washington DC

nuclear armament which resulted in more than 70.000 nuclear missiles worldwide. The Cold War, along with the process of mass armament, had three other important effects. The first was the redirection of huge amounts of money dedicated to social welfare and development projects and the redirection of intellectual and technological resources to military programs as the second effect. But, the most important was the deflection of conflict from a direct confrontation between the superpowers to ""alternative" conflicts which they led indirectly. Many wars from 1945 until the end of the 20th century, which include Korea, Vietnam, Afghanistan and other countries, were led in the shadow of the Cold War and caused many casualties.[3] The early 90s of the 20th century were marked by three big changes concerning army conditions and its deployment. The first was the fact that the states of the former Soviet Union were undergoing a deep economical crisis which, among other things, has resulted in the total collapse of their military forces. The second big change was a combination of unilateral and bilateral measures of nuclear disarmament through which the arsenals of the USA and Russia were decreased from 70.000 to 20.000 nuclear missiles, although the stored nuclear warheads were never permanently deactivated. Also, an important international agreement has been signed[4] on the Chemical Weapons Convention which led to the destruction of great chemical arsenals, a very technologically demanding process which required a few years to complete. In the end the US military forces have undergone a progressive transformation. There was a considerate decrease in Cold War type weaponry (heavy armored vehicles and tanks in Europe, US Navy anti-submarine warfare systems), but at the same time the spending for maintenance and upgrading of the long range warfare systems has increased. Great attention has been dedicated to amphibian forces, aircraft carriers, long range air systems and Special Forces, as to the national and global missile defense shield. By the end of the 20th century the United States were the only country with a true global reach and their policy of using military force to maintain this "state of security" was deeply rooted.

The worlds political scene has undergone through major changes in 1991 after the collapse of the Soviet Union, Yugoslavia and other socialist countries, but this change didn't bring the expected positive effects because the funds promised from the reduction of military budgets were still being invested in the national defense and police armament. The collapse of the Warsaw Pact wasn't met with the similar gesture from the USA in the sense of disbandment of the NATO alliance. The United States of America soon afterwards showed their true intent for global domination when George H.W. Bush announced, in a Pentagon document from March 1992 named "Defense Planning Guidance"[5] and constructed by Paul D. Wolfowitz (U.S. Undersecretary of Defense for Policy), plans not only for the USA but also for the entire World. The first mission of this plan was to stop the emergence of a new rival taking also into consideration the interests of the most developed countries thus discouraging any kind of dispute over the American leadership or any attempt of destroying of the established political and economical order. It has also been stated that the USA has to maintain the deterrent mechanisms for any possible rival and that they will keep and expand the functions of the NATO alliance so they could prevent the creation of an independent European safety arrangement. The Gulf War followed with the goal to drive the Iraqi armed

[3] Rogers, P. (2005). „A World Becoming more Peaceful?" na www.*OpenDemocracy.net*,

[4] A bilateral agreement between the USA and Russia signed in 1990 to stop the production of chemical weapons, reducing their stockpiles by 20% and the beginning of its destruction in the year 1992. - www.opcw.org /Chemical Weapons Convention/Genesis and Historical Development.

[5] The document draft, known also as the *Wolfowitz Doctrine*, has "leaked" from the Pentagon and published by the New York Times, March 8th 1992. George Packer later used and explained the same document in his book „The Assasin's Gate: America in Iraq" in 2005. - www.nytimes.com/1992/03/08

forces out of Kuwait and in this way to secure the precious oil fields. The lands that were caught in these changes were going through rough times. In some of them there even came to ethnic and territorial conflicts with the weakening and destabilization of government control and authority which resulted in the inability to stop the escalation of organized crime. The implementation of western political, economical and cultural values in this new environment led to a counter reaction of those political groups that had a hard time accepting these changes. In many countries the sense of discontent among the socially affected population led to their turning to socialist, nationalist or religious radicalism. All those problems that were suppressed in the bipolar world order now became the most important element of international relations. Countries and national securities had to face new threats which were not any more hostile relations between nations, but the constantly growing socio-economical disparities and the inadequate development of large regions strengthened by the spread of radical ideology, especially in countries with a weak government that was allowing groups of extremists the organization of terrorist acts across the globe.

Before the attacks of September 11 in 2001, the Bush administration rose to power with neoconservative beliefs deeply imbedded into their foreign and security politics. Numerous multilateral weapon control agreements were regarded as limiting and unfit, they were against the new International Court of Justice and they withdrew from the Kyoto protocol. The USA firmly believed their mission was to encourage other countries to follow their economical and political system because it would surely lead to a safer world. The attacks of September 11 shattered this concept. The Taliban regime in Afghanistan was quickly dealt with, the "Axis of evil" composing of Iraq, Iran and North Korea was identified and the strategy of preemptive strikes against potential threats was adopted, all under the wider "Bush Doctrine".[6] With 20 military bases and several large combat groups with air support from the aircraft carriers, the USA established a very strong military presence in the Middle East. Despite this, terrorist activity remains high, even higher than before September 11. There is no end in sight to these conflicts and as mentioned previously there are various interests to keep the whole Persian Gulf a volatile and conflict torn region for as long as possible.

Technology is today probably one of the best indicators of a countries development, but at the same time also of its military power. Naturally, military power is hard to maintain without sufficient economical power, because strong industry and a developed economy allow the development of one's defense potential. China had for many years the largest land army, but with very limited military capabilities. While the size of the Chinese army was enormous, the training quality wasn't high and the technology they were using was outdated. In the past two decades the Chinese economy has been growing extremely fast and the government started the modernization of their armed forces constantly increasing the funding for military needs. This modernization is very expensive, but the advantages of technologically advanced systems and units are more than worth the cost and this is the main reason why large investments are being made for the development of cutting edge technologies. The demonstrations of modern weapons capabilities, which are the result of USAs technological superiority, left many governments with a sense of discomfort after seeing how much superior were the American systems to their own. Advance technologies give the USA military capabilities which are by far superior compared to the rest of the world. The geopolitical implications of new technologies on international relations and foreign policy are great. Countries that own and are developing new technologies will be more and more advanced and

[6] A study from the John Hopkins University which was published in the British medical journal "The Lancet" in October 2006.

as the gap between them and the lesser sophisticated countries grows, so will the possibility of conflict. The increase in productivity and economical benefits that innovations allow will result in a shift of economical influence marginalizing the less developed countries and putting them in unfavorable economical position. The losers in this technological race will lose their economical productivity, which can lead to a decreased GDP and a possible economical depression.

The security environment of the future will be shaped by international threats which will vary from wars, violent extremism, pandemics, natural disasters, all the way down to the problems that are not being handled properly like poverty, organized crime and the degradation of the environment. Technology will remain the key factor which will influence a countries military power, but at the same time it will be a source of power for violent extremists, not only in the form of higher destructiveness of their actions but also for propaganda purposes. Global communications have huge power which can be used, through information filtering and their manipulation, to worsen and deepen the psychological effect of possible threats and events right after incidents. The sum of all these conditions will lead to a higher state of anxiety and insecurity on an international level, with a high concern for personal safety, well being and even sustainability of human existence. Population growth puts the biggest strain on the already depleted natural resources and if we take into consideration that by the year 2050 there will be 9,5 billion[7] inhabitants on this planet, with the biggest growth in the poorest countries, than we can with certainty predict the problems that those countries and the entire world will face. The division between the rich countries and the poor ones will grow faster than ever and this very fact will fuel the hatred towards all that is modern and advanced. This hatred will be primarily based on fear, real and imaginary.

[7] Official UN assessment, New York, February 24th 2005. Source: www.un.org

2. TRENDS IN MILITARY EXPENDITURES

Military expenditures have been changing throughout history as has the very meaning of the armed forces that were the military power of a country. While the development of firearms was still rudimentary and primitive, man count and their motivation were the determining factors of an army's size and force potential (B. Liddell-Heart, C. Clark).[8] The end of the 20th century practically marks the end of the massive armies' era and the turning point in this evolutionary process was the Gulf War in 1991, which was very different from any other conflict in the past century and marks the beginning of a new type of armed conflicts later known as "asymmetric wars". This type of armed conflict redefines the military skill tradition and customs by introducing new elements into the tactical military operation plan. The first time in history military operation planners use certain market logic when contemplating about the use of its armed forces and weapon systems because by the end of the 20th century weapons and military technology became extremely expensive. Managing and piloting these new combat systems has also become very complicated and requires a special crew selection with, from the (public) expense aspect, a long (and expensive) training and education. In this situation, the loss of every combat aircraft, battleship or modern tank is a serious problem, not only because valuable war machinery was lost and it's replacement is a heavy strike on the tax payers (which they don't take very lightly), but foremost because when such a loss occurs we usually also lose the highly trained crew which cannot be replaced in a short period of time. This is the main reason why it is necessary to carefully manage the troops and cut down the losses to the minimum.

The next table shows the ten most powerful world powers according to their active troop count. However, the order of countries in this table does not relate to their real combat power, but only to their army's troop size count. Even though China and India have a very big military growth potential, the USA is currently the mightiest power in the world and the main reason behind this is their technological supremacy which is ensured with high investments into military programs and the military itself. Even when we consider how well its forces are equipped, the USA is far ahead from every other country in the world which only proves their global range of operations.

[8] Lidell Hart, B. H. (1954). „Strategy: The indirect approach", Frederick A. Praeger, New York.

Table 1

The ten most powerful world forces in 2008.

Rank	State	Active troops (in thousands)	Reserves (in 000.)	Defense Budget (in billions USD)	Tanks	Aircraft carriers	Cruisers	Destroyers	Fregates	Corvettes	Nuclear submarines	Air force*	Nuclear weapons
--	The World	17,442	44,925	2,410.00	86,681	78	71	204	319	335	150	27,489	20.000
1.	China	2,255	800	70.2	7,580	0	0	26	49	~93+	8	1900	410
2.	USA	1,452	1,458	611.1	7,620	12	22	61	30	5	71	2471	5400
3.	India	1,325	1,155	40	4,160	2	0	8	13	24	0	1430	40-50
4.	DNR Korea	1,190	7,700	4.89	3,500	Nd	Nd	Nd	6	3	Nd	590	4-13
5.	Russia	1,037	1,150	50	22,950	1	~5	23	~15	~145	36	2,118	14,000
6.	Rep. Korea	690	4,500	28.9	2,360	0	0	7	9	28	0	610	0
7.	Pakistan	619		4.4	2,461	0	0	0	7		0	340	24-48
8.	Iran	545	350	6.2	1,613	0	0	0	5		0	271	0
9.	Turkey	514	380	8.7	4,205	0	0	0	24	6	0	1,199	NATO**
10.	SR Vietnam	484	4,000	3.47	1,315	0	0	0	6	5	0	221	0

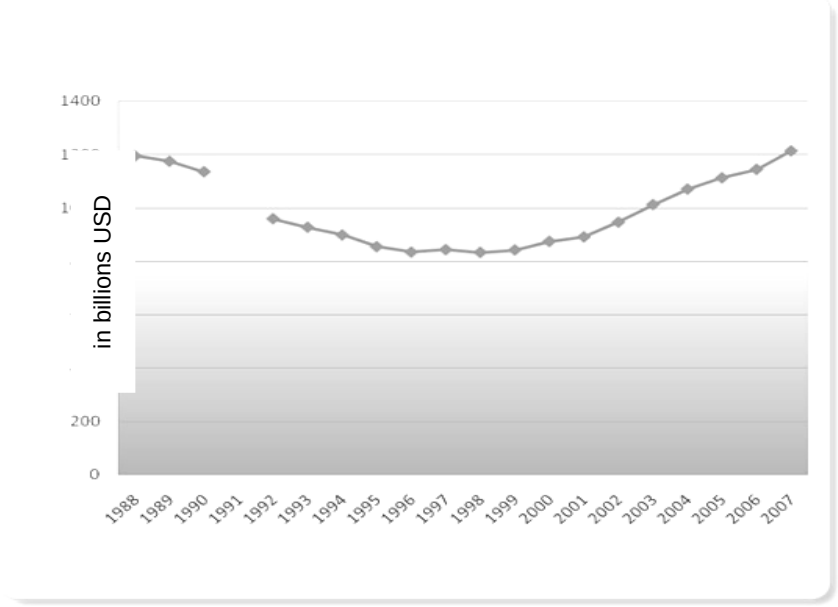
All provided data is official. Where official data could not be retrieved or is missing, official approximations from various institutions have been used.
*The stated numbers refer only to combat aircraft.
**Turkey is using the NATO nuclear weapon sharing strategy. It doesn't have any nuclear missiles, but it has tactical nuclear capabilities.
Source: Departments of Defense from various states, Centre for Strategic and International Studies (CSIS), Centre for International security and cooperation (FAS), CIA, NTI (2005 – 2009)

The trend of world military expenditures between the years 1988 and 2007 is shown in the next chart from which we can clearly see a sudden drop in the total military expenditures after the collapse of the Soviet Union and the Warsaw Pact, but also a constant growth in the period from the year 2000 to 2007. The total world military expenditures for the year 2007 have been estimated to 1.339 trillion USD, which is a real increase of 6% in comparison to the year 2006 and an increase of 45% in comparison to 1998. If we compare this amount to the world GDP, 2.5% of the world gross domestic product is used for military expenditures or 202 USD per capita on the world level. The region with the biggest expenditure growth over the 10 years period (1998 – 2007) was Eastern Europe with 162%. This region has also, in 2007, recorded the largest increase in expenditures of 15%, from which 86% refers to Russia whose increase was 13%. The US military expenditures make 48% of the total world military spending in 2008. Compared to the year 2001, American military expenses have risen by 67%, mostly because of larger spending to fund military operations in Afghanistan and Iraq, but also because they increased the basic military budget. The other regions that recorded military expenditures over 50% in this 10 year period are North America with 65%, the Middle East with 62%, South Asia with 57% and Africa and East Asia both with 51%. Regions with the lowest increase were West Europe with 6% and Central America with 14%.[9]

[9] Stockholm International Peace Research Institute Yearbook 2008

Chart 1

World military expenditures in the period between the years of 1988 and 2007

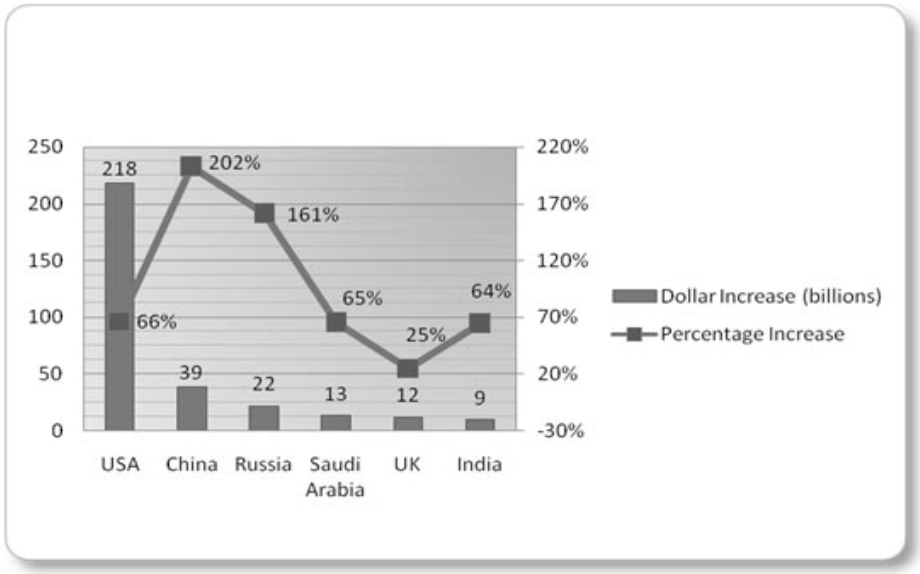


Source: Stockholm International Peace Research Institute Yearbook 2008, www.sipri.org

From the following chart we can see that in the year 2008 the US military spending was higher than ever in the period after World War II. However, because of the US economy and total public expenditure growth, the economical and financial burden of military expenditures is lower now than ever before in the stated period. Chinese military spending rose three times in the last decade, but because of their fast economic growth, this level of spending represents no burden whatsoever and amounts to 2.1% GDP. Except for China, large increases in military expenditures have been recorder in the South Caucasus lands, Georgia, Armenia and Azerbaijan. The reason behind this is probably the sensitive and unstable situation in this region which is marked by rebellions and conflicts, but also the involvement of external factors. This increase in expenditures has been made possible by the boosted economy from oil and gas exports. The factors that encourage this world military expenditure growth include state foreign policy goals, real and estimated threats, armed conflicts and the policy for participating in multilateral peace missions, all balanced on the available economical resources.

Chart 2

Increase of military expenditures for the chosen countries in the period between the years 1998 and 2007



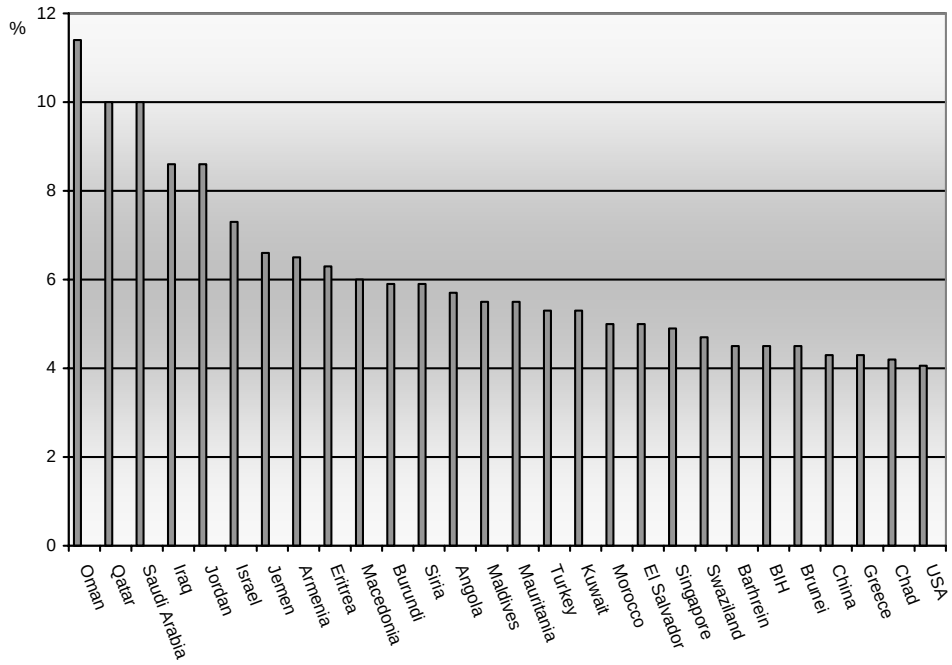
Source: SIPRI Military Expenditure Database, 2009

When military expenditures from different countries are observed, their level is very important since it directly influences the development and purchasing power of a country. Comparing the level of spending will give us an insight to which are the most powerful countries in the world, but it won't tell us how these expenditures affect its economy. To better understand this, we have to observe military expenditure as the percent of GDP of these countries. The percentage of each expenditure in the GDP reveals the priorities of the observed country. If military expenditures have a high percent in the GDP, it is safe to assume that this country is military oriented. USA, with the highest military expenditures in the world which make only 4% of their GDP, is the best example that a high military budget doesn't have to have a deep influence on the economy of a country.

From the next chart we can clearly notice that Oman (11.4%), Qatar (10%), Saudi Arabia (10%), Iraq (8.6%), Jordan (8.6%) and Israel (7.3%) are on top of the list of countries with the highest military expenditures percent in the GDP. All the named countries are located in the Middle East, which is the main focal point of numerous conflicts in today's world. Figures for some of the countries are not available for the reasons of isolation politics or secrecy of data concerning military affairs, as in the example of North Korea. Unofficial data for North Korea suggest a level of military expenditures of around 25% of their GDP. High military expenditure levels as percent of the GDP are characteristic for less developed countries that still rely on outdated military forces with high maintenance costs.

Chart 3

Classification of countries according to their military expenditure percent of GDP in 2008.



Source: Index Mundi, 2009

Although big growth in military expenditures in most countries has marked the last decade, the year 2009 will be in many opinions a turning point that could stop this trend. The main reason behind this opinion is the big economic crisis which slowly spreads and affects countries one after the other. The decrease in economic growth, recession and various saving methods will greatly affect military expenditures in most countries and it is safe to expect their decrease. Still, the threat of North Korea and Iran and their frequent nuclear tests brings up the issue of global security and it calls the international community to find a solution, in peaceful or military nature. Military and economic analysts throughout the world are torn between two contradictory views: to lower military spending in order to lower the general level of public spending or to rise military spending in order to control the growing global instability and the changes in military power.[10] The basic budget of the US Department of Defense, not including the funds for nuclear weapons and the 12 billion dollars each month for the "war on terror", rose between the years of 2001 and 2009 by almost 70%. The economic climate, globalization, war against terrorism and the rapid advancement of China and India, gave all the needed excuses and material both to the politicians and military experts. However, the global economic crisis combined with the drastic reduction in oil prices, forces them to think hard about future military spending. The Russian economy[11] is taking a nose dive in the middle of a reform and expansion plan for their military forces, which have been

[10] Abbott, C., Rogers, P., Sloboda, J., (2006). "Global responses to global threats: Sustainable security for the 21st century", Oxford Research Group, Oxford

[11] Homeland Security Research (2009). "Balancing Military Spending and Economic Crisis", www.homelandsecurityresearch.net. Refers to all the named countries.

in a state of disarray ever since the collapse of the Soviet Union. Oil profits, which were supposed to be used to finance a newly equipped and influential Russian military, have gone dry leaving many plans and ideas unrealized. Even the Russian arms and military technology export, which is a valuable source of income and foreign currency, is growing weaker as the economic crisis is decreasing the credit potential of potential buyers. The Indian government and their military experts are in a very unpleasant situation. In one hand, the Indian economy is in a very difficult position because of the economic market decrease throughout the world and will have a big impact on the Indian military budget, which was growing very fast over the whole last decade. On the other hand, the vulnerability on foreign and domestic threats, both conventional and asymmetric, is constantly growing. Indian defense experts point out that their main rivals, China and Pakistan, are spending around 4% of their GDP for military expenditures, while the defense budget of India is barely 2%. Taking into consideration the whole situation, it has been decided to increase the Indian defense budget for the next year to 40 billion USD (3% of GDP), slowing down economic trends, which can lead even to protests. Chinese military spending also shows its dependence on the large long term economic growth. It is very hard to acquire actual data, but experts estimate that by the year 2010 the Chinese military budget will be between 100 and 180 billion dollars. [12] The Chinese army modernization is in danger because of the world market weakening economic activity, which may lead to serious internal destabilization or to the growing sensation of vulnerability to outside factors. Even the British army is facing problems with the lack of funds. Politics and profession are trying to find a balance between perceived threats and the needed budget cuts. In the meantime, the British army is constantly diminishing, while its involvement in Iraq and especially Afghanistan presents a great strain for the soldiers and the equipment. The proven vulnerability to terrorist threats puts additional pressure on this situation, and with the world economy in crisis, neither the constituency nor the politicians want to hear about how it is important to spend billions on wars that the majority considers to be an excuse to the American imperialistic ambitions.[13]

The traditionally big military equipment buyers, like the states of the Persian Gulf, are also feeling the consequences from the drop in oil prices and are forced to change their military plans and projects. This will surely affect the American, French, British and every other arms exporter. If this crisis persists, there is a high chance for the total cancellation of military projects and military equipment purchase, thus damaging military suppliers and the workers in the military industry through the entire western hemisphere. With the economic crisis and its long term consequences and the fact that countries around the world are growing more and more accustomed to the influences of this crisis on their economy, it is likely to expect decreases and stagnation of military budgets in the future. In the next few years it will be very hard to make long term plans for military spending, but changes are definitely necessary. A way has to be found on how to keep the delicate balance between military expenditures and economic growth, decreasing the basic military budgets, but at the same time increasing the readiness and efficiency of the army itself and the whole defense system.

[12] Official Chinese data show that the amount in question is only 60 billion dollars.
[13] Feickert, A. (2005). „U.S. Army's Modular Redisgn“ CRS report for Congress

2.1. USA – THE MEANING AND LEVEL OF MILITARY EXPENDITURE

The United States of America are without a doubt the strongest military force in the last few years. The American military spending is the main determinant of the world military spending, which is on the raise since 1998. If compared to the rest of the world, the following conclusions about the American military spending can be made:

- The US military spending makes almost for the half of the entire world military spending (48%).
- The US military expenditure is higher than those of the combined expenditure of the next 46 countries.
- The US military expenditures are 5.8 times higher than those of China, 10.2 times higher than those of Russia and 98.6 times higher than the military expenditures of Iran.
- The US spending is higher than the combined spending of the next 45 countries.
- The USA and its strongest allies (NATO countries, Japan, South Korea and Australia) spend together 1.1 trillion dollars on their armies, making up for 72% of the total world military spending.
- The six possible "enemies" (Cuba, Iran, Libya, North Korea, Sudan and Syria), Russia and China have a combined military spending of 250 billion dollars, which is in fact 29% of the US military budget.[14]

From the next table is noticeable that in the observed period of time there is a national defense budget growth, which implies the growth of the total military expenditures. The US Government Budget is very complex, especially its military component. In the part of the budget intended for the Department of Defense, combat operations and their costs are not included. These funds are additionally allocated through a Congress resolution. The costs for nuclear weapons, which are allocated under the Department of Energy, amount to 29 billion dollars in 2009. Accordingly, every other expenditure like the war veteran spending, military training and rescue, health care plans and covert operations can be allocated under other departments or counted separately. In this way the military expenditures are being concealed because the military budget is already too big. The decrease in spending for the last two years is the consequence of the reduction and reorganization of the armed forces in Iraq and Afghanistan, but also a consequence of the global financial crisis which is expected to have an impact on the American military expenditures.

[14] Center for Arms Control and Non-Proliferation, 2009.

Table 2

US military budget in the period from the year 2000 till 2010

Year	National Defense Budget (billion $)	War supplements (billion $)	Total military expenditures (billion $)
2000.	387	0	387
2001.	401	25	426
2002.	428	20	448
2003.	472	75	547
2004.	489	81	570
2005.	451	114	565
2006.	471	134	605
2007.	471	134	660
2008.	516	194	710
2009.	536	144	680
2010.*	534	130	664

***** Forecast

Source: Center for Arms Control and Non-Proliferation, 2009.

Advocates of the high American military expenditures usually point out that the use of sums in dollars, as a system of expressing the height of military expenditure, is unfair, and that these expenditures should be shown as the percent of GDP or per capita. The American economy might be able to handle with high military expenditures, but the question being raised here is it really necessary to spend so much on the army and if these funds are being distributed to the real priorities.[15] What also needs to be taken into consideration that, even for a big economy as the American one, military expenditures of this magnitude are not sustainable in the long run. Along with the insight in military expenditure trends, SIPRI added that the massive increase in US military expenditures was one of the factors that contribute to the weakening of the American economy ever since the year 2001. Experts also add that along with the direct effects of high military expenditures, there are also indirect ones and those that will be visible in the future. The SIPRI study[16], which takes into consideration these factors, states that the overall costs, past and future ones, for the US war in Iraq will reach 2,267 trillion dollars till the year 2016.

2.2. GREAT BRITAIN - THE MEANING AND LEVEL OF MILITARY EXPENDITURE

The British foreign policy, according to the words of Winston Churchill, has always been formed in a traditional way in three mutually overlapping spheres. The first is certainly the British role as the post imperialistic power with many post colonial obligations and close relations with the Commonwealth countries. The second is the special relation between Great Britain and the USA and the third is its role as a European country and a member of the EU. It is only natural that in the interaction between these three roles tensions would rise up and periods when one role is prioritized over the other two. The Evolution of British defense policy can be followed through a series of strategic documents, The Defence White Papers, from 1991 all the way down to the last one "Future Capabilities" from June 2004. Throughout

[15] Grunberg, Isabelle (1990). "Exploring the "Myth" of Hegemonic Stability", International Organization, br. 44, str. 431-477, Cambridge

[16] Refers to the SIPRI Institute study which is a part of their yearbook from 2007

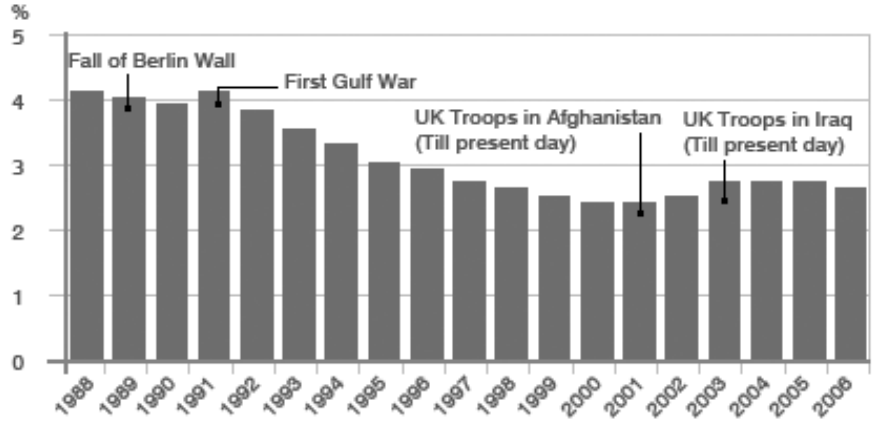
the Ministry of Defence budget, long term and expensive projects are dominant, and beside the large investments made into each project, an interest web has been imbedded around them in certain industrial circles, government administration, armed forces and the local community which all stand in the way of their review and possible cancellation depending on real needs and economic analysis. Still, Great Britain as the biggest US ally has a different structure of military expenditures than the USA.

From the attached charts a conclusion can be made that military expenditures in Great Britain are not a priority, as it is in the case of the USA, and that are more socially oriented. Still, the trend in military expenditure growth cannot go unnoticed. If they are observed as the percent of GDP, than we can see that their share is decreasing over the years, but in the last two it began to rise again. In 1990 military expenditure had a share of 4% of the British GDP and in 2006 it was 6%. Another thing that needs to be considered is the fact that the British army has undergone through a restructuring process in the last few years that raised the total costs. By the year of 2011 military spending is predicted to be 11% higher than the one from 1997 and this period of time represents the longest period of military expenditure growth since the 80s. This growth has been forecasted in 2007 by a revision held by the British government and by a statement from the Minister of Defence that military spending will grow by 1.5% each year over the next three years. The involvement in the Iraq and Afghanistan conflicts and the military force modernization plans, like the building of new aircraft carriers and restoration of the nuclear submarine fleet, have brought the Ministry of Defence budget under pressure, which has been confirmed by the Ministry itself[17] and has led to the insecurity and postponement of new projects. The Ministry of Defence continues to use external resources, partners and business arrangements in order to develop and make available the use of the newest defense systems. The willingness for the cooperation with experts that are not from the Ministry of Defence and through the elaboration of their own technologies and strategies, they create new and improved national defense strategy models. Through the analysis of future technologies and their own needs certain fields can be indentified that, through investments and development, would bring major advantages.

[17] The UK Ministry of Defence – Defence White Paper (2003) "Delivering Security in a Changing World"

Chart 5

Military expenditures of Great Britain in the period from 1988 till 2006
(Percent of GDP)



Source: UK Ministry of Defence, 2007.

3. WHAT ABOUT THE MILITARY EXPENDITURES IN THE REPUBLIC OF CROATIA?

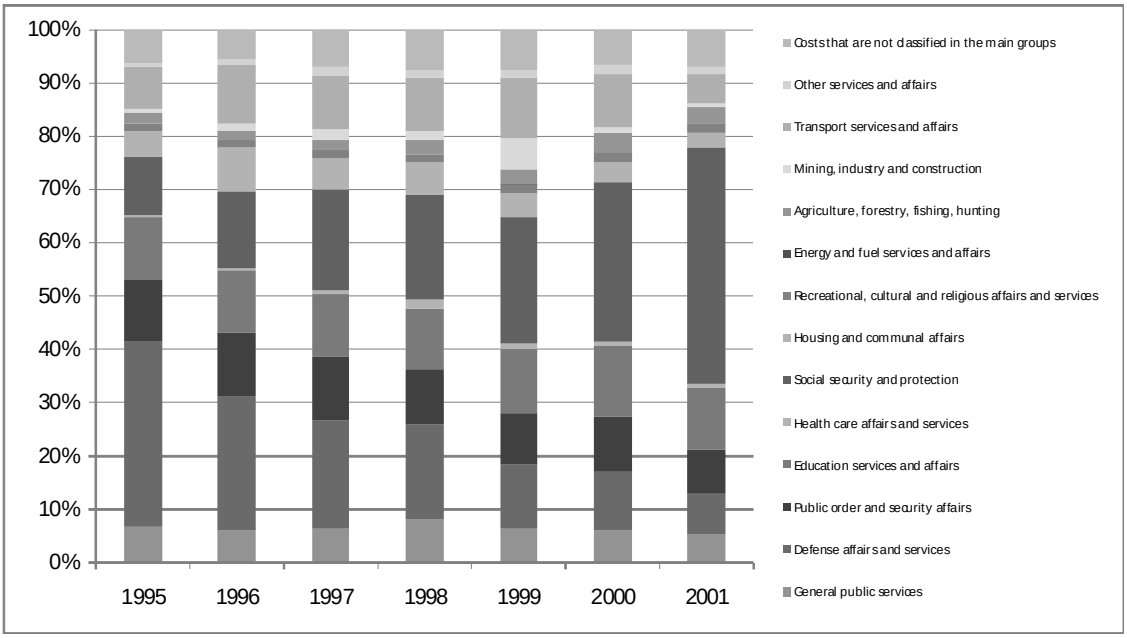
The early 90s were marked by great changes and shifts in the balance between military powers, especially in countries from the socialistic block. The aspirations for dominance and Great Serbian ideas, the fall of the communist system along with the economic crisis that struck Yugoslavia at the end of the 80s, started a chain reaction which resulted in the declaration of Croatia, Slovenia and Macedonia as independent states in 1991, and Bosnia and Herzegovina in 1992. But, with the independence and the creation of a new democratic and market oriented country, Croatia had to face, at the beginning of the 90s, a war called the Croatian War of Independence (The Homeland War) and with no inherited military forces from the previous regime it had to create its own under very difficult circumstances in regards of transition and war. Through the decree of establishment of the forces named "Zbor narodne garde", the Croatian President dr. Franjo Tuđman formed, on April 20th 1991, the first professional armed formation for Croatian national defense purposes. By the end of 1991, under the Law of Defense, the armed forces were united and renamed into the Croatian Army, marking the beginning of a more systematic mobilization of reserve soldiers and the set up of formations, commands and institutions, allowing more efficient usage of military force. The war was waged from 1991 till 1995, but Operation Storm brought the decisive turnover on the military strategic plan. On the economic side, the war has additionally exhausted Croatia. Direct war damages exceeded 236 billion of Croatian Kuna and the costs of waging war and army outfitting were enormous. The actual data on military spending in the period from 1991 till 1998 is very hard to find. There are estimations that military expenditures reached 15% of GDP during the war. After the war for independence the time had come for damage control and a long recovery period followed, with the diminishing role of the army in the budget. With the after war situation stabilized a reform period of the whole Croatian military sector followed. With the extra army forces that appeared after the war, cuts in the number of

personnel had to be done and return the extra soldiers to civilian life and civilian structures. This proved to be a great challenge for the institutions and the individuals because of different organizational and especially financial demands. The inadequacy and economic burden of the old cold war military conception and the changed security environment triggered changes in the Croatian Armed Forces. The restructuring process of the defense system started in 2002. The reorganization and reform goals were the establishing of a modern defense system structure which would be able to respond to modern challenges, taking also into consideration the future Croatian membership in the NATO alliance and other security arrangements under the European Union. The main directives for this reform were laid down in the strategic documents that Croatia passed, named „Strategija nacionalne sigrnosti RH“ (National security strategy of the Republic of Croatia), „Strategija obrane RH“ (Defense strategy of the Republic of Croatia) and „Vojna strategijom RH“ (Military strategy of the Republic of Croatia). One of the most important steps was the concept of a professional army and the cancellation of the compulsory military service.[18] A professional army is not necessarily without drafted recruits, but at the same time the food, equipment, arms and drill for new recruits represents a large expenditure for the Ministry of Defense of the Republic of Croatia (MORH). A drafted army represents an non perspective segment of active Croatian military forces, especially if we take into consideration that their knowledge and expertise are very limited and the result of only 8 months of training. Professional soldiers should be put as a top priority and they would, with extra training and learning, gain special military knowledge needed for the accomplishment of missions during times of peace or war. The document known as “Strategijski pregled obrane” (Strategic survey of defense) from 2005 gave a clearer picture of the Croatian military forces planned size, the development of the civilian and military component of defense, with an emphasis on the development of abilities for international military operations. Today the military needs of each country are different and countries base the development of their military according to its own strategy. Croatia is developing its own Armed Forces to become NATO operational and functional in the structure of allied forces in order to be deployable, adaptable, efficient and equipped with modern gear according to available budget resources. The next charts show the state budget expenditure trend between 1995 and 2007 according to functional classification. It is clear that the defense expenditures in 1995 were 9.9 billion Kuna or 34.8% of Croatian total expenditures, but in the following years they were rapidly decreasing. The lowest point of defense expenditure level was reached in 2005 when they were 3.5 billion Kuna that equaled 4% of total Croatian expenditure or 1.5% of GDP, which is the lowest ever recorded level of military expenditure in Croatia. The year 2005 was also a sort of a turning point considering defense spending, because in this very year the reform of the Croatian Armed Forces began. By 2007 defense expenditure increased up to 4.5 billion Kuna and this trend was continued till the year 2009. From the end of the war till the year 2004, more than 6 billion Kuna has been spent for costs unrelated to the equipping and modernization of the army, building new infrastructure for army needs or for the improvement of the training for new soldiers, which has been revealed in the analysis and revision of the MORH budget. A very big portion of the defense budget is being spent for employee payrolls and expenses, more than 2 billion, which makes for 40% of the Ministry of Defense 2009 budget. A very large military expenditure reform is needed that would lower and remove unnecessary costs and thus allow the growth and development of the Croatian Armed Forces.

[18] Ministry of Defense (2006) “Dugoročni plan razvoja Oružanih snaga Republike Hrvatske 2006. – 2015.”

Chart 10

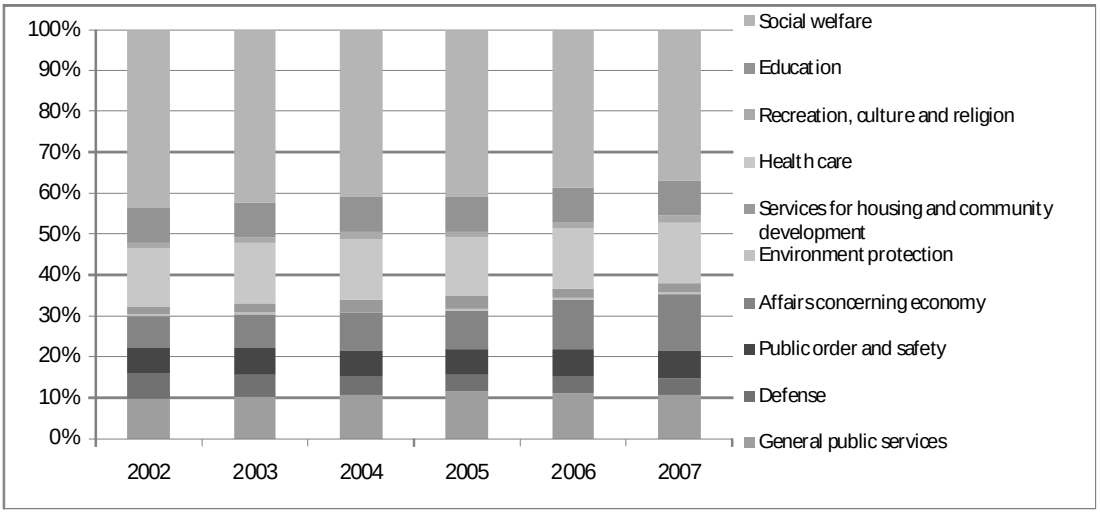
Government budget spending according to the functional classification for the period between the years 1995 and 2007 (in %)



Source: Yearbooks from the Ministry of Finance, Ministry of Finance Republic of Croatia www.mfin.hr

Chart 11

Government budget spending according to the functional classification for the period between the years 2002 and 2007 (in %)



Source: Yearbooks from the Ministry of Finance, Ministry of Finance Republic of Croatia www.mfin.hr

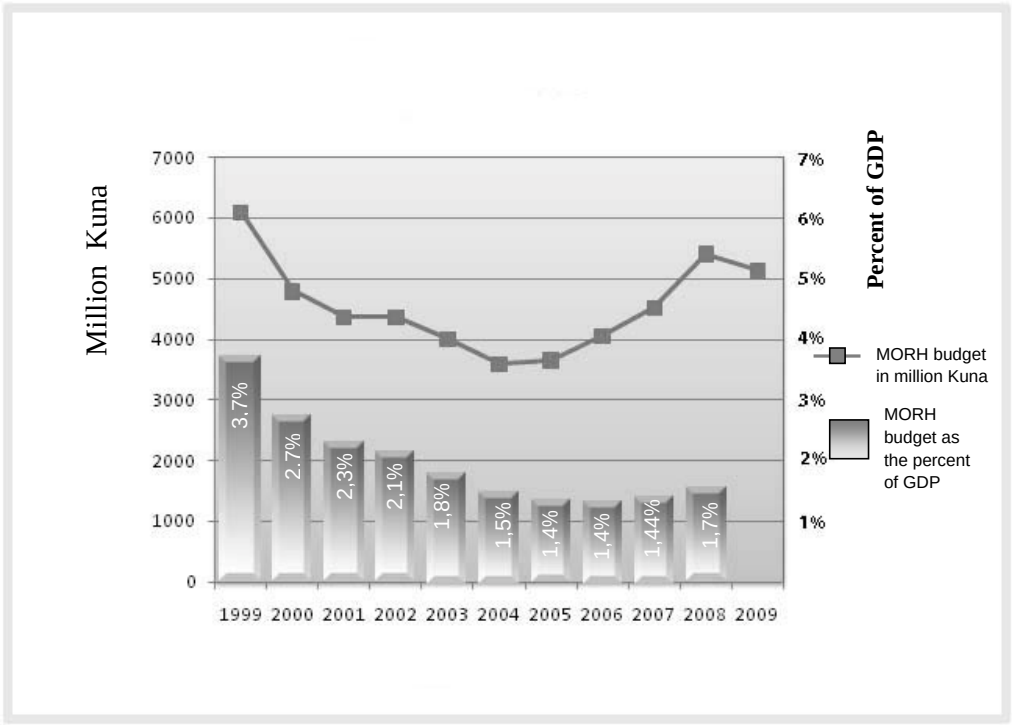
*The charts have been divided into these two time periods because the expenditures from the year 2002 onwards are expressed according to the GFS 2001 methodology. What is specific about this is the fact that in accordance

with the valid methodology in financial reporting in the Republic of Croatia, under the functional classification, along with the expenditures, the acquisition of non financial property in gross sums is also included.

The MORH budget change throughout the years can be observed on the next chart. A decrease till the year 2004 is clearly visible and is a direct consequence of bad investment and army neglection. This very neglection led to the creation of very serious problems in the Croatian Armed Forces (OSRH) like outdated equipment or the inadequate level of military training. In the year that followed (2005), a strategic plan on military reform has been devised and it triggered many positive changes within the Armed Forces. The restructuring of the Armed Forces is the main reason why the Croatian military budget started to raise after 2005. If military spending is observed as the percent of GDP, a conclusion can be made that military expenditure were of low priority throughout the years. Their share in the GDP has been decreasing till the year 2005 and during the years 2007 and 2008 it only increased slightly by 0.04% in 2007 and 0.26% in 2008. The share of military expenditure in the GDP is definitely too small considering the restructuring plans made and because of this most of the projects are delayed or haven't been even started.

Chart 12

The Croatian Ministry of Defense in the period from 1999 till 2008



Source: National budget archive, Ministry of Finance Republic of Croatia, 2008

Therefore a conclusion can be made that Croatia still needs to work a lot on the highly needed military modernization, which is currently in a very bad condition. This modernization is a bit late considering the fact that there wasn't any considerable investment in the military

for the past 15 years. The war has drained the already weakened economy and it took a long time for Croatia to recover from the damages caused by the war. The military wasn't an investment priority which led to a long term decrease of the Ministry of Defense budget. The direction of modernization is based on a complete modernization and equipping of every Armed Forces division, consisting of numerous capital projects and the restructure of the Ministry of Defense by decreasing the number of its employees. In this way the military budget would be unburdened and necessary funds would be made available for the needed modernization. The investment in the modernization and equipping of the Croatian army opens many possibilities in various economy sectors like shipbuilding, metal industry and the manufacturing of combat equipment thus creating a multiplicative effect in the Croatian economy. From a strategic point of view, Croatia would with this modernization strengthen its position as the regional leader in this part of Europe as a member of the EU and NATO alliance, insuring the peace and stability of the whole region, also improving its image as a reliable, friendly and partner country.

4. CONCLUSION

In today's globalized world, interlaced wit problems, uncertainties and rapid technological progress, it is next to impossible to take into consideration all the factors that could affect the security situation of a country. Financial assets are becoming thinner and if the military evolution is not to be focused on specific development areas, saving budget funds in the process, there is a high danger that the whole financial construction of a country would collapse. Because the possibilities and situation, domestic and foreign, of each country in the world is different, so should also be the approach to the situation at hand.

Every amount that is spent on unnecessary projects or becomes lost because of a bad judgment represents a heavy blow to the state treasury. The key aspect that every military in the world should turn to is the efficiency of the armed forces and to maximize it their restructuring is needed, along with the expenses that follow them. The USA, Great Britain, China and many other countries have already began with their armed forces restructuring plans. Even though the whole process is very expensive, long term effects should be positive because of all the investments made into technology and equipment. The biggest focus is being put on mobility, accuracy and army sustainability, and all these goals are accomplishable through the advantages of networked military communications, guided armaments and joint military operations.

The world military expenditures have been growing in the past few years. In 2007, 2.5% of the world GDP or 202 US dollars per capita of the world population was used for military needs. The United States of America have by far the largest military expenditures that represent 48% of the total world military expenditures, which means that the USA is spending almost as much as the rest of the whole world. China, India, North Korea, Russia, France, Great Britain are all countries that also have a high level of military expenditures. The developments in technology and the globalization have thoroughly changed the conception of waging wars, while in the same time countries around the world are strengthening their cooperation and their joint acting presents the future of warfare. All this is being done while keeping close attention to the financial aspects of military expenditures in the way of armed forces restructuring and diverting resources for military needs according to the financial possibilities of a country.

BIBLIOGRAPHY

1. Abbott, C., Rogers, P., Sloboda, J., (2006). „Global responses to global threats“, Oxford Research Group, Oxford
2. Ball, N., Leitenberg, M. (1983). The Structure of the defense industry: an international survey, Routledge, London, UK
3. Brunham, G., Lafta, R., Doocy, S., Roberts, L. (2006). „Mortality after the 2003 invasion of Iraq: A cross-sectional cluster map survey“, The Lancet, no. 9545, pages 1421.-1428., London
4. CIA World Factbook - www.cia.gov/library/publications/the-world-factbook
5. Feickert, A. (2005). „U.S. Army's Modular Redisgn“ CRS report for Congress
6. Grunberg, I. (1990). “Exploring the “Myth” of Hegemonic Stability”, International Organization, no. 44, pages 431.-477., Cambridge
7. Homeland Security Research - www.homelandsecurityresearch.net
8. Hrvatski vojnik – Croatian military magazine in the edition of MORH, various numbers, - www.hrvatski-vojnik.hr
9. Index Mundi - indexmundi.com
10. Leger Sivard, R. (1987-1996). editions „World Military and Social Expenditure“, WMSE Publications, SAD
11. Lidell Hart, B. H. (1954). „Strategy: The indirect approach“, Frederick A. Praeger, New York
12. Mahečić, Z. (2003). “Izazovi reforme i smanjenja Oružanih snaga Republike Hrvatske: Politika personalnog upravljanja kao posljedica ratnih zbivanja i izgradnje Oružanih snaga Republike Hrvatske”, Polemos, no. 11.-12., pages 49.-69., Jesenski i Turk, Zagreb
13. Military Factory - www.militaryfactory.com
14. Military Industrial Complex - www.militaryindustrialcomplex.com
15. Ministry of Finance Republic of Croatia. Yearbooks from the Ministry of Finance, various numbers - www.mfin.hr
16. US Department of Treasury - www.ustreas.gov
17. Ministry of Defense Republic of Croatia (2006). „Dugoročni plan razvoja Oružanih snaga Republike Hrvatske“ - www.morh.hr
18. US Department of Defense (2008). 2008 National Defense Strategy, Washington DC
19. US Department of Defense (2008). National Security and Nuclear Weapons in the 21st Century, Washington
20. UK Ministry of Defence (2006). „The DCDC Global Strategic Trends Programme 2007-2036“ - www.mod.uk/DefenceInternet/Home
21. Ministry of Defense Republic of Croatia (2008). „Godišnje izvješće o spremnosti obrambenog sustava, provođenju kadrovske politike i ukupnom stanju u Oružanim snagama RH“
22. Ministry of Defense Republic of Croatia, Croatian Armed Forces General Staff (2005). „Doktrina školovanja za potrebe OS RH u razdoblju 2005. do 2010.“
23. Croatian Armed Forces - www.osrh.hr
24. British Armed Forces - www.armedforces.co.uk
25. Rogers, P. (1988). „A Guide to Nuclear Weapons“, Berg Publishers, Oxford
26. Rogers, P. (2005). „A World Becoming more Peaceful?“, Open Democracy (www.opendemocracy.net).
27. Russell, A. (2008). „A Day in the Future – Accelerating Solutions to Security Threats“, EastWest Institute
28. Stockholm International Peace Research Institute - www.sipri.org
29. United Nations - www.un.org

30. Council on Foreign Relations - www.cfr.org
31. Wiatr, J. (2001). „Demokratska transformacija oružanih snaga – slučaj Poljska“, Polemos, br. 6., Jesenski i Turk, Zagreb
32. The Law on the changes and amandments on the Law on Defense, N.N. no. 76/07.
33. The Law on Defense, N.N. br. 33/02
34. The Law on the involvment of the Armed Forces, police, civil protection and state officials and employees in peacekeeping operations and other international activities, N.N. no. 33/02.

VOJNA POTROŠNJA U VRTLOGU GLOBALIZIRANOG SVIJETA

Sažetak

Koncept vojne potrošnje je star koliko i prve stare civilizacije. Vojska je, kao prva i jedina crta obrane, oduvijek imala veliku ulogu u potrošnji zemalja. Vojna potrošnja se mijenjala kroz povijest baš kao i shvaćanje vojnih snaga koje su predstavljale vojnu silu neke zemlje. Razvojem društva pojavili su se mnogi drugi prioriteti po pitanju državne potrošnje, no s obzirom na to da je usmjerena na obranu stanovništva, održavanje mira i očuvanje državnih granica kao primarnih oblika javnog dobra, vojna potrošnja je zadržala svoj status kroz cjelokupnu povijest čovječanstva.

Globalizirani svijet u kakvom danas živimo je sve to promijenio, posebno kad govorimo o obrani države od stranih i domaćih prijetnji. Razvoj tehnologije i sama globalizacija su drastično promijenile koncept ratovanja a time i samu strukturu i razinu vojne potrošnje. Tehnološka razina je jedan od najboljih pokazatelja razvoja jedne zemlje, no i snage njene vojske. Naravno, vojnu silu je teško održati bez jednako adekvatne gospodarske sile jer su upravo razvijeno gospodarstvo i jaka industrija ono što omogućuje razvoj obrambenog potencijala zemlje i njegovo financiranje.

Ključne riječi: *vojna potrošnja, globalizacija, oružje, SAD, Velika Britanija, Hrvatska*

Ciprian Necula*

UDK 336.761.5
Original scientific paper
Izvorni znanstveni rad

A COPULA-GARCH MODEL

ABSTRACT

In the present study we develop a new two-dimensional Copula-GARCH model. This type of two-dimensional process is characterized by a dependency structure modeled using a copula function. For the marginal densities we employ a GARCH(1,1) model with innovations drawn from a t-Student distribution. The model can be easily extended by using more sophisticated processes for the marginal densities. The static specification of the model assumes that the dependency structure of the two data series does not vary in time implying that the parameters of the copula function are constant. On the other hand, the dynamic specification models explicitly the dynamics of these parameters. We econometrically estimate the parameters of the two specifications using various copula functions, focusing on the mixture between the Gumbel and Clayton copulas. We employ daily index returns from two emerging and two developed financial markets. The main finding is that including a varying dependency structure improves the goodness-of-fit of the Copula-GARCH model.[1]

Keywords: *copula functions, multidimensional GARCH, volatility, dependency structure*

JEL Classification: C51, F37, G17

Acknowledgements: I would like to thank Professor Moisă Altăr for useful comments and suggestions. Financial Support from PN II PCE Grant 1863/2009 entitled "Modeling the Influence of the Trinomial Uncertainty-Volatility-Risk on the Dynamics of Complex Financial-Economic Systems" and financed by The Romanian National University Research Council (CNCSIS) is gratefully acknowledged.

1. INTRODUCTION

The linear correlation coefficient is central to the modern financial modeling. Unfortunately, when the return distribution deviates from the elliptic class which includes the Gaussian, the correlation coefficient is not able to correctly capture the dependency structure between the assets. Several studies have empirically proved that asset returns are heavy tailed and successfully fitted to the data leptokurtic distributions like the Generalized Hyperbolic Distributions. For example, Necula (2009a) estimated the parameters of the Generalized Hyperbolic Distribution for the returns of several Eastern European emerging markets and concluded that the estimated GH distribution represents a good approximation (at least up to the 4th order term) of the empirical distribution quantified using nonparametric kernel

* Senior Lecturer, DOFIN, Faculty of Finance and Banking, Bucharest University of Economics, Bucharest, Romania; Researcher, Center for Advanced Research in Finance and Banking (CARFIB), Bucharest University of Economics, Bucharest; Researcher, Centrul de Analiză şi Prognoză Economico-Financiară (CAPEF); email: ciprian.necula@fin.ase.ro; home page: www.dofin.ase.ro/cipnec/

[1] Paper received 8 October 2009.

methods. Moreover, the linear correlation coefficient cannot capture a non-linear dependency structure in the data (Blyth, 1996; Shaw, 1997). Copulas represent a way to surpass the deficiencies of the linear correlation coefficient. The theory of copulas dates back to Sklar (1959), but its application in financial modeling is far more recent. Nelsen (1999) provide an introduction to copula theory, while Cherubini *et al.* (2004) provide a discussion of copula methods for financial applications.

Volatility clustering is a phenomenon well documented in the financial literature. Since the pioneering work of Engle (1982) and Bollerslev (1986) manifold variations of the one-dimensional GARCH volatility model have been developed. However, in order to quantify more exactly the market risk one has to account both for the volatility of the assets and for the dependency structure between them. The Copula-GARCH is a multidimensional GARCH process that models the dependency structure using a copula function. Jondeau and Rockinger (2006) developed a two-dimensional Copula-GARCH model using the Planket copula, the Gaussian copula and the t-copula. Since the Planket copula and the Gaussian copula does not account for tail dependence the authors concluded that dependency should be modeled with t-copulas. Unfortunately, this kind of model can not be extended easily to three or more dimensions since the number of parameters of the t-copula increases with a square law. Patton (2006a, 2006b) employed the Clayton copula, and Hu (2006) used the Gumbel copula. The Gumbel copula captures dependence only in the upper tail, while the Clayton copula models the dependence only in the lower tail. However, a series of studies pointed out that the asset returns are characterized by dependency both in the lower and in the upper tails. One can capture such a dependence structure with the t-copula or with a Gumbel-Clayton mixture. For example, Necula (2009b) assessed the dependency structure between stock indexes in several Eastern European markets by econometrically estimating the parameters of various parametric copula functions and concluded that the mixture between a Clayton copula and a Gumbel copula and the t-copula are the most appropriate copula functions to capture the dependency structure of two financial return series. The advantage of the Gumbel-Clayton mixture is that the number of parameters remains constant as the dimension increases, while the number of the parameters of the t-copula increases with a power law.

In the present paper we develop a new two-dimensional Copula-GARCH model. To account for heavy tails we model the marginal densities using a GARCH(1,1) process with innovations drawn from a t-Student distribution. The static specification of the model assumes that the dependency structure of the two data series does not vary in time implying that the parameters of the copula function are constant. On the other hand, the dynamic specification models explicitly the dynamics of these parameters. We econometrically estimate the two specifications using various copula functions, focusing on the mixture between the Gumbel and Clayton copulas. Models based on this kind of mixtures capture dependence both in the lower and in the upper tails and can be easily extended to more dimensions.

The rest of the paper is organized in three sections. In the second section we introduce the static and the dynamic specifications of the model. In the third section we analyze the results of the econometrical estimation of the two specifications. The final section concludes.

2. THE COPULA-GARCH MODEL

As it is well-known, a copula represents the cumulative distribution function (cdf) of a multidimensional distribution with uniform marginal distributions. Sklar (1959) proved that a copula function represents the connection between a bi-dimensional distribution and its two marginal distributions, capturing the dependency structure. More precisely, if F is the cdf of

the bi-dimensional distribution and F_1 and F_2 are the cdfs of the marginal distributions, there is a unique copula C such that:

$$F(x_1, x_2) = C(F_1(x_1), F_2(x_2)), \quad (1)$$

Also, if the cdfs for the bi-dimensional and for the marginal distributions are known, the associated copula function is given by (Sklar, 1959):

$$C(u_1, u_2) = F(F_1^{-1}(u_1), F_2^{-1}(u_2)), \quad (2)$$

An important class of copula functions consists of Archimedean copulas. An Archimedean copula is given by:

$$C(u_1, u_2) = \psi^{-1}(\psi(u_1) + \psi(u_2)), \quad (3)$$

where the generator function ψ has the following properties: $\psi(1) = 0$, $\psi' > 0$, and $\psi'' < 0$.

The most commonly used copulas in finance are the product copula (i.e. the copula that models independence), the Gaussian copula, the t-copula, and three Archimedean copulas: Frank, Gumbel and Clayton. As we have already mentioned, financial series usually have dependence both in the lower tail and the upper tails. Such a dependence structure can be modeled using the t-copula or with a Gumbel-Clayton mixture, the latter having the advantage of being more parsimonious as the dimensions increases.

2.1 THE STATIC SPECIFICATION

Let x_{1t}, x_{2t} the two asset returns series. The static specification of the Copula-GARCH(1,1) is given by the following characteristics:

❖ t

he dynamics of x_1 is described by a GARCH(1,1) process with leptokurtic innovations:

$$\begin{cases} x_{1t} = \mu_1 + \varepsilon_{1t} \\ \varepsilon_{1t} = \sigma_{1t} z_{1t} \\ z_{1t} \quad iid \quad t(\nu_1) \\ \sigma_{1t}^2 = \omega_1 + \alpha_1 \varepsilon_{1t-1}^2 + \beta_1 \sigma_{1t-1}^2 \end{cases}, \quad (4a)$$

❖ t

he dynamics of x_2 is described by a GARCH(1,1) process with leptokurtic innovations:

$$\begin{cases} x_{2t} = \mu_2 + \varepsilon_{2t} \\ \varepsilon_{2t} = \sigma_{2t} z_{2t} \\ z_{2t} \quad iid \quad t(\nu_2) \\ \sigma_{2t}^2 = \omega_2 + \alpha_2 \varepsilon_{2t-1}^2 + \beta_2 \sigma_{2t-1}^2 \end{cases}, \quad (4b)$$

❖ t

he dependency structure between the innovations z_{1t}, z_{2t} is modeled by a copula function C_{θ_t}, characterized by the vector of parameters θ_t;

❖ t

he dependency structure *does not vary in time:* $\theta_t = \theta$.

To model the dependency structure we employ the following copula functions:

❖ t

he Gaussian copula ($\theta := \rho$):

$$C_{\rho}^{Gauss}(u_1, u_2) = \phi_{2,\rho}\left(\phi^{-1}(u_1), \phi^{-1}(u_2)\right), \quad (5a)$$

where ϕ is the cdf of the standard normal distribution, and $\phi_{2,\rho}$ the cdf of the bi-dimensional normal distribution with correlation ρ.

❖ t

he t-copula ($\theta := (\nu, \rho)$):

$$C_{\nu,\rho}^{t}(u_1, u_2) = t_{2,\nu,\rho}\left(t_{\nu}^{-1}(u_1), t_{\nu}^{-1}(u_2)\right), \quad (5b)$$

where t_{ν} is the cdf of the t distribution with ν degrees of freedom, and $t_{2,\nu,\rho}$ the cdf of the bi-dimensional t distribution with correlation ρ.

❖ F

rank copula ($\theta := \alpha, \alpha \neq 0$):

$$C_{\alpha}^{F}(u_1, u_2) = -\frac{1}{\alpha}\ln\left(1 + \frac{\left(e^{-\alpha u_1} - 1\right)\left(e^{-\alpha u_2} - 1\right)}{e^{-\alpha} - 1}\right), \quad (5c)$$

❖ C

layton copula ($\theta := \alpha, \alpha > 0$):

$$C_{\alpha}^{C}(u_1, u_2) = \max\left(\left[u_1^{-\alpha} + u_2^{-\alpha} - 1\right]^{-\frac{1}{\alpha}}, 0\right), \quad (5d)$$

❖ G

umbel copula ($\theta := \alpha, \alpha > 1$):

$$C_{\alpha}^{G}(u_1, u_2) = \exp\left(-\left[(-\ln u_1)^{\alpha} + (-\ln u_2)^{\alpha}\right]^{\frac{1}{\alpha}}\right), \quad (5e)$$

❖ G

umbel-Clayton mixture ($\theta := (\omega, \alpha_1, \alpha_2)$):

$$C_{\omega,\alpha_1,\alpha_2}^{mix}(u_1, u_2) = \omega C_{\alpha_1}^{C}(u_1, u_2) + (1 - \omega) C_{\alpha_2}^{G}(u_1, u_2), \quad (5f)$$

As was already mentioned, the main advantage of the Archimedean copulas (Frank, Clayton, Gumbel and the G-C mixture) resides in the fact that the number of the parameters is constant no matter the dimension of the model.

2.2 THE DYNAMIC SPECIFICATION

The dynamic specification of the Copula-GARCH(1,1) is given by the following characteristics:

❖ t

he dynamics of x_1 is described by a GARCH(1,1) process with leptokurtic innovations given by equation (4a);

❖ t

he dynamics of x_2 is described by a GARCH(1,1) process with leptokurtic innovations given by equation (4b);

❖ t

he dependency structure between the innovations z_{1t}, z_{2t} is modeled by a copula function C_{θ_t}, characterized by the vector of parameters θ_t;

❖ t

he dependency structure *may vary in time*, the parameters of the copula function

having a dynamics given by:

$$\theta_t = f\left(\theta_{t-1}, z_{1t-1}, z_{2t-1}\right). \quad (6a)$$

Although several alternatives were tested for the dynamics of the copula parameters, we arrived at the conclusion that the most appropriate specification is of the form:

$$\theta_t = T\left(a_1 + a_2\theta_{t-1} + a_3 z_{1t-1} z_{2t-1}\right), \quad (6b)$$

where $T(\cdot)$ is a proper transform than ensures that the parameter is inside the existence interval of the copula function.

The model can be extended to encompass a more general specification of the dynamics of the copula parameters:

$$\theta_t = T\left(a_0 + \sum_{i=1}^{p} a_{1i}\theta_{t-i} + \sum_{i=1}^{q} a_{2i} z_{1t-i}^2 + \sum_{i=1}^{r} a_{3i} z_{2t-i}^2 + \sum_{i=1}^{s} a_{4i} z_{1t-i} z_{2t-i}\right), \quad (6c)$$

In the dynamic specification of the model we employ only the three copula functions that fit best the data from Eastern European markets (Necula, 2009b): Frank copula, t-copula and Gumbel-Clayton copula. The specification of the dynamics of the parameters of these copula functions is as follows:

- ❖ Frank copula C_{α_t}:

$$\alpha_t = T\left(a_0 + a_1 z_{1t-1} z_{2t-1}\right), \quad (7)$$

where $T(x) = x$;

- ❖ Gumbel-Clayton mixture:

$$C_{\omega_t, \alpha C_t, \alpha G_t} = \omega_t C_{\alpha C_t}^{Clayton} + (1-\omega_t) C_{\alpha G_t}^{Gumbel}, \quad (8a)$$

$$\begin{cases} \theta_t = ct = \hat{\theta} \\ \alpha G_t = ct = \hat{\alpha} G \\ \alpha C_t = T\left(a_0 + a_1 z_{1t-1} z_{2t-1}\right) \end{cases}, \quad (8b)$$

where $T(x) = x^2$, and $\hat{\theta}, \hat{\alpha} G$ are the estimated values obtained in the static specification of the model; therefore, in this case, only the parameter of the Clayton copula is allowed to vary in time.

- ❖ t-copula C_{ν_t, ρ_t}:

$$\begin{cases} \nu_t = ct = \hat{\nu} \\ \rho_t = T\left(a_0 + a_1 z_{1t-1} z_{2t-1}\right) \end{cases}, \quad (9)$$

where $T(x) = \tanh\left(\frac{x}{2}\right)$, $\hat{\nu}$ is the estimated value obtained in the static specification of the model, and only the dynamics of the correlation parameter is studied.

In the following section we econometrically estimate the two specifications of the model and analyze whether the dynamic specification is statistically superior to the static one.

3. ESTIMATION RESULTS

The data used in the study consists of daily returns between January 1998 and March 2009 for stock indexes from two Eastern European emerging markets, Czech Republic

(PX50) and Hungary (BUX) and from two developed financial markets, Germany (DAX) and USA (SP500).

The methodology for estimating the Copula-GARCH model for the pair PX50 and BUX, and the pair DAX and SP500 consists of the following steps:

- estimating the GARCH(1,1) model for each of the two data series using Maximum Likelihood Estimation, and obtaining the residuals;
- estimating the parameters of the copula function by maximizing the likelihood function, $L = \sum_{t=1}^{T} \ln c\left(F_1\left(\hat{z}_{1t}\right), F_2\left(\hat{z}_{2t}\right); \theta_t\right)$, where $c(u_1, u_2) = \frac{\partial^2 C}{\partial u_1 \partial u_2}(u_1, u_2)$ is the so-called copula density, $\hat{z}_{1t}, \hat{z}_{2t}$ the two residual series, and F_1, F_2 are the cdfs of the residuals.

Therefore, we estimated the parameters of the Copula-GARCH by using the Inference Functions for Marginals (IFM) method (Yan, 2006). This method provides consistent estimators for the parameters of the copula and it is less computing intensive than the Exact Maximum Likelihood (EML). The econometric methods and techniques employed in the study have been implemented in Maple.

First we estimate the static specification. The estimated parameters of the copula functions of the residuals series are presented in Table 1 and in Table 2[2].

Table 1

Estimated parameters for BUX - PX50 GARCH residuals

Copula	Parameters			AIC	GoF statistics	
					KS	AD
Frank	4.3459*** (0.2115)			-412.22	0.0319	3.1472
Clayton	0.8743*** (0.0471)			-315.06	0.0672	8.2341
Gumbel	1.5658*** (0.0343)			-366.85	0.0521	5.7926
G-C mixture	0.3702*** (0.0665)	1.2421*** (0.1951)	1.6852*** (0.0651)	-403.22	0.0424	3.6671
Gaussian	0.5652*** (0.0162)			-398.12	0.0551	7.1321
t	8		0.5806*** (0.0197)	-418.39	0.0411	3.8231

*standard errors in parenthesis; *** denotes statistical significance at 1%; AIC is the Akaike Information Criterion statistic; KS and AD are the Kolmogorov-Smirnov and Anderson-Darling goodness of fit tests statistics*

The parameters of the copula functions are highly statistically significant in both cases. To better assess the performance of each specific copula function we implemented the Kolmogorov-Smirnov test and Anderson-Darling test for copula goodness-of-fit (Fermanian, 2005).

[2] The estimation results of the GARCH models can be provided upon request.

Table 2

Estimated parameters for DAX - SP500 GARCH residuals

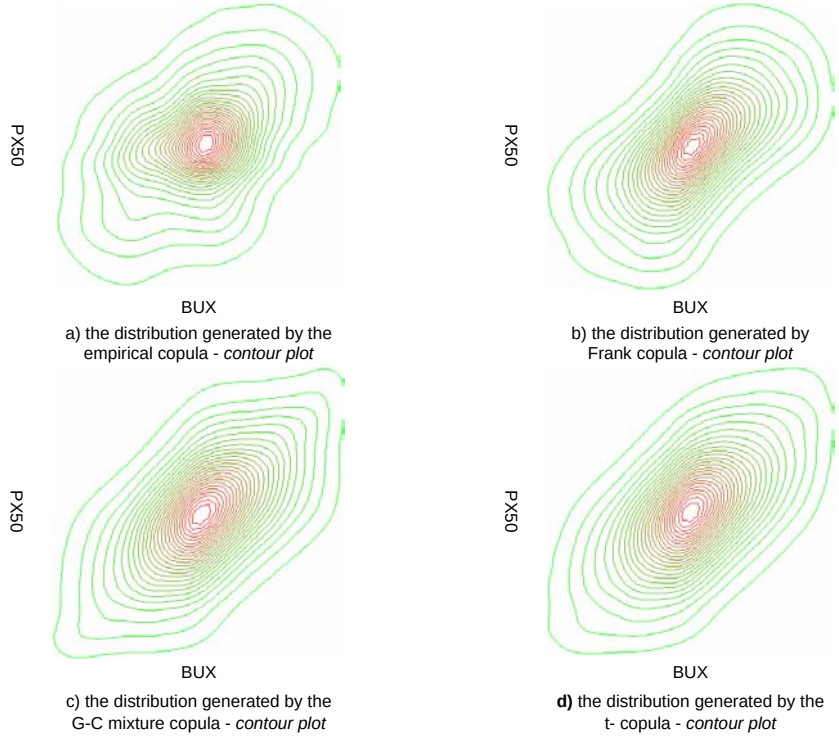
Copula	Parameters			AIC	GoF statistics	
					KS	AD
Frank	3.9444*** (0.2283)			-320.42	0.0447	2.7880
Clayton	0.7727*** (0.0611)			-308.59	0.0657	7.7741
Gumbel	1.6054*** (0.0427)			-310.94	0.0427	2.7381
G-C mixture	0.2149*** (0.0575)	1.2269*** (0.6935)	1.8933*** (0.0718)	-330.22	0.0212	0.5426
Gaussian	0.5574*** (0.0202)			-315.23	0.0557	5.1065
t	5		0.5628*** (0.0234)	-348.13	0.0344	1.5933

*standard errors in parenthesis; *** denotes statistical significance at 1%; AIC is the Akaike Information Criterion statistic; KS and AD are the Kolmogorov-Smirnov and Anderson-Darling goodness of fit tests statistics*

More specifically, this kind of copula goodness-of-fit tests are based on the assumption that, under the null of a correctly specified copula function, an appropriate transformation of the residuals is $\chi^2(2)$ distributed, fact that can be tested using the standard Kolmogorov-Smirnov and Anderson-Darling nonparametric tests for equality between two one-dimensional distributions. Using the Akaike Information Criterion (AIC) and the two goodness-of-fit statistics we can conclude that, in the case of the two returns pairs analyzed in the study, the Frank copula, the t-copula and the Gumbel-Clayton mixture copula are the most appropriate to model the dependency structure of the normalized residuals from the two one-dimensional GARCH(1,1) processes.

Figure 1 depicts the estimated bi-dimensional distribution for BUX-PX50 GARCH residuals using the best three estimated parametrical copulas. For comparison, the bi-dimensional distribution computed using the so-called empirical copula is also depicted. The empirical copula (Deheuvels, 1979) was estimated using non-parametric econometric techniques (Gijbels and Mielniczuk, 1990; Fermanian and Scaillet, 2003). The kernel empirical copula ($\hat{C}$) is given by $\hat{C}(u_1,u_2)=\frac{1}{T}\sum_{i=1}^{T} G_{u_1,h}\left(\frac{u_1-\hat{F}_1\left(x_1^i\right)}{h}\right)G_{u_2,h}\left(\frac{u_2-\hat{F}_2\left(x_2^i\right)}{h}\right)$, where $G_{u,h}(\cdot)$ is the Gaussian kernel with bandwidth h, and $\hat{F}_1,\hat{F}_2$ are the empirical cdfs of the two marginal distributions, estimated by non-parametric one-dimensional kernel methods. The length of the bandwidth was chosen according to the well-known "rule of thumb" of Silverman (1986).

Figure 1
Estimated bi-dimensional distributions for BUX-PX50 GARCH residuals



a) the distribution generated by the empirical copula - *contour plot*

b) the distribution generated by Frank copula - *contour plot*

c) the distribution generated by the G-C mixture copula - *contour plot*

d) the distribution generated by the t- copula - *contour plot*

Next we estimate the dynamic specification of the model. In this specification we only analyze the three copula functions that best fitted the static specification: the Frank copula (eq. 7), the Gumbel-Clayton mixture (eq. 8b), and the t-copula (eq. 9). The results are presented in Table 3 and Table 4.

Table 3
Estimated parameters of the dynamics equation for BUX - PX50 pair

Copula	Parameters		AIC dynamic specification	AIC static specification
	a_0	a_1		
Frank	4.0652*** (0.2091)	0.4326*** (0.1640)	-415.23	-412.22
G-C mixture	1.0321*** (0.0872)	0.2341*** (0.0649)	-413.41	-403.22
t	1.2623*** (0.0549)	0.1065*** (0.0421)	-422.74	-418.39

*standard errors in parenthesis; *** denotes statistical significance at 1%; AIC is the Akaike Information Criterion statistic*

Table 4
Estimated parameters of the dynamics equation for DAX-SP500 pair

Copula	Parameters		AIC dynamic specification	AIC static specification
	a_0	a_1		
Frank	3.6736*** (0.2265)	0.6870*** (0.1914)	-310.29	-300.42
G-C mixture	0.4564*** (0.0069)	0.6484*** (0.1008)	-361.56	-330.22
t	1.2244*** (0.0679)	0.1438*** (0.0464)	-352.86	-348.13

*standard errors in parenthesis; *** denotes statistical significance at 1%; AIC is the Akaike Information Criterion statistic*

The parameters of the dynamic equation of the parameters of the copula functions are highly statistically significant in both cases. The Akaike Information Criterion statistic implies that the dynamic specification fits the data better than the static one.

4. CONCLUDING REMARKS

In the present paper we developed a new two-dimensional Copula-GARCH model. To account for heavy tails we modeled the marginal densities using a GARCH(1,1) process with innovations drawn from a t-Student distribution, but the model can be easily extended to employ more sophisticated leptokurtic distributions such as α- stable distributions or Generalized Hyperbolic Distributions. The static specification of the model assumes that the dependency structure of the two data series does not vary in time implying that the parameters of the copula function are constant. On the other hand, the dynamic specification models explicitly the dynamics of these parameters.

We econometrically estimated the two specifications using various copula functions, focusing on the mixture between the Gumbel and Clayton copulas. Models based on this kind of mixtures capture tail dependence and can be easily extended to more dimensions. The estimation of the copula function parameters was performed using the Inference Functions for Marginals (IFM) method. For the static specification, according to the Kolmogorov-Smirnov and Anderson-Darling „goodness-of-fit" tests, the mixture between the Clayton copula and the Gumbel copula, the Frank copula, as well as the t-Student copula are the appropriate copula functions to capture the dependency structure of the two normalized residuals series. For the dynamic Copula-GARCH model we analyzed various specifications of the dynamics of copula parameters opting for the parsimonious ones. According to the Akaike Information Criterion the dynamic Copula-GARCH model outperforms the static one.

This result implies that including a varying dependency structure may improve the estimation of market risk using Monte Carlo method due to improvements in the consistency of the simulations of future evolution paths of the two prices. As further research we intend to develop a framework for market risk assessment of a portfolio under the assumption that the returns of the assets follow the dynamic specification of the Copula-GARCH model.

REFERENCES

Blyth, S. (1996), "Out of line", *Risk*, 9, 10, 82-84.

Bollerslev, T. (1986), "Generalized Autoregressive Conditional Heteroskedasticity," *Journal of Econometrics,* 31:307–327.

Cherubini, U., Luciano, E.; and W. Vecchiato, (2004), *Copula Methods in Finance*, Wiley.
Deheuvels, P. (1979), "La fonction de dependance empirique et ses proprietes. Un test non paramtrique d'independence," *Acad. Roy. Belg. Bull. Cl. Sci.*, 65:274-292.
Engle, R. (1982), "Autoregressive Conditional Heteroscedasticity with Estimates of the Variance of United Kingdom Inflation," *Econometrica*, 50:987–1007.
Fermanian, J. D. (2005), "Goodness-of-fit tests for copulas," *Journal of Multivariate Analysis* 95:119-152.
Fermanian, J. D. and O. Scaillet (2003), "Nonparametric estimation of copulas for time series", *Journal of Risk*, 5:25–54.
Gijbels, I., and J. Mielniczuk, (1990), "Estimating the density of a copula function," *Comm. Statist. Theory Methods*, 19:445-464.
Hu, L. (2006), "Dependence Patterns across Financial Markets," *Applied Financial Economics*, 10:717-729.
Jondeau, E., and M. Rockinger, (2006), "The Copula-GARCH model of conditional dependencies," *Journal of International Money and Finance*, 25:827-853.
Necula, C. (2009a), "Modeling Heavy Tailed Stock Index Returns Using the Generalized Hyperbolic Distribution", *Romanian Journal of Economic Forecasting*, 10(2):118-131.
Necula, C. (2009b), "Modeling the Dependency Structure of Stock Index Returns Using a Copula Function Approach", *Romanian Journal of Economic Forecasting*, forthcoming.
Nelsen, R.B. (1999), *An Introduction to Copulas*. Springer-Verlag.
Patton, A. (2006a), "Modeling Asymmetric Exchange Rate Dependence," *International Economic Review*, 47:527-556.
Patton, A. (2006b), "Estimation of Multivariate Models for Time Series of Possibly Different Lengths," *Journal of Applied Econometrics*, 21:147-173.
Shaw, J. (1997), "Beyond VAR and Stress Testing", in: S. Grayling (Ed), *VaR: Understanding and Applying Value at Risk*, London: Risk Publications, 211-224.
Silverman, B.W. (1986), *Density Estimation for Statistics and Data Analysis*, Chapman and Hall.
Sklar, A. (1959), "Fonctions de répartition à n dimensions et leurs marges," *Publications de l'Institut de Statistique de l'Université de Paris* 8:229–231.
Yan, J. (2006), "Multivariate Modeling with Copulas and Engineering Applications", in: H. Pham (Ed.), *Handbook of Engineering Statistics*, Springer, 973-990.

COPULA-GARCH MODEL

SAŽETAK

U ovom smo istraživanju razvili novi dvodimenzionalni Copula-GARCH model. Ovu vrstu dvodimenzionalnih procesa karakterizira zavisna struktura stvorena koristeći spojnu funkciju (kopulu). Za marginalne gustoće koristili smo GARCH(1,1) model s inovacijama preuzetim iz t-Student distribucije. Model se može lako proširiti koristeći sofisticiranije procese za marginalne gustoće. Statička specifikacija modela pretpostavlja da zavisna struktura dva niza podataka ne varira u vremenu te tako podrazumijeva da su parametri spojne funkcije konstantni. S druge strane, dinamička specifikacija eksplicitno određuje dinamiku ovih parametara. Ekonometrijski procjenjujemo parametre dvije specifikacije koristeći razne spojne funkcije, uz naglasak na mješavinu između Gumbelove i Claytonove kopule. Koristili smo dnevne indekse zarade s dva razvijena i dva financijska tržišta u razvoju. Glavni nalaz upućuje na to da uključivanje promjenjive zavisne strukture poboljšava sukladnost distribucije Copula-GARCH modela.

***Ključne riječi**: spojne funkcije, multidimenzionalni GARCH, volatilnost, zavisna struktura*

Mateja Jerman*

Slavka Kavčič**

Bogdan Kavčič***

UDK 347.77:334.724>:658.511:657.375>
(497.5:497.4:437.1:430:73)"2004/2008"
Original scientific paper
Izvorni znanstveni rad

THE SIGNIFICANCE OF INTANGIBLES: A COMPARATIVE ANALYSIS BETWEEN CROATIA, SLOVENIA, CZECH REPUBLIC, GERMANY AND THE USA

ABSTRACT

According to the growing importance of intangible assets, the research aims to investigate the significance of intangibles for Croatian, Slovenian, Czech, German and US publicly traded companies. The analysis is focused on intangibles that meet the criteria for the recognition in financial accounts. The results of the analysis prove that in the period 2004-2008 intangibles constitute an important asset for traditional market economies, which does not result for post-transition and transition economies, despite the fact that many analyses underline their growing significance in today's business environment. Independent t-test was used to test a difference between selected companies. A future research approach should analyze the proportion of intangibles that do not meet the criteria for their recognition and found out if transition economies actually possess a significantly lower proportion of intangibles.†

JEL: M41, M48

Key words: *intangible assets, goodwill, comparative analysis, financial reporting*

I. INTRODUCTION

In today's knowledge economy the rising importance of intangible assets has driven its attention (Hussi and Ahonen, 2002, Gerpott, Thomas and Hoffmann, 2008). Furthermore case studies and analysis have provided evidence that intangible assets are the fundamental source of competitive advantages for firms in most industries (García-Ayuso, 2003). The characteristics of the economy changed from the industrial one to today's more service and information oriented. The traditional financial accounts changed over the last decades (Brännström and Giuliani, 2009). According to Edvinsson (2000) the future value creation is in the shaping of intangibles. Accounting changes in recent years have increasingly recognized the importance of intangibles, such as intellectual capital and goodwill (Dunse, Hutchinson and Goodacre, 2004).

In accordance with an increasing number of mergers and acquisitions (Mergerstat, 2009), the importance of goodwill as an intangible assets became apparent. Acquisitions reveal the hidden value of intangible assets (Boekenstein, 2009), that previous did not meet the criterion for their recognition. The results of Boekenstein's study (carried out for pharmaceutical sector) reveled that in mergers and acquisitions the total value of the acquired company increases approximately six times. Knowledge-related assets including goodwill are primarily responsible for this increase. A similar study was performed also by Busacca and Maccarone

* University of Primorska, Faculty of Management Koper, Slovenia. Cankarjeva 5, 6000 Koper, e-mail: mateja.jerman@fm-kp.si.

** University of Ljubljana, Faculty of Economics, Slovenia. Kardeljeva pl. 17, 1000 Ljubljana, e-mail: slavka.kavcic@ef.uni-lj.si.

*** Faculty of Commercial and Business Sciences, Slovenia. Lava 7, 3000 Celje, e-mail: bogdan.kavcic@telemach.net.

† Paper received 1 November 2009.

(2007) who found out, that the most important sources of value for the telecommunications industry are represented by intangibles.

According to the rising phenomenon of intangibles the analysis aims to analyze the significance of identifiable intangible assets for Croatian publicly traded companies, taking part of Croatian stock exchange index CROBEX. Croatian companies are subject of comparison with Slovene, Czech, German and American publicly traded companies. American companies were selected as they represent the most developed traditional market economy. On the other hand Germany is a representative European traditional market economy. Croatia, as a transition economy is additionally compared with post-transition economies, which are in our case Slovenia and Czech Republic (for characteristics see Dolenc, 2009 and Stubelj, 2009). According to the growing importance of goodwill (related to the fact that many intangibles still do not meet the criteria for their recognition) the paper additionally analysis its importance in the structure of intangible assets.

The research carried out by Lahovnik (Lahovnik, 2000) provided evidence that in 39, 5 % of Slovene acquisitions the acquirer paid for the acquiree at least 50 % less than its book value (recognition of negative goodwill). In the case of Polish companies even Schroeder (2007) found out that the recognition of negative goodwill was very frequent. The results imply evidence that in the period of transition companies do not posses intangible assets which are not recognized in the balance sheet as the acquirers were not willing to pay for companies more than their book value. Consequently in the period of transition instead of goodwill, the acquirer often recognizes negative goodwill, which is not a typical phenomenon for traditional market economies. According to stated characteristics of the transition, an obvious hypothesis for post-transition and transition economies would be the following:

$H_1 =$ The significance of intangibles is less important for post-transition and transition economies in comparison with traditional market economies,

$H_2 =$ The share of goodwill for post-transition and transition economies is insignificant in comparison with traditional market economies,

The paper is structured as follows. After the introduction, the accounting for intangibles background is presented. In the third part the data collection and research methodology are explained. The results of the analysis and discussion are presented in the fourth part. The fifth part draws the conclusion.

II. ACCOUNTING FOR INTANGIBLES

In the current literature we can found an abundance of definitions as to what intangible assets are, but there still no general accepted definition that could be adopted internationally (Kristandl and Bontis, 2007). IFRS define intangible assets as identifiable non-monetary assets without physical substance (IAS 38.8), while Lev and Daum (2004) define intangibles as capabilities and "potential" for future growth and income. According with the International accounting standards (IAS 38.9) entities most often recognize intangible resources as scientific or technical knowledge, design and implementation of new processes or systems, licences, intellectual property, market knowledge and trademarks (including brand names and publishing titles).

After the initial recognition, intangibles have to be arranged in groups with definite and indefinite useful lives. Assets with indefinite useful lives are subject of annual impairment, while those that do have a definite useful live are still subject of amortization. For the measurement after its initial recognition a company shall choose either a cost or the revaluation model. In accordance with the cost model an intangible asset is measured at its cost less any accumulated amortization and any accumulated impairment loss, while

revaluation model requires that it has to be carried at the revaluated amount less any accumulated amortization and impairment losses.

The most controversial topic concerning intangibles is undoubtedly the recognition of goodwill. Goodwill represents the residual between the purchase price of an entity and its fair value of net assets. In accounting terms it can be recognized in financial accounts just in cases of mergers and acquisitions. There is no internationally accepted definition, nor a widely accepted accounting approach for its measurement. The majority of definitions state that goodwill is a claim for future benefits (Seetharaman, Balachandran and Saravanan, 2004), but there is no clear definition of what the elements of goodwill are (as it captures a wide range of intangibles that do not meet the recognition criteria). According to the standard for business combinations from 2004, goodwill acquired in a business combination was initially measured at its cost, which exceeded the acquirer's interest in net fair value of the identifiable assets, liabilities and contingent liabilities.

Many changes in the field of accounting for goodwill demonstrate that there is no evidence about its useful life, whether it has to be tested for impairment or amortized and even if it has to be recognized as an asset or not. Goodwill can be recognized only if it is acquired in a business combination. Internally generated goodwill can not be recognized as an asset because it is not an identifiable resource controlled by the entity that can be measured reliable (IAS 38.49). According to the current accounting approach, companies that prefer organic growth can not recognize internally generated goodwill which consequently leads to noncomparable financial accounts (Seetharaman et al., 2004).

Despite many efforts of standard preparers to provide an adequate accounting approach to account for intangibles, traditional accounts still face many problems concerning their initial recognition and subsequent measurement.

III. DATA COLLECTION AND RESEARCH METHODOLOGY

For the purposes of the analysis the sample of Croatian, Slovenian, Czech, German and US publicly traded companies was selected. The sample includes Croatian companies that were included in Croatian stock exchange index CROBEX (24 companies). Croatian companies were subject of comparison with Slovene companies, included in Slovenian stock exchange index SBI 20 (15 companies), Czech companies included in the stock index PX-GLOB (25 companies), German companies included in German stock exchange index DAX (30 companies) and US publicly traded companies included in American index Dow Jones (30 companies). The data were selected for companies that were included in stated indexes on the day of 28th October 2008.

This sample of companies was selected because of their data availability, as they provide a greater extent of disclosures in comparison with smaller companies. The selected European companies prepare their annual accounts in accordance with IFRS which require a certain extent of disclosures that are not so comprehensive for smaller companies. The research was limited to the sample of publicly quoted companies as they use the IFRS which ensure international comparability of selected European accounts. The collected data were selected on the basis of publicly available consolidated annual accounts and notes to consolidated annual accounts for the period 2004-2008. The study is focused on intangibles that meet the criterion for their recognition in financial accounts; non-identifiable intangibles (often categorized as intellectual capital), which do not meet the criterion for the recognition, are not subject of this analysis.

The means of intangible's shares, goodwill's shares and shares of goodwill in the structure of intangibles were calculated as an arithmetic mean.

For the hypothesis testing, the independent t-test was carried out. Independent t-test was used to test a difference between two independent groups on the means of a continuous variable. T-test was used to test the differences between groups of companies that are part of selected indexes. For the purposes of testing the differences between groups of selected companies on the means of intangible's and goodwill's shares, the null and alternative hypotheses were formed:

H_0 = The means of the two groups are not significantly different and

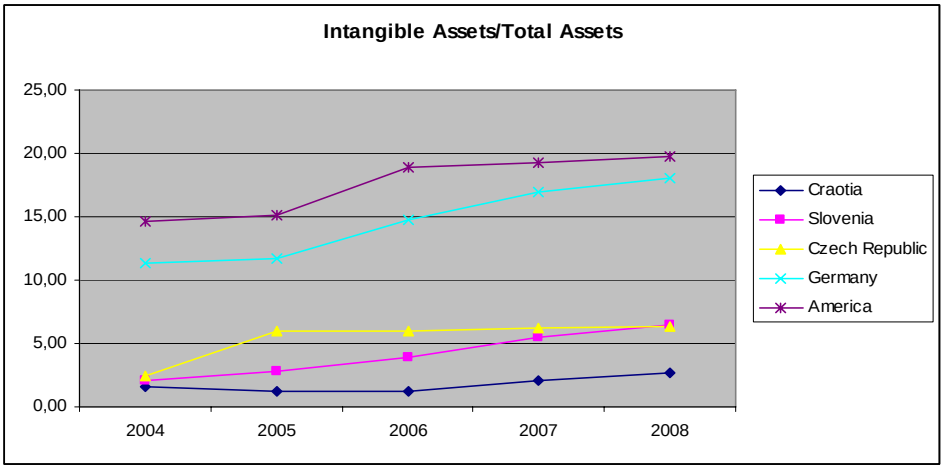
H_1 = The means of the two groups are significantly different.

IV. RESULTS AND DISCUSSION

The results of the analysis prove that there is a significant difference (sig. < 0,05) in the share of intangibles between Croatian, German and American selected companies (the detailed results of the t-test are presented in table 3). The results of the t-test demonstrate that we can not prove a statistical difference between Croatian, Slovenian and Czech companies (sig. > 0,05). Differences also do not result between American and German companies. The difference between selected companies implies the fact that post-transition and transition economies operate with a significantly lower share of intangibles in comparison with traditional market economies. The only exception was present in the year 2005 for the sample of Czech companies, when the difference between Czech and German companies was not significant. The significance of intangibles in the entire structure of assets for selected companies is presented in the figure 1.

Figure 1.

The share of intangible assets in total assets for the period 2004-2008



On the basis of data provided in table 1, a rising importance of intangible assets can be ascertained. A continuous growth of intangibles was presented in Slovene, German and American companies, meanwhile in Croatian (2005) and Czech (2006) companies a smaller decrease was notable.

Table 1.

The share of intangibles for selected companies in the period 2004-2008

Year	Croatia	Slovenia	Czech Republic	Germany	America
2004	1,59	2,11	2,44	11,33	14,63
2005	1,27	2,79	6,01	11,66	15,12
2006	1,28	3,96	5,96	14,72	18,96
2007	2,04	5,55	6,19	16,91	19,21
2008	2,63	6,50	6,40	18,10	19,80
Mean	1,76	4,18	5,40	14,55	17,55

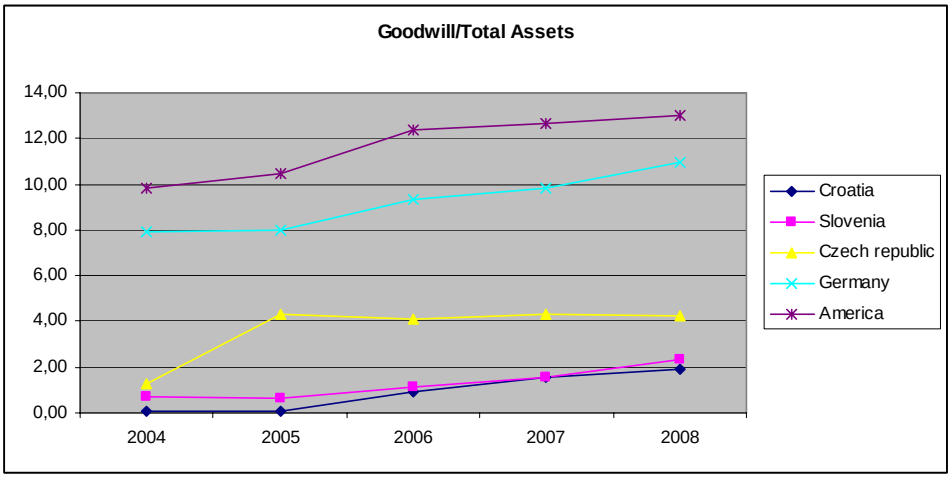
The analysis proves that intangible assets are becoming more and more important for today's business environment, but there is still a significant difference between different types of economies. The most important significance of intangibles is present in German and American selected companies, where their share in 2008 achieved nearly one fifth of the total assets.

According to the fact that numerous researches draw attention to goodwill as a more and more important intangible asset, the research moreover investigates the importance of goodwill for selected companies. Similar to previous results, an increasing share of goodwill is evident (figure 2), but differences between economies, although some unexpected results ascertained, still can be found. Significant differences can be found for Croatia and Slovenia in comparison with Germany and America. However there are no statistical significant differences between Czech and German companies in the period 2005-2008. The comparison between Czech Republic and America revels that the differences are not ascertained only in the year 2005. The results show that in the case of goodwill Czech companies do not differ in comparison with German one. The results might be the consequence of a convergence process. Future research could provide evidence of a convergence process between market, post-transition and transition economies.

However there are still no significant differences between German and American companies, the same as between Croatian, Slovenian and Czech companies. The detailed results are presented in the table 3.

Figure 2.

The share of goodwill in total assets for the period 2004-2008



The results visible demonstrate that goodwill does not represent an important intangible asset for Croatian companies. A similar situation is present in Slovenia, while German and American companies posses a significantly higher share of goodwill (table 2). Czech companies posses a superior share of goodwill in comparison with Croatian and Slovene companies, but there is no significant difference between them.

Table 2.

The share of goodwill for selected companies in the period 2004-2008

Year	Croatia	Slovenia	Czech Republic	Germany	America
2004	0,10	0,67	1,28	7,95	9,80
2005	0,10	0,61	4,33	8,02	10,47
2006	0,91	1,10	4,12	9,36	12,35
2007	1,52	1,56	4,32	9,80	12,66
2008	1,93	2,33	4,25	10,98	13,04
Mean	0,91	1,26	3,66	9,22	11,66

In continuation table 3 presents the results of the t-test for equality of means tested for intangible assets and goodwill.

Table 3.

Results of the t-test for equality of means

	Sig. (2-tailed)	Croatia	Slovenia	Czech Republic	Germany	America
2004	Croatia	x	.555	.537	.000	.000
	Slovenia	*.132*	x	.828	.000	.000
	Czech Republic	.329	*.543*	x	.001	.000
	Germany	*.000*	*.000*	*.001*	x	.352
	America	*.000*	*.000*	*.000*	*.479*	x
2005	Croatia	x	.194	.164	.000	.000
	Slovenia	*.275*	x	.447	.001	.000
	Czech Republic	*.127*	*.180*	x	.147	.036
	Germany	*.000*	*.000*	*.231*	x	.332
	America	*.000*	*.000*	*.067*	*.360*	x
2006	Croatia	x	.077	.117	.000	.000
	Slovenia	*.755*	x	.607	.002	.000
	Czech Republic	*.358*	*.220*	x	.036	.005
	Germany	*.000*	*.000*	*.091*	x	.344
	America	*.000*	*.000*	*.016*	*.324*	x
2007	Croatia	x	.066	.179	.000	.000
	Slovenia	*.961*	x	.872	.003	.001
	Czech Republic	*.379*	*.368*	x	.017	.005
	Germany	*.000*	*.000*	*.082*	x	.619
	America	*.000*	*.000*	*.014*	*.349*	x
2008	Croatia	x	.082	.252	.000	.000
	Slovenia	*.726*	x	.981	.005	.001
	Czech Republic	*.502*	*.531*	x	.014	.005
	Germany	*.001*	*.002*	*.051*	x	.725
	America	*.000*	*.000*	*.009*	*.536*	x
	Sig. (2-tailed) - intangible assets					
	Sig. (2-tailed) - goodwill					

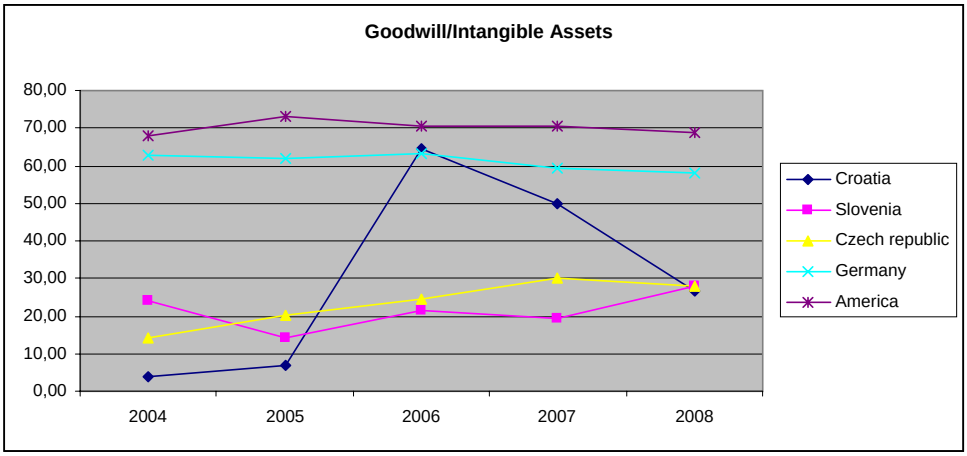
Despite the fact that selected companies are all large companies and their annual reports are prepared according to IFRS (except Slovenian banks, included in the sample that introduced the use of IFRS in 2006 and insurance companies that reported according to IFRS only in 2007; the sample included 1 bank and 2 insurance companies), the structure of

intangible assets for Slovenian and Croatian selected companies was not always disclosed. The reasons are undoubtedly linked with the insignificance of recognized intangible assets and goodwill, which was confirmed also by the qualitative research. The disclosures of Czech, German and American companies are of a greater extent and provide more detailed information.

In conformity with the results, the research additionally investigates the importance of goodwill as an intangible asset. The results prove that goodwill represents the most important intangible assets for German and American selected companies (figure 3). Their share of goodwill is considerably higher than 50 %.

Figure 3.

The share of goodwill in the structure of intangible assets for the period 2004-2008



On the other hand an important growth was present in Croatian companies in the year 2006, when goodwill increased to 64, 36 % (table 4). Despite the growth of goodwill in 2006, the share instantly decreased in 2007 and 2008.

Slovenian and Czech companies did not evident any greater growth nor decrease in the analyzed period. The significance of goodwill in the structure of intangibles was not denoted. The smallest share of goodwill in the analyzed period was present in Slovenian companies. Croatian companies evidenced a greater portion of goodwill in comparison with Slovenian and Czech companies, but goodwill still did not represent the most important intangible asset as it was ascertained for German and American companies.

Table 4.

The proportion of goodwill in the structure of intangible assets in the period 2004-2008

Year	Croatia	Slovenia	Czech Republic	Germany	America
2004	3,96	24,20	14,24	62,78	67,78
2005	6,78	14,07	20,34	62,07	73,07
2006	64,36	21,34	24,65	63,18	70,54
2007	49,74	19,39	30,03	59,42	70,65
2008	26,60	27,86	27,81	58,04	68,98
Mean	30,29	21,37	23,41	61,10	70,21

According to the results of the analysis we can confirm the first hypothesis which stated that the significance of intangibles is less important for post-transition and transition economies in comparison with traditional market economies.

The second hypothesis can be confirmed only partially. There is a significant difference between Slovenia and Croatia in comparison with Germany and America, while Czech companies unexpectedly did not demonstrate the expected difference.

The reasons that lead to these results might be a consequence of the current accounting approach in use. As stated by Powell (2003, 805-806) a significant proportion of internally developed intangibles is not recognized in the financial statement of an entity. The failure to recognize these assets means that investors are not receiving relevant information about the entity. That is why future research approach should analyze the proportion of intangibles that do not meet the criteria for the recognition and to find whether if we take into account both; i.e. recognized and non-recognized intangibles, if the difference between different economies still exists.

According to the results of our analysis, emerging economies will have to dedicate more attention to disclosure items. Just by disclosing more information about non-recognized intangibles, the information asymmetry between recognized and non-recognized intangibles will be eliminated. Recent researches suggest that the lack of information provided by preparers of financial accounts shell be improved (Sevin, Schroeder and Bhamornsiri, 2007, Gerpott et al., 2008). Kristensen and Westlund (2003) believe that it is crucial to understand the gap between market and book value, which is linked with incomplete information about intangibles. Models that could be used to report about financial and non-financial assets are presented by Fincham and Roslender (2003). Research of capital market impacts, of disclosure of enhanced business reporting information, found that disclosures can reduce information asymmetry and improve company valuation (Boedker, Mouritsen and Guthrie, 2008).

Standard preparers, academics, users of financial accounts and financial experts should engage all the necessary efforts to assure an indispensable reporting model which will provide useful, timely, quality and reliable information needed. This is undoubtedly the challenge of the future accounting system.

V. CONCLUSION

The results of the analysis prove that there is a significant difference in the share of intangibles (recognized in financial accounts) between market economies and post-transition and transition one. A different picture resulted for the case of goodwill. Despite the fact that differences between Croatia and Slovenia in comparison with Germany and America can be identified, Czech companies do not demonstrate a statistical difference in comparison with market economies. Notwithstanding the fact that recent analysis dealt with the growing importance of intangibles the analysis proves that in the case of Croatia, Slovenia and Czech Republic they do no represent an important asset that is recognized in financial accounts. The increasing trend demonstrates that in the near future also these companies will face a grater changes in the structure of their financial accounts. To that end a major attention to their disclosures shall be provided.

This study is limited to selected companies that are part of the national stock exchange indexes. It could be part of future research to asses these differences also for other economies and different sizes of companies.

REFERENCES

Boedker, C., Mouritsen, J., Guthrie, J., (2008), "Enhanced business reporting: international trends and possible policy directions", *Journal of human resource costing & accounting*, 12 (1): 14-25.

Boekenstein, B., (2009), "Acquisitions reveal the hidden intellectual capital of pharmaceutical companies", *Journal of intellectual capital*, 10 (3): 389-400.

Brännström, D., Giuliani, M., (2009), "Accounting for intellectual capital: a comparative analysis", *The journal of information and knowledge management systems*, 39 (1): 68-79.

Busacca, G. A., Maccarone, P., (2007), "IFRSs and accounting for intangible assets: the Telecom Italia case", *Journal of intellectual capital*, 8 (2): 306-328.

Dolenc, P., (2009), "Trend brakes in the public debt management in Slovenia", *Ekonomický časopis*, 57 (1): 95-103.

Dunse, N. A., Hutchinson, N. E., Goodacre, A., (2004), "Trade related valuations and the treatment of goodwill", *Journal of property investment & finance*, 22 (3): 236-258.

Edvinsson, L., (2000), "Some perspectives on intangibles and intellectual capital 2000", *Journal of intellectual capital*, 1 (1): 12-16.

Fincham, R., Roslender, R., (2003), "Intellectual capital accounting as management fashion: a review and critique", *European accounting review*, 12 (4): 781-795.

García-Ayuso, M., (2003), "Intangibles: Lessons from the past and look into the future". *Journal of intellectual capital*, 4 (4): 597-604.

Gerpott, T. J., Thomas, S.E., Hoffmann A. P., (2008), "Intangible asset disclosures in the telecommunications industry", *Journal of intellectual capital*, 9 (1): 37-61.

Hussi, T., Ahonen, G., (2002), "Managing intangible assets – a question of integration and delicate balance", *Journal of intellectual capital*, 3 (3): 277-286.

International financial reporting standards. Available at: http://ec.europa.eu/internal_market/accounting/ias/index_en.htm (accessed 15 August 2009).

Kristandl, G., Bontis, N., (2007), "Constructing a definition for intangibles using the resource based view of the firm", *Managerial decision*, 45 (9): 1510-1524.

Kristensen, K., Westlund, A. H., (2003), „Valid and reliable measurements for sustainable non-financial reporting", *Total quality management*, 14 (2): 161-170.

Lahovnik, M., (2000), "Uspešnost prevzemov podjetij v Sloveniji v devetdesetih letih", *Economic and business review*, 2 (February 2000): 131-143.

Lev, B., Daum, J. H., (2004), "The dominance of intangible assets: consequences for enterprise management and corporate reporting", *Measuring business excellence*, 8 (1): 6-17.

Mergerstat. Available at: https://www.mergerstat.com/newsite/ (accessed 20 July 2009).

Powell, S., (2003), "Accounting for intangible assets: current requirements, key players and future directions", *European accounting review*, 12 (4): 797-811.

Schroeder, M., (2007), "Goodwill on consolidation as an indicator of progress in transition economies: evidence form Polish listed group financial statements", *Research in accounting, banking and corporate financial management in emerging economies*, Vol. 7: 11-27.

Seetharaman, A., Balachandran, M., Saravanan, A. S., (2004), "Accounting treatment of goodwill: yesterday, today and tomorrow: Problems and prospects in the international perspective", *Journal of intellectual capital*, 5 (1): 131-152.

Sevin, S., Schroeder, R., Bhamornsiri, S., (2007), "Transparent financial disclosure and SFAS No. 142", *Managerial auditing journal*, 22 (7): 674-687.

Stubelj, I., (2009), "The cost of equity capital: the case of selected Slovene publicly traded companies", *Management*, 4 (1), 21-38.

ZNAČAJ NEMATERIJALNE IMOVINE: KOMPARATIVNA ANALIZA HRVATSKE, SLOVENIJE, ČEŠKE, NJEMAČKE I SAD

SAŽETAK

S obzirom na rastuću važnost nematerijalne imovine, cilj istraživanja je utvrđivanje značaja nematerijalne imovine za hrvatska, slovenska, češka, njemačka i američka javna poduzeća. Analiza je usredotočena na nematerijalnu imovinu koja ispunjava uvjete za ulazak u financijska izvješća. Rezultati analize dokazuju da u periodu 2004.-2008. nematerijalna imovina predstavlja bitan dio imovine za gospodarstva s tradicionalnim tržištima, što nije slučaj u post-tranzicijskim i tranzicijskim gospodarstvima, usprkos činjenici da mnoge analize naglašavaju njenu rastuću važnost u današnjem poslovnom okruženju. Buduća bi istraživanja trebala analizirati udio nematerijalne imovine koja ne ispunjava uvjete za prepoznavanje i provjeriti posjeduju li zaista tranzicijska gospodarstva znatno manji udio nematerijalne imovine.

Ključne riječi: nematerijalna imovina, goodwill, komparativna analiza, financijska izvješća