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ECONOMIC EFFICIENCY OF INSURANCE COMPANIES: CROSS-COUNTRY COMPARISON OF PRODUCTIVITY GROWTH

ABSTRACT: This paper focuses on the economic efficiency of the insurance companies in Croatia, Serbia, and Slovenia. Data Envelopment Analysis (DEA) is used to examine the contributions of technical and economic efficiency change to the productivity growth in the insurance industries of these countries by applying the generalized output-oriented Malmquist index for the 2014-2015 period. The output-input data consists of a panel of 19 insurance firms in Serbia, 23 insurance companies in Croatia and 13 Slovenian companies chosen as the sample of the study. The study utilizes four inputs and two outputs: commission and management costs, stock capital and labor force, as well as premium and net investment income, respectively. The efficiency is measured using the Malmquist index which can be decomposed into two components: the efficiency change index and the technical change index. The results have shown that up to 50% of Croatian and Slovenian companies are efficient, compared to 30% of Serbian companies.

KEY WORDS: economic efficiency, insurance, productivity, growth, cross-country.

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1. Introduction

The concept and practice of insurance have been developed to protect individuals and businesses from various risks. Insurance provides indirect protection by way of financing loss impacts and thus facilitating economic growth. Insurance helps stabilize the financial situation of individuals and businesses and thus boosts trade and commerce. Additionally, insurance can encourage loss mitigation and can be a substitute for and complement government security programs (Skipper, 2001). Government expenditures can be reduced by loss financing transfer, and the surplus can be used for boosting growth instead. Additionally, insurance companies act not only as providers of risk transfer solutions and loss indemnification but also as institutional investors at financial markets. Many studies (Skipper and Kwon, 2007; Dorfman, 2008) have demonstrated the multiple benefits of insurance to the economy and society. Zweifel and Eisen (2012) state that “insurance influences production and consumption, internal and international trade, transaction payment as well as the conservation of existing and creation of new wealth.” According to Zweifel and Eisen, “insurers reduce losses and therefore increase the efficiency of the economy and contribute to its stability and growth”.

The empirical evidence from the developed economies demonstrates that insurers are major employers, investors, and tax contributors in the U.S. (Insurance Information Institute, 2015), in the U.K. (Association of British Insurers, 2015) and in the EU (Insurance Europe, 2015). The insurance industry is a major U.S. employer, providing about 2.4 million jobs. The industry’s financial assets amounted to about \$6 trillion in 2013. Insurers contribute more than \$413 billion to the U.S. gross domestic product. Insurance companies paid \$17.4 billion in taxes to the 50 states in 2013, or about 2% of all state taxes (Insurance Information Institute, 2015). UK insurance industry manages investments of £1.9 trillion (equivalent to 25% of the UK’s total net worth), employs around 334,000 individuals and pays nearly £12 billion in taxes (Association of British Insurers, 2015). In 2014, European insurers generated premium income of nearly €1,170 billion, employed over one million people and invested nearly €9,900 billion in the economy (Insurance Europe, 2015).

The insurance industry in Eastern and Southeastern Europe, measured by premium per capita, has been growing more slowly than in developed economies. Prior to the economic transition in this region, “private insurance was neither much needed nor purchased” (Dorfman, 2008), because of the excessive use of public funds to cover losses, prevalent social insurance system and state ownership of the means of production. Privatization (denationalization) initiated the development of risk management and growth of insurance demand. At the same time, insurance markets became deregulated and liberalized, with many foreign insurance companies entering insurance markets of these countries (Roaf et al., 2014). These insurance markets are still modestly developed in terms of insurance density compared to the Western European countries; however, insurance premium growth in Eastern European countries has outpaced premium growth in developed economies (e.g., Marovic et al., 2010). This study focuses on the performance of the insurance industries in Croatia, Serbia, and Slovenia by comparing the efficiency of insurance companies in these countries. To our knowledge, this is the first study that compares the performance of insurance industries in the countries of former Yugoslavia.

Many studies on the performance of other financial service industries, such as deposit-taking institutions, have been conducted worldwide. So far, few of them have been concerned with the insurance industry. Investigating the performance of the insurance industry is crucial since this industry is currently facing many challenges, including increased competition, consolidation, solvency risks, and a changing regulatory environment. Measuring the efficiency of this industry is important as it will help determine how the industry will respond to these challenges and which firms are likely to survive (Berger et. al, 1993).

This study measures the efficiency of insurance companies in Croatia, Serbia, and Slovenia in 2014 – 2015 using the Data Envelopment Analysis (DEA). In the DEA technique, efficiency is measured by the Malmquist index. The Malmquist efficiency measures are decomposed into two components: efficiency change and technical change index. Efficiency change is further decomposed into pure and scale efficiency. The output-input data consisted of 19, 23 and 13 insurance firms from Serbia, Croatia, and Slovenia, respectively. Four inputs (share capital,

number of employees, commission, and management expenses) and two outputs (total premium collected and net investment income) were used. Another study on the efficiency of Serbian insurance companies was done using the third output data, which was unavailable for Croatia and Slovenia – the number of insurance contracts. The paper consists of 4 sections: Literature Review, Methodology (explaining the DEA and Malmquist Index), Results and Discussion, and finally, Concluding Remarks.

2. Literature review

Many studies on the performance of financial services industries, especially banks, have been conducted worldwide; yet only a few have been concerned with the insurance industry. Investigating the performance of the insurance industry is crucial since this industry is currently facing many challenges, including increased competition, consolidation, solvency risks, and a changing regulatory environment. The research findings reveal the need for insurance operators to improve their competitiveness and underline the importance of stability of the financial institutions which can be achieved through joint action of policymakers and insurance companies' regulators.

Among the most widely used methods for measuring the efficiency of the insurance industry are Stochastic Frontier Analysis (SFA) and Data Envelopment Analysis (DEA). The SFA, also known as the Econometric Frontier Approach, was developed by Aigner et al., (1977). This approach specifies a functional form for cost, profit or production relationship among inputs, outputs, and environmental factors and allows for random error (Berger and Humphrey, 1997). The econometric approach has the main disadvantage of using strong assumptions regarding the form of the efficient frontier. Data Envelopment Analysis (DEA), or the mathematical programming approach, was introduced by Charnes et al. (1978) and is based on the efficiency concept in Farrell (1957). According to Charnes et al. (1978), DEA estimates efficiency under the assumption of constant returns to scale, while Banker et al. (1984) assumed variable returns to scale. This approach constructs the frontier of the observed input-output ratios by linear programming. It assumes that linear substitution is possible between observed input combinations on an isoquant.

Wanke and Barros (2016) investigated heterogeneity, represented by different types of insurance provided, served by Brazilian insurance companies, while Nektarios and Barros (2010) estimated the effects of deregulation after the implementation of the Third Insurance Directive in the Greek insurance market. Both studies used DEA and the Malmquist Index decomposed into technical efficiency change (pure technical and scale efficiency) and technological change. The findings suggest that the mixed insurance companies had the lowest productivity. Bertoni and Croce (2011) examined the implications of the Third Directive on productivity evolution in the European life insurance industry. The authors applied DEA to a panel of 602 life insurance companies operating in five European countries (Germany, France, Italy, Spain, and the UK) between 1997 and 2004. They developed a generalized Malmquist efficiency decomposition to gauge the relative importance of the improvement of best practices, and the adoption of practices currently adopted by local or foreign best-in-class insurers. Miyashita et al. (2011) estimated how the selection of the insurance underwriting portfolio affects the cost efficiency of non-life insurers in different market environments. The results showed that the efficiency of insurers deteriorates as they decreased their diversification. This indicates that non-life insurers can successfully improve their efficiency by diversifying their insurance policy portfolio. Marie et al. (2009) investigated cost inefficiencies and how they relate to value drivers of insurers in United Arab Emirates (UAE). The study revealed that there were 21-33% cost inefficiencies in these insurers under different model specifications of stochastic frontier and DEA. Cummins and Xie (2013) examined efficiency, productivity, and scale economies in the US property-liability insurance industry. Productivity change was analyzed using Malmquist indices, and efficiency was estimated using DEA. The results indicate that most firms below median size in the industry are operating with increasing returns to scale, while most firms above median size are operating with decreasing returns to scale. Segovia et al. (2009) used data from 80 000 car insurance policies to assess the combinations of risk that generate the highest returns for the company under existing pricing practices.

3. Data and Methodology

Four inputs and outputs have been used in the efficiency investigation of insurance firms in Croatia, Serbia, and Slovenia. The inputs are commission and management expenses, number of employees and stock capital. The outputs are total premium collected and net investment income. The Serbian insurance companies sample consists of the following: AMS, AXA Non-Life, AXA Life, DDOR, Dunav, Energoprojekt, Generali, Globos, Grawe, Merkur, Milenijum, Sava Non-Life, Sava Life, Societe, Sogaz, Triglav, Uniqa Non-Life, Uniqa Life, and Wiener. The Croatian companies include: Agram Life, Allianz Zagreb, BNP Paribas Cardif, Croatia, Croatia Health Insurance, Ergo, Ergo Life, Erste Vienna Insurance Group, Euroherc, Generali Croatia, GRAWE Croatia, HOK, Hrvatsko Kreditno Osiguranje, Izvor, Jadransko, Merkur Croatia, Societe Generale, TRIGLAV Croatia, Uniqa, Velebit, Velebit Life, Wiener Vienna Insurance Group, Wüstenrot Life. The sample of Slovenian companies consists of the following: Adriatic Slovenica, GENERALI Slovenia, GRAWE Slovenia, Merkur Zavarovalnica, Modra Zavarovalnica, NLB Vita Življenjska Zavarovalnica, SID – Prva Kreditna Zavarovalnica, Skupna Pokojninska Družba, Triglav Zdravstvena Zavarovalnica, Vzajemna Zdravstvena Zavarovalnica D. V. Z, Zavarovalnica Maribor (Sava), Zavarovalnica Tilia, Zavarovalnica Triglav.

Data on inputs and outputs have been collected for the 2014-2015 period. All monetary values were adjusted for inflation and calculated in euros by 2015 exchange rates. The data for the Serbian insurance companies were taken from the National Bank of Serbia website. The data for Croatian and Slovenian companies were taken from companies' annual financial reports.

The generalized output-oriented Malmquist index, developed by Fare et al. (1994) was used to measure the technical and efficiency change to the growth of productivity in the insurance industries. The Malmquist indexes are constructed using the Data Envelopment Approach in the following manner:

$$M_0(x^t, y^t, x^{t+1}, y^{t+1}) = \frac{D_0^{t+1}(x^{t+1}, y^{t+1})}{D_0^t(x^t, y^t)} \cdot \left[\left(\frac{D_0^t(x^{t+1}, y^{t+1})}{D_0^{t+1}(x^{t+1}, y^{t+1})} \right) \cdot \left(\frac{D_0^t(x^t, y^t)}{D_0^{t+1}(x^t, y^t)} \right) \right]^{\frac{1}{2}},$$

where the notation $D_0^t(x^{t+1}, y^{t+1})$ denotes the distance from the period t+1 to the period t technology. The first ratio on the right-hand side of the formula measures the change in relative efficiency between year t and t+1. The second term, i.e., the geometric average in the brackets measures the shift in technology, or movements of the frontier function itself.

Table 1 presents the descriptive statistics of the outputs and inputs of 55 insurance firms in the three countries during 2014-2015. Within this period, the Slovenian company *Triglav zavarovalnica* acquired 600 million in premiums, while ERGO life had just under 150 thousand Euros. However, for the second output, i.e., investment income, the Croatian UNIQA had the highest income. As for inputs, *Croatia insurance* has the highest acquisition costs, while *Triglav zavarovalnica* has the highest management expenses of around 90 million.

Table 1. Descriptive statistics

	input variables				output variables	
	<i>Capital</i>	<i>Commision expenses</i>	<i>Manage-ment expenses</i>	<i>Emplo-yees</i>	<i>Premiums</i>	<i>Investment income</i>
Mean	17550217	9961296	9855878	499	64201572	5181446
Median	7984555	5322000	3953391	228	27062095	1707656
St. Dev.	25528436	11640280	15895398	682	103179055	6571392
Minimum	3081545	5628	232668	9	143717	0
Maximum	152200000	49590838	88671593	3047	584869502	21393194

Source: Authors' calculations

Table 2 show the percentage of the actual output level compared to the maximum potential output level at the given input mix. Due to the wide range of output values, we opted for the variable returns to scale. 19 companies remained efficient in both years, 4 gained full efficiency in 2015 (*Uniqa Slovenia, Sava, HOK, Generali Serbia*), one lost full efficiency from 2014 (*Merkur, Serbia*). Serbian *AXA Non-Life* remained at the efficiency bottom, producing only 4.3% and 9.1% of its potential output in 2014 and 2015 respectively.

Table 2. Efficiency of the insurance firms – variable returns to scale, Malmquist index and changes

Country	DMU Name	2015		2014		MI	Technical change	Efficiency change
		Obj. Value	Efficient	Obj. Value	Efficient			
S e r b i a	AMS	0,469		0,394		1,036	0,930	1,190
	AXA n	0,091		0,043		1,907	0,916	2,111
	AXA l	1,000	Yes	1,000	Yes	0,947	0,896	1,000
	DDOR	0,640		0,620		1,126	1,052	1,032
	Dunav	0,747		0,553		1,523	1,071	1,351
	Energoprojekt	1,000	Yes	1,000	Yes	1,015	1,030	1,000
	Generali	1,000	Yes	0,948		1,149	1,187	1,055
	Globos	0,298		0,315		0,868	0,842	0,946
	Grawe	0,861		0,776		1,190	1,151	1,109
	Merkur	0,824		1,000	Yes	0,877	1,135	0,824
	Milenijum	1,000	Yes	1,000	Yes	1,029	1,060	1,000
	Sava n	0,453		0,496		0,953	1,093	0,912
	Sava z	1,000	Yes	1,000	Yes	1,065	1,135	1,000
	Societe	1,000	Yes	1,000	Yes	1,172	1,375	1,000
	Sogaz	0,516		0,383		1,454	1,165	1,347
	Triglav	0,417		0,427		0,958	0,963	0,977
	Uniqa n	0,435		0,341		1,270	0,992	1,275
	Uniqa l	0,731		0,379		1,279	1,160	1,130
	Wiener	0,677		0,803		0,860	1,040	0,843

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C r o a t i a	AGRAM LIFE	0,938		0,724		1,411	1,187	1,295
	ALLIANZ ZAGREB	1,000	Yes	1,000	Yes	0,907	0,823	1,000
	BNP Paribas	0,399		0,402		0,986	0,989	0,992
	CROATIA osiguranje	1,000	Yes	1,000	Yes	1,065	1,134	1,000
	CROATIA zdravstveno	0,539		0,422		1,287	1,012	1,279
	ERGO osiguranje	0,190		0,102		1,853	0,989	1,863
	ERGO I	1,000	Yes	1,000	Yes	1,070	1,146	1,000
	Erste osiguranje Vienna	1,000	Yes	1,000	Yes	1,070	1,145	1,000
	EURO-HERC osiguranje	0,724		0,884		0,711	0,753	0,820
	GENERALI OSIGURANJE	0,672		0,557		1,206	0,999	1,207
	GRAWE Hrvatska	1,000	Yes	1,000	Yes	1,133	1,284	1,000
	HOK OSIGURANJE	1,000	Yes	0,544		1,770	0,928	1,837
	Hrvatsko kreditno osiguranje	1,000	Yes	1,000	Yes	1,021	1,043	1,000
	IZVOR OSIGURANJE	0,199		0,202		0,949	0,929	0,984
	JADRANSKO OSIGURANJE	0,486		0,534		0,967	1,128	0,911
	MERKUR OSIGURANJE	1,000	Yes	1,000	Yes	0,799	0,638	1,000
	Societe Generale	1,000	Yes	1,000	Yes	1,085	1,177	1,000
	TRIGLAV OSIGURANJE	0,430		0,274		1,418	0,815	1,570
	UNIQA osiguranje	1,000	Yes	0,849		0,992	0,710	1,177
	VELEBIT OSIGURANJE	0,197		0,237		0,820	0,976	0,830
VELEBIT ZIVOTNO OSIGURANJE	0,271		0,229		1,370	1,335	1,186	
Wiener osiguranje VIG	0,778		0,778		1,061	1,125	1,001	
Wustenrot zivotno	1,000	Yes	1,000	Yes	1,039	1,080	1,000	

S l o v e n i a	Adriatic Slovenica	0,891		0,894		0,971	0,950	0,996
	GENERALI zavarovalnica	0,454		0,513		1,044	1,394	0,884
	GRAWE Zavarovalnica	0,567		0,549		1,101	1,136	1,033
	Merkur zavarovalnica	0,733		0,799		1,035	1,273	0,917
	Modra zavarovalnica	0,803		0,803		1,112	1,236	1,000
	NLB Vita življenjska zavarovalnica	1,000	Yes	1,000	Yes	1,158	1,342	1,000
	SID Prva kreditna zavarovalnica	0,243		0,214		1,131	0,992	1,136
	Skupna pokojninska družba	1,000	Yes	1,000	Yes	0,995	0,990	1,000
	Triglav Zdravstvena zavarovalnica	1,000	Yes	1,000	Yes	0,918	0,843	1,000
	Vzajemna zdravstvena zav	1,000	Yes	1,000	Yes	1,040	1,082	1,000
	Zavarovalnica Maribor Sava	1,000	Yes	1,000		0,991	0,982	1,000
	Zavarovalnica Tilia	0,344		0,305		0,927	0,674	1,129
Zavarovalnica Triglav	1,000	Yes	1,000	Yes	1,033	1,067	1,000	

Source: Authors' calculations

The Malmquist index is further decomposed into its two components, technical change and efficiency change. The results of technical change and efficiency change are displayed in the last 3 columns of Table 2. The index values of technical progress or regress as measured by average shifts in the best-practice frontier from 2014 to 2015. The results show that all the firms experienced both technical progress and regress. Of the Serbian insurance companies, DDOR marked the highest technical change of over 55%, while Globos experienced technical regress by over 15%. The Croatian companies changed less dramatically. Merkur Croatia regressed technically by

36%, while Velebit health insurance increased its technical efficiency by 33%. Finally, the Slovenian companies' technical efficiency coefficients ranged from a decrease of 32% for Zavarovalnica Tilia to an increase of 39% for Generali. We have observed large efficiency differences between the 55 companies from 3 countries.

Concluding Remarks

In this study, DEA is used to explore the contributions of technical and efficiency change to the change in productivity in three countries of former Yugoslavia: Croatia, Serbia, and Slovenia. We applied the generalized output-oriented Malmquist index for the 2014-2015 period. The efficiency measures do not bear out the hypothesis that the biggest companies are also the most efficient, since the efficiency was rather uniformly distributed throughout the companies and countries.

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EKONOMSKA EFIKASNOST OSIGURAVAJUĆIH KUĆA: UPOREDNA ANALIZA RASTA PRODUKTIVNOSTI NA NIVOU DRŽAVA

APSTRAKT: Ovaj rad se bavi analizom ekonomske efikasnosti osiguravajućih društava u Hrvatskoj, Srbiji i Sloveniji. U radu se koristi DEA analiza kako bi se ispitalo u kojoj meri promene tehničke i ekonomske efikasnosti doprinose rastu produktivnosti u sektoru osiguranja u navedenim zemljama. U analizi je primenjen generalizovani izlazno-orijentisani Malmkvistov indeks za period od 2014. do 2015.godine. Podaci za ulaz i izlaz prikupljeni su na osnovu uzorka od 19 osiguravajućih društava iz Srbije, 23 osiguravajuća društva iz Hrvatske i 13 osiguravajućih društava iz Slovenije. U istraživanju su korišćena četiri vrste ulaza i dva izlaza: troškovi provizije i upravljanja, akcijski kapital i radna snaga, odnosno prihod od premija i neto investicije. Efikasnost se meri korišćenjem Malmkvistovog indeksa koji se može podeliti na dve komponente: indeks promene efikasnosti i indeks tehničkih promena. Rezultati su pokazali da je do 50% hrvatskih i slovenačkih kompanija efikasno, u poređenju sa 30% srpskih kompanija.