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AN EMPIRICAL STUDY OF EFFICIENCY IN CROATIA AND SLOVENIA INSURANCE MARKETS

Abstract

In this paper we analyze insurance efficiency in Slovenia and Croatia between 2006 and 2010 using a Data Envelopment Analysis. We perform both intra- and inter- country efficiency surveys. The intra country survey indicates that on average companies in Croatia operate more efficiently than companies in Slovenia. A positive trend of scale efficiency improvement due to mergers and acquisitions which took place in recent years in Croatia is also detected. Nevertheless, the inter-industry analysis indicates that the Slovenian insurance industry dominates Croatian cost and technical efficiency, which shows a low efficiency position of the insurance market in Croatia. Analysis also shows that inefficiency in Croatia is more affected by inefficient internal company operation than in Slovenia.

Keywords: *Data Envelopment Analysis, Cost Efficiency, Technical Efficiency, Scale Efficiency, Croatia, Slovenia*

JEL: *C14; G22; C67; D61*

1. INTRODUCTION

When we try to analyse the insurance sector within one region or country it is often done by measuring their performance relative to other companies within the sector or region. Benchmarking is a commonly used approach to measure relative performance. The insurance industry traditionally uses measures like ROE, combined ratio, loss ratio, cost ratio, and others to measure relative performance of the company. With the rapid development of frontier efficiency methodologies, conventional methods are being upgraded with new approaches which clearer explain sources of inefficiency.

One of the benefits of a frontier efficiency analysis is that it can provide a benchmark beyond county borders, since it allows comparisons of efficiency in the insurance industry with the region or internationally. Such results could provide valuable insight into the competitiveness of insurance industries in different countries, and could be of particular interest of regulators, investors, and managers.

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Analysing efficiency at the international level has for a long time attracted significant attention among researchers., This kind of study is of particularly interest for the European market (see Diacon et al., 2002) because of the implementation of the single insurance licence, which was the basis for deregulation of the EU insurance industry. As a consequence many studies have been done to investigate this topic. Hussels and Ward (2007), for example, found out that increased competition in the UK is reflected in the higher intra-industry cost efficiency, but international comparison shows that German industry dominates UK efficiency, both before and after deregulation. Fenn et al., (2008) concluded that most European insurers operate under increasing returns to scale. The results indicate that mergers and acquisitions, facilitated by the liberalized EU market, have led to efficiency gains. They also find similarly as Rai (1996) that larger firms and firms with high market shares operate at higher levels of cost inefficiency. Recently, Eling and Luhnen (2010) analysed efficiency with a comparison of 6462 insurers from 36 countries, and found that developed countries in Europe and Asia achieve higher efficiency scores than emerging markets.

Despite many efficiency studies on the insurance industry there was not much done to analyse the insurance sector of new EU members or future accession countries. Only a few efficiency studies of the financial sector have been published so far for Slovenia and Croatia, mainly covering banks; among them Kraft et al., (2002), Jemrić and Vujčić (2002), Kavčič and Medved (2004), and Medved (2004).

Slovenia joined the EU in 2004, and Croatia is in the closing process to do the same. In this respect it is interesting to investigate the efficiency of the Croatian insurance market in more detail, since single insurance licence will also be valid for Croatia after entering the EU. We believe that Slovenia, as a young member of the EU, could be the best candidate for first international comparisons and benchmarking. The purpose of this paper is to analyse the efficiency of the insurance market in Croatia in comparison to the insurance industry in Slovenia. To do this we utilize the Data Envelopment Analysis (DEA) method, which is a non-parametric method to estimate frontier efficiency. We analyse the technical, cost, and scale efficiency of the insurance sector in both countries separately and together. This study adds to the literature by investigating insurance efficiency of two emerging markets.

The structure of this paper is as follows. In section 2 we give a short analysis of the Croatian and Slovenian insurance markets. Section 3 presents the main theoretical background for an efficient frontier analysis. In Section 4 the choice of variables is discussed. Section 5 presents the results. Section 6 outlines the final conclusions.

2. THE CROATIAN AND SLOVENIAN INSURANCE SECTOR

According to the Croatian Supervisory Agency monthly report gross insurance premiums written in 2010 amounted to EUR 1.27 billion, of which non-life premiums totalled EUR 0.93 billion and life premiums EUR 0.34 billion. The Slovenian market total written premium amounted to EUR 1.94 billion, which is around 50% more than in Croatia. The gross written premiums for non life operations in Slovenia is EUR 1.44 billion, and the gross written premiums for life insurance operation is EUR 0.50 billion.

The aggregate market share in 2010 of the four major insurance companies is above 55% in Croatia and 76% in Slovenia. The insurance sector in both countries has more similarities than not. They are both dominated by single, state owned composite company with a market share of more than 31% in Croatia and 37% in Slovenia. The majority of participants perform both non-life and life insurance operations, since they were established before the new insurance act, which strictly divides life and non-life business. At present time there is no strong presence of foreign companies in Slovenia, since their market share represents only 10% of the total market share. This market share in Croatia is much higher, amounting to 44% in accounting year 2010. A much lower market share of foreign participants in Slovenia may be explained by the relatively small market, which in combination with the relatively high penetration rate is not so interesting for investors.

In terms of regulation both Slovenia and Croatia have similar regulations, both arising from EU insurance directives. One of the main differences in regulation is the fact that Slovenia is an EU member, which allows direct cross border insurance operation from other companies in the EU. That is why some EU insurance companies operate in Slovenia directly or by branch office, which is currently not the case in Croatia.

The development of markets could be measured by penetration rate, i.e. the gross written premium divided by the gross domestic product. From Table 1 we can see that penetration rates for both life and non-life insurance operation is, for Slovenia, almost doubled as it is for Croatia. If we compare life insurance penetration to the EU average we can conclude that both countries, Slovenia and Croatia still have a long way to go to reach the EU average.

Table 1. Penetration rate in Slovenia and Croatia

	Croatia	Slovenia	EU average
Life penetration rate	0.8	1.8	4.5
Non Life penetration rate	2.1	4.2	3.1
Total	2.9	6.0	7.6

Note: data from CEA 2009 statistics

During the period 2002 – 2010 the number of players in Slovenia didn't change much, which indicates a relatively passive market. In other words, not much happened in recent years on the market, except one merger and a relatively low level of cross border operations. In contrast to recent years we have been witness to many mergers and acquisitions in the Croatian market.

We could categorize Slovenia and Croatia as a medium-sized market for life and non-life insurance, and one where premiums are growing modestly. Given the very slow growth of population in both countries, much of the growth is being driven by an increase in life density.

3. DATA ENVELOPMENT ANALYSIS

The idea behind efficiency measurement is to measure a company's performance relative to "best practice" frontiers in the sense that companies lying on best practice frontiers represent the most efficient companies in the industry. The pioneer of this concept was Farrell (1957),

who originally developed the underlying theory.

The Authors identify two principal types of efficiency methodologies – the econometric (parametric) approach and the mathematical programming (non-parametric) approach (see Eling and Luhnen, 2010). The econometric approach requires the specification of a production function, such as the translog or composite cost, and therefore expects a certain underlying economic behaviour, which may not be valid. In this respect the parametric approach is vulnerable to errors in the specification of the functional form and error term. On the other side, the mathematical programming approach avoids an a priori assumption about the analytical form of the production function, and an assumption about the error term is required. Both approaches have their supporters, and there is no consensus as to which method should be treated as superior (see Hussels and Ward, 2006).

Data Envelopment Analysis (DEA), as a member of the nonparametric approach, employs linear programming techniques where the set of best practice or efficient frontier are those which no other observed entities or decision-making unit (DMU) has as much or more of every output with the given input. The DEA frontier is given as the linear combination which connects the set of best practice observations or benchmarks. Efficient firms are situated on the frontier, while inefficient firms are below the frontier (see Mahlberg and Url, 2003).

An important advantage of DEA is that it can be used even for the small number of companies under investigation, which is not possible for parametric approaches (see Cooper, Seiford, Tone, 2006). This is especially important for Slovenia and Croatia with a relatively small number of insurance companies in relation to other western EU countries. However, a key drawback to the DEA approach is the general assumption that there is no random error. In this respect the frontier is sensitive to extreme observations and measurement errors (see Berger and Humphrey, 2000).

In our study, efficiency values are calculated assuming input orientation and constant returns to scale technology. The R programming package Benchmarking (Bogetoft and Otto, 2011) was used together with author's calculations. Technical efficiency, scale efficiency, and cost efficiency in each country are addressed.

Initially introduced by Charnes, Cooper in Rhodes (1978), the basic DEA model (also called 'CCR model') is built on the assumption of constant returns of scale (CRS) of activities. In the case of the constant returns to scale assumption, all firms are assumed to operate at an optimal scale. Let's assume that we observe n DMU's, and each DMU_j has an input vector $\mathbf{x}_j = \left(x_{1j}, x_{2j}, ..., x_{mj}\right)^T$ and an output vector $\mathbf{y}_j = \left(y_{1j}, y_{2j}, ..., y_{sj}\right)^T$. Our task is to determine the weights $\mathbf{v} = \left(v_i\right)_{i=1}^m$ and $\mathbf{u} = \left(u_i\right)_{i=1}^s$ using linear programming to maximize ratio (Cooper, Seiford, Tone, 2007):

$$\max \quad \theta \quad = \quad \frac{\sum_{i=1}^{s} u_i y_{ij}}{\sum_{i=1}^{m} v_i x_{ij}} \tag{1}$$

subject to

$$\frac{\sum_{i=1}^{s} u_i y_{ir}}{\sum_{i=1}^{m} v_i x_{ir}} \leq 1, \quad (r = 1,2,...,n)$$
$$u_1,...,u_s \geq 0$$
$$v_1,...,v_m \geq 0. \tag{2}$$

The weights are chosen in such a way that assigns the best set of weights to each DMU. The term 'best' is used to mean that resulting output to input ratio for each DMU is maximized relative to all other DMU when those weights are assigned to these inputs and outputs for every DMU. We say that DMU_j is CRS-efficient (technical efficient) if $\mathrm{q}^* = 1$ and there exists at least one optimal solution $\left(\mathbf{v}^*, \mathbf{u}^*\right)$ with $\mathbf{v}^* > 0$ and $\mathbf{u}^* > 0$.

We can rewrite model (1) into a matrix form. Let's define the matrix of inputs and outputs

$$\mathbf{Y} = \begin{pmatrix} y_{11} & \cdots & y_{1n} \\ \vdots & \ddots & \vdots \\ y_{s1} & \cdots & y_{sn} \end{pmatrix} \quad \text{and} \quad \mathbf{X} = \begin{pmatrix} x_{11} & \cdots & x_{1n} \\ \vdots & \ddots & \vdots \\ x_{m1} & \cdots & x_{mn} \end{pmatrix}. \tag{3}$$

Now we can write a linear program in matrix form as:

$$\begin{aligned} \max \quad & \theta = \mathbf{u}^T \mathbf{y}_j, \\ & \mathbf{v}^T \mathbf{x}_j = 1 \\ & \mathbf{u}^T \mathbf{Y} \leq \mathbf{v}^T \mathbf{X} \\ & \mathbf{u} \geq \mathbf{0} \\ & \mathbf{v} \geq \mathbf{0}. \end{aligned} \tag{4}$$

The dual problem of linear program (4) is expressed with a real variable q and non-negative vector $\lambda = \left(\lambda_1,\ldots,\lambda_n\right)^T$ of variables as follows:

$$\begin{aligned} \min \quad & \theta \\ & \theta \mathbf{x}_j - \mathbf{X}\lambda \geq \mathbf{0} \\ & \mathbf{Y}\lambda \geq \mathbf{y}_j \\ & \lambda \geq \mathbf{0}. \end{aligned} \tag{5}$$

For inefficient DMU we can reduce the use of inputs by q that $(\theta \mathbf{x}_j, \mathbf{y}_j)$ lies on the efficiency frontier. The CRS model assumes the constant return-to-scale production possibility set, which postulates that radial expansion and reduction of all observed DMUs. Since CRS efficiency does not distinguish whether DMU is "big "or "small," we can use this model to measure the theoretical inefficiency gap of each DMU in respect to the efficiency frontier. In this respect the SCR score is also called 'global technical efficiency' (Cooper, Seiford, Tone, 2007).

In (5) we have constraint $\boldsymbol{\lambda} \geq \mathbf{0}$, which defines, as mentioned above, a constant return to scale. In the case when using $\|\boldsymbol{\lambda}\| = 1$ in equation (5) we have a variable return to scale model (VRS) (Mahlberg, Url, 2003). Scale efficiency measures the distance between the frontier under VRC and CRS technology. It can be interpreted as a potential cost saving of a firm from adjusting to the optimal size. It is calculated as a ratio between CRS efficiency and VRS efficiency.

Cost efficiency can also be measured by the estimation of efficient frontiers. In this case the efficient frontier represents the optimal cost level for a given use of inputs and output. Cost efficiency was first introduced by Fare, Grosskopf, and Lovell (1985). They define cost efficiency of DMU_j as follows. First we solve linear program

$$\begin{aligned} \min \quad & \mathbf{c}_j^T \bar{\mathbf{x}} \\ \bar{\mathbf{x}} \ & \geq \mathbf{X}\boldsymbol{\lambda} \\ \mathbf{y}_j & \leq \mathbf{Y}\boldsymbol{\lambda} \\ \boldsymbol{\lambda} \ & \geq \mathbf{0}. \end{aligned} \tag{6}$$

where $\mathbf{c}_j$ is the unit cost vector of input vector $\mathbf{x}_j$ and may vary from one DMU to another. Based on the optimal solution $\left(\mathbf{x}^*, \boldsymbol{\lambda}^*\right)$, the cost efficiency of DMU_j is defined as

$$E_C = \frac{\mathbf{c}_j^T \mathbf{x}^*}{\mathbf{c}_j^T \mathbf{x}_j}. \tag{7}$$

For additional, in-depth explanations of the DEA methodology and different models, the reader is referred for example to Cooper et al., (2007).

4. CHOOSE OF INPUTS AND OUTPUTS

For our analysis we choose the period from 2006 to 2010. The Croatian data was collected from FINA (Croatian Financial Agency) for years 2007 to 2010 which are publicly available. For year 2006 the data was inputted manually from the respective annual company accounts. After eliminating companies where data was only available for a short part of the sample period, 24 life and non life insurance companies, representing for 98 percent of total premiums, were included in the final analysis. Data for Slovenian insurance firms was provided by the Slovenian insurance association and includes data of their members. After eliminating firms with incomplete data, the sample comprised 15 companies, which again representing 98 percent of the industry premiums.

Defining appropriate inputs, outputs, and their prices is critical in every efficiency analysis. Results obtained from DEA could be misinterpreted if the quantities are poorly defined. In this respect it is important to understand the services offered by the underlying financial sector to identify proper set of inputs and outputs, which will be analyzed. This is especially important in the insurance industry where many outputs are intangibles (see Ivanjko, 1996).

It is commonly agreed among researchers that insurer inputs can be classified into three principal groups: labor, business services and materials, and capital (Cummins, Weiss, 2000). If

data is available it makes sense to split labor into agent labor and back office labor since agency labor costs represents variable cost, while back office personnel usually represents a fix cost and those two could have different price. However, since companies include internal agents costs as a part of labor salaries and external commission as a part of acquisition cost, using separate data could be misleading.

In some studies (see Ennsfellner et al., 2004, Hussells et al., 2007) authors argue that the operating expenses should be treated as a single input in order to reduce the number of parameters. In this analysis we follow this approach. When analyzing the operating expenses of the insurance market, it can be clearly seen that these are mostly labor and commission related, in respect to both, life and non-life insurance operations, with the two largest items are acquisition costs and employee salaries (see Medved 2004). We therefore concentrate on insurance labor costs to determine the price of the operating expenses input factor. The price of labor is taken as an average gross monthly salary for the insurance industry taken from AJPES (The Agency for Public Legal Records and Related Services), classification 66.0 for Slovenia, and taken from the Croatian bureau of statistics, classification 65.0.

Because the number of employees and agents at the company level are not publicly available in Slovenia and Croatia, we follow the approach taken in the majority of insurance efficiency studies to estimate the quantity of labor by dividing expenditure for operating expenses with average monthly gross wage rate for the insurance industry (see Cummins, Weiss, 2000). With such an approach companies are ranked on the same level, regardless of sales strategy they perform (internal or external sales force). This simplification is also common in many other international surveys (Fenn et al., 2008, Eling et al., 2010) using the same arguments as we do in our survey.

One way of deriving cost of capital is the three-tier approach to measuring cost of equity capital based on AM Best ratings as proposed by Cummins et al., (2000). Since company ratings are not available for the Croatia and Slovenia market (at least not for all participants), we use as a proxy for cost of capital a nine and a half year average of the yearly rates of return of the country-specific stock market indices. The respective average was calculated from year 1991 up to first half of 2011. This gives a cost of capital for the Croatian market in the amount of 15.95% and 15.44% for Slovenia. The same approach to determine price of capital was proposed by Hussels et al., (2007).

In order to directly compare monetary values, all monetary values are deflated by the harmonized indices of consumer prices using base year 2006 (see Cummins et al., 2000). Country-specific Harmonised Indices of Consumer Prices (HICP) for services was obtained from EUROSTAT statistics. This index, which is similar to CPI, allows international comparisons and has also been published for the Croatian market since 2005.

In contrast to insurance input there is no common consensus among researchers regarding which insurance outputs are most appropriate for an optimization measurement in the insurance industry. Different outputs have been tested in surveys, among them: gross premiums, net written premium, policyholders reserve, addition on reserves, number of policies, incurred claims, investment income, and others (see Cummins, et al., 2000, Eling et al., 2010). The most

appropriate output measure for the insurance industry would be the embedded value of company, but usually this company information is not publicly available.

We will follow the value-added approach to define appropriate measure output (see Cummins and Rubio-Misas 2006). According to Eling et al., (2010a) the value-added approach to define output is clearly dominant in the insurance industry: So far, 78 out of 93 studies have applied this approach. However, there is no consensus whether benefits (claims for non life operation and mathematical reserve for life operation) or premiums are more appropriate proxy for the value-added approach. Taking insurance claims as output is questionable since under such an assumption management should seek to maximize the value of insurance claims which is clearly not the case (see Diacon et al., 2002). Claims reserves can be regarded as a stochastic process which in addition adds stochastic variability to data.

In this survey we define output as gross written premium, separate for life and non-life business. Some authors (Yuengert, 1993) have criticized such an approach, because premiums represent price time quantity of output and could not be output as such. But if we look at gross written premiums as a market measure, we can perform an optimization survey on that basis. Since Slovenian, as well as Croatian, insurance management in general optimize market share as a strategic goal, we believe this is the right choice. In their survey, Hussels et al., (2007) found a similar efficiency score for the German insurance industry using either claims or premiums output. Since Germany is a typical representative of the highly regulated insurance market before adoption of the single passport, and on the other hand, Slovenia and Croatia belong to the same group, indicates that use of premiums will generate representative results.

The descriptive statistics for each county are presented in Table 2. While operating expenses (salaries, commission, and business services cost) are comparable in both countries, average gross written premiums for life and non life insurance business is more than twice as high in Slovenia than in Croatia. The capital position in both countries goes in line with premiums, since it is according to solvency regulation in each country correlated with premiums. Average gross monthly salary in the period from 2006 to 2010 for the insurance industry sector is 37% higher in Slovenia, but the difference has been closing up since 2008. All financial data is presented in EUR, using the average exchange rate for the year of observation.

Table 2. Descriptive statistics

	Croatia				Slovenia			
Variable	Mean	Stdev	Min	Max	Mean	Stdev	Min	Max
Monthly gross salary	1,531.8	77.4	1,450.0	1,635.0	2,104.4	111.8	1,922.0	2,212.0
Salaries, commission and business services costs (Mio EUR)	20.42	28.63	0.75	145.40	29.16	36.74	1.02	145.60
Capital (Mio EUR)	29.94	47.54	2.98	250.73	56.75	115.96	0.99	482.67
GWP Life (Mio EUR)	16.04	16.43	0.00	58.69	35.36	56.10	0.00	232.10
GWP Non Life (Mio EUR)	44.75	82.82	0.00	398.75	100.18	142.81	0.00	531.34

Source: Author calculation

5. EMPIRICAL RESULTS

Table 3 provides the various DEA measures of efficiency for the Croatian insurance market using gross written premiums as the output measure. Technical efficiency (under CRS technology), scale efficiency, and cost efficiency are presented. Estimates are calculated from separate frontiers for Croatia, measuring efficiency taking into account interrelationship benchmark within the market. The efficiency of the total market is calculated as a geometrical mean of scores of individual firms.

By applying benchmark technology under technical efficiency, the market can improve efficiency by reducing inputs by 26%, meaning that the market could produce the same output (premiums) with 26% less resources. The results by weighing of geometric mean indicate that technical inefficiency is more affected by small companies.

Taking into account mergers and acquisitions which have taken place in recent years in the Croatia insurance market it is interesting to see, whether companies can actually improve their efficiency by increasing the size of their company. Table 2 also presents average scale efficiency for all years. The average value of 0.79 in the last five years indicates that insurance companies would be able to improve their efficiency on average by 21% by adjusting to the right size. But there is a clear trend of improving scale efficiency starting from 2008, which may reflect mergers activities in recent years. Since the Croatian insurance market is still in the developing stage these results are within expectations. Having scale efficiency on an average higher than global technical (CRS) efficiency meaning that technical inefficiency of the insurance industry

is more attributed to the inefficiency of company operations rather than scale (see Cooper et al., 2007).

Turning to cost efficiency results shows decline in cost efficiency from the 2006 to 2008 period. After that period cost efficiency in the Croatian insurance market started to increase quite rapidly. This might indicate that due to the financial crisis, which started in 2008, management was forced to allocate available resources more efficiently. The average result of cost efficiency of 66% indicates that the average firm could reduce their cost by 34%. In depth analysis shows that above average cost efficient have specialized companies performing only non- life insurance operations and the least cost efficient are firms performing only life insurance operations. This might be explained by the fact that the Croatian life insurance market is still in the developing phase, and the current size of income from those operation does not allow management to operate more cost efficiently, since fixed costs for every insurance operations are significant.

Table 3. Efficiency score for Croatia

	2010	2009	2008	2007	2006	Average
CRS						
Geom. mean	0.76	0.73	0.60	0.73	0.89	0.74
Weighted geom. mean	0.83	0.82	0.85	0.88	0.96	0.87
Standard deviation	0.22	0.23	0.30	0.22	0.15	0.22
Max	1.00	1.00	1.00	1.00	1.00	1.00
Min	0.15	0.10	0.02	0.04	0.55	0.17
Scale Efficency						
Geom. mean	0.83	0.78	0.64	0.79	0.93	0.79
Weighted geom. mean	0.86	0.85	0.88	0.92	0.98	0.90
Standard deviation	0.20	0.22	0.30	0.22	0.12	0.21
Max	1.00	1.00	1.00	1.00	1.00	1.00
Min	0.15	0.10	0.02	0.04	0.62	0.19
Cost Efficiency						
Geom. mean	0.72	0.67	0.50	0.60	0.81	0.66
Weighted geom. mean	0.79	0.79	0.76	0.80	0.91	0.81
Standard deviation	0.20	0.22	0.27	0.22	0.18	0.22
Max	1.00	1.00	1.00	1.00	1.00	1.00
Min	0.14	0.09	0.02	0.03	0.49	0.15
Number of DMU	20	23	23	21	14	20

Source: Author calculation

Results for the Slovenia insurance market are presented in Table 4. Comparing the results for inter efficiency measures for Slovenia and Croatia, which are measured separately, we can observe that on average companies in Croatia operate more efficiently than companies in Slovenia.

The results for technical, scale, and cost efficiency in Slovenia stay close to their mean values throughout the observed period. A slow decrease could be observed in technical efficiency in the period from 2008 to 2010, indicating that management of insurance companies did not succeed in reducing resources after the crash of the financial market – which in the insurance industry has the consequence of dropping written premiums. Relatively low scale efficiency over the last two years could be interpreted that in recent years there were no mergers and acquisitions in the market, and also indicates potential in the market for investors. Average cost efficiency of 49% indicates, that companies in Slovenia could reduce their cost by almost 51%. Large companies are more cost efficient than small meaning that the size of small companies is not optimal.

In addition, we compared companies that are active in only one line of business (either life or non-life) with companies that are active in more than one line of business (composite insurance company). The average technical efficiency for specialized companies is 15% larger than those for composite companies. This finding is in line with Cummins et al., (2008), who conclude that diversifying in different lines of business is not always better than a strategic focus on one line.

Table 4 Efficiency score for Slovenia

	2010	2009	2008	2007	2006	Average
CRS						
Geom. mean	0.60	0.62	0.65	0.60	0.54	0.60
Weighted geom. mean	0.65	0.74	0.73	0.65	0.60	0.67
Standard deviation	0.26	0.27	0.26	0.28	0.27	0.27
Max	1.00	1.00	1.00	1.00	1.00	1.00
Min	0.15	0.14	0.14	0.10	0.11	0.13
Scale Efficency						
Geom. mean	0.69	0.69	0.74	0.74	0.69	0.71
Weighted geom. mean	0.69	0.77	0.76	0.74	0.68	0.73
Standard deviation	0.27	0.28	0.26	0.26	0.27	0.27
Max	1.00	1.00	1.00	1.00	1.00	1.00
Min	0.15	0.14	0.14	0.10	0.11	0.13
Cost Efficiency						
Geom. mean	0.55	0.55	0.48	0.44	0.40	0.49
Weighted geom. mean	0.61	0.66	0.56	0.51	0.51	0.57
Standard deviation	0.26	0.25	0.24	0.25	0.26	0.25
Max	1.00	1.00	1.00	1.00	1.00	1.00
Min	0.14	0.14	0.12	0.10	0.09	0.12
Number of DMU	14	14	13	13	13	13.4

Source: Author calculation

Results we present here for Slovenia are in line with results from the survey made by Hussels and Ward (2007) when they measured various efficiency scores for Germany. The average cost efficiency of the German insurance industry in their study was calculated at 0.560, and the average scale efficiency at 0.713. Since both countries belong to a continental approach to the insurance industry those results are not surprising.

Table 4 presents the selected DEA measures of efficiency where the estimates are calculated from the combined frontiers of Croatia and Slovenia to analyze each country's firms as if it would be operating under a single market. This allows us to compare internationally the performance of the insurance industry in each market. Croatian average cost efficiency on the joint frontier is 28% and the Slovenian is 49%. Similar is the technical efficiency for Slovenia whose result is 0.6, which is higher than in Croatia (0.37). In this respect it is more likely that Slovenian insurance companies define the joint frontier, and are therefore the more efficient industry. For example, in 2010 there was no Croatian insurance company which would lie on the cost efficient frontier, since the maximum score for that year was 0.748 for companies operating on the Croatian market. On other hand, if we compare results from a single frontier (see Table 2 and Table 3), we can conclude that the Croatian insurance industry locally on average operates closer to an efficient frontier than the Slovenian insurance market. Taking into account the results from Table 4, we could make the conclusion that the Croatian insurance market is less competitive. But in 2010 more than 65% of insurance companies in our sample were foreign owned companies, which make it unlikely that the Croatian market will be in a low competitive environment.

Two points have to be mentioned here. First, in our survey we could not include the influence transaction costs could have on our results, since that data is not available. Especially for the companies that are members of international financial groups transaction costs could be an important driver for efficiency. Evidence from a banking sector survey in Slovenia (see Kavčič et al., 2004) also shows that foreign banks adjust the pricing structure to local circumstances in order to retain part of the extra profit which is offered by the market. This might also happening in the Croatia insurance sector. Secondly, the insurance market is a highly regulated industry with high fixed costs connected to the labor force and capital. Since the Croatian insurance market is still underdeveloped (this is especially true for life insurance operation) management of companies has a much harder task to improve cost efficiency. Our conclusion then could be, that the efficiency of the Croatian insurance sector could be improved with the development of the insurance sector as such.

Table 5. Efficiency measures with joint frontier for Croatia and Slovenia

		2010	2009	2008	2007	2006	average
Technical (CRS)	CRO	0.366	0.404	0.321	0.366	0.373	0.366
	SI	0.598	0.617	0.649	0.597	0.543	0.601
Scale	CRO	0.654	0.607	0.480	0.570	0.759	0.614
	SI	0.692	0.768	0.761	0.741	0.688	0.730
Cost	CRO	0.331	0.334	0.219	0.223	0.267	0.275
	SI	0.555	0.550	0.482	0.438	0.403	0.485

Source: Author calculation

On other hand, results from Table 4 show a similar pattern of scale efficiency for companies from both countries in last few years. Taking into account the lower technical efficiency of Croatia compared to Slovenia, this indicates that inefficiency in Croatia is more affected by inefficient internal operation than in Slovenia. This means that the insurance sector in Croatia will have to invest more in technology, and probably also into research and development in order to improve current trends.

5. CONCLUSION

The purpose of this paper is to analyse the development of the efficiency of the insurance industry in Croatia and Slovenia. In this respect we performed both intra and international efficiency surveys. Comparing the results for intra efficiency measures for Slovenia and Croatia we can observe that on average companies in Croatia operate locally more efficiently than companies in Slovenia. Mergers and acquisitions in recent years in Croatia had a positive effect to scale efficiency improvement. It was detected that technical inefficiency of the insurance industry in Croatia is more attributable to inefficient internal operations rather than scale. This result is important for both managers and investors when defining company strategy and targets. The average result of cost efficiency of 66% in Croatia indicates that the average firm could reduce their cost by 34%. In depth analysis shows that above average cost efficiency have specialized companies performing only non- life insurance operations, and the least cost efficient are firms performing only life insurance operations. The results for Slovenia are not so favorable as for Croatia, but they goes in line with the efficiency scores which were detected in Germany.

We get a reverse picture of efficiency scores when combing the frontiers for Croatia and Slovenia into a single frontier. This allows us to compare the performance of the insurance industry in both markets. The Croatian average cost efficiency of the joint frontier is now much lower and equal to 28%, indicating that insurance industry in Croatia is highly cost inefficient. This might be explained due to fact, that the Croat insurance market is still in the developing phase, and the current size of income from those operation does not allow management to operate more cost efficiently, since fixed costs for every insurance operation is significant.

We can get another explanation of cost inefficiency by observing descriptive statistics where operating expenses (salaries, commission, and business services costs) are comparable in both countries, while the average gross written premium for life and non life insurance business is more than twice as high in Slovenia as in Croatia.

Taking into account lower technical efficiency of Croatia compared to Slovenia, and comparable scale efficiency, this indicates that inefficiency in Croatia is more affected by inefficient internal operation than in Slovenia. The similar findings we have in intra efficiency analysis. This could mean that the insurance sector in Croatia will have to invest more in technology, and probably also into research and development in order to improve internal company efficiency.

A number of open questions regarding efficiency in both markets still need to be addressed. First of all, one needs to analyse the efficiency position of emerging markets within European insurance market as whole and answer to the question how policy makers could help to improve efficiency position of companies in those markets. This could be especially interesting for regulators and politicians to see how EU deregulation effects efficiency position of emerging markets.

At the country level in depth research of technical progress over the financial sector is needed. Suggested by many researchers this could be measured by the Malmquist productivity index.

Last but not least we need to analyse how the efficiency of different lines of insurance operations (such as liability, homeowner, auto, or life insurance) contributes to overall efficiency of the company in both countries. Evidence from the Croatian insurance market shows that companies specialised only in one line of business (life insurance) are the least efficient on the market. This finding is not supported by surveys in other countries– also in Slovenia – and needs to further investigated.

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EMPIRIJSKO ISTRAŽIVANJE UČINKOVITOSTI TRŽIŠTA OSIGURANJA U HRVATSKOJ I SLOVENIJI

Sažetak

U ovom radu analiziramo učinkovitost tržišta osiguranja u Sloveniji i Hrvatskoj između 2006. i 2010. godine korištenjem DEA metode. Vršimo i intra-i inter-državnu analizu učinkovitosti. Unutar pojedinačne zemlje rezultati pokazuju, da u prosjeku društva za osiguranje u Hrvatskoj posluju učinkovitije od društva za osiguranje u Sloveniji. Otkriven je pozitivan trend rasti učinkovitosti opsega, kao posljedica akvizicija i spajanja u posljednjih nekoliko godina u Hrvatskoj. Ipak, međunarodna analiza pokazuje, da je slovenska industrija osiguranja troškovno i tehnički učinkovitija, što pokazuje nisku poziciju učinkovitosti na tržištu osiguranja u Hrvatskoj. Analiza također pokazuje da je neučinkovitosti u Hrvatskim društvima za osiguranje više pod utjecajem neučinkoviti unutarnjih procesa nego u Sloveniji.

Ključne riječi*: DEA, troškovna učinkovitost, tehnička učinkovitost, učinkovitost opsega, Hrvatska, Slovenija*

JEL*: C14; G22; C67; D61*