

PERFORMANCE OF THE CROATIAN INSURANCE COMPANIES - MULTICRITERIAL APPROACH

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Abstract

This paper will perform a multi-criteria analysis of the insurance sector in the Republic of Croatia. The analysis is performed based on five indicators for the eight largest insurance companies in Croatia. The multicriteria business performance is calculated with use of a score, the weighted sum of relative values of indicators. The score is obtained by calculating weights as a solution of a goal programming problem. The goal of a specific insurance company is to increase the value of an indicator in comparison to its value a year before. Hence, some insurance companies have more goals that they wish to obtain. The results reveal that the Croatian insurance sector has given the highest priority to return on investment and return on equity for 2011.

Key words: *Insurance Companies, Goal Programming, Multicriteria performance, Ranking, Profitability*

1. INTRODUCTION

This paper analyses the business performance of insurance companies, specific non-deposit financial institutions that deal with collecting and underwriting risk. Collecting risk allows the insurance companies to recoup policyholders that sustained accidental damages, that are insured. The financial burden is divided on all the members of the risk community. In view on the specificity of their

business, insurance companies keep accounts and financial records in their own specific way that is dictated by the regulations of the Croatian Financial Services Supervisory Agency (CFSSA). Taking that into account, the analysis of their success is obtained by using financial indicators that are modified to the peculiarities of the insurance sector, and differ from other classical indicators that are used in the financial sector (Toby, 2011).

The Croatian insurance sector for 2011. consisted of 28 insurance and reinsurance companies. The share of their assets consisted of 6,1%¹ of all assets of financial institutions at the end of 2011. Based on their market share, this paper observes the business performance of the eight largest insurance companies. Gross written premium is used as the indicator that represents market share. The following insurance companies are observed: Jadransko osiguranje d.d., Basler osiguranje Zagreb d.d., Euroherc osiguranje d.d., Croatia osiguranje d.d., Allianz Zagreb d.d., Kvarner Vienna Insurance Group d.d., Triglav osiguranje d.d. and Grawe Hrvatska d.d. Among above mentioned companies, two of them provide only non-life insurance services, while the other ones provide both, life and non-life insurance services. The observed insurance companies generated 78,3% of the total gross written premium in 2010. and 77,6% of the total gross written premium for 2011.

The indicators are derived from the financial reports of the insurance companies for two consecutive years, 2010 and 2011. The five chosen financial business indicators are those that the CFSSA uses in their annual reports. The first criterion is the combined ratio which shows operating results before including income from investments. The second criterion is return on investment that shows net income from investments for every 100 invested units. The third criterion is debt ratio which shows the amount of assets financed by liabilities which do not include capital and reserves. The fourth criterion is return on equity (ROE) showing how much net profit of the accounting period can be generated by 100 units of equity. The fifth and last criterion is the market share indicator that represents the share of a single insurance company in the insurance market. All five indicators are calculated taking into account the whole performance of insurance companies, ie for companies that provide life and non-life insurance, both lines of business are taken into consideration.

The purpose of this research is a multicriteria analysis of insurance companies business in the The Republic of Croatia using the above mentioned indicators. The multicriteria business performance is calculated with the use of a score, the weighted sum of relative values of indicators. Since the weight values depend on subjective assesment, this paper proposes the evaluation of indicator values using goal programming. The goal of a specific insurance company is formulated on the assumption of what

¹ source: Croatian National Bank

is their strategy for the observed period. For that goal the insurance company does not want to deviate from.

The approach here differs from the approach in previous papers (Garcia, F., Guijarro F., Moya I. 2010), (Vojvodić Rosenzweig, V., Volarević, H., Varović, M., 2011), in view of the chosen sector and the number of goals for the insurance companies.

The calculated indicator values show what was the multicriteria performance of the insurance companies for the given year. The insurance companies goals in the first model are indicator values that have increased in relation to the values from the year before. The goal in the second model is the maximum score for every insurance company. For the remaining indicators it is assumed that the insurance companies strategy did not force their improvement. The score, as an insurance company multicriteria business performance, should be as close to the given goals as possible. The distance is calculated using the enhanced Chebyshev norm or the Dinkelbach-Isermann norm.

By solving the given goal programming model we obtain the weights assigned to individual indicators and the score of every specific insurance company.

The paper consists of five sections. The first section is the introduction. The second section describes the specific indicators that are used as criteria needed for the analysis in the business performance of insurance companies. In the third section the goal programming model is formulated that is applied on indicator values. The fourth section produces the results of the analysis, while the closing considerations are in the fifth section.

2. INSURANCE BUSINESS INDICATORS SELECTION

In order to apply a multicriteria approach using goal programming, we need to select indicators, i.e. criteria. Five insurance business indicators are selected in this paper, which CFSSA uses in their annual reports. The indicators are as follows:

1. **The combined ratio** is the sum of the claims ratio and expense ratio and it shows operating results before including income from investments. The claims ratio is the ratio of the sum of claims paid, changes in claim provisions and changes in other technical provisions (including changes in life assurance technical provisions when the policyholder bears the investment risk) to insurance premiums earned multiplied by 100, with net value of reinsurance being included into the calculation. The expense ratio is the ratio of the sum of operating expenses (acquisition costs and administrative costs) and other technical charges to gross written premium, reduced by premiums ceded to reinsurance, multiplied by 100.

$$Y_1 = \text{combined ratio} = \frac{\text{claims paid} + \text{changes in provisions} + \text{changes in other technical provisions}}{\text{premiums earned}} * 100 + \frac{\text{operating expenses} + \text{other technical charges}}{\text{gross written premium} - \text{premiums ceded to reinsurance}} * 100$$

2. **Return on investment** is calculated as the ratio of income from investments reduced by investments expenses to the amount of investment, multiplied by 100.

$$Y_2 = \text{return on investment} = \frac{\text{investment income} - \text{investment expenses}}{\text{amount of investment}} * 100$$

3. **The debt ratio** is calculated as the ratio of total liabilities to total assets. This ratio shows the amount of assets financed by liabilities which do not include capital and reserves.

$$Y_3 = \text{debt ratio} = \frac{\text{total liabilities} - \text{capital and reserves}}{\text{total assets}} * 100$$

4. **Return on equity (ROE)** represents the relationship between after-tax profit or loss of the accounting period and equity (subscribed capital, premium on shares issued, revaluation reserves, reserves and accumulated profit or loss). It is expressed as a percentage, showing how much net profit of the accounting period can be generated by 100 units of equity.

$$Y_4 = \text{ROE} = \frac{\text{after - tax profit or loss}}{\text{equity}} * 100$$

5. **Market share indicators** represents the share of each insurance company in the total insurance market. Gross written premium is used as a market share indicator in this analysis.

$$Y_5 = \text{market share indicator} = \frac{\text{gross written premium of insurance company}}{\text{total gross written premium}} * 100$$

Table 1. The indicator values of the selected insurance companies for 2010

| 2010 | Y ₁ | Y ₂ | Y ₃ | Y ₄ | Y ₅ |
|-------------|----------------|----------------|----------------|----------------|----------------|
| Jadransko | 89,650 | 2,358 | 64,610 | 7,588 | 6,900 |
| Basler | 132,933 | 3,289 | 93,356 | -43,940 | 4,400 |
| Euroherc | 96,202 | 3,690 | 70,516 | 11,263 | 10,800 |
| Croatia | 102,157 | 2,586 | 78,697 | 2,638 | 31,400 |
| Allianz | 109,134 | 6,282 | 84,707 | 15,227 | 10,600 |
| Kvarner VIG | 135,666 | 6,502 | 94,499 | -5,220 | 5,500 |
| Triglav | 116,546 | 5,513 | 87,386 | -20,979 | 4,400 |
| Grawe | 136,825 | 6,114 | 90,960 | 10,214 | 4,300 |

Source: Authors' results

By using the formulas mentioned above, we obtained the values of the five chosen indicators for the eight selected insurance companies for the given period of two years.² They are shown in tables 1 and 2.

Table 2. The indicator values of the selected insurance companies for 2011

| 2011 | Y ₁ | Y ₂ | Y ₃ | Y ₄ | Y ₅ |
|-------------|----------------|----------------|----------------|----------------|----------------|
| Jadransko | 88,755 | 3,146 | 61,328 | 13,740 | 7,000 |
| Basler | 138,534 | 2,331 | 91,255 | -58,024 | 4,500 |
| Euroherc | 86,023 | 4,054 | 67,852 | 20,108 | 10,900 |
| Croatia | 113,878 | 4,250 | 78,960 | 4,794 | 30,500 |
| Allianz | 104,057 | 6,142 | 85,166 | 18,901 | 11,200 |
| Kvarner VIG | 160,795 | 1,512 | 87,320 | -41,507 | 4,900 |
| Triglav | 109,308 | 4,186 | 87,620 | 0,533 | 4,300 |
| Grawe | 137,503 | 7,081 | 90,475 | 12,477 | 4,300 |

Source: Authors' results

The first and the third criteria are cost criteria, that means that it is preferable that their values are as small as possible. The second, fourth and fifth criteria are benefit criteria, that means that it is preferable that their values are as large as possible.

It is necessary that all the criteria in the table are either benefit or cost criteria, so we transform the cost criteria into benefit criteria by calculating their reciprocal values. The obtained benefit criteria are transformed into their relative values in order for them to be in the same measuring units. The relative values of the criteria are obtained by standardizing the empirical values with the following relation:

$$X_{ij} = \frac{y_{ij} - y_j^{\min}}{y_j^{\max} - y_j^{\min}}$$

As in Garcia, Guijarro and Moya (2010). The standardised indicator values are shown in tables 3 and 4.

Table 3. The standardised indicator values of the selected insurance companies for 2010

| 2010 | 1/X ₁ | X ₂ | 1/X ₃ | X ₄ | X ₅ |
|-------------|------------------|----------------|------------------|----------------|----------------|
| Jadransko | 1,000 | 0,000 | 1,000 | 0,871 | 0,096 |
| Basler | 0,056 | 0,225 | 0,026 | 0,000 | 0,004 |
| Euroherc | 0,802 | 0,321 | 0,735 | 0,933 | 0,240 |
| Croatia | 0,645 | 0,055 | 0,434 | 0,787 | 1,000 |
| Allianz | 0,482 | 0,947 | 0,250 | 1,000 | 0,232 |
| Kvarner VIG | 0,016 | 1,000 | 0,000 | 0,654 | 0,044 |
| Triglav | 0,331 | 0,761 | 0,176 | 0,388 | 0,004 |
| Grawe | 0,000 | 0,906 | 0,084 | 0,915 | 0,000 |

Source: Authors' results

² Data source for indicators calculation are Annual Reports of the selected insurance companies.

Table 4. The standardised indicator values of the selected insurance companies for 2011

| 2011 | $1/X_1$ | X_2 | $1/X_3$ | X_4 | X_5 |
|-------------|---------|-------|---------|-------|-------|
| Jadransko | 0,934 | 0,293 | 1,000 | 0,918 | 0,103 |
| Basler | 0,185 | 0,147 | 0,000 | 0,000 | 0,008 |
| Euroherc | 1,000 | 0,456 | 0,707 | 1,000 | 0,252 |
| Croatia | 0,474 | 0,492 | 0,319 | 0,804 | 1,000 |
| Allianz | 0,627 | 0,831 | 0,147 | 0,985 | 0,263 |
| Kvarner VIG | 0,000 | 0,000 | 0,092 | 0,211 | 0,023 |
| Triglav | 0,542 | 0,480 | 0,085 | 0,749 | 0,000 |
| Grawe | 0,195 | 1,000 | 0,018 | 0,902 | 0,000 |

Source: Authors' results

3. GOAL PROGRAMMING APPROACH

In a multicriteria problem, with five benefit criteria, the Pareto optimal solution or an efficient solution is the solution which is not dominated by any other solution (Ehrgott, M., Klamroth, K., Schwehm, C. 2004). In this paper the solution is an insurance company. That is why the comparison of the relative value vectors easily show us which insurance companies are not efficient. In 2011. Basler osiguranje is inefficient because it is dominated by Jadransko osiguranje, because the value of every noted indicator for Jadransko osiguranje is greater than the value of Basler in the same indicator. Also Kvarner VIG is not efficient because it dominated by Euroherc osiguranje and Triglav osiguranje is dominated by Allianz. The remaining insurance companies that are not dominated by any other insurance company are efficient. This means we can not say which one is the best. That is why we introduce the score in the usual way, that is used most often in literature, ie the weighted value of indicator relative values. That is why the selection of weights defines the ranking of an insurance company based on the total amount of points obtained by the score. In order to avoid any subjectivity, we formulated the goal programming model. The goal reflects the strategy of the insurance company for the given year, where their management have to designate which business segment needs improvement.

The notations in the formulated model are as follows:

1. i – insurance company, $i = 1, \dots, 8$.
2. j – indicator $j = 1, \dots, 5$.
3. w_j – weight of criteria j , $j = 1, \dots, 5$.
4. x_{ij} – relative value of indicator j of insurance company i , $i = 1, \dots, 8$; $j = 1, \dots, 5$.
5. S_i – score of insurance company i , $i = 1, \dots, 8$.
6. g_{ik} – goal k of insurance company i , $i = 1, \dots, 8$; $k = 1, \dots, 5$.
7. d_{ik}^- – negative deviations from the goal k of the insurance company i , $i = 1, \dots, 8$; $k = 1, \dots, 5$.
8. d_{ik}^+ – positive deviations from the goal k of the insurance company i , $i = 1, \dots, 8$; $k = 1, \dots, 5$.

The score of insurance company i is S_i , defined in the usual way:

$$S_i = \sum_{j=1}^5 w_j x_{ij}, i=1, \dots, 8 \quad (1)$$

The score can be defined differently, that can be observed in Triantaphyllou (2000).

We label ($i = 1, \dots, 8$) for every one of the eight insurance companies(1 – Jadransko; 2 –Basler; 3 – Euroherc; 4 – Croatia; 5 – Allianz; 6 – Kvarner VIG; 7 – Triglav; 8 – Grawe).

Two goal programming models are defined dependent on the appointed goals. For the first model it is assumed that the goals are the indicator values that have improved in relation to the same values the year before and that every insurance company did not have more than two goals. The goal values are as follows:

$$g_{11} = x_{12}, g_{12} = x_{14}, g_{21} = x_{25}, g_{31} = x_{34}, g_{41} = x_{42}, g_{42} = x_{44}, g_{51} = x_{54}, g_{61} = x_{63}, g_{71} = x_{74}, g_{81} = x_{84}.$$

Note that only two insurance companies have two goals.

The general problem of goal programming is finding the solution as close as possible to the assigned goal (Ignizio and Romero, 2003). In this case, it is necessary to find indicator weights for which the deviation of the score, i.e. the values of the business performance of the noted goals is the smallest. The distance of the goal $g = (g_{11}, g_{12}, g_{21}, g_{31}, g_{41}, g_{42}, g_{51}, g_{61}, g_{71}, g_{81})$ and the score $S = (S_1, S_1, S_2, S_3, S_4, S_4, S_5, S_6, S_7, S_8)$ is usually defined by a metric. This paper uses augmented Chebyshev metric (2), also known as the Dinkelbach-Isermann, for more detail (Sawaragi, Nakayama i Tanino, 1985).

Using the mentioned norm the goal programming model (P_a) is formulated as follows:

$$\min (\|g - S\|_{\infty} + \alpha \sum_{i=1,4}^2 \sum_{k=1}^2 (d_{ik}^+ + d_{ik}^-) + \alpha \sum_{\substack{i=1 \\ i \neq 1,4}}^8 (d_{i1}^+ + d_{i1}^-)) \quad (2)$$

$$S_i + d_{ik}^- - d_{ik}^+ = g_{ik}, i = 1, 4; k = 1, 2 \quad (3)$$

$$S_i + d_{i1}^- - d_{i1}^+ = g_{i1}, i = 2, 3, 5, 6, 7, 8 \quad (4)$$

$$S_i - \sum_{j=1}^5 w_j x_{ij} = 0, i = 1, \dots, 8 \quad (5)$$

$$\sum_{j=1}^5 w_j = 1 \quad (6)$$

$$d_{i1}^-, d_{i1}^+, d_{11}^-, d_{12}^+, d_{41}^-, d_{42}^+, w_j \geq 0, i = 2, 3, 5, 6, 7, 8; j = 1, \dots, 5$$

The parameter α is a small positive number. Alongside non-negativity, the following constraints are defined in the mathematical model. The value of the score can differ from the appointed goal (3) and (4). The group of constraints (5) define the score. Constraint (6) refers to norming weights. The goal

function (2) as is defined in the given mathematical model, in the optimal solution at least one of the variables d_{ik}^- or d_{ik}^+ have the value zero:

$$d_{ik}^- d_{ik}^+ = 0, \quad i = 1, \dots, 8; k = 1, 2 \quad (7)$$

This statement can be checked in Sawaragi ET. al. (1985).

We assign as

$$y = \| \mathbf{g} - \mathbf{S} \|_{\infty} \quad (8)$$

Because of relations (7) and (8) we have:

$$y \geq d_{ik}^- + d_{ik}^+, \quad i = 1, 4; k = 1, 2 \quad (9)$$

$$y \geq d_{i1}^- + d_{i1}^+, \quad i = 2, 3, 5, 6, 7, 8 \quad (10)$$

The problem (\mathbf{P}_a) is transformed into an equivalent problem ($\mathbf{P}_{y\alpha}$) using (8):

$$\min (y + \alpha \sum_{i=1,4}^2 \sum_{k=1}^2 (d_{ik}^+ + d_{ik}^-) + \alpha \sum_{\substack{i=1 \\ i \neq 1,4}}^8 (d_{i1}^+ + d_{i1}^-))$$

$$S_i + d_{ik}^- - d_{ik}^+ = g_{ik}, \quad i = 1, 4; k = 1, 2 \quad (11)$$

$$S_i + d_{i1}^- - d_{i1}^+ = g_{i1}, \quad i = 2, 3, 5, 6, 7, 8 \quad (12)$$

$$S_i - \sum_{j=1}^5 w_j x_{ij} = 0, \quad i = 1, \dots, 8 \quad (13)$$

$$\sum_{j=1}^5 w_j = 1 \quad (14)$$

$$d_{ik}^- + d_{ik}^+ \leq y, \quad i = 1, 4; k = 1, 2 \quad (15)$$

$$d_{i1}^- + d_{i1}^+ \leq y, \quad i = 2, 3, 5, 6, 7, 8 \quad (16)$$

$$d_{i1}^-, d_{i1}^+, d_{11}^-, d_{12}^+, d_{41}^-, d_{42}^+, w_j \geq 0, \quad i = 2, 3, 5, 6, 7, 8; j = 1, \dots, 5$$

$$y \geq 0$$

For the second model we assume that the goal of every insurance company is the highest score, i.e. the best business performance for the given year:

$$\mathbf{g} = (\max S_1, \max S_2, \max S_3, \max S_4, \max S_5, \max S_6, \max S_7, \max S_8).$$

The problem is solved using the same norm as in the the first model, while the model itself can be found in (Vojvodić Rosenzweig, V., Volarević, H., Varović, M., 2011).

4. RESULTS

Problem ($\mathbf{P}_{y\alpha}$) is solved for the following parameter values $\alpha = 0,1$ i $\alpha = 0,01$.

Optimal weight values are as follows:

$w_1 = 0,0639$; $w_2 = 0,4966$; $w_3 = 0$; $w_4 = 0,4356$; $w_5 = 0,0038$.

The solution of the problem gives the highest weight values to the return on investment and the return on equity indicators. The indicators combined ratio and the market share indicator have a very small value in the total score, while the weight of the debt ratio is equal to zero. If we analyse the weight values, we can conclude that the strategy of the insurance companies was directed to improve profitability, what is the fundamental goal of every joint stock company. The second part that they concentrated on is the investment segment, i.e. actively managing assets with the goal of the highest return on total invested assets. The combined ratio criteria has a very small weight value assigned to it, which means that the insurers have given a certain amount of attention in their business to the enhancement of their business score, that arises from the pure insurance component of the performance. The market share criteria also has a very small value, which can be attributed to the fact that the total gross written premium is constantly declining since 2009. And that the entire economic situation does not favor expanding business on the insurance market. The debt ratio criteria has the weight value of 0, which shows us that insurance companies did not include the increase of their own capital in their business strategies. It is obvious they are aware that there is no new capital on the market that they can attract. The increase of asset is based on the increase of liabilities other than capital and reserves (debt liabilities).

The obtained weight values indicate that insurance companies have based their strategy on improving the indicators return on equity and return on investment.

The score values are:

$S_1 = 0,6055$; $S_2 = 0,0849$; $S_3 = 0,7270$; $S_4 = 0,6287$; $S_5 = 0,8829$; $S_6 = 0,0920$; $S_7 = 0,5993$; $S_8 = 0,9020$.

If we rank the insurance companies based on their score we obtain the following ranking:

1. Grawe osiguranje d.d.; 2. Allianz Zagreb d.d.; 3. Euroherc osiguranje d.d., 4. Croatia osiguranje d.d., 5. Jadransko osiguranje d.d., 6. Kvarner VIG d.d., 7. Triglav osiguranje d.d., 8. Basler osiguranje d.d.

The second model assumes that the goal of every insurance company is their maximal score. The model is solved for the values $\alpha=0,1$ and gives the following optimal weight values assigned to individual indicators for 2010.

$w_1 = 0$; $w_2 = 0,1818$; $w_3 = 0$; $w_4 = 0,8182$; $w_5 = 0$.

This means that return on equity indicator is the most important, followed by return on investment, while the rest are unimportant.

The score values are:

$S_1 = 0,7126$; $S_2 = 0,0409$; $S_3 = 0,8217$; $S_4 = 0,6539$; $S_5 = 0,9904$; $S_6 = 0,7169$; $S_7 = 0,4149$; $S_8 = 0,9134$.

If we rank the insurance companies based on their score we obtain the following ranking:

1. Allianz Zagreb d.d., 2. Grawe osiguranje d.d.; 3. Euroherc osiguranje d.d., 4. Kvarner VIG d.d., 5. Jadransko osiguranje d.d., 6. Croatia osiguranje d.d., 7. Triglav osiguranje d.d., 8. Basler osiguranje d.d.

The solution of the second model for 2011 is as follows:

$w_1 = 0$; $w_2 = 0$; $w_3 = 0$; $w_4 = 1$; $w_5 = 0$.

While the score values are:

$S_1 = 0,9180$; $S_2 = 0$; $S_3 = 1$; $S_4 = 0,8040$; $S_5 = 0,9850$; $S_6 = 0,2110$; $S_7 = 0,7490$; $S_8 = 0,9020$.

The weight value of one is given to return on equity, while the values of the rest are equal to zero.

The score values give us the following ranking:

1. Jadransko osiguranje d.d., 2. Allianz Zagreb d.d., 3. Euroherc osiguranje d.d., 4. Grawe Hrvatska d.d., 5. Croatia osiguranje d.d., 6. Triglav osiguranje d.d., 7. Kvarner VIG d.d., 8. Basler osiguranje d.d.

5. CONCLUSIONS

This paper applies a multi-criteria approach in order to analyze the business performance of insurance companies in the Republic of Croatia for 2010. and 2011. by formulating a goal programming model. Eight insurance companies are observed that have the largest share on the market measured by gross written premium. Five insurance business indicators that the CFSSA uses in their annual reports are used in the model. Two goal programming models are solved that differ in relation to the appointed goals. Both of the models use the same norm, the Dinckelbah-Isermann norm, in order to measure the difference from the ascertained goals. It is assumed in the first model that the goals for insurance companies business for 2011. are those that increased in value in comparison to their value in 2010. The obtained optimal weight values assigned to individual indicators show the importance of the given indicators in the business strategies of the observed group of insurance companies. The highest weight is assigned to the return on investment indicator, while an insignificantly smaller value is assigned to return on equity. The weights assigned to the combined ratio and market share indicators have small values, while the weight assigned to debt ratio indicator is equal to zero.

The business strategy of the observed insurance companies that is derived from the weight values can be explained by the current economic situation. For the observed year their business strategy did not include the growth of their share on the insurance market because of the constant decline of the total gross written premium since 2009. The insurance companies did nothing in order to attract fresh equity capital, aware of the fact that there is no such capital on the market. Their business strategy is directed towards increasing revenue from active asset management and the increase of profitability. Insurance companies have coordinated their business strategies with the economic environment in which they currently operate. The score values obtained from the model are used to rank the insurance companies. The second model assumes that the business goal is the maximum score. Based on the ascertained score values, the ranking of the observed insurance companies was obtained for every of the observed years.

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