“Modeling of the rating assessment of insurance companies’ financial soundness”

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Modeling of the rating assessment of insurance companies' financial soundness

Abstract

The article studies the problem of analyzing the activities of various insurance companies. It finds that most of the indicators used in the analysis are not comparable with each other and cannot give an objective assessment of financial stability of insurance companies. It discovers that quite often analysts do not have sufficient information about the company's activity and are unable to form an objective rating of companies. It offers to use the method of aggregates to solve the abovementioned problem that takes into account any additional numerical, inaccurate and incomplete information about the relative weight of individual indicators.

Keywords: analysis, insurance company, ratios of financial soundness, ranking, aggregate and weight indicators, rating.
JEL Classification: G22.

Introduction

Problem statement. In modern conditions of dynamically changing market environment and reforms of the economic system there is a growing objective need to ensure reliable functioning of insurance companies and consumer protection in the field of insurance. In this regard, it should be clearly understood what is the company's financial condition, its ability to meet obligations to policyholders, that is, whether the company is a reliable partner. One of the forms of reliability assessment is multidimensional indicator such as rating. Therefore, there is an objective need to develop a methodical approach to building a rating of insurance companies' financial soundness.

Analysis of the recent research and publications. Today, economic science has accumulated certain works, which study the problems of formation and development of insurance. In Ukraine, the main problems of the theory and practice of insurance in the market economy were investigated by V. Bazylevych [1] O. Kozmenko [2, 3, 4, 5], S. Osadets [8] V. Shahov [6], K. Shelekhov [7] and others. However, insufficient attention is given to the research of formation and development of mechanism for evaluating the insurer's financial soundness, as well as the instruments for its improvement.

Earlier unsolved parts of the problem. The analysis of scientific research shows the lack of a common approach to building and implementing the system of statistical monitoring of insurance companies' financial health in Ukraine.

The article's goal is to develop a methodical approach to assess the financial soundness of insurance companies by ranking them.

Presentation of the main material. The study of financial activities of insurance companies must include a real and comprehensive assessment of the achieved results, highlight positive and negative aspects of their work, and identify specific ways to solve common problems in the insurance industry.

Under financial soundness one should understand a mathematical characteristic that reflects the dynamic stability of the company to changes in internal and external environment.

The proposed model for the statistical monitoring of insurance companies' financial health will help protect the consumers of insurance services from distressed companies, check the company's financial soundness and its ability to respond to changes in the competitive environment, as well as to identify priority areas for strategic development.

According to its general purpose the model for calculating the rating of insurance companies' stability is an applied model. It analyzes the functioning of a specific economic object (insurance company) and the results of the research are used in practice. According to the end use it is a model of optimization as it is designed to select the best option from a certain number.

Regarding the time factor it is a dynamic model as it describes economic processes taking time factor into account. Given the uncertainty factor this model is stochastic because of the random factor in determining weight coefficients as they are estimated by certain groups of people at different time periods. Therefore, these estimates may differ depending on the situation.

For the construction of rating of insurance companies it is necessary to collect information on the basis of three positions: first, the timely and full implementation of insurance liabilities and protection of policyholders' rights; second, the conformity of the quality of reserves to the structure of the taken risks; third, the effectiveness and profitability of the insurance company.

The rating assessment of insurance companies' financial stability is based on the complex analysis of equity, composition and structure of insurance port-

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folio, investment analysis (Fig. 1). In our opinion, the main indicators of insurance companies' financial soundness should be: loss coefficient turnover; coefficient of accounts payable on insurance payments; coefficient of the current liquidity; coefficient of debt burden; coefficient of insurance reserves' adequacy; coefficient of deductions from premiums; coefficient of profitability of sales; coefficient of profitability; coefficient of business activity.

We propose to study insurance companies of Ukraine and twelve earlier proposed indicators: $x_1^{(j)}(t),\dots x_9^{(j)}(t)$, $j = 1,2,\dots,12$ determined for the period, t_1, t_1, t_1, t_1, t_1.

All information for the calculations is obtained from sources that are publicly available.

Let us describe the method in more detail.

We will consider the vector of values $x^{(j)}(t),\dots x_1^{(j)}(t),\dots, x_1^{(j)}(t)$, $j = 1,2,\dots,9$ as a value of vector $x = (x_1,\dots, x_9)$ of the initial characteristics of insurance companies' soundness, the role of which is performed by corresponding indicators calculated according to the insurer's data. Then on a fixed date $t = t_s$, $s = 1, 2, 3, 4, 5$ the studied object j (insurance company number j) is identified with the vector of values $x^{(j)}(t_s)$.

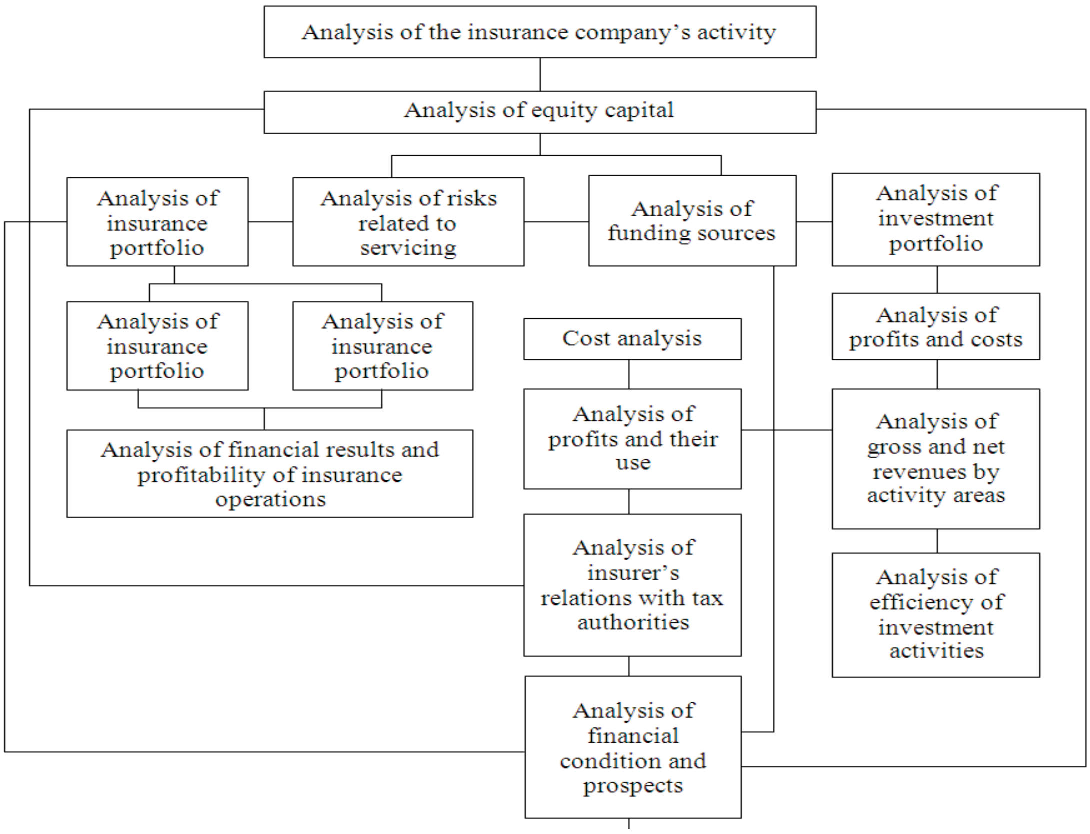


Fig. 1. Generalizing (rating) assessment of the insurance company's soundness

Today it is difficult to conduct efficient ranking of insurance companies, in particular, to determine what parameters will impact the search for the "best" or the "worst" company. The situation is complicated by the fact that by using the same indicators it is impossible to determine the best insurer, because according to some indicators a certain company can be "the best" while, at the same time, another company can be "the best" according to other indicators. The result of this is that companies can not be adequately compared.

The described problem can be solved with the method of aggregates that includes a large number of indicators, the analysis and assessment of which make it possible to fully assess and determine the level of financial soundness of companies.

In this context, during the construction of a model within the scientific and methodical approach we consider it from the perspective of different participants on the insurance market, in particular, the insurer, the reinsurer and the shareholders.

We modify the value of initial characteristics based on the following requirements. We assume that the modified indicator q_i (based on the corresponding initial indicator (x_i) possesses the value in the interval [0, 1], while the value $q_i = 0$ ($q_i = 1$) corresponds to the most reliable insurer estimated in terms of an individual criterion associated with the initial characteristic x_i. Considering the positivity of the nine used indicators the initial requirement can be formulated as a requirement to the monotony of functions $q = q(x)$ on semi-axis $[0, +\infty)$. Functions $q_i = q_i(x_i)$, $i = 2, 3, 4, 5, 7, 8, 9$ corresponding to those initial standards, the increase of which leads to an increase (ceteris paribus) in the insurer's soundness, are monotonic non-decreasing functions

$(x_i < x'_i) => (q_i (x_i) \leq q_i (x'_i)$, $i = 2, 3, 5, 7, 8, 9$.

Functions $q_i = q_i (x_i)$, $i = 1, 4, 9$ corresponding to those initial standards, the increase of which leads to a decrease (ceteris paribus) in the insurer's soundness, are monotonic non-increasing functions.

$(x_i < x'_i) => (q_i (x_i) \geq q_i (x'_i)$, $i = 1, 4, 9$.

As a normalizing function $q = q (x)$ we use the function that equals zero (one) on semi-axis (-∞, min], monotonically increases (decreases) on the interval [min, max] and equals one (zero) on semi-axis [max, + ∞). One of admissible functions of such type is a piecewise linear function defined for characteristics x_2, x_3, x_4, x_5, x_6, x_7, x_8, by equation 1.

$$q_i = q_i(x_i)\begin{cases} = 0, x_i, \leq \min(i), \\ = (x_i - \min(i)) / (\max(i) - \min(i)), \min(i) \leq x_i \leq \max(i), \\ = 1, x_i \geq \max(i) \end{cases} \quad (1)$$

And for initial characteristics x_1, x_4, x_9 – by equation 2:

$$q_i = q_i(x_i)\begin{cases} = 1, x_i, \leq \min(i), \\ = (\max(i) - x_i) / (\max(i) - \min(i)), \min(i) \leq x_i \leq \max(i), \\ = 0, x_i \geq \max(i) \end{cases} \quad (2)$$

where values *min* (*i*), *max* (*i*) are the function's parameters.

By using the formulas 1 and 2, we obtain the values $q_i (j, t)$; $i = 1,…9$; $j = 1,…,12$ of certain indicators of insurance companies' reliability calculated for all five periods. We accept these values of individual indicators calculated taking into account the limitations and all the earlier expressed observations as a result of the stage for determining certain indicators within this group of insurance companies to be used during the next stages of the aggregate method.

Let us consider the problem of choosing the type of function Q (q; w) integrating the aggregate indicator of an insurance company, taking into account the information about the vector of certain stability indicators $q = (q_1…q_m)$ and information about the vector of weight coefficients $w = (w_1…w_m)$, the components of which determine the importance of individual indicators.

We use a certain synthesizing function in the construction of the proposed model. It refers to the type of the so-called generalized mean values, while the most prevalent are weighted static means of equation 3:

$$Q_\lambda (q, w) = \left[\sum_{i=1}^{m} q_i^{\lambda} w_i \right]^{1/\lambda}, \quad (3)$$

where the parameter λ determines a particular type of integration function.

For example, if $\lambda = 1$ we have a normal weighted mean arithmetic (equation 4):

$$Q + (q, w) = \sum_{i=1}^{m} q_i w_i. \quad (4)$$

For the vector $q = (q_1…q_m)$, if $\lambda = 0$, we have a weighted geometric mean (equation 5):

$$Q_x (q, w) = \prod_{i=1}^{m} q_i w_i. \quad (5)$$

For vector $q = (q_1…q_m)$ at $\lambda = 2$ we have a weighted mean square, at λ= -1 we have a weighted geometric mean. Weighted generalized means of the order X have a number of features that make it possible to interpret them as real means (equation 6-10):

$$\min(q_i) < Q_\lambda (q, w) < \max(q_i), \quad (6)$$

$$Q_\lambda (q, w) \to \lambda_{\to -\infty} \min(q_i), \quad (7)$$

$$Q_\lambda (q, w) \to \lambda_{\to +\infty} \max(q_i), \quad (8)$$

$$(\lambda_0 < \lambda_1) => (Q\lambda_0 (q, w) \leq Q\lambda_1 (q, w)), \quad (9)$$

$$Q\lambda (0, ..., 0, w) = 0, Q\lambda (1, ..., 1; w) = 1. \quad (10)$$

There are some advantages to the use of the aggregate's arithmetic mean.

First, it is the analytical and computational simplicity of the synthesizing function Q (q, m) that makes this type of convolution widespread.

Second, the linear function can be interpreted as a linear approximation to the "true" functional dependence Q (q, i) of aggregate indicator q on the vector of individual indicators $q = (q_1…q_m)$ and the vector of weight coefficients $w = (w_1…w_m)$. Third, linear convolution Q ($q - w$) is universal in the sense that the ranking of objects conducted by random convolution Q (q, w) can be obtained by selection of variables and weight coefficients for the corresponding linear synthesizing function.

As a rule, the researcher has limited information I about weight coefficients. Therefore, our next step is the estimation of weight coefficients $w = (w_1 \ldots w_m)$.

In addition, limited information determines not only one vector of weight coefficients $w = (w_1 \ldots w_m)$, but a whole set of such vectors $W(I)$. In other words, there is an uncertainty regarding weight coefficients based on limited information.

Among the numerous approaches to determining weight coefficients we will focus on the approach, when the range $W(I)$ of admissible vectors of weight coefficients $w = (w_1 \ldots w_m)$ is determined by the so-called ordinal information I in the form of "the weight of indicator q_i that is more (less, equal) than the weight of indicator q_j. This ordinal information I can be formalized as a system:

$I = \{w_i = w_j,\ w_k > w_l,\ w_r < w_s, \ldots\}$.

Let us study the expert approach to determining weight indicators.

We consider four situations to build the ranking:

$I0$ – researcher does not have information about the comparable weight indicators;
$I1$ – information situation from the point of view of insurer;
$I2$– information situation from the point of view of reinsurer;
$I3$ – information situation from the point of view of a shareholder of the insurance company.

The obtained set $W(I)$ of admissible vectors of weight coefficients $w = (w_1 \ldots w_m)$ satisfying the equality and inequality of the system I, is a subset of the set:

$W = \{w = (w_1, \ldots w_m): w_i \geq 0, w_1 + \ldots + w_m = 1\}$. of all possible vectors of weight coefficients.

Based on the expert survey it is possible to determine and formalize the following weight coefficients depending on information situation:

– researcher does not have information about the comparable weight indicators:

$I = \{w_1 = w_2 = w_3 = w_4 = w_5 = w_6 = w_7 = w_8 = w_9\}$;

– from the point of view of insurer

$I = \{w_1 \geq w_4 \geq w_3 \geq w_5 \geq w_4 \geq w_6 \geq w_9 \geq w_8 \geq w_7\}$;

– from the point of view of reinsurer

$I = \{w_4 \geq w_5 \geq w_6 \geq w_2 \geq w_1 \geq w_3 \geq w_9 \geq w_7 \geq w_8\}$;

– from the point of view of a shareholder of the insurance company

$I = \{w_4 \geq w_8 \geq w_6 \geq w_5 \geq w_7 \geq w_9 \geq w_1 \geq w_2 \geq w_3\}$.

If we arrange insurance companies according to descending aggregates of reliability indicator $\overline{Q}_j^{(l)}(t), (j,1$ – fixed), we get a function $R(j; l; t)$ that attributes to each insurer its rating. The ranking $R(j; l; t)$ is indexed with aggregate indicator $\overline{Q}_j^{(l)}(t)$.

As an example of the proposed methodology Table 1 presents the rating of financial soundness of insurance companies in the absence of information about the comparability of indicators.

The analysis revealed that in cases when weight indicators are the same, the best insurance companies in terms of their dynamics are: joint stock insurance company "ASKA", joint stock insurance company "European Tourist Insurance", joint stock insurance company "Alfa Insurance", joint stock insurance company "Cardif"; less reliable – joint stock insurance company "TAS", joint stock insurance company "Universal" and joint stock insurance company "INGO Ukraine".

Table 1. Rating of financial soundness of insurance companies in the absence of information about the comparability of indicators

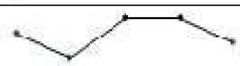
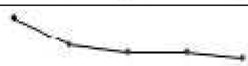
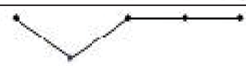
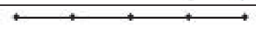
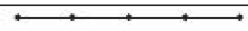
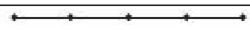
Insurance company	2009	2010	2011	2012	2013	Graphical interpretation
ORANTA	7	10	8	9	10	
INGO Ukraine	5	2	7	7	4	
TAS	9	4	2	6	2	
Universal	10	6	5	5	4	
European Tourist Insurance	11	8	11	11	11	
AXA Insurance	7	7	8	6	7	
European insurance alliance	11	9	8	7	7	

Table 1 (cont.). Rating of financial soundness of insurance companies in the absence of information about the comparability of indicators

Insurance company	2009	2010	2011	2012	2013	Graphical interpretation
Cardif	11	10	10	11	10	
Uniqa	10	9	9	8	8	
Arsenal Insurance	9	9	9	9	9	
Alfa Insurance	10	10	10	10	10	
ASKA	11	11	11	11	11	

The final results are presented in Table 2.

Table 2. Rating of 12 insurance companies of Ukraine at the end of 2013

Insurance company	Information situation			
	I0	I1	I2	I3
ORANTA	10	10	8	10
INGO Ukraine	4	3	3	8
TAS	2	2	2	2
Universal	4	3	3	7
European tourist insurance	11	8	9	11
AXA Insurance	7	7	8	6
European insurance alliance	7	6	6	7
Cardif	10	7	8	10
Uniqa	8	8	8	8
Arsenal Insurance	9	9	9	9
Alfa Insurance	10	10	10	10
ASKA	11	11	11	11

The testing of the proposed scientific and methodical approach to determining the financial soundness rating of insurance companies in Ukraine makes it possible to draw the following conclusions:

- the level of financial soundness of insurance companies according to different information situations (from the point of view of insurer, reinsurer and shareholder of insurance company) varies slightly, that is, the most reliable in insurance company in Ukraine is the joint stock insurance company "TAS", while the least reliable is the private joint stock company "ASKA";
- in the analyzed period the most volatile are the values of indicators of the joint stock company "INGO Ukraine".

Conclusions

On the basis of the limited, non-comparable information about the activities of insurance companies it is possible to form their rating based on the proposed model for the dynamics of financial indicators. The model for the dynamics of financial indicators of insurance companies on the basis of aggregate indicators makes it possible for any user to carry out their comparative characteristics. This model also allows the management of insurance companies and stakeholders (insurers, reinsurers) to make flexible decisions to achieve their objectives with the minimal risk of losses.

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