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Improvement of the methodology for assessing the capital adequacy to cover the reinsurance default risk

Abstract. *Introduction.* The development of the insurance market in Ukraine is closely associated with the instruments used by domestic insurers to manage low capitalisation, including coinsurance and reinsurance services. Reinsurance helps insurance companies to take very large and expensive risks. Thus, the questions of generalisation of both national and international experience in default risk assessment of reinsurers in an insurance company and provision of recommendations to ensure reliability of activity of insurance companies are relevant. *The purpose* of the paper is to provide recommendations to improve capital adequacy assessment concerning the coverage of the reinsurance default risk. *Methodology.* The methodological basis of this study is the theory of insurance and insurance concepts. Scale measurement of capital adequacy of insurance companies relevant to the coverage of the reinsurance default risk was conducted by using methods of mathematical statistics. *Results.* Based on the example of 50 Ukrainian insurance companies, we have conducted scale measurement of capital adequacy to cover the default risk of reinsurers for the years of 2015-2016. *The originality of the research* lies in the improvement of capital adequacy assessment concerning the coverage of the reinsurance default risk, which, unlike the existing methodology, considers the designed scale and criteria of the capital adequacy indicator of the insurance company to cover the reinsurance default risk at «inadequate», «adequate», «medium», «good» and «excellent» levels. *Conclusions.* The practical value of the paper lies in the proposed approaches to improve capital adequacy assessment concerning the coverage of the reinsurance default risk, which will enhance the level of reinsurance and facilitate the fulfillment of obligations by insurance companies.

Keywords: Reinsurance Default Risk; Methodology; Scale Measurement; Capital Adequacy; Insurance Company
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Удосконалення методики оцінки достатності капіталу на покриття ризику дефолту перестраховика

Анотація. У статті удосконалено методику оцінки достатності капіталу на покриття можливих збитків у разі настання ризику дефолту перестраховика, яка, на відміну від існуючих, враховує розроблені шкали та критерії для показника достатності капіталу страхової компанії для покриття цього ризику за «незадовільним», «задовільним», «середнім», «добрим» та «відмінним» рівнями. Практична цінність роботи полягає у запропонованому підході до удосконалення методики оцінки достатності капіталу на покриття ризику дефолту перестраховика, що надасть змогу підвищити рівень управління операціями з перестрахування та сприятиме виконанню зобов'язань страховими компаніями.

Ключові слова: ризик дефолту перестраховика; методика; шкальне вимірювання; достатність капіталу; страхова компанія.

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Усовершенствование методики оценки достаточности капитала на покрытие риска дефолта перестраховщика

Аннотация. В статье усовершенствовано методику оценки достаточности капитала для покрытия возможных убытков в случае наступления риска дефолта перестраховщика, которая, в отличие от существующих, учитывает разработанные шкалы и критерии для показателя достаточности капитала страховой компании для покрытия этого риска согласно «неудовлетворительного», «удовлетворительного», «среднего», «хорошего» и «отличного» уровней. Практическая ценность работы заключается в предложенном подходе к усовершенствованию методики оценки достаточности капитала для покрытия риска дефолта перестраховщика, что позволит повысить уровень управления операциями по перестрахованию и будет способствовать выполнению страховыми компаниями обязательств.

Ключевые слова: риск дефолта перестраховщика; методика; шкальное измерение; достаточность капитала; страховая компания.

1. Introduction

The development of the insurance market in Ukraine is closely associated with the instruments used by domestic insurers to manage low capitalisation, including coinsurance and reinsurance services. Thus, the use of reinsurance services by insurance companies is a way to protect the insurer from insolvencies and liquidation, which proves the urgency of the study. The basis of risk management by the reinsurer includes default risk assessment.

The value of reinsurance manifests itself in protection mechanisms of both a particular insurance company and the insurance market, since reinsurance protects the direct insurer against financial losses, which could be incurred due to the need of insurance payments and claims on insurance contracts without reinsurance coverage.

Reinsurance helps insurance companies to take very large and expensive risks. Thus, the questions of generalisation of both national and international experience in default risk assessment of reinsurers with regard to insurance companies and provision of recommendations to ensure reliability of activity of insurance companies are relevant.

2. Brief Literature Review

A wide range of issues related to the provision of reinsurance in insurance companies are reflected in the works of Ukrainian scientists such as A. Boiko (2011) [1], Yu. Dyachkova (2010) [2], V. M. Oliinyk and Ye. K. Bondarenko (2014) [3], O. Kuzmenko (2013) [4], L. Pozdnyakova and Yu. Kovalenko, (2006) [5], N. Opeshko (2015) [6] and others.

The problems of the assessment methodology and mechanism to ensure financial stability of insurance companies in Ukraine by using reinsurance are offered in the works by A. Boiko (2011) [1], Yu. Diachkova (2010) [2] and N. Opeshko (2015) [6]. Scientists considered the effect of reinsurance on the activity of insurance companies. J. D. Cummins and P. Barrieu (2013) [4], who are recognized experts on insurance and re-insurance, argued that «increase in the frequency and severity of catastrophic losses, capital management needs in the life insurance industry, market inefficiencies created by (re)insurance underwriting cycles and regulation, advances in computing and communications technologies, and other factors ... have led to the development of hybrid insurance/financial instruments that blend elements of financial contracts with traditional reinsurance as well as new financial instruments patterned on asset-backed securities, futures, and options that provide direct access to capital markets». They studied the hybrid and pure financial markets instruments, not only emphasizing CAT bonds but also covering futures, options, industry loss warranties, and sidecars. Another issue addressed by N. Opeshko (2015) [6] was to define the essence of capital adequacy of insurance company and the impact of using reinsurance on it.

An essential pillar in the structure of insurance regulation is capital requirements for insurance and reinsurance activities with respect to potential risks - insurance, systemic, credit, market and operational.

These risks were considered in the papers [7-11]. In particular, Gatzert and Kolb (2014) examined the effects of operational risk on fair premiums and solvency capital requirements under Solvency II [9].

Researchers [12-14] examined the problem of risk and uncertainty that both insurer and reinsurer are facing. Reinsurance helps insurance companies to take very large and expensive risks. At the same time, using reinsurance raises the question of reinsurer default risk. This risk is very important for insurance companies in Ukraine to cover. Default risk of reinsurer was reflected in the works [15-16].

Canadian researchers J. Cai, C. Lemieux and F. Liu (2014) [16] assumed that the initial capital or reserve of a reinsurer is regulated by the value-at-risk of its promised indemnity. However, insurance regulation in Ukraine needs to use different methods to identify and cover reinsurer default risk. European risk-based regulatory framework Solvency II still is not implemented in Ukraine and furthermore, indicator of SCR is difficult to calculate. Thus, this raises the question of improvement methodology of capital adequacy assessment for reinsurer default risk coverage of insurance companies in Ukraine.

The application of the Solvency II regime in European Union (EU), in particular in Poland, begins at 1st of January 2016. At Mid-April 2016, the first prudential reporting within undertakings under Solvency II with reference to the first day of application (for undertakings with financial year end on 31 December) took place [17].

In Ukraine, unlike the countries of EU, Solvency II requirements have not yet been introduced, which holds back the search for mechanisms for increasing capital, introducing new mechanisms for managing risks and insurers' finances.

3. The purpose of the paper is to provide recommendations to improve capital adequacy assessment concerning the coverage of the default risk of reinsurers.

The methodological basis of this study is the theory of insurance and insurance concepts. Scale measurement of capital adequacy of insurance companies relevant to the coverage of the default risk of reinsurers was conducted by using methods of mathematical statistics.

4. Results

The effective performance of insurance companies in Ukraine is related to the implementation of reinsurance because the majority of insurance companies are lacking funds to cover risks. The main problems relevant to reinsurance in Ukraine include the inability of the reinsurer or several insurers to meet their obligations due to deterioration in their

creditworthiness; attracting reinsurers with a specific rating and their large concentration in different programs. It should be noted that the use of reinsurance services by an insurance company is characterised by the following risks: the risk of a recession of (rating) the level of the reinsurer (the risk that the future possibility of the reinsurer's default will adversely affect the present value of the contract with him); the reinsurance risk (the risk of choosing an inappropriate strategy or inadequate implementation of the chosen strategy, which may result in a change in the value of reinsurance); the direct reinsurance default risk (the risk that the insurer does not receive the money because the other party, the reinsurer, has defaulted on its obligations).

The capital of insurance companies should be sufficient to cover the following risks: the market risk, the reserve risk, the operational risk and the risk of default of the counterparty [18]. In the domestic practice, the classification of insurers' risk to reflect the shortfall of insurance recoveries by an insurer from reinsurers determines the credit risk and the reinsurance risk, whereas the concept of reinsurance default is applied in foreign practice.

The reinsurance default risk reflects possible losses due to the unexpected default or deterioration in the credit position of the reinsurer over the next 12 months. The direct reinsurance default risk is a risk that the insurer does not receive the money because the other party, the reinsurer, has defaulted on its obligations [19]. According to the assessment methodology of capital adequacy to cover possible losses in case of the reinsurance default risk, it is proposed how to evaluate capital adequacy to cover reinsurer default risk (SCR_{def}) in the structure of solvency capital requirement (SCR) [21] under the EU Solvency II [19; 20]. The risk of default on reinsurance share in insurance payments is the most essential part SCR_{def}. The complexity of its calculation consists in limited information on counterparties and the nature of cooperation between the insurance company and its counterparty with regard to external users.

In this case, solvency capital requirement to cover the reinsurance default risk should be calculated by Formula 1 [22].

$$SCR_{def} = k_{\gamma} \cdot \overline{\sigma}_{def} \cdot P_{per} = k_{\gamma} \cdot \sqrt{1-\omega} \cdot P_{per}, \quad (1)$$

where:

P_{per} - the amount of premiums transferred to reinsurers;

$1 - \omega = 0{,}2382$.

Under EU Directive Solvency II, supervisory authorities should require that insurance and reinsurance companies own respective own funds to cover risks [17].

The relevance of own funds to solvency capital requirement is determined by the solvency ratio (SR). The formula for calculating the solvency ratio is [22]:

$$SR = \frac{OF}{SCR}, \quad (2)$$

where:

OF - own funds;

SCR - solvency capital requirement.

In EU Directive Solvency II, the SR helps to assess capital adequacy of the insurance company. Capital adequacy characterizes solvency of the insurance company and testifies its ability to cover losses and fulfil obligations towards counteragents and policyholders at its own expense. Where the SR is less than 0.75, financial position of the insurance company is deemed critical, from 0.75 to 0.99 - anxious, more than 1 - the insurance company has sound financial position [23].

Hence, based on the European practice of solvency assessment, the authors propose to measure the indicator of capital adequacy to cover the reinsurance default risk (SR_{def}) according to Formula 3:

$$SR_{def} = \frac{OF}{SCR_{def}}, \quad (3)$$

where:

SCR_{def} - solvency capital requirement to cover the reinsurance default risk.

Own funds are defined as funds at the disposal of the insurance company to ensure compliance with all obligations under agreements in case of unforeseen events, given the requirements of the regulatory body. Under EU Directive Solvency II, own funds include capital assets (excess of assets over liabilities, attracted liabilities) and additional own funds (the unpaid part of the share capital or initial funds were not used, credit letters and letters of guarantee and any other legally required compulsory payments received by insurance or reinsurance companies) [22].

To enable high-quality interpretation of the results of evaluation of capital adequacy to cover the reinsurance default risk and its comparison with the dynamics, the authors offer to conduct scale measurement of the capital adequacy indicator to cover the reinsurance default risk. This will improve the assessment methodology related to capital adequacy to cover possible losses in case of the reinsurance default risk. The largest contribution to the mathematical theory of measurement and scaling was made by such scientists, as V. Liamiec [24], A. Nedosekin [25] and others.

The rational use of information, namely the importance of indicators to measure stress resistance of insurance companies, is subject to transformation into a form suitable for further analysis aimed at decision-making of managers of insurance companies, national regulators and consumers of insurance services.

To provide greater information content, these indicators are used thresholds to build an interval scale. To meet own funds of the insurance company's solvency capital requirement to cover the reinsurance default risk, it is appropriate to apply the interval scale, since this scale allows making the measurement values of the relevant intervals and determine the difference between the indicators of intensity, while the zero reference point is set arbitrarily.

To build the scale interval, the authors used the three sigma rule, which says that 97.7-97.8% of the total value features provide its normal distribution in the range of plus/minus three values standard deviation from its average value. The methods of construction of interval scales are based on the axiom of normality. Rental rates in the economy are distributed by Gauss' law of, when the extreme intensity index is less common than the intensity close to the average. In most cases, figures are not distributed according to the above law, which indicates the need for factor correction.

Thus, to build the interval scale of the indicator of capital adequacy risk of insurance companies, it is necessary to checking the normality of the distribution of indicators. In the case of normal compliance of the distribution of the scale indicator for according to the three sigma, the indicators have a range of values $(\overline{X} - 3\sigma; \overline{X} + 3\sigma)$; in the case of deviations from the distribution of the normal law and the presence of asymmetry, the scale is also built according to the three sigma rule, however either the arithmetic mean or the mode of variation range or its median is taken as the starting point in this case with the use of the correction factor (k) proposed by N. Prytula (2008) [26], which is shown in Formula 4:

$$k = \frac{S}{n}, \quad (4)$$

where:

S - the distance between the mode and the median;

n - the number of scale divisions stationed to the right and to the left of the median.

In the case of the right-sided asymmetry, the distance between the mode and the median is calculated by Formula 5; in the case of the left-sided asymmetry, Formula 6 is used [26]:

$$S = \frac{M - Mo}{M}, \quad (5)$$

$$S=\frac{Mo - M}{Mo}, \quad (6)$$

where:
M - the median;
Mo - the mode.

By using SPSS Statistics, the authors have verified the relevancy indicator of own funds to solvency capital requirement to cover the reinsurance default risk, which is calculated on the example of 50 Ukrainian insurance companies in the years 2015 and 2016.

Table 1 shows the performance data sample of descriptive statistics of the calculation results matching own funds of solvency capital requirement to cover the reinsurance default risk of insurance companies.

Tab. 1: **Indicators of descriptive statistics for indicator of capital adequacy to cover the reinsurance default risk of the insurance companies in Ukraine**

Indicator	Symbol	Value
Average	$\bar{x}$	0.312
Median	M	0.27
Mode	Mo	0.12
Standard deviation	σ	0.192
Asymmetry coefficient	A	0.496

Source: Own calculation

Table 1 contains the results of calculating the average value for the sample median, the mode, the standard deviation and the coefficient of asymmetry. The asymmetrical distribution is characterised by the fact that most of the indicators located on one side of the mean value, while the other part of them is located at a significant distance from it. According to the asymmetry coefficient, the distribution has the right-side asymmetry (as the asymmetry coefficient is greater than 0). This conclusion is also confirmed graphically by a clear picture of the distribution of statistical sampling. With regard to the right-side asymmetry, the range of values of the scale by the three sigma rule is as follows: (M - 2σk; M + 2σ (k + 1)).

Tab. 2: **Scale intervals for the indicator of capital adequacy of the insurance companies to cover the reinsurance default risk in Ukraine**

Order of calculation	Scale intervals	Indication of capital adequacy of the insurance company to cover the reinsurance default risk
[-∞; M -2σk)	[0; 0.185)	Inadequate level
[M-2σk; M – 1σk)	[0.185; 0.227)	Adequate level
[M – 1σk ; M + 1σ(k+1)	[0.227; 0.505)	Medium level
[M + 1σ(k+1) ; M + 2σ(k+1)	[0.505; 0.739)	Good level
[M + 2σ(k+1); +∞)	[0.739; +∞]	Excellent level

Source: Own calculation

The asymmetrical distribution is characterised by the fact that most of the indicators located on one side of the mean value, while the other part is located at a distance from the other side. Based on the non-compliance of the values of the mode, the median and the average of the presence of asymmetry in the distribution of the intensity intervals of the indicator while building the scale, it is more appropriate to use the median instead of the average [26]. To calculate the correction coefficient, authors have determined the distance between the mode and the median by using Formula 5 (based on the sample of the right-side asymmetry). It has been defined that the scale has five slots indicating inadequate, adequate, medium, good and excellent levels, hence the n index = 5/2 = 2.5.

Based on Table 1, it is possible to conduct further scaling of the indicators with regard to the right-side asymmetry provided the index is not distributed normally.

The construction of the scale with the correction factor (k) and the median allows getting scale intervals for the relevancy of own funds of insurance companies to cover the reinsurance default risk (Table 2).

According to the designed scale shown in Table 2, the authors propose to assess the degree of the risk of reinsurers in Ukraine in terms of compliance with own funds of the insurance company solvency capital requirement to cover the reinsurance default risk in the insurance company.

5. Conclusion

Thus, for the purpose of adaptation of the requirements of the EU Directive Solvency II for the reinsurer default assessment to the conditions of the activity of the insurance companies of Ukraine, five levels of capital adequacy of the insurance company to cover the reinsurance default risk have been developed and the criteria for capital adequacy assessment for reinsurer default risk coverage have been proposed.

Based on the example of 50 insurance companies in Ukraine, the authors have conducted scale measurement of capital adequacy to cover the reinsurance default risk of by using various methods of mathematical statistics. The proposed approach makes it possible to determine the solvency of insurance companies under the worst condition, which is the default of the reinsurer. The article provides recommendations in order to improve the relevant methodology.

The authors have developed the scale and the criteria of the capital adequacy indicator of the insurance company to cover the reinsurance default risk at «inadequate», «adequate», «medium», «good» and «excellent» levels. The practical value of the article lies in the proposed approaches to improve capital adequacy assessment concerning the coverage of the reinsurance default risk, which will enhance the level of reinsurance and facilitate the fulfillment of obligations by insurance companies.

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