– timely and simple definition of the risk of insurance companies intake in suspicious transactions (rapid approach);

– a detailed analysis of the impact (specific gravity) forming the risks of insurance companies usage in suspicious transactions incidents and indicators;

– accumulation within integrated assessment of the risks of insurance companies intake in suspicious transactions of historical data and risk factor characteristics nowadays.

In terms of government regulation, supervisory and control authorities, developed scientific and methodical approach allows distinguishing a number of insurance companies with «high» and «critical» risk levels of suspicious transactions using and to form a system of management measures in financial monitoring concerning them.

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OPTIMIZATION OF THE RISK LEVEL OF NET RETENTION IN THE INSURANCE MARKET

Abstract. *Introduction.* In this paper, the authors discuss key optimization aspects of net retention ratio in the risk transfer process for reinsurance as a factor of financial stability and security in the insurance company. For this purpose, an algorithm was developed, which estimated a net retention ratio in the context of the insurance company responsibility for ensuring the minimum required level of the insurer's financial security. Implementation of suggested approach has been performed based at economic and mathematical model («linear programming»), subject to the insurance market performance.

Purpose of this research is to develop an estimation algorithm of a net retention ratio which should be the responsibility of the insurance company for ensuring the minimum required level of the insurer's financial security.

Methods. The methodological basis of the paper lies in identifying main trends of financial and insurance theory, development of domestic and foreign science in insurance and reinsurance activities and optimal financial security by determining the net retention ratio.
Results. The practical application of this model allows calculating the minimum required level of net retention risk among insurance market participants. On the bases of the insurance market analysis in Ukraine, it must be noted that only 50 companies accumulate more than 50% of all insurance premiums, which is the reason why the practical implementation of the model is conducted using these companies. Having executed settlements according with a developed technique, a ranking of insurance companies in the context of their net retention level has been made. Achieved results allow stating that all analyzed market participants for ensuring the minimum required level of financial security should cede a significant proportion of earned premiums.

Conclusion. The scientific novelty of this study is development of the model for retention risk ratio estimation by the insurance market participants, considering the minimum required level of financial security. The importance of this work is in potential for this model usage from a perspective of loss reduction by the insurance companies. Findings obtained under practical application of suggested approach allow valuing the net retention ratio of each insurance company, needed for ensuring the minimum required level of financial security.

Keywords: insurance market; financial security of the insurance market; net retention; net retention risk; reinsurance; economic and mathematical model.
JEL Classification: G22, B41, C60, C61

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ОПТИМІЗАЦІЯ РІВНЯ ВЛАСНОГО УТРИМАННЯ РИЗИКУ НА СТРАХОВОМУ РИНКУ

Анотація. У статті розглянуто ключові аспекти оптимізації частки власного утримання ризику страховою компанією (СК) у процесі його передачі в перестрахування як фактору забезпечення фінансової стабільності та безпеки СК. Для цього дослідження було розроблено алгоритм, що дозволяє визначити частку власного утримання, яка повинна залишатися на відповідальності страхової компанії для забезпечення мінімально необхідного рівня фінансової безпеки страховика. Запропонований авторами підхід, що ґрунтується на результатах економіко-математичного моделювання, проходить практичну апробацію в ряді СК України.
Ключові слова: страховий ринок; фінансова безпека страхового ринку; власне утримання; перестрахування; економіко-математичне моделювання.

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ОПТИМИЗАЦИЯ УРОВНЯ СОБСТВЕННОГО УДЕРЖАНИЯ РИСКА НА СТРАХОВОМ РЫНКЕ

Аннотация. В статье рассмотрены ключевые аспекты оптимизации собственного удержания страховой компанией (СК) риска в процессе его передачи в перестрахование как фактора обеспечения финансовой стабильности и безопасности СК. Для данного исследования был разработан алгоритм определения доли собственного удержания, которая должна оставаться на ответственности страховой компании для обеспечения минимально необходимого уровня финансовой безопасности страховщика. Предложенный авторами подход, который базируется на результатах экономико-математического моделирования, проходит практическую апробацию в ряде СК Украины.
Ключевые слова: страховой рынок; финансовая безопасность страхового рынка; собственное удержание; перестрахование; экономико-математическое моделирование.

Introduction. In this paper, we discuss key aspects of net retention ratio optimization due to risk transfer for reinsurance as a factor of financial stability and security in the insurance company. A net retention ratio algorithm, which should be the responsibility of the insurance company for ensuring the minimum required level of the insurer's financial security, was developed for this study. The implementation of suggested approach is performed based at economic and mathematical model («linear programming»), subject to the insurance market performance.

Brief Literature Review. Fundamental studies of insurance and reinsurance business as well as their performance during the crisis and approaches to its stabilization were carried out by the following scientists: Thomas S. (2005) [1], Chen X., (2007) [2], Ravindran M. (2011) [3] et al. Among domestic scholars and practitioners Hamankova O. O. (2009) [4], Boyko A. (2009) [5], Kuzmenko O. (2011, 2014) [6; 7], Kozmenko O. (2009, 2011) [5; 7] et al. made contribution to the development of reinsurance activity as a mechanism for financial security in the insurance market. However, there is a need for further developments related to the insurer's financial security as a key component in the insurance market. Studying the optimal allocation of net retention level will ensure: making insurance benefits or liabilities within acceptable limits; optimization of insurer's profitability by adopting a compromise on the distribution of portion of received premiums.

Purpose of this research is to develop a net retention ratio algorithm which should be the responsibility of insurance company for ensuring the minimum required level of the insurer's financial security.

Results. Development of the insurance market, which accepts reliable guarantees of violated property rights and interests restoration, associated with life and health, with losses caused by fire, natural catastrophes and other unforeseen events, is one of financial security indicators in any country. At the same time, insurance not only indemnifies the state against costs for losses compensation caused by unforeseen events, but also remarkably affects strengthening its financial position. Insurance is an effective form of citizens' funds accumulation and a significant stable source of long-term investments.

At first glance, reinsurance protects insurers, but it implicates the protection of employees of insurance companies from work loss and shareholders from fall in profits. For insurers it means the preservation of insurance rates as long as changes, resulting in an increase in losses, do not change their sudden nature to continuing. Finally, it is guaranteed that the state will receive tax refunds from insurance activities. As well as time saving which is obtained by insurance companies through reinsurers offices allows evaluating changes in all spheres of human activity and finds an optimal solution in order to account for these changes in future.

For one part, reinsurance has a task to balance the insurance portfolio, its protection from catastrophic or large insurance events etc., it contributes to better general financial results of the ceding company's activity. For the other part, reinsurance is connected to transfer of premiums parts to insurers; consequently, depending on results of reinsurer's business, the financial indicators of the ceding company can degrade or improve. Therefore, an appropriate definition of the extent in insurance is important for every insurer. As a result, the main determinant is a so-termed net retention of an original insurer, constituting the economically feasible sum of money within which the original insurer is responsible for a certain share of insurance risks; and transfers funds to reinsurance exceeding this level.

As a general principle an original insurer fixes the liability limits or net retention limits in a specified payment, relating to the entire insurance risk for one insurance type: vessels, cargoes, industrial facilities, residential buildings, etc. [1; 4].

An appropriate definition of the extent in insurance is important for every insurance company. As a result, the main determinant is a so-termed net retention of an original insurer, constituting economically feasible sum of money within which the insurance company keeps (holds) on its responsibility a certain share of insurance risks, which are insured, and transfers funds to reinsurance exceeding this level. In the present case a surplus treaty is the most common form of reinsurance treaty.

The net retention level is a very important index both for insurer and for reinsurer. For reinsurer a net retention means a magnitude of risk, which would not deteriorate the financial stability. For the other part, risk sharing means fractional increase of policy administration, since besides ordinary costs (policy

administration, rent or maintenance of premises, payment for blank materials, promotional activities, commissions paid to insurance agents and brokers, costs for repairing the environmental damage) reinsurance expenses should be paid (contracts and agreements execution, transfer instruments, arrangements for accounting and payment etc.) [5; 6]. Justification of a net retention rate should be carried out in compliance with the abovementioned criteria; also it should be finished till risk-taking, as the net retention rate can influence insurance conditions. If a net retention limit is fixed at an understated level, the insurance company will be obliged to cede insurance an extra portion of premium, which could be potentially saved by a correct determining of a net retention limit. However, if a net retention limit is too high, it can negatively impact on case outcomes.

For insurer the reinsurer's net retention rate is also significant, as an undersized net retention rate does not give insurers confidence that reinsurer is sufficiently attentive while risks acceptance, since on a very low retention level negative insurance outcomes can be compensated for a commission or a tantieme rather significantly, than partially [2; 7].

Therefore, it is necessary to develop a net retention ratio algorithm, which should be the responsibility of an insurance company for ensuring a minimum required level of the insurer's financial security. The calculation for this model will be based on preliminary existing statistical data. Obtained results will demonstrate the minimum required net retention rate for providing $K_{fs} \geq 1$, subject to $K_{fs} \to min$, where K_{fs} – financial stability index, fs – financial stability [6; 3].

While research a series of input data, information application of investigation in net retention ratio of insurance risks in the insurance companies in the insurance market should be formed: θ – gross premium received by the insurer; V – payments; SK – authorized capital; SR – amount of assets in reserve funds; $\theta *$ – transferred to reinsurance. The quantitative formalization of financial stability index for insurance company as a dependence function on net retention ratio (control variable) and measures (retained earnings, amount of assets in reserve funds, authorized capital, maximum scope of responsibility), includes a series of activities:

1. The definition of financial stability index as a fraction, where the numerator is a sum of retained earnings, amount of assets in reserve funds, authorized capital, and a common denominator – maximum scope of responsibility, which mathematically may be expressed as follows:

$$K_{fs} = \frac{NP + SR + SK}{\xi}, \qquad (1)$$

where K_{fs} – financial stability index; NP – retained earnings; SR – amount of assets in reserve funds; SK – authorized capital; ξ – maximum scope of responsibility.

2. The representation of retained earnings (one of the financial stability indexes in the insurance company) as a dependence function on net retention ratio:

$$NP = \theta \cdot p - \theta * \cdot (1-\alpha) \cdot p - \alpha \cdot V, \qquad (2)$$

where θ – gross premium received by the insurer; p – probability of insurance event; $\theta *$ – transferred to reinsurance; α – net retention ratio; V – payments.

3. The calculation for probabilities of insurance event as one of the financial stability parameters in insurance companies as a whole and retained earnings in particular (Column 7 of Table 1) as the ratio of payments to gross premium received by the insurer:

$$p = \frac{V}{\theta}. \qquad (3)$$

4. The quantitative estimation of maximum scope of responsibility on the ratio of gross premiums to this index in the insurance market as a whole, is expressed as a fraction, the numerator is a quotient of the companies' net retention in the insurance market and payments, a denominator is a quotient of gross premium in a maximum scope of responsibility with the insurance than:

$$\xi = \alpha \cdot V / \beta, \qquad (4)$$

where β – share of gross premiums in the maximum scope of responsibility pertaining to the insurance market.

$$\beta = w_d \cdot \frac{\theta_d}{\xi_d} + w_o \cdot \frac{\theta_o}{\xi_o}, \qquad (5)$$

where w_d – share of voluntary insurance in gross premiums, collected by insurance companies in the insurance market as a whole; θ_d – gross premiums of companies in the insurance market with regard to voluntary insurance; ξ_d – the maximum scope of companies' responsibility in the insurance market pertaining to voluntary insurance; w_o – share of compulsory insurance in gross premiums, collected by insurance companies in the insurance market as a whole; θ_o – gross premiums of companies in the insurance market with regard to compulsory insurance; ξ_o – the maximum scope of companies' responsibility in the insurance market with reference to compulsory insurance.

5. The inequality formalization of first-order condition in providing a minimum allowed level of financial security by insurance companies in the insurance market through optimization of net retention ratio in the insurance market. For this purpose let us write the financial stability index as a dependence function on the net retention ratio:

$$K_{fs} = \frac{\theta \cdot p - \theta * \cdot (1-\alpha) \cdot p - \alpha \cdot V + SR + SK}{\alpha \cdot V / \beta} > 1. \qquad (6)$$

The desired inequality can be obtained from inequality (6) by simple transformations:

$$\theta \cdot p - \theta * \cdot (1-\alpha) \cdot p - \alpha \cdot V + SR + SK > \alpha \cdot V / \beta, \qquad (7)$$

where θ – gross premium received by insurer; p – probability of insurance event; $\theta *$ – transferred to reinsurance; α – net retention ratio; V – payments; SR – amount of assets in reserve funds; SK – authorized capital; β – share of gross premiums in the maximum scope of responsibility with reference to the insurance market.

The following inequality can be obtained from inequality (7) after expressing a control variable – net retention ratio of insurance risks by companies in the insurance market:

$$\alpha < \frac{\theta \cdot p - \theta * \cdot p + SR + SK}{V / \beta - \theta * \cdot p + V}. \qquad (8)$$

6. The construction of economic and mathematical optimization model for calculating the net retention ratio of insurance risks by companies in the insurance market as a nonlinear programming problem and its solution per application of MS Excel tools «decision making». Then, a target function is a value of financial stability index, which can obtain a minimum allowable value – one, the task limitations are limitations as for taking the net retention ratio of the insurance risks by the companies in the insurance market zero-one variable and applying a value no less than one by a target function:

$$K_{fs}(\alpha) = \frac{\theta \cdot p - \theta * \cdot (1-\alpha) \cdot p - \alpha \cdot V + SR + SK}{\alpha \cdot V / \beta} \to min$$
$$\begin{cases} K_{fs} = \frac{\theta \cdot p - \theta * \cdot (1-\alpha) \cdot p - \alpha \cdot V + SR + SK}{\alpha \cdot V / \beta} \geq 1 \\ 0 \leq \alpha \leq 1 \end{cases} \qquad (9)$$

The result of a calculated algorithm is to obtain a system of equations that allows determining the required level of net retention for ensuring the minimum required level of financial security index.

Despite the large number of insurance companies on the Ukrainian market as well as ever-increasing volume of incoming insurance premiums, the represented data show a low level of reinsurance in Ukraine, that directly affects the financial security on the insurance market (see Figure). That is what makes actual the necessity for model development, which allows determining the minimum required level of net retention for ensuring the optimum value of financial security.

Build upon conducted analysis of the insurance market, it was concluded that only 50 companies accumulate more than
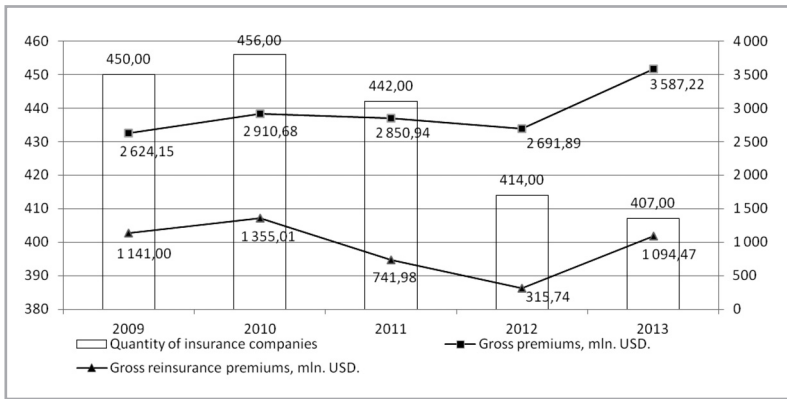
Figure: **The performance indicators of the insurance market in Ukraine, 2009-2013**
Source: Authors' calculations based at [8]

50% of all insurance premiums. For a practical implementation of the model of risk retention ratio, information on these companies was used, according to received statistics data as of 2013 (see Table) [8].

Relying on undertaken studies, most researchers lean toward the idea that the optimum value of net retention ratio by companies in the market ranges within 50-95% of gross measures in the insurance payments. If an indicator value is higher than a suggested limit, it means a practical lack of reinsurance, if the indicator value is lower –this implies a high level of dependence of financial security in the insurance company from partners in reinsurance [3; 5; 6].

Having executed settlements according with a developed technique for definition the minimum required level of net retention ratio, the ranking of insurance companies as per case criterion was made (Table). This fact allows to state that all analyzed market participants for ensuring the minimum required level of financial security should cede a significant proportion of earned premiums. Thus, results show low reinsurance participation rate of all insurance companies which have 50% of insurance premiums in the market. For most of them with a view to optimum performance and execution of assumed obligations towards insurers, it is necessary to cede a significant proportion of earned premiums. Based on undertaken investigation, one may state that only one insurance company (Lemma), from among the 50 most powerful market operators, can leave on the net retention a part of insurance premiums ranging from 36% to 40% for ensuring the optimum value of financial security. A specified level most closely resembles the statutory value, but it does not meet the conditions.

Findings to a significant extent make actual the issue of risk-free business terms and conditions between the insurance and reinsurance companies under conditions of instability in the insurance markets, as the financial security of each market's object markedly affects customers' solvency and financial security. Thus, the results of practical application of this model show

that financial security of insurance companies in Ukraine is at a low level.

Conclusions. The research finding is development and implementation of the valuation model of retention ratio by insurance market participants, taking into account ensuring the minimum required level of their financial security. The importance of this work is in potential for use from a perspective of loss reduction by insurers subject to occurrence insured events. The calculation of suggested model allows maintaining that a representative selection of insurance companies among the 50 most powerful insurance market participants in Ukraine does satisfy the conditions of optimum net retention. Elaborated model is an effective instrument for optimum net retention evaluation by insurance companies, which is necessary to keep for ensuring the optimum level of insurer's financial security.

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Table: **The differentiation of insurance companies according to the net retention ratio**

Net retention volume, %	Company name	The number of insurance companies
5-10	Delta, Dominanta, Illichivska, UOSK	4
11-15	Alfa Insurance, Providna, Dniproinmed, VUSO, Brokbusiness, Persha, QBE Ukraine, BUSIN, Kyivskyi Strahovyi Dim, Zlagoda	11
16-20	ASKA, UNIQA, Viena Insurance Group, PZU Ukraine, Universalna, NGS, Garantiya, Express-Insurance, stroypolicy, Unives, Vidi-insurance	11
21-25	AXA-Ukraine, Arsenal-Strahovanie, TAS-insurance, UPSK, Garant Avto, Kniazha, Europian Insurance Alliance, Globus, Skide, ASKODS, NASTA, Strahovi Garantii, Ukrainian Insurance Standart	13
26-30	PRO100, Allianz Ukraine, Kraina, Unison Garant, MTIBU, Motor Garant	6
31-35	Alliance, HDI Insurance, Utico	3
36-40	Lemma	1

Source: Authors' calculations