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THE LATEST TOOLS FOR OPTIMIZING THE TAX REGULATION OF THE INSURANCE BUSINESS

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ABSTRACT

The article applies a scientific-methodical approach to the taxation of insurers' incomes in order to achieve an optimal balance between the revenue base of the budget and the minimization of budget risks. Empirical measurement of relationships between the financial results of insurers and tax regulation of their activities using economic models and mathematical apparatus made it possible to develop the latest financial decision-making tools based on the Census II method. These tools contribute to the formation of the tax base (income after insurance activities) from the point of view of minimizing the impact of budgetary risks on the level of state budget revenues. The foundation of the developed scientific-methodological approach is the algorithm of actions for determining the actual deviation of the tax base from the calculated trend cycle. This allows us to minimize the risk of not receiving budget revenues and create multiple scenarios of resilience to the influence of external factors.

The proposed approach makes it possible to produce alternative financial decisions regarding the choice of the taxation mechanism of domestic insurers in order to minimize budgetary risks. The practical significance of the obtained results is revealed in the developing theoretical and methodological provisions and outlined methodological approaches in practical activities, which justify the optimal choice of the tax base of insurance companies with the lowest level of variability, taking into account the influence of exogenous processes in a dynamic market background. This will form prerogatives to minimize the risk of not receiving budget revenues. It has been empirically proven that the specified scientific-methodical approach will contribute to the optimization of the insurance business taxation process, ensuring a balance between the interests of the state and all participants in this market.

Keywords: financial solutions, tax instruments, insurance business, insurers, tax regulation, taxation, financial results of insurers

JEL Classification: C22, G18, G22, G28

INTRODUCTION

The realities of the insurance sector transformation create the prerogatives for the construction of a balanced state policy in relation to tax regulation of the insurance businesses, which is a guarantee of ensuring the efficiency of insurance activities, an indicator of the transparency and competitiveness of the market environment, and the creation of guarantees for the provision of reliable insurance protection to its participants. At the same time, a significant step is the progress of modern methodologies to the structure of the mechanism of tax regulation of the insurers' activities through the empirically determined levers and tools that modify the relationship between the participants of insurance relations and the state, forming the basis for increasing the revenue base of budgets of various levels.

Accordingly, the development of the insurance businesses in the conditions of the latest challenges and threats is possible by revising the policy of taxation in the field of insurance in the context of generating alternative financial solutions regarding the choice of the tax object of Ukrainian insurance companies with a purpose of reducing budgetary risks and evaluating the results and outcomes of their adoption for establishing strategic development directions of the Ukrainian insurance market.

LITERATURE REVIEW

A crucial assessment of available recent publications, which have started to solve the problem of optimizing the tax regulation of the insurance market, is studied by many scientists. Ukrainian scientists V. Baranov and O. Baranova [2] consider the state regulation problems of insurance activity in the environments of military realities, paying the main attention to the analysis of normative legal acts that regulate insurance activity, and the improvement of taxation of insurers as an unexplored issue. O. Kneisler, when developing principles of regulation of business processes in the reinsurance market, applies a number of methods, in particular, structural and correlation-regression analysis, formalization and economic modelling with the aim of identifying the market structure and determining the market position of its subjects, evaluating the competitive environment, outlining directions for improving the taxation of reinsurers [6].

In the monograph edited by L. Shirinyan, the assessment of indicators regarding the income tax of insurers to the Consolidated Budget of Ukraine is grounded on a dynamic approach using the evolution period of macroeconomic indicators. In addition, a regression analysis was used on the basis of proposing and testing a hypothesis regarding the factor dependence of the indicator of income tax revenues of insurers [11].

At the same time, in their works, the emphasis is on the theoretical foundations, and the practical aspects using the economic-mathematical modelling tools of choosing the optimal tax base for the insurers in the circumstances of reducing the risk of underpayment of tax income to the budget are not revealed. At the same time, the works of K. Raevskyi and Ya. Yeleiko [13], S. Bulgakova and I. Mykytyuk [14] are devoted to the mathematical justification of budget risks at diverse stages of taxonomy.

The development of economic-mathematical instruments for evaluating budget risks was also reflected in the studies of I. Kushlyk-Dyvulska and B. Kushlyk [15], V. Vitlinskyi [16]. However, these works do not address the development of instruments for quantitative calculation of budget risk. Additionally, they lack an assessment of potential income or budget losses when choosing the optimal tax base for insurer income.

V. Kravtsiv and I. Storonianska [17] emphasize the clarification of possible budget losses due to the occurrence of various risks, but the issue of optimizing the insurer's tax base and its impact on budget risks is not covered.

Concurrently, N. Bakerenko [18] proposes to quantitatively assess the risks of budgets using statistical analysis with the help of dispersion indicators, standard deviation and coefficient of variation, however, it is impossible to calculate the loss of the budget due to ineffective taxation of insurers' income using these indicators.

Accordingly, efficient analysis of scientific works on the researched issues shows that, despite considerable and important scientific and theoretical works, the development of the economic-mathematical instruments for evaluating possible losses in the event of budget risks due to ineffective choice of the tax base of the insurer's incomes has not found an adequate coverage in the compositions of modern scientists. Therefore, scientific outcomes will be based on the systematization of the opinions achieved by scientists, with the aim of developing our own methodological basis for research on the selection of the optimal tax base.

AIMS AND OBJECTIVES

The main purpose is to improve a theoretical and applied approach centred on the use of economic-mathematical modelling tools for the formation of the optimal tax base (revenues from insurance activities) from the viewpoint of reducing budgetary risks and meeting the national interests and balancing the interests of all insurance market participants. Achieving the set target needs clearing up the following intentions:

- to identify the theoretical dominants upon which the development of a methodical approach to optimizing the tax base (gross revenues from insurance activity) will be grounded. This approach will focus on minimizing budgetary risks while satisfying state interests through the application of the "Census II" method;
- to develop the stages of economic and mathematical modelling by building the adaptive and multiplicative time series models;
- to simulate and visualize the economic and mathematical model of alternative options for choosing the tax base of insurance companies, performed according to the "Cesus II" method using the "STATISTICA" application program package in order to balance the interests of the insurance relations' issues and the particular state in the context of minimizing budget risks.

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METHODS

To perform the set goal and work out the formulated tasks, the methodological arsenal is enriched by the use of common scientific, economic and mathematical methods. Empirical, statistical, and mathematical methods were used during the study, analytical assessment of tax base (gross profits from insurance activities): structural index - to determine the determinants of imbalances in the taxation of insurance companies; directions for optimizing the choice of the tax base of insurers were developed with the help of economic modelling tools using the "Cesus II" method and the "STATISTICA" application program package. A graphic method was also used to interpret the results of economic and mathematical modelling and approbate the resulting modelling indicators, and a generalization method in the context of formulating research conclusions was used.

RESULTS

The state's tax policy should be inextricable in relation to budget planning. The regularity of budget revenues is an important prerequisite for quality budget planning, as regular budget revenues are more predictable and are characterized by a lower level of budget risk. We share the opinion of S. Bulhakova and I. Mykytiuk that budget risks are "...potentially possible deviations of the budget indicator from its planned value under the influence of risk-creating factors. Risk factors should include reasons, circumstances, and conditions that create the possibility of adverse situations and negative results" [14, p. 61-62]. Therefore, the existence of budgetary risks is closely related to the variability of the market environment, it depends on the financial and economic conditions of the functioning of insurance companies, which significantly affect their financial results and determine the variability of the indicators of the tax base formation.

The traditional method of budget risk assessment, which is emphasized by most specialists, is a statistical method with calculations of dispersion indicators, root mean square (standard) deviation and coefficient of variation [19; 20]. L. Koval claims that "the interpretation of the results of such an assessment, at first glance, is quite simple: the larger the values of dispersion, mean square deviation or the coefficient of variation, the greater the risk will be, as the stability of the results decreases and the uncertainty increases. The most clearly formulated are the results of the risk level assessment based on the coefficient of variation: the coefficient of variation is less than 0.1 – the risk level is low; the value of the coefficient of variation in the range from 0.1 to 0.25 is an average (moderate) level of risk, exceeding the value of 0.25 is a high level of risk, or: 0 to 0.1 is a minimal risk; 0.1–0.25 – low risk; 0.25–0.5 is an acceptable risk, 0.5–0.75 is a critical risk, 0.75–1 is a catastrophic risk" [19, p. 21].

Yu. Karagozliu singles out the following zones of budget risk to assess the risk of budgets: "risk-free zone (the absolute coincidence of planned and actual values of budget indicators); zone of acceptable risk (budgetary risk level – up to 10%); critical risk zone (budgetary risk level – 10%-25%); zone of catastrophic risk (the level of budgetary risk is more than 25%)" [20].

N. Spasiv singles out the following indicators for the quantitative assessment of budget risk: "...the average expected value of the possible result of the execution of the local budget (expenditures and revenues) since either the frequency or the weight of the corresponding value is used as the probability of each result; mean square deviation as a measure of changeability (variability) of possible results" [21, p. 181].

However, in our opinion, such a quantitative method of risk assessment makes it possible to assess only the result of the implementation of the budget risk, leaving out of consideration the root cause of its appearance - the variability of the indicators of the formation of the tax base, as well as the factors that affect fluctuations in their size. In addition, in our opinion, it is appropriate to conduct a risk-oriented analysis of the tax base for insurers at the stage of the formation of the tax policy and the formation of the insurance activity taxation mechanism.

Taking into account the above-mentioned, we offer an alternative option for justifying the choice of policyholders of tax base from the perspective of reducing budget risk (the risk of not receiving budget income) - based on the application of the "Census II (quarterly)" composite analysis method. Note that this method will make it possible to split the time series of the analyzed indicator into trend-cyclic, quarterly (seasonal) and random components. The general tendency of the development of the series is called a trend, while the random component is distinguished when a certain event occurs very rarely and unexpectedly, and the trend-cyclical one - the period of fluctuation exceeds more than one year.

If the quarterly component has a regular periodicity, then the effect of cyclical influencing factors is longer and changes from cycle to cycle. The cyclical component in the "Census II" method is considered to be included in the trend (cyclical

trend) component. Thus, both components, trend and cyclic ones, are combined into one, the functional relationship between which is determined in two ways: adaptive and multiplicative [22].

The advantages of using the "Census II (quarterly)" method are as follows:

- firstly, the implementation of several successive refinements of estimates to obtain the latest, final trend-cyclical, quarterly and random components. At the same time, the following are defined as pre-adjusted series; more precisely adjusted series; final adjusted series;
- secondly, the levelling of "outliers". Most real-time series contain "outliers", that is, observations that stand out sharply and are caused by certain exceptional events. Such "outliers" can distort component and trend estimates. The "Census II" method provides an adjustment for such "outliers" based on the use of "principles of statistical control": values outside the 2.5 σ range may be modified or omitted. Only then the final estimates of model parameters will be calculated.

Among the disadvantages of using the "Census II (quarterly)" method, it is advisable to highlight the following:

- firstly, the method is quite complex and involves a large number of calculations, so its implementation is possible only with the use of computing equipment and a package of statistical application programs;
- secondly, the method is designed to use monthly or quarterly data. It cannot be used to record other data.

Based on the main research of scientists Hyndman Rob J., Makridakis Spyros G., and Wheelwright Steven C. [23], we can build an economic-mathematical model of time series analysis using the "Census II" method and evaluate the risk of not receiving tax income from insurance companies to the budget in connection with the variability of the indicators of the formation of the tax base of their incomes and results. Let's introduce the following designations of the components of the time series:

- TC_t – trend-cyclical component;
- S_t – quarterly component;
- I_t – a random, irregular component or fluctuation;
- t – moment of time.

Then the additive time series model will look like this:

$$Y_t = TC_t + S_t + I_t. \quad (1)$$

Multiplicative time series model:

$$Y_t = TC_t \times S_t \times I_t, \quad (2)$$

where: Y_t– is the value of the time series at time t.

Note that if the range of quarterly fluctuations increases when the values of the variable change, then a multiplicative model of the time series is used. If the range of quarterly fluctuations does not change with an increase (decrease) in the values of the variable, then the additive model of the time series is used (Figures 1-2).

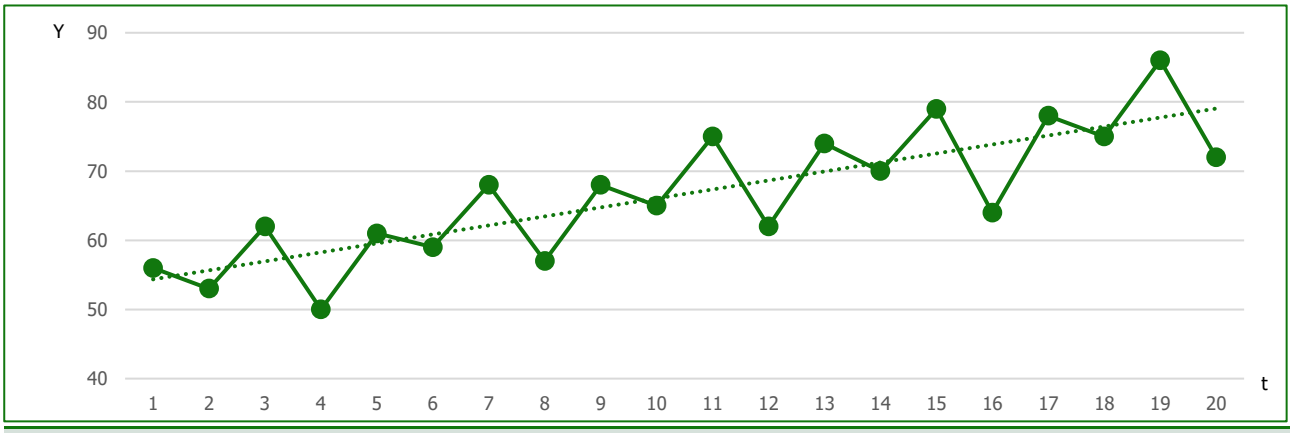

Figure 1. Additive time series model.

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At the same time, we note that multiplicative models are used in the analysis of relative, qualitative indicators – financial results of the insurance companies. Additive models are created to analyze quantitative indicators of the insurers' activities.

According to this methodological approach, the following mathematical problem is solved in our research - in the context of the analysis of insurance premium indicators and financial outcomes from typical activities to taxation of insurers, not only their dynamics are determined, but also their compliance with a certain time series model (additive or multiplicative).

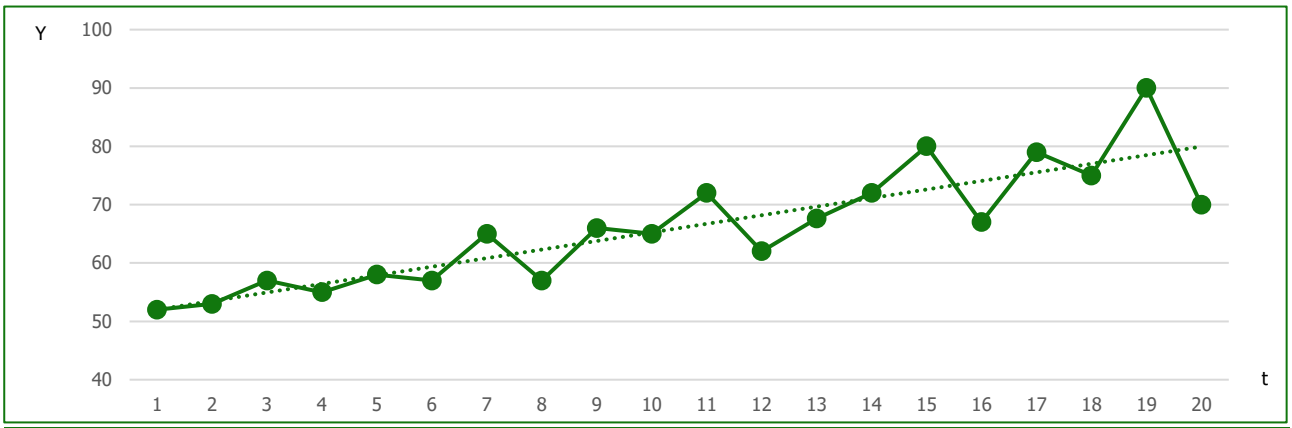

Figure 2. Multiplicative model of conditional time series.

To optimize the taxation of the insurance businesses, we develop methodological basics for the selection of the tax base of insurers from the point of view of reducing budgetary risk, which involves the performance of further economic and mathematical calculations.

Based on the time series of the output data, we calculate the 4-member centred moving average using the following formulas:

$$F_t(A) = \frac{Y_{t-2}+Y_{t-1}+Y_t+Y_{t+2}}{4}, \quad (3)$$

$$F_t(B) = \frac{Y_{t-1}+Y_t+Y_{t+1}+Y_{t+2}}{4}, \quad (4)$$

$$F_t = \frac{F_t(A)+F_t(B)}{2}. \quad (5)$$

When calculating F_t the quarterly ups and downs of the data mutually compensate each other, and then as a result we get an approximate estimate of the trend-cyclic series, which is "cleaned" from the influence of the quarterly and random components.

Let's calculate the quarterly and random components (SI_t) of the time series of data. For the additive model, SI_t is equal to:

$$SI_t = Y_t - F_t \quad (6)$$

For the multiplicative model, SI_t is determined by the following formula:

$$SI_t = \frac{Y_t}{F_t}. \quad (7)$$

We can make a preliminary estimate of the quarterly component S_t by calculating the 5-member moving average SI_t according to the formula:

$$S_t = \frac{1}{9}SI_{t-8} + \frac{2}{9}SI_{t-4} + \frac{3}{9}SI_t + \frac{2}{9}SI_{t+4} + \frac{1}{9}SI_{t+8}, \quad (8)$$

where: S_t *– average value SI.*

In the moving-centred average $S_t$more weight (3/9) is given to the middle term, and the extreme members get less weight (1/9). The obtained $S_t$is the value determined by averaging the SI values for the 5 nearest quarters of the same name.

Using the values of S_t we calculate the 4-term centered moving average $S_t^{'}$:

$$S_t'(A) = \frac{S_{t-2}+S_{t-1}+S_t+S_{t+1}}{4}, \quad (9)$$

$$S_t'(B) = \frac{S_{t-1}+S_t+S_{t+1}+S_{t+2}}{4}, \quad (10)$$

$$S_t' = \frac{S_t'(A)+S_t'(B)}{2}. \quad (11)$$

We get an estimate of the random component:

for the additive model I_t':

$$I_t' = SI_t - S_t' \quad (12)$$

- for the multiplicative model SI_t':

$$I_t^{'} = \frac{SI_t}{S_t^{'}} \quad (13)$$

Let's determine the refined trend of a series of data (Y_{ds}):

- for the additive model Y_{ds}:

$$Y_{ds} = Y_t - SI_t \quad (14)$$

- for the multiplicative model Y_{ds}:

$$Y_{ds} = \frac{Y_t}{SI_t} \quad (15)$$

We can clarify the value of the trend component by smoothing using a 5-term Henderson moving average:

$$TC_t' = -0{,}073Y_{ds\,t-2} + 0{,}294Y_{ds\,t-1} + 0{,}558Y_{ds\,t} + 0{,}294Y_{ds\,t+1} - 0{,}173Y_{ds\,t+2}, \quad (16)$$

We get an updated estimate of the quarterly and random components:

- for additive model:

$$SI_t' = Y_t - TC_t' \quad (17)$$

- for the multiplicative model:

$$SI_t' = \frac{Y_t}{TC_t'}. \quad (18)$$

To obtain the specified values of the quarterly and random components, calculations (8) - (13) must be performed again.

Approbation in practice of this scientific and methodical approach takes place using the "Census II" method and the "STATISTICA" application program package.

Based on the approval, for the quantitative comparison of alternative options for choosing the tax base of the insurers, we suggest introducing the variability indicator of the tax base and calculating it as the deviation of the actual values of the time series from the trend cycle (υ) according to the formula:

$$\upsilon = \frac{1}{t}\sum_{i=1}^{t}\frac{|Y_t - TC_t|}{TC_t} \times 100, \quad (19)$$

where: Y_t *– actual time series data;* TC_t *– trend cycle.*

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The variation indicator (υ) for alternative options for choosing the tax base of the insurers characterizes the level of budget risk (the risk of not receiving budget revenues), which is a significant indicator in the process of balancing the interests of the insurers and the state. The structural and logical scheme of the analysis of the tax base of the insurers in a generalized form is presented in Figure 3.

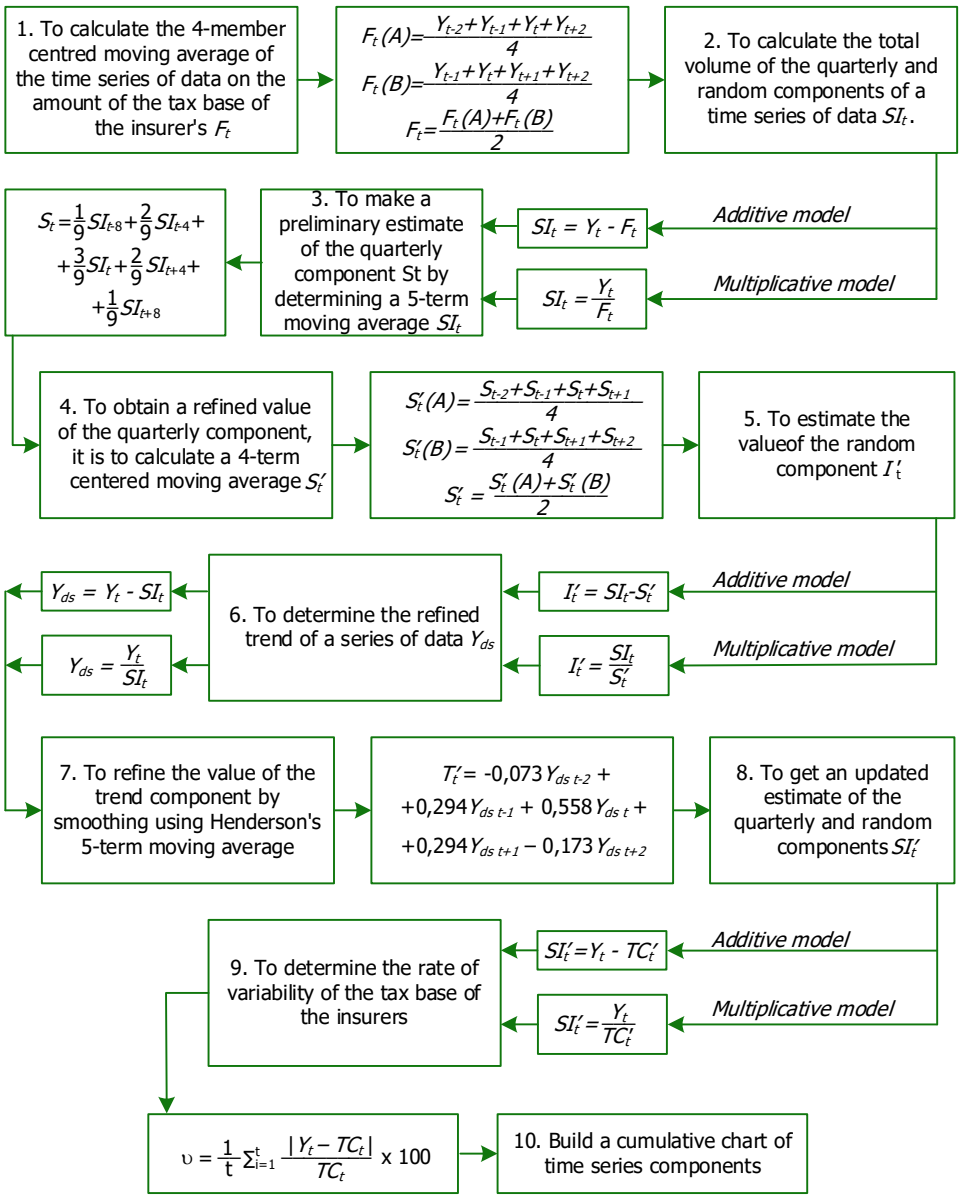

Figure 3. Structural and logical modelling of the tax base of insurers.

Thus, summarizing all of the above, we note that the proposed scientific approach to choosing the tax base of Ukrainian insurers from the perspective of reducing budget risks involves a composite analysis of time series data of alternative options for the tax base of insurers, with the allocation of trend-cycle, quarterly and random component based on the application of the "Census II" method.

The implementation of such an approach with the help of economic and mathematical calculations using statistical methods of analysis will make it possible to substantiate the optimal choice of the tax base of the insurers with the lowest level of variability under the impact of external reasons of the market environment and to minimize the risk of underpayment of tax income to the budget. This will contribute to the optimization of tax regulation of the insurance business from the standpoint of balancing the interests of the state and all participants in the insurance market.

DISCUSSION

In the sources of scientific literature, until now, studies of ways to optimize the selection of the tax base of insurers have not been conducted considering the impact of external factors on the market environment and under the condition of reducing the risk of not receiving tax revenues to the budget using the tools of economic and mathematical modelling. For example, Y. Cherniakhovskyi [10], L. Shirinian [11], and T. Yavorska [12] combine the practical component with theoretical postulates in their research, but they pay insufficient attention to methodical approaches to optimizing the tax regulation of the insurance market. O. Hamankova [4] mainly focuses on the study of the theoretical foundations of the insurance services market, while the mathematical apparatus is used to determine the efficiency of insurance activities of the market in general.

At the same time, in the research of Y. Karahozliu [20], a model was developed for assessing the risk of budgets in terms of revenue shortfall, in particular at the local level, based on the calculation of variation coefficients [20]. According to the author [20], the statistical assessment of the riskiness of local budgets should be calculated grounded on the indicators of dispersion, standard deviation and coefficient of variation. This approach is debatable, as it identifies only areas of budgetary risk, and in the context of our economic-mathematical problem, it does not solve the dominant problem at all - the choice of the insurer's taxation base, under which the state will not lose revenue to the budget and at the same time ensure the preservation of the resulting activity indicators of the insurance companies at a level not lower than the previous one.

CONCLUSIONS

Accordingly, the condition of the economic-mathematical problem is the presence of a probabilistic event, because under the influence of external elements of the market environment, the uncertainty associated with risk increases, and it is necessary to empirically measure and predict such a probabilistic event regarding the optimal choice of the tax base of the insurers, where the risk of not getting revenues to the budget will be minimized.

It is possible to solve this mathematical problem when using a modified version of "Census II" as a classical decomposition method, based on the division of a dynamic series into components, which, with exponential smoothing, makes it possible to forecast the given values a year in advance. The use of "Census II" in the context of the optimal range of the tax base from the standpoint of reducing budgetary risks, as evidenced by our economic and mathematical modelling, is valid.

Accordingly, we applied "Census II" in the part of conducting a composite analysis of time series data of alternative variants of the tax base of the insurers, with the allocation of trend-cycle, quarterly and random components, and on this basis, proposals were made regarding the choice of the policyholders' tax base from the point of view of reducing the risk of underpayment to the tax revenue budget, which is the most adapted to the mathematical problem defined by us.

As a result of the research, an organisational and rational scheme of the compositional examination of the tax base of the insurers was developed based on the application of the "Census II (quarterly)" method, which involves the calculation of the variability indicator of this base as a deviation of the actual prices of its volumes from the tendency cycle. An alternative version of the justification for the choice of the tax base of the insurers from the standpoint of reducing the risk of not getting tax income to the budget is proposed.

An important direction of further scientific research is the modernization of tax regulation of the insurers under the effect of military risks with the purpose of progressive development of the Ukrainian insurance market, balancing the interests of insurers and the state, which requires the development of modern methods of assessing budgetary risks.

ADDITIONAL INFORMATION

AUTHOR CONTRIBUTIONS

All authors have contributed equally.

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CONFLICT OF INTEREST

The Authors declare that there is no conflict of interest.

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НОВІТНІЙ ІНСТРУМЕНТАРІЙ ОПТИМІЗАЦІЇ ПОДАТКОВОГО РЕГУЛЮВАННЯ СТРАХОВОГО БІЗНЕСУ

У дослідженні розроблено науково-методичний підхід до вибору бази оподаткування страховиків в умовах мінімізації ризику недоотримання податкових надходжень до бюджету. Емпірично виміряні взаємозв'язки між показниками фінансових результатів страховиків та податковим регулюванням їхньої діяльності із застосуванням інструментарію економіко-математичного моделювання дали змогу отримати новітній інструментарій ухвалення фінансових рішень із використанням методу «Census II» щодо формування альтернативного вибору податкової бази (доходів від страхової діяльності) з позиції мінімізації бюджетних ризиків та задоволення інтересів держави. В основу розробленого науково-методичного підходу покладено алгоритм дій щодо встановлення відхилення фактичних значень податкової бази від тренд-циклу, що дає змогу розробити шляхи мінімізації ризику недоотримання бюджетних надходжень, формуючи множини сценаріїв стійкості до впливу зовнішніх чинників.

Запропонований підхід дає змогу генерувати альтернативні фінансові рішення щодо вибору бази оподаткування українських страховиків із позицій мінімізації бюджетних ризиків. Практичне значення одержаних результатів полягає в можливості використання запропонованих теоретико-методологічних положень і методичних підходів у практичній діяльності при обґрунтуванні оптимального вибору бази оподаткування страхових компаній із найнижчим рівнем варіативності під впливом зовнішніх чинників ринкового середовища, що сформує преротативи для мінімізації ризику недоотримання податкових надходжень до бюджету. Емпірично доведено, що саме такий розроблений авторами науково-методичний підхід сприятиме оптимізації податкового регулювання страхового бізнесу через призму збалансування інтересів держави та всіх учасників цього ринку.

Ключові слова: фінансові рішення, податкові інструменти, страховий бізнес, страховики, податкове регулювання, оподаткування, фінансові результати страховиків

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