

Opeshko N. S.

*PhD in Economics, Simon Kuznets Kharkiv National
University of Economics*

*Lecturer at financial services management department; Ukraine
e-mail: nopeshko@gmail.com*

Ivashura K. A.

Trainee-consultant

*PJSC «INDUSTRIAL-INSURANCE COMPANY»; Ukraine
e-mail: ivashura.k@rambler.ru*

IMPROVEMENT OF STRESS TESTING OF INSURANCE COMPANIES IN VIEW OF EUROPEAN REQUIREMENTS

Abstract. The paper has identified the essence of the stress testing of the insurance company according to results of the morphological analysis. There was developed the classification of methods of stress testing for insurers used in national and international practice. Main risks of insurance companies' activities were analyzed. The authors identified, that the main risks of insurance companies are insurance, market, credit and operational. Examples of stress scenarios for the main types of risks of insurance companies were presented. The authors identified the main requirements of the Directive of EU Solvency II, the Standards and Principles of the International Association of Insurance Supervisors in stress testing of insurers. There were developed recommendations to the adaptation of European requirements in stress testing of insurance companies on the insurance market of Ukraine. The economic-mathematical model of stress testing of the insurance risk impact on the activities of the insurance company was developed.

Keywords: stress testing of insurance companies, the risks of insurers, stress scenarios, methods of stress testing.

JEL Classification: G22, F36.

Formulas: 2; fig.: 1; tabl.: 3; bibl.: 17

Опешко Н. С.

*к.е.н., Харківський національний економічний
університет імені Семена Кузнеця*

*викладач кафедри управління фінансовими послугами; Україна
e-mail: nopeshko@gmail.com*

Івашура К. А.

стажер-консультант

*ПРАТ «ПРОМИСЛОВО-СТРАХОВА КОМПАНІЯ»; Україна
e-mail: ivashura.k@rambler.ru*

УДОСКОНАЛЕННЯ ОРГАНІЗАЦІЇ СТРЕС-ТЕСТУВАННЯ СТРАХОВИХ КОМПАНІЙ З УРАХУВАННЯМ ЄВРОПЕЙСЬКИХ ВИМОГ

Анотація. Визначена сутність поняття «стрес-тестування страхової компанії» за результатами проведення морфологічного аналізу. Розроблена класифікація методів стрес-тестування страховиків, які використовуються у

вітчизняній та міжнародній практиці. Проаналізовано ризики в діяльності страхових компаній. Встановлено, що основними для страховиків є страховий, ринковий, кредитний та операційний ризики. Наведено приклади стресових сценаріїв для основних видів ризиків страхових компаній. Визначено вимоги Директиви Solvency II та стандартів і принципів Міжнародної асоціації органів нагляду за страховою діяльністю до проведення стрес-тестування страховиків. Запропоновано рекомендації з адаптації європейських вимог до організації стрес-тестування страхових компаній на страховому ринку України. Розроблено економіко-математичну модель стрес-тестування впливу страхового ризику на діяльність страхової компанії.

Ключові слова: стрес-тестування, ризики страховиків, стресові сценарії, методи стрес-тестування.

Формул: 2; рис.: 1; табл.: 3; бібл.: 17

Опешко Н. С.

*к.э.н., Харьковский национальный экономический университет имени Семёна Кузнеця
преподаватель кафедры управления финансовыми услугами; Украина
e-mail: nopeshko@gmail.com*

Ивашура К. А.

*стажер-консультант
ЧАО «ПРОМЫШЛЕННО-СТРАХОВАЯ КОМПАНИЯ»; Украина
e-mail: ivashura.k@rambler.ru*

СОВЕРШЕНСТВОВАНИЕ ОРГАНИЗАЦИИ СТРЕСС-ТЕСТИРОВАНИЯ СТРАХОВЫХ КОМПАНИЙ С УЧЕТОМ ЕВРОПЕЙСКИХ ТРЕБОВАНИЙ

Аннотация. Определена сущность понятия «стресс-тестирование страховой компании» по результатам проведения морфологического анализа. Разработана классификация методов стресс-тестирования страховщиков, используемых в отечественной и международной практике. Проанализированы риски в деятельности страховых компаний. Установлено, что основными для страховщиков являются страховой, рыночный, кредитный и операционный риски. Приведены примеры стрессовых сценариев для основных видов рисков страховых компаний. Определены основные требования Директивы Solvency II, стандартов и принципов Международной ассоциации органов надзора за страховой деятельностью по проведению стресс-тестирования страховщиков. Предложены рекомендации по адаптации европейских требований к организации стресс-тестирования страховых компаний на страховом рынке Украины. Разработана экономико-математическая модель стресс-тестирования влияния страхового риска на деятельность страховой компании.

Ключевые слова: стресс-тестирование, риски страховщиков, стрессовые сценарии, методы стресс-тестирования.

Формул: 2; рис.: 1; табл.: 3; библи.: 17

Introduction. Insurance supervisors worldwide are actively implementing stress

testing in insurance. It is necessary to identify the potential impact of stressful situations on the financial condition of insurers for decision-making and application of sanctions. The importance of stress testing in Ukraine has increased significantly due to the deployment of financial and economic crisis, the growth the number of insurance companies with the interim administration, reducing the ability of insurers to fulfill their obligations and falling consumer confidence in insurance services. Requirements of National Insurance supervisors is the main incentive for insurance companies to exercise a stress testing. Therefore, the National Commission for the State Regulation of Financial Services Markets has to improve approach of insurers' stress testing according to the leading international experience, which determines the relevance of research topic.

The analysis of research and problem definition. The organization of stress testing of insurance companies has institutional and theoretical prerequisites. The institutional prerequisites include international and national legislative acts, for example Requirements of National Commission for the State Regulation of Financial Services Markets about regular stress testing of insurers and disclosure of key risks and the results of stress testing [1], Directive of EU Solvency II [2], Standards and Principles of the International Association of Insurance Supervisors (IAIS) [3], recommendations of European Insurance and Occupational Pensions Authority (EIOPA) [4] etc.

The theoretical prerequisites of stress testing in insurance are scientific works of national and foreign scientists, such as S. Achkasova [5], L. Klapkiv [6], M. Ionin and N. Karlova [7], G. Tlusta [8], K. Yarantseva [9] etc.

Although the problems of stress testing of insurers were investigated by different scientists [2–4], the issue of implementation of international experience of stress testing of insurance companies in the insurance market of Ukraine are not enough developed. Therefore, the purpose of the study is to develop practical recommendations on improvement of stress testing of insurance companies according to the leading international experience.

The results of the research. It is necessary to develop particular recommendations for stress testing to ensure sustainable development of insurers. The main task for improving the organization of stress testing of insurance companies is to determine the essence of the notion «stress testing of the insurance company» according to the investigations of national and foreign scientists [1, 9], national legislation [1] and international experience [2, 3, 4, 10].

In Ukraine, the procedure of stress testing of insurers is regulated by the Order of National Commission for the State Regulation of Financial Services Markets «Requirements for regular stress testing of insurers and disclosure of key risks and the results of stress testing» [1]. According to this legal act [1], stress testing is method of measuring the potential impact of the exceptional, but plausible events (stresses), on the financial position of insurer. Now it is necessary improve stress testing of insurers in Ukraine according to the principles of the Directive of EU Solvency II [2].

The Directive Solvency II [2] requires insurance companies regularly conduct stress testing to verify the adequacy of their capital to fulfill the obligations. In some European countries, stress testing is current requirement of insurance supervisors.

According to the Standards and Principles of the IAIS, stress testing is a standard risk management tool that can be used to identify potential threats due to exceptional but

adverse plausible events to a licensed institution's financial condition. The results of stress testing should be incorporated into the licensed institution's capital management plan. Specifically, it should be used to determine: the extent by which capital will be eroded to mitigate the threats identified and the impact on the licensed institution's financial health; the actions that will be required to mitigate the threats identified [3].

In recommendations of EIOPA stress testing is determined as an important risk management tool. It is used by financial institutions, micro-prudential and macro-prudential supervisors to explore vulnerabilities and assess the resilience of financial institutions (e.g. banks, insurers) and whole systems (e.g. the banking sector, the insurance sector) to severe, but plausible external shocks. Stress tests assess adverse outcomes under a variety of risks. They provide an indication of the impact and potential losses on materialization of these risks, and help to indicate areas where further supervisory actions are needed [4].

According to the definition of Bank for International Settlements, stress testing is the term, which defines the different methods used by financial institutions to assess their own vulnerability to the impact of exceptional, but possible events [10].

S. Achkasova gives her own definition: stress testing of insurance company is an risk identification tool, which used by insurance supervisors and managers of insurance companies to assess the readiness of insurers to possible crisis situations, the amount of required capital to cover possible losses in case of risks, when using promising methods to assess the impact of risk factors on the financial position of insurance company [5].

In the work of M. Kudryavceva stress testing is determined as general term, which comprises different methods for assessing the impact of adverse exceptional, but possible events on the financial position of insurer [11].

According to the work of D. Kondratenko, stress testing is method of quantitative risk assessment that defines excess of liabilities over assets and determines changes in the external factors, such as demand for insurance, competition among the insurers, foreign exchange rate and interest rate [12].

K. Yarantseva defines stress testing as a model, which requires consideration of positive and negative scenarios of insurer's development [9].

According to the recommendations of IMF, stress testing is a forward-looking technique that aims at measuring the sensitivity of a portfolio, an institution, or even an entire financial system to events that have a small probability of occurrence, but a significant impact, if they were to occur [13].

M. Ionin and N. Karlova mention, that the final goal of stress testing is forecasting the cost of assets at the end of the reporting period and the trends of the insurer's capital [7].

In the work of M. Bhatia stress testing is a risk management technique used to evaluate the potential effects on an institution's financial condition of a specific event and/or movement in a set of financial variables [14].

G. Tlusta considers stress testing with two opinions: 1) as a tool to control risk; 2) as a method of quantitative risk assessment. According to the first approach, stress testing is risk management technique, which used to assess potential financial effects of specific events and/or changes in several financial variables. According to the second approach,

stress testing is a range of methods, which aimed to measure the sensitivity of any financial portfolio to a number of extraordinary, but plausible shocks [8].

L. Klapkiv defines stress testing as method of analyzing and assessing the impact of financial risk on the activities of insurance companies [6].

There are many definitions of notions «stress testing of the insurance company» [1–14], which are different from each other. Therefore, it is necessary to conduct the morphological analyze of the notions. The results of analyze are presented in the Table 1.

Table 1

The morphological analyze of the notion «stress testing of the insurance company»

| Criterion of comparison | Structural composition of the notion |
|--------------------------------|---|
| Keyword | Method [1, 6, 8, 10, 11, 12]; tool [1, 3, 4]; model [9]; technique [8, 13, 14] |
| Purpose of the stress testing | Measuring the potential impact of stresses on the financial position of insurer [1, 5, 6, 10, 11, 14]; to identify potential threats to the financial condition of licensed institution [3]; to assess the readiness of insurers to possible crisis situations [1]; to assess the amount of required capital to cover possible losses [1]; to define excess of liabilities over assets and determine changes in the external factors [12]; consideration of positive and negative scenarios of insurer's development [9]; measuring the sensitivity of a portfolio, an institution, or even an entire financial system to stresses [4, 8, 13]; forecasting the cost of assets and the trends of the insurer's capital [7] |
| Subjects of the stress testing | Financial institutions [1, 3, 4, 10]; micro-prudential supervisors [1, 4]; macro-prudential supervisors [4] |
| Types of stresses | Exceptional, but plausible events [1, 3, 10, 11]; severe, but plausible external shocks [4]; possible crisis situations [1]; events that have a small probability of occurrence; but a significant impact [13]; specific event [8, 14]; extraordinary, but plausible shocks [8] |
| Object of the stress testing | Financial position of financial institution [1, 3, 11, 14]; financial institution [1, 4, 6, 9, 10, 13]; financial system [4, 13]; net-assets of financial institution [7, 12]; portfolio of financial institution [8, 13], financial variables [8, 14] |

Source: author's development

As shown in Table 1, scientists [1 –14] determine stress testing as a method, a tool, a model or a technique. The analysis of the definitions of these concepts (methods, tools, methods, models) in the explanatory dictionary showed that method (way of knowledge, study something or practical implementation) is the most appropriate definition of stress testing. Most scientists [1, 5, 6, 10, 11, 14] agree that the purpose of the stress testing is measuring the potential impact of stresses on the financial position of insurer. According to the authors' opinion, it is necessary to expand the list of objects of the stress testing. Thus, the purpose of the stress testing is the assessment the impact of stressful events not only on the financial condition of financial institutions, but also on the financial portfolio and the financial system as a whole. In the definition of subjects of the stress testing, authors agree with EIOPA's approach, whereby the stress testing is conducted by financial institutions, micro-prudential and macro-prudential supervisors. Definitions the types of stresses in different works are related.

According to results of the morphological analysis (Table 1), authors determines stress testing of insurance companies as a method of measuring the potential impact of

exceptional, but plausible events on the assets' portfolio, financial condition of insurer or insurance market, which is conducted by insurer or insurance supervisor.

The main stage of the stress testing is to choose the modeling method and types of stress event. There are many approaches to classification the methods of stress testing. Synthesis of these approaches is presented in the Fig. 1.

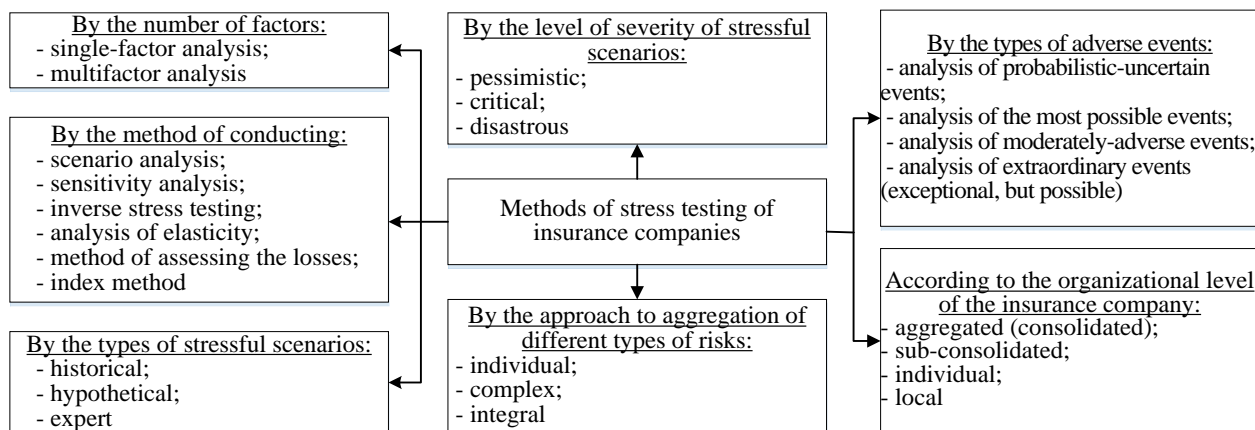


Fig. 1. Classification of methods of stress testing of insurance companies
Source: author's development

The classification of methods of stress testing of insurance companies (Fig. 1) creates conditions for the development of modern tools to assess the impact of adverse events on the activities of the insurance company and determine the optimal measures to neutralize such events.

The important task in stress testing is to determine the risk factors that will effect on the financial stability of the insurance company. Solvency II [2] and Standards of the IAIS [3] identified four main risks (insurance, market, credit and operational) that must be covered in the stress testing.

Classification of risks and examples of stressful scenarios under EU law [2, 3] are presented in Table 2.

Table 2

Classification of risk factors and stress scenarios of insurance companies

| Type of risk | Factors of risk | Stressful scenarios |
|----------------|---|---|
| 1 | 2 | 3 |
| Insurance risk | Inappropriate setting of insurance rates; inappropriate calculation of technical provisions; occurrence of catastrophic events etc. | Variations in frequency, the average size of loss and time to payment of insurance claims; changes in the level of the cost of doing business; variations in the levels of early termination of the contracts; inaccurate forecasting of catastrophic events; change in volume of underwriting portfolio |
| Market risk | Interest rate risk for the «up» shock; interest rate risk for the «down» shock; equity risk; property risk; spread risk; risk concentrations; currency risk; illiquidity premium risk | Fluctuations in the market value of shares; fluctuations in the yield of government securities; fluctuations in foreign exchange rates; fluctuations in the difference in yield between corporate bonds and government bonds; fluctuations in market prices for real estate; changes in the level of assets portfolio diversification |

Continuation of Table 2

| 1 | 2 | 3 |
|------------------|---|--|
| Credit risk | Unexpected default of the counterparties and debtors of undertakings in relation to reinsurance arrangements, securitizations and derivatives, any other risk mitigating contracts, cash at bank, deposits with ceding institutions, receivables from intermediaries, policyholder debtors etc. | Downgrade in credit rating of the reinsurers; deterioration in credit worthiness of other counterparties and intermediaries; default by reinsurers and debtors; greater losses from bad debts than anticipated |
| Operational risk | Risk of loss arising from inadequate or failed internal processes, or from personnel and systems, or from external events | Error in pricing or reserving; fraud on insurance claims; failure of back-up systems or failure in the efficiency and effectiveness of off-site back-up facilities; loss of confidence in the insurer and high surrender rates |

Source: author's development

The process of stress testing include assessment of risks (Table 2), determining the impact of these risks on the financial position of the company, development the measures of risks management.

In the article, authors developed a model of assessing the impact of insurance risk on the insurance company activity (formula 1) using multiple regression analysis to improve the organization of stress testing. The dependent variable of the model (Y_x) is capital adequacy ratio (available solvency margin is divided onto required solvency margin) calculated according to the Law of Ukraine «About insurance» [17]. This indicator characterizes capital adequacy of insurance company to cover unexpected losses. There are four independent variables in the model, such as the growth rate of gross insurance premiums (X_1), level of insurance payments (X_2), severity of the damage (X_3) and share of the costs of doing business in gross insurance premiums (X_4).

$$Y_x = 27,05 - 9,53 \cdot X_1 - 20,74 \cdot X_2 - 34,19 \cdot X_3 - 35,66 \cdot X_4 \quad (1)$$

The multiple R-squared ($R=0,93$) indicates a very strong correlation between the dependent variable and independent variables. This provision demonstrates the applicability of the model (formula 1) to assess the impact of the insurance risk on insurance company activity. The reliability of the model is confirmed by significance level of Fisher criterion (0,004), which is much less than 0,05. The calculated coefficient of determination ($R^2=0,86$) shows that variation of independent variables (X_1-X_4) explains the variation of dependent variable (Y_x) on 86%.

Authors have calculated the coefficient of elasticity (formula 2) to assess the impact of independent variables on dependent variable.

$$E = \sum_{j=1}^{n=5} E_j = \sum_{j=1}^{n=5} b_j \cdot \frac{\bar{X}_j}{\bar{Y}_x} \quad (2)$$

where E is an aggregate coefficient of elasticity;

E_j is the coefficient of elasticity, which characterize the influence of independent variable X_j on dependent variable Y;

\bar{X}_j is the arithmetic average of the j-th variable;

\bar{Y}_x is the arithmetic average of the dependent variable Y;

b_j is the coefficient in the regression model.

The results of calculation of coefficients of elasticity are presented in the Table 3.

Table 3

The elasticity coefficient of regression model

| Indicator | Indicator value | Interpretation of indicator value |
|-----------|-----------------|---|
| E_1 | -1,16 | Capital adequacy ratio reduces by an average of 1,16 % by increasing the growth rate of gross insurance premiums by 1% |
| E_2 | -0,57 | Capital adequacy ratio reduces by an average of 0,57 % by increasing the level of insurance payments by 1% |
| E_3 | -0,07 | Capital adequacy ratio reduces by an average of 0,07 % by increasing the severity of the damage by 1% |
| E_4 | -0,40 | Capital adequacy ratio reduces by an average of 0,40 % by increasing the share of the costs of doing business in gross insurance premiums by 1% |
| E | -2,29 | Capital adequacy ratio reduces by an average of 2,29 % by increasing all factors by 1% |

Source: author's calculation

As shown in Table 3, the growth rate of gross insurance premiums has the main impact on capital adequacy ratio of insurance company. The connection between these indicators is the reverse. Therefore, if the growth rate of gross insurance premium increases, the dependent variable will reduce. This is because the rise of insurance premiums increases the amount of risk of insurance company. In addition, these trends indicate that the main factor of insurance premiums growth is the development of more risky types of insurance. Therefore, in order to prevent the negative impact of stressful situations on insurers' activity it is necessary to develop less risky types of insurance, improve tariff policy and rise the diversification of the insurance portfolio.

Thus, the proposed model (formula 1) can be used in the activities of insurance companies to develop measures to prevent and neutralize the effects of stress events on the activities of insurers.

Conclusions. Development of the theoretical provisions and practical recommendations to stress testing of insurance companies is a necessary condition for successful activity Ukrainian insurers in the conditions of Euro integration. According to the requirements of Directive of EU Solvency II and the Standards of IAIS, authors improved the definition of the stress testing, developed approaches to risk identification and assessment of the impact of stressful events on insurance companies. Further work will focus on development the methodological support of impact assessment of market,

credit and operational risks on the activity of insurance company.

Література:

1. Вимоги щодо регулярного проведення стрес-тестування страховиками та розкриття інформації щодо ключових ризиків та результатів проведення стрес-тестів [Електронний ресурс] : Розпорядження Нацкомфінпослуг № 484 від 13.02.2014 р. – Режим доступу: <http://zakon4.rada.gov.ua/laws/show/z0352-14>.
2. Directive 2009/138/EC of the European Parliament and of the Council of 25 November 2009 on the taking-up and pursuit of the business of Insurance and Reinsurance (Solvency II) (recast) // Official Journal of the European Union (OJEU). – 17.12.2009. – L. 335. – P.1-155.
3. Insurance Core Principles, Standards, Guidance and Assessment Methodology [Electronic resource] : Standard IAIS, October 1, 2011 // International Association of Insurance Supervisors : official website. – Mode of access : <http://www.iaisweb.org>.
4. 2016 EIOPA Insurance Stress Test Report [Electronic resource] : EIOPA 16/302, December 15, 2016 // European insurance and occupational pensions authority : official website. – Mode of access : <https://eiopa.europa.eu/Publications/Surveys/EIOPA-BOS-16-302%20Insurance%20stress%20test%202016%20report.pdf>
5. Ачкасова С. А. Оцінка стресостійкості страхових компаній: автореф. дис...канд. екон. наук : спец. 08.00.08 «Гроші, фінанси і кредит» / С. А. Ачкасова. – Харків, 2013. – 23 с.
6. Клапків Л. М. Стрес-тестування як інструмент оцінки ризику у страхових товариствах / Л. М. Клапків // Наука молода. – 2014. – № 21. – С. 148–155.
7. Іонін М. Є. Стрес – тестування як інструмент ризик-менеджменту страхової компанії / М. Є. Іонін, Н. П. Карлова // Вісник студентського наукового товариства ДонНУ. – 2012. – № 4. – С. 159–163.
8. Тлуста Г. Стрес-тестування в системі ризик-менеджменту страхових компаній / Г. Тлуста // Вісник Київського національного університету імені Тараса Шевченка. – 2013. – №135. – С. 43–46.
9. Яранцева Е. А. Методы оценки рисков, воздействующих на финансовую устойчивость страховых организаций : дис...к. э. н. : спец. 08.00.08 «Финансы, денежное обращение и кредит» / Е. А. Яранцева. – Москва, 2015. – 223 с.
10. Blaschke W. Stress Testing of Financial Systems [Electronic resource] : An Overview of Issues, Methodologies, and FSAP Experience / IMF Working Paper, 2001. – Mode of access : <https://www.imf.org/external/pubs/ft/wp/2001/wp0188.pdf>.
11. Кудрявцева М. Г. Что тестирует стресс-тест / М. Г. Кудрявцева [Електронний ресурс]. – Режим доступу: <http://www.rcb.ru/rcb/2006-02/7432>.
12. Кондратенко Д. В. Регулювання страхової діяльності на основі оцінки ризиків / Д. В. Кондратенко. – Х.: – 2006. – 20 с.
13. Jobst A. A. Macroprudential Solvency Stress Testing of the Insurance Sector : International monetary fund Working paper WP/14/133 / A. A. Jobst, N. Sugimoto, T. Broszeit // International monetary fund : official website. – Mode of access : <https://www.imf.org/external/pubs/ft/wp/2014/wp14133.pdf>.
14. Bhatia M. Stress Testing in Insurance Industry [Electronic resource]. – Mode of access : https://www.actuariesindia.org/downloads/gcadata/12thGCA/Stress%20Testing%20in%20Insurance%20Industry_Mohan%20Bhatia.pdf.
15. Житний П. Є. Світова практика стрес-тестування у банках України / П. Є. Житний, С. М. Шаповалова, Г. М. Карамішева // Вісник Української академії банківської справи. – 2011. – №1(30). – С. 67–72.
16. Карминский А. М. Методы и модели стресс-тестирования рыночных рисков портфеля финансовых инструментов / А. М. Карминский, Е. В. Серякова // Вестник МГИМО Университета. – 2015. – №4. – С. 53-63.
17. Про страхування [Електронний ресурс] : Закон України № 85/96-ВР від 07.03.1996 р. – Режим доступу : <http://zakon.rada.gov.ua/cgi-bin/laws/main.cgi?nreg=85%2F96>.

References

1. Rozporyadzhennya Natskomfinposluh (2014, February). *Vymohy shchodo rehulyarnoho provedennya stres-testuvannya strakhovykamy ta rozkryttya informatsiyi shchodo klyuchovykh ryzykiv ta rezul'tativ provedennya stres-testiv*. Available at: <http://zakon2.rada.gov.ua/laws/show/z0352-14>.
2. Directive 2009/138/EC of the European Parliament and of the Council of 25 November 2009 on the taking-up and pursuit of the business of Insurance and Reinsurance (Solvency II) (recast). (2009). *Official Journal of the European Union (OJEU)*, 335, 1–155.
3. Insurance Core Principles, Standards, Guidance and Assessment Methodology : Standard IAIS. (2011). Available at: <http://www.iaisweb.org>
4. 2016 EIOPA Insurance Stress Test Report (2016). European insurance and occupational pensions authority : official website. Available at: <https://eiopa.europa.eu/Publications/Surveys/EIOPA-BOS-16-302%20Insurance%20stress%20test%202016%20report.pdf>.
5. Achkasova, S. (2013). Otsinka stresostiykosti strakhovykh kompaniy. *Extended abstract of candidate's thesis*. Sumy [in Ukraine].
6. Klapkiv, L. M. (2014). Stres-testuvannya yak instrument otsinky ryzyku u strakhovykh tovarystvakh. *Nauka moloda*, 21, 148–155.
7. Ionin, M. Y., Karlova, N. P. (2012). Stres-testuvannya yak instrument ryzyk-menedzhmentu strakhovoyi kompaniyi. *Visnyk student-s'koho naukovoho tovarystva DonNU*, 4, 159–163.
8. Tlusta, H. (2013). Stres-testuvannya v systemi ryzyk-menedzhmentu strakhovykh kompaniy. *Visnyk Kyivivs'koho natsional'noho universytetu imeni Tarasa Shevchenka*, 135, 43–46.
9. Yarantseva, E. A. (2015). Metodyi otsenki riskov, vozdeystvuyuschih na finansovuyu ustoychivost strahovyih organizatsiy. *Extended abstract of candidate's thesis*. Moskva [in Russia].
10. Blaschke, W. (2001). Stress Testing of Financial Systems : An Overview of Issues, Methodologies, and FSAP Experience. Available at: <https://www.imf.org/external/pubs/ft/wp/2001/wp0188.pdf>.
11. Kudryavtseva, M. G. Chto testiruet stress-test. Available at: <http://www.rcb.ru/rcb/2006-02/7432>.
12. Kondratenko, D. V. (2006). Rehulyuvannya strakhovoyi diyal'nosti na osnovi otsinky ryzykiv, 20.
13. Zhytnyy, P. Y., Shapovalova, S. M., Karamysheva H. M. (2011). Svitova praktyka stres-testuvannya u bankakh Ukrayiny. *Visnyk Ukrayins'koyi akademiyi bankivs'koyi spravy*, 1, 67–72.
14. Karmynskyy, A. M., Seryakova, E. V. (2015). Metodyi i modeli stress-testirovaniya ryinochnyih riskov portfelya finansovyih instrumentov lya perevoda. *Vestnik MGIMO Universiteta*, 4, 53-63.
15. Jobst, A. A. (2014). Macroprudential Solvency Stress Testing of the Insurance Sector : International monetary fund Working paper WP/14/133. Available at: <https://www.imf.org/external/pubs/ft/wp/2014/wp14133.pdf>.
16. Bhatia, M. Stress Testing in Insurance Industry. Available at: https://www.actuariesindia.org/downloads/gcadata/12thGCA/Stress%20Testing%20in%20Insurance%20Industry_Mohan%20Bhatia.pdf.
17. Zakon Ukrainy (1996, March). Pro strahunaniya. Available at: <http://zakon.rada.gov.ua/cgi-bin/laws/main.cgi ?nreg =85%2F96>.