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SOLVENCY II INFLUENCE ON THE INSURANCE COMPANIES'SOLVENCY MANAGEMENT: LOGISTICAL ASPECT

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RETUME OF DOCTOR'S DISSERTATION

INTRODUCTION

Relevance of study

Across Europe the growth of the insurance industry is facing new challenges. Increasing diversity of insurance services and increasing complexity of their pricing makes the search for the insurance products pricing solutions more relevant.

As the insurance sector is developing and the range of provided services is expanding, insurance companies inevitably face more and more diverse forms of risk of its own activity and more complex evaluation of their severity. This leads to the increased management problem of insurance company's risk which determines the capacity of solvency. In 2007, 10th of July the European Commission has proposed a substantial revision of EU insurance laws (replacing14now existing directives with one). It is predicted that at the time of the review will be set new requirements on insurance companies' financial position, taking into account the recent developments in the field of insurance, risk management, financial accounting methods and so on. New system of rules „Solvency II" is to replace the 30 years existing insurance juridical framework, which is thought to underestimate the true risks of insurance companies.

The complexity of insurance companies 'risk assessment is determined by the complexity and uncertainty of insurance products, especially in cases of appearance of long-term insurance. Complex insurance products, especially long-term, such as life insurance, are required to evaluate variety of factors, in order to specify the exact value of these products and expected insurance company's profits and losses at the insurance contract period. Therefore, there is a continuous search for improved methods of assessing the insurance services, allowing more precise definition of the expected cash flows of service and to identify for the policy holder and the insurer a reasonable price of the service in line with the risk provided by the service.

In the insurance sector it is common to associate the cost of the insurance service, directly dependent on the insurance object's risk factor, with the change of money value in time, using the traditional exponential model of money value change in time, which overlooks the influence of capital base to the pace of capital accumulation. Such a calculation method of money value change is widely prevalent in the financial sector, particularly in lending activities, but in the insurance sector, reaching for the more exact evaluation of insurance contracts, which is highlighted by the Solvency II, forms a need to use more precise methods that define money value change in time.

One possible way to assess more accurately the insurance risk and the resulting price of the service is an economic logistic analysis adjusted for the insurance sector. Economic logistic analysis covering the logistic capital growth and the capital market saturation factors creates a basis for a long-term insurance contracts' risk assessment, reflecting the likely level of cost of such a service, therefore it is expedient to investigate its potential application in the insurance sector and the potential of use.

Problem testing level

According to the principal Solvency II provisions, to ensure an adequate stability and solvency of insurance sector, the focus should be on the insurance sector's supervisory system strengthening process, stability of financial markets and greater consistency of insurance law, which leads to the need to evaluate all aspects of the insurance company's activity in the aspects of risk and solvency which arises from the risk management factors. In order to make more accurate risk assessment of an insurance company, will be inevitably used the advanced risk measurement techniques and methods that allow characterizing risk and solvency level according the variety of factors influencing insurance company's activity. To this end, it is worth considering the possibilities to assess insurance company's solvency using the provisions of economic logistical analysis.

Insurance companies 'solvency assessment is a relevant and quite often a problematic issue at the academic level. In recent years, the insurance companies' solvency problems were studied by A.Chen (2007), D.J.Cummins and N.A.Doherty (2005), R.Norberg (2002) and M.Peičius (2005), T.C.Wilson (2007), J.F.Anderson and R.L.Brown (2005), J.Lantinga (2007), R.Kaas, M.Goovaerts, J.Dhaeneand M.Denuit

(2003), M. Eling (2007), W.Schulte-Herbruggen (2006), E.G.Baranoff, T.W.Sager, R.C.Witt (1999), G.C.Taylor (2000), A.Grosen and P.L.Jorgensen (2002), IAA(2000), C. Bernard, O. Le Courtois and F.Quittard-Pinon (2005),who analyzed by the various layers the insurance companies' solvency's structure and its management tools and strategies.

Many authors analyzing solvency of insurance companies (Anderson, Brown, 2005, Schulte-Herbruggen 2006, Taylor 2000, Grosen, Jorgensen 2002, Norberg 2002, Eling 2007, Kaas, Goovaerts, Dhaene, Denuit 2003), agree with the statement that the precise and unambiguous assessment of the insurance companies' solvency is a complicated process, largely dependent on what standpoint is followed to evaluate the insurance companies' insurance contracts' value. The need to revise existing provisions and principles of the valuation of insurance companies'contracts is highlighted by M. Eling (2007), J.F.Anderson and R.L.Brown (2005) and W. Schulte-Herbruggen (2006), pointing out that in the insurance contracts'values should not only be reflected the static assessment of the time factor but also the economic status indicators, from which belong or may belong an insurance contract value's changes over time.

Considering the Solvency II principles, stressing out the necessity of financial resources adequacy to cover insurance claims and insurers' incentive to manage properly their risks, arises the need to find more effective solutions for risk management in the various insurance activity's areas which may affect the solvency valuation of the insurance company.

This dissertation study focuses on one of such areas - the life insurance contract value's evaluation, depending on which accuracy and reliability largely depends the insurance company's solvency assessment. Having examined the published results of the researches of contract value assessment problem analyzed by J. Bongaarts (2005), M. Coppola, E. Di Lorenzo and M. Sibillo (2005), T. Moller (2002), P. Emms(2007), P. Emms and S. Haberman(2005),P. Embrechts (2000), R. Kaas, M. Goovaerts, J. Dhaeneand M. Denuit (2003), E. Collins, L. Kong, S. Robertson-Dunn, and F. Tang(2005), A. Wurth (2008), A. Melnikov and V.Skornyakova (2006), McCarthy (2003), A.Chen and M. Suchanecki (2007), P. Bouwknegt and A. Pelsser (2001), W. Gerke, F. Mager, T. Reinschmidt and C. Schmieder (2006), it can be seen that there is quite a broad variety of standpoints towards the reliability of insurance contracts' value

assessment methods, making it difficult to clearly define using which methods it is possible to reliably assess the long-term life insurance contracts' held by the insurance company portfolio's value at any moment in time, from which belongs the solvency of insurance company.

Contributing to finding the solution to the earlier mentioned problem, in this dissertation study it is examined one of the possible means of insurance contract's value assessment, using the economic logistic analysis, which allows more reliably than the usual exponential complex percent method assessing the current value of the insurance contract, depending on future cash flows and general capital size in the insurance company's business environment, which determines the additional value of capital resources.

Economic logistic analysis was analyzed in different layers by S.Girdzijauskas (2006, 2008), P.S.Meyer, J.W.Yung and J.H.Ausubel (1999), R.Norberg (2002), A.Tsoularis and J.Wallace (2002), J.H.Wilson (2005), V.Moskaliova (2009), S.Hohler (2005), M.Florio and S.Colautti (2005). In Lithuania this theory is actively promoted by S.Girdzijauskas (2006, 2008)together with co-authors (Girdzijauskas, Čepinskis, Jurkonytė 2007; Girdzijauskas, Boguslauskas 2005; Girdzijauskas, Mackevičius 2009; Girdzijauskas Štreimikienė 2007; Girdzijauskas, Pikturna, Ivanauskas and others 2008; Gronskas, Štreimikienė, Girdzijauskas 2008; Girdzijauskas, Štreimikienė 2009; Girdzijauskas, Dubnikovas 2010 and others) submitting its application solutions in the insurance sector, in the economic cycle management, analysis of the financial pyramids and other areas. Given the authors' input in the development of the economic logistic analysis, there forms an assumption that the economic logistic analysis can be an appropriate insurance companies' solvency management tool, enabling a more trusted assessment of insurance contracts thereby complying with Solvency II principal provisions, relating to the insurance companies' activity's accuracy and reliability increase. This assumption is partially supported by the research made by the dissertation thesis author with co-authors, the results of which were published in the academic literature and presented at scientific conferences (Girdzijauskas, Čepinskis, Jurkonytė 2007; Jurkonytė, Girdzijauskas 2010; Girdzijauskas, Čepinskis, Jurkonytė 2008) and this dissertation thesis seeks to develop and fully reason it, forming the concrete solutions for

the economic logistic analysis' application for the insurance companies' solvency management.

The problem of the research

What would the benefits of the economic logistic analysis application assessing the solvency of the insurance companies according the Solvency II provisions, focusing on the insurance company's contracts' value determination, depending on risk and capital factors.

The object of the research

The object of the research is defined as an insurance companies' solvency management.

Matter of the research

Matter of the research - insurance companies'solvency management based on the economic logistic analysis.

The aim of the research

Aim of the research - to examine the possibilities of adaptation of economic logistic analysis assessing the solvency of insurance companies under the Solvency II provisions.

Tasks of the research

To achieve the formulated objective of the dissertation research these provided tasks must be solved:

1. To identify the most important theoretical aspects of insurance companies 'solvency management, relevant while assessing the impact of Solvency II to the insurance companies'activity.
2. Provide economic logistic analysis application solutions for the insurance companies'solvency assessment in the context of Solvency II.
3. Develop a logistic insurance companies'solvency management model based on the principles of the economic logistic analysis.
4. Determine the suitability logistic of insurance companies' solvency management model for the practical use, based on the results of empirical research.

The structure of the research

Dissertation research consists of three main parts:
1. In the first part of the research it is presented the analysis of theoretical aspects of the insurance companies'solvency management, discussing the concept of insurance companies'solvency, insurance companies' capital requirements'determination decisions and assessing the impact of the Solvency II to insurance companies'activity.
2. In the second part it is examined the insurance companies'solvency management using the economic logistic analysis, in the result of which the logistic insurance companies'solvency management model is prepared.
3. In the third part there are presented the empirical results of logistic insurance companies 'solvency management model's application to practice, with which the practical relevance of a prepared model is justified.
4. The dissertation thesis'results are summarized with the conclusions.

The literary sources used in the research

In the dissertation thesis there was used various scientific literature of the Lithuanian and foreign authors, in Lithuanian, English and Russian languages,

information sources, documents, data of performed studies, statistics, scientific and survey articles, monographs.

Major attention was given for the foreign authors, who examine solvency of the insurance companies'and the questions of insurance contracts'value evaluation and S. Girdzijauskas and other author's publications that deal with the economic logistic analysis and its application.

Methods of the research

In the dissertation thesis were used following research methods:

1. Analyzing the theoretical aspects of the insurance companies' solvency management and the application possibilities of the economic logistic analysis for the insurance companies' solvency assessment in the context of the Solvency II, in the dissertation thesis were used the general science research methods - logistic analysis, systematic and comparative analysis of the scientific literature (books, articles, conference reports) and documents (reports, recommendations, announcements), and theoretical modeling.

2. Examining the practical application of the insurance companies' solvency management model, there is used the method of case study, which allows to adapt the prepared model using the actual performance data of the chosen insurance company without the direct intervention to the insurance company's activity and modeling certain insurance activity's results according the model presented in the thesis.

3. Analyzing the relevance in economic term of the solvency management of the insurance company using the logistic insurance companies'solvency management model, was used the correlation analysis method.

Theoretical and practical significance of the working results

The scientific significance of the dissertation thesis at the theoretical level is described by the obtained results: (1) examined and systematized various authors'

opinions towards the problem of insurance service value assessment, the principles of insurance companies' solvency assessment, the problem of insurance companies' capital requirement's evaluation solutions and Solvency II impact to the insurance companies' activity, which allow to specify the essential insurance activity's characteristics associated with insurance companies' solvency's, as the characteristics' showing the operational reliability, evaluation, and (2) the prepared logistic insurance companies' solvency management model, in which there are presented the solutions for the economic logistic analysis application to the insurance companies' solvency management covering the logistic capital management, insurance companies' solvency assessment and the areas of Solvency II principal provisions.

The practical significance of the dissertation research is revealed through the presented solutions of the use of the economic logistic analysis for the insurance companies'solvency management in the context of Solvency II allowing the insurance companies a more reliable assessment of the portfolio value of the held insurance contracts, which determines their solvency assessment. It was performed a logistic insurance companies' solvency management model's application in practice research in two directions - defining the saturation level of capital and insurance premium's connection in case of life insurance and assessing the logistic capital management theory's effect on the assessment of insurance companies' solvency –forms the guidelines for the insurance companies for the formation of life insurance service pricing and the principles of the offering of such services.

The novelty of the work

Scientific novelty of the dissertation research is described by the following aspects:

- Analyzed possibilities of the economic logistic analysis application in the insurance sector, introducing and describing the interaction of logistic insurance premium's accumulation function with the economic growth model concept.
- The provisions of the economic logistic analysis were applied to the insurance companies'solvency's assessment, which based on the insurance companies'

solvency management model were adjusted to the solvency management of insurance companies in the context of Solvency II project.

Work limitations and difficulties

While preparing the dissertation research, a few limitations were faced.

Analyzing the application possibilities of the economic logistic analysis to the insurance companies' solvency assessment was faced a lack of modern literature. The general aspects of the economic logistic analysis were analyzed actively by various authors till the 9th decade of the XXth century, but later the focus on the theory has subsided, therefore there are only a few literature sources related to this theory that are dealing with the current issues of insurance sector. At this point the foundation of S. Girdzijauskas has been very useful - a monograph and rather big number of scientific articles in the field of economic logistic analysis.

Performing a research of logistic insurance companies' solvency management model's application in practice - an actual data limitations were faced– firstly, insurance companies operating in Lithuania, are particularly interested in the confidentiality of the data needed for the research, therefore so reluctant to reveal it even for the aims of a scientific research; secondly, the computer programs of insurance contracts' management which are spreading the insurance companies, reduce the information available to the employees of the insurance companies about the insurance contract values, the mathematical algorithms used to calculate the contributions and benefits, therefore it is not always possible to accurately determine applying which method the insurance company determines the insurance contract's value or the required contribution. These limitations resulted in a narrower-than-planned practical research, limiting it to the case analysis performed in a few sections, but without the planned experiment of the logistic insurance companies'solvency management model's application in the concrete insurance company's activity.

Scope of the research

The thesis consists of an introduction, 3 parts of enunciation and conclusions. The main scope of thesis - 159 pages, 15 tables, 30 figures, one appendix, was used 149 scientific literature and information sources.

Work results'approval

The material on the dissertation topic was published in 6 scientific publications and 4 international scientific conferences.

STRUCTURE OF THE DISSERTATION CONTENT

IN THE FIRST PART „1. THEORETICAL ASPECTS OF INSURANCE COMPANIES' SOLVENCY MANAGEMENT" it is presented the analysis of the theoretical aspects of the insurance companies' solvency management, discussing the concept of solvency of insurance companies, insurance companies' capital requirement solutions and assessing the impact of Solvency II to insurance companies activity.

In the section *"1.1. The conception insurance companies' solvency"* it is considered an insurance and insurance companies' solvency concept, in order to highlight the most important aspects that determine the increased attention to the solvency category in the insurance sector.

The subsection "1.1.1. Insurance concept and realization principles" covers the key principles of insurance activity and characterizes the insurance concept through the prism of solvency management relevance.

The subsection "1.1.2. Insurance services' value assessment problem", analyses the insurance services value's assessment problem, which highlights the insurance companies' solvency management relevance.

The subsection "1.1.3. Insurance companies' solvency assessment principles" addresses the most important, insurance companies' solvency-related aspects. This analysis showed that in insurance activity, the essence of which is the acceptance of risk for a particular fee, one of the key success factors of a proper assessment of the insurance company's solvency possibilities, depending on the level of the risk assumed and expected risk compensation scale. Therefore, the solvency of the insurance sector has always been paid much attention.

The section "1.2. Insurance companies' capital requirement assessment solutions" properly analyses insurance companies' capital requirement assessment solutions, which reveal more capital saturation level's evaluation relevance in the insurance sector.

In the section "1.3. Solvency II impact on the insurance companies' activity" it is analyzed the Solvency II meaning for the insurance sector and the expected influence to the insurance companies' operating principles.

The examined theoretical aspects of insurance companies' solvency management and the Solvency II impact on insurance companies' activity, show that the solvency of insurance companies and the level of it's assessment is relevant to contemporary insurance companies seeking to optimize their operations and to coordinate incoming and outgoing cash flows, taking into account the need to manage the risks, by linking it to the insurance rates, technical suspensions and capital requirement. Current tendencies in the insurance sector show that assessing the insurance companies' solvency, it is important to consider not only the traditionally highlighted factors of the risk level and conditions of insurance, but it is also important to assess the market capacity, which is defined by the maximum level of capital available in a particular market or in its individual sector, taking into account all market participants' financial capacity and it's change specificity. Analyzed various authors' viewpoints towards the insurance market and insurance activity's specifics revealed that in most cases, saturation of the market factor is ignored, regardless of it's importance in assessing financial flows of insurance and capital growth rates. Many of the authors, considering a variety of factors affecting insurance activities, fail to emphasize the capacity of the market as an important element characterizing the insurance market, which limits the options of emphasis of the current insurance operational individualities.

In the second part "2. INSURANCE COMPANIES' SOLVENCY MANAGEMENT ACCORDING TO THE SOLVENCY II MODEL, USING THE ECONOMIC LOGISTIC ANALYSIS" it is analyzed the insurance companies' solvency management using the economic logistic analysis, as the result of which logistic insurance companies' solvency management model is prepared.

In the section "2.1. The concept of the economic logistic analysis" there are analyzed the conceptual principles of economic logistic analysis considering the relevance of the logistic growth model application to the economy. Economic logistic analysis is mainly studied on the basis of the researches in this field made by S. Girdzijauskas (2002, 2005, 2006, 2008, 2009, 2010), emphasizing that in the real circumstances the capital usually can not grow for a long time at the same rate - the growth of the real capital, as it approaches the potential capital, naturally leads to the slower growth rates of capital and lower extra value of capital gains. In addition, the

logistic dependence of internal capital rate is bigger than the classical discounted values, also increasing saturation coefficient increases the logistic dependence of internal capital rate, which means that increasing saturation increases the system's internal rate of return.

In the section „2.2. Economic logistic analysis conception in the insurance activity" there are analyzed provisions of the economic logistic analysis, characterizing the nature of the logistic growth of capital and allowing to adapt the economic logistic analysis while evaluating the insurance companies' solvency margin requirement, depending on their incurred level of risk. Considering that life insurance service is based on existing policyholder's need to accumulate a certain amount of assets over a specified period of time, after which he would receive benefits projected in advance (specified or expected) and the insurance company has to secure the required margin of solvency to fulfill the contractual obligations, the general logistic function of the life insurance value can be expressed in this manner:

$$\sum_{j=0}^{n-1} \frac{{}_j p_x \cdot P \cdot S_m}{S_m \cdot (1+i)^j - {}_j p_x \cdot P \cdot ((1+i)^j - 1)} = \sum_{j=n}^{w-x} \frac{{}_j p_x \cdot S \cdot S_m}{S_m \cdot (1+i)^j - {}_j p_x \cdot S \cdot ((1+i)^j - 1)} \quad (1)$$

here, x – age of the insured at the time of the contract,

    n – the time lag between the start of the premium's payment and the start of receiving the benefits,

    w – the age of the insured till which the rent is paid determined at the time of making the contract,

    S – insurance amount,

    P – periodic premium amount,

    S_m – critical capital resources (market volume),

    i – capital return (interest rate),

    ${}_j p_x$ – the probability, that the person aged x will survive j years more,

Presented formula reflects the general concept of the economic logistic analysis adaptation to the life insurance activity – using the economic logistic analysis, it is verified the current value of collected insurance premiums and current value of

future (expected)   payments,   which mutual identity (equality   of   current values) warrants the   life   insurance   product's offered   by   the   insurance company financial flows 'balance in the long-term perspective. Depending on the specifics of the certain   life insurance   product,   this formula   can be supplemented (modified)   with separate elements relevant in individual cases, while maintaining the principal condition of current incoming and outgoing cash flow values' equality.

In the section "2.3. Logistic insurance companies 'solvency management model" there are presented the prepared logistic insurance companies' solvency management model's solutions based on the economic logistic analysis.

In the subsection "2.3.1. General concept of the logistic insurance companies' solvency management model" it   is   discussed   the general model structure, anticipating, that the   logistic   insurance   companies'   solvency   management model is formed from three main structural components, which include all life insurance aspects analyzed   in   the relevant case: (1) the   insurance company's   solvency assessment (2), logistic capital management solutions, (3) provisions of Solvency II.

The   subsection "2.3.2. Solvency II   provisions" covers   the Solvency II principles relevant in   the   context   of insurance company's   solvency valuation. According to T.C.Wilson (2007), A.   Chen   (2007)   and Deloitte (2011) publications,   there   were excluded these main Solvency II provisions forming the principles of economic logistic analysis application for the insurance companies' solvency assessment: (1) the adequacy of rates for the risk, (2) the technical suspensions' adequacy, (3) capital requirements based on the a risk assessment.

In the subsection „2.3.3. Insurance company's solvency assessment" is discussed the logistic   insurance   companies'solvency management model's   element's, which includes the insurance company's solvency assessment solutions, structure. This part of the model is based on three elements'- insurance service, insurance fee and risk – inter-connection. Insurance risk   determining   the insurance   company's   solvency,   with reference   to   R. Enz (2000), J.F.   Anderson and   R.L.   Brown (2005), L.Belinskaja, K.Bagdonavičius and A.Šernius (2001), J. Čepinskis and D. Raškinis (2005), A. Linartas (2005),   A.Linartas   (2003),   L. Ballotta   and   S. Haberman (2006), M. Coppola, E. Di Lorenzo and   M. Sibillo   (2000) and   M. Peičius   (2005),   is   split into   two main structural   parts: (1) insured event   risk,   which   is   directly related   to   the

insured events' probability and extent assessment, (2) capital market's risks associated with assets' held by the insurance company financial management performance results. The full insurance fee, based on A.Grosen and P.L.Jorgansen (2002) and P. Bouwknegt and A. Pelsser (2001), is split down into: (1) the risk covering cost, (2) capital accumulation premium (3) administrative costs.

In the subsection "2.3.4. Logistic capital management solutions" are provided logistic insurance companies'solvency management model's solutions, relating to the economic logistic analysis' provisions application to the insurance companies'solvency assessment. These solutions in the model are split into two sub-systems of procedures: (1) the compatibility of capital flows, where are performed the insurance benefits and insurance companies' assessment and mutual harmonization procedures, and (2) calculations of logistic capital accumulation, where are performed mathematical annuity and insurance contribution value setting procedures, using logistic capital value assessment formulas. Insurance benefits' prognosis and contributions' requirement are set using logistic capital accumulation functions given in Table 1: (1) the common life insurance value logistic function (2) current insurance benefits' value's valuation function, (3) the current cumulative insurance premiums' value assessment function.

1 table

Logistic capital accumulation functions for the logistic insurance companies'solvency management model

Title	Function	Variables
Common life insurance value's logistic function	$$P_{x+n} = {}_nA_{\frac{x}{w}}$$	P_{x+n} – current accumulative insurance premiums' value, ${}_nA_{x/w}$ – curent insurance benefits' value, x – age of insured at the time of forming the contract, n – time lag between the

Current insurance benefits value ($_nA_{x/w}$)	$$_nA_x = \sum_{j=n}^{w-x} \frac{_jp_x \cdot S \cdot S_m}{_jp_x \cdot S + (S_m - _jp_x \cdot S) \cdot (1+i)^j}$$	payment of premiums and benefits' receiving start, w – the age of the insured till which the rent will be paid determined at the time of forming the contract, considering suspension of the payment, if the rent is terminable
Current accumulative insurance premiums' value (P_{x+n})	$$P_{x+n} = \sum_{j=0}^{n-1} \frac{_jp_x \cdot S \cdot S_m}{_jp_x \cdot P + (S_m - _jp_x \cdot P) \cdot (1+i)^j}$$	S – the size of insurance sum, S_m – marginal capital stock, i – capital return (interest rate), $_jp_x$ – probability, that a person aged x will survive j years more, $_nA_{x/w}$ – onetime insurance premium (current value of insurance benefits). P – size of a periodic premium, P_{x+n} – current value of cumulative insurance premiums.

Source: composed by the author according to: S.Girdzijauskas (2006), A.Tsoularis and J.Wallace (2002), P.S.Meyer, J.W.Yung and J.H.Ausubel (1999)

In the subsection „2.3.5. Logistic insurance companies'solvency management model's structure" there is presented the general logistic insurance companies' solvency management model's logical and graphic image.

Logistic insurance companies'solvency management model consists of three main elements: (1) assessment of the solvency of insurance company, (2) logistic capital management solutions and (3) The provisions of Solvency II. Assessing the solvency of insurance company through the prism of the economic logistic analysis, these logistic insurance companies'solvency management model's elements are interrelated:

- The insurance company's solvency assessment depends on the Solvency II provisions and their implementation in the insurance company and in the insurance sector principles and the insurance company's solvency itself is assessed according the logistic capital management principles, that were formed in the framework of economic logistic analysis.

- Logistic capital management solutions are appointed for the insurance company's solvency assessment, taking into account the features of the insurance service and full insurance contribution's structure. On the other hand, the logistic capital management solutions are inseparable from the Solvency II provisions that define the principles and guidelines for the application of mathematical methods for insurance company's solvency assessment.

- Solvency II provisions as the basis for calculating the solvency margin size of the insurance company determine the insurance company's solvency assessment and thus form the practice for insurance company's solvency margin calculation, using the principles of the economic logistic analysis.

Logistic insurance companies'solvency management model shows the possibilities of the economic logistic analysis' solutions implementation in the insurance sector, focusing on the insurance companies'solvency assessment. This model allows to determine the insurance company's solvency in regard to the individual clients, insurance types and insurance company's portfolio, comparing the calculated insurance benefits'requirement (discounted current value) to the actual capacity of insurance company, i.e. held resources to ensure solvency. Also, this model makes it possible to plan the insurance activity, forming the insurance services'pricing, depending on the projected characteristics of benefits and contributions.

Risk of insurance events

Logistic capital cumulation

Capital flows' compatibility

Full insurance contribution

Insurance service

Annuity size

Benfits' forecast

Service providing costs

Insurance events

Size of insurance contribution

Capital accumulation premium

Duration of insurance coverage

Contributions' requirement

Risk assumption costs

Characteristics of insured

Capital saturation limit

Capital costs rate

- **Capital market's risk**
- **Market saturation risk**

LOGISTIC CAPITAL MANAGEMENT

INSURANCE COMPANY'S SOLVENCY

SOLVENCY II

Rates' adequacy for risk

- advanced risk assessment
- linking capital requirement with risk level changes
- individualization of capital requirement

Technical suspensions' adequacy for risk

- linking technical suspensions with risk sources
- technical suspensions' requirement's assessment in modern methods

Capital requirement based on risk assessment

- advanced risk assessment
- linking capital requirement with risk level changes
- Individualization of capital requirement

1 pav. Logistic insurance companies' solvency management model

In the third part "3. RESEARCH OF THE LOGISTIC INSURANCE COMPANIES' SOLVENCY MANAGEMENT MODEL'S APPLICATION IN PRACTICE" there are presented the results of the empirical research of the logistic insurance companies' solvency management model's application in practice, justifying the practical relevance of a prepared model.

*In the section "3.1. Research methodology of the logistic insurance companies'solvency management model's application in practice"*is provided the methodology of the performed empirical research.

The object of research - the logistic insurance companies'solvency management model's practical application.

Aim of the research – to justify the logistic insurance companies' solvency management model's practical benefits for the life insurance sector.

For the Model's Practical applicability's research was selected a case study method, allowing to reveal the possibilities of the model in specific analyzed cases evaluating the results of model's applicability in chosen case and their variations while changing the individual parameters of the selected case.

At the time of the research the logistic insurance companies'solvency management model's practical applicability is analyzed in two ways:

- There is studied capital saturation level and the insurance premium's connection in the case of life insurance, demonstrating what role plays capital saturation element's implication into the insurance contracts'cash flows'calculation.
- There is analyzed the economic logistic analysis' impact on the insurance companies' solvency assessment, emphasizing market saturation factor, analyzing the life insurance contracts' value changes depending on the capital saturation level and other parameters of the model related to the economic logistic analysis.

Graphic structure of the performed research is shown in Figure 2, which reflects the logic of the research and the main aspects of the study.

The empirical study covers all the major aspects of the model presented in the thesis and it allows to suggest that the study accurately reflects the practical applicability of the model's potential.
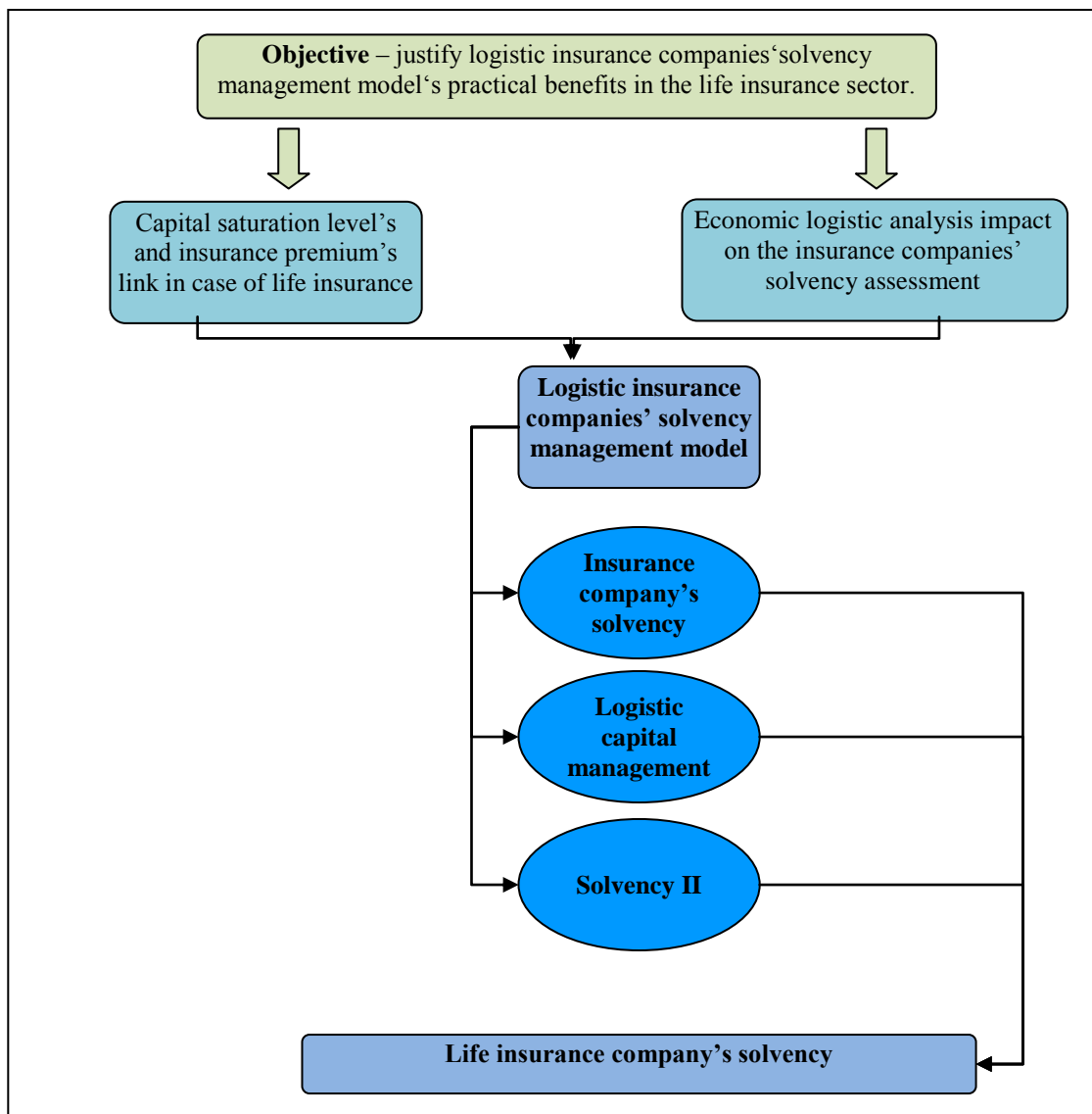
2 pav. Graphic study structure of

logistic insurance companies' solvency management model's application in practice

In the section "3.2. Determination of saturation level of capital and insurance premium's connection in case of life insurance„ there are presented and discussed the research results of capital saturation level's and insurance premium's connection setting in the case of life insurance. In this chapter are presented the results of the study, which shows, how the saturation level of

capital may affect the capital solvency requirements, depending on how changes the current value of the insurance contract and the insurance premium.

The calculations are carried out in the case of the cumulative life insurance with annuity payments, which allows to compare, how in a case of such a contract changes the annual insurance premium, expressing it with the current value and the total current value of such a contract, while changing the capital saturation.

The examined connection between capital saturation level and insurance premium in the case of life insurance shows that according to the economic logistic analysis'provisions the capital saturation level (market volume) is an important factor in calculating insurance benefits and premiums'sizes in the case of long-term insurance contracts. Therefore it can be concluded that the appropriate assessment of capital saturation level is important to the insurance company, seeking to determine more precisely it's insurance contracts'current values, combining the expected flows of benefits and contributions, and thus ensuring adequate solvency stock level.

In the section "3.3. The research of the logistic capital management theory's impact on the insurance companies' solvency management" there is more fully analyzed the capital saturation level's impact on the life insurance contracts' value and their solvency margin requirements, studying the economic logistic analysis impact on the insurance companies' solvency assessment according to the logistic insurance companies' solvency management model.

The performed analysis shows that using the logistic insurance companies' solvency management model for the determination of the insurance company's solvency stock, insurance company's contracts are valued more carefully, with a lower risk tolerance – this proposition is supported by the fact that in the case of logistic capital the current insurance contract's value is higher than in the case of the normal discounting. Such a difference conditions that in the case of logistic capital the insurance company has to determine a higher solvency margin.

Using the logistic insurance companies' solvency management model, the insurance company can adjust the solvency margin, depending on the saturation level of the capital. In this case, saturation level of capital can be regarded as an insurance company's risk management tool, allowing to include the market factor into the solvency margin's calculations: increasing saturation of the market appears

possibility to reduce the capital saturation level and thus increase the required solvency margin of the insurance company. Such a measure enables the insurance company to quantify the insurance market situation, reacting to the economic cycles and expected market bubbles.

In the section „3.4. Insurance company's solvency management's topicality using logistic insurance companies 'solvency management model from the economic viewpoint„ it is presented a justification of the insurance company's solvency management, using the logistic insurance companies 'solvency management model, relevance from the economic viewpoint.

Trying to justify that the solvency margin has a direct impact on insurance companies' activities' economic results, the research was carried out, analyzing life insurance companies' operating in Lithuania life financial results dependence on the various factors affecting them, including the solvency margin.

Summarizing the results of the performed investigation, can be declared that the solvency margin increase would have a relatively large negative impact on Lithuanian life insurance companies in the economic point of view, which shows that the solvency margin is an important factor adversely affecting insurance companies' operating in Lithuania, profitability and loss indicators. This confirms the assumption that project's Solvency II requirements, conditioning an increase of solvency margin for the insurance companies, will negatively affect the company's financial performance in the short term perspective.

CONCLUSIONS

Examined economic logistic analysis'possibilities of adaptation valuating the insurance companies'solvency according to Solvency II provisions, lead to the following conclusions:

1. Analysis of insurance companies' solvency management theoretical aspects allows to distinguish the following main aspects:

   a. Insurance on the economic point of view can be characterized by three main characteristics: risk distribution between the participants of the system, a large number of participants in the system and operating agent in the system, distributing risk losses. Such an approach towards the insurance refers to the insurance services'environmental sources and allows characterizing more precisely the nature and direction of environmental effects.

   b. The basis of insurance activity is risk, whose existence or likely occurrence creates a demand for insurance from risk losses. The insurance company taking over the risk of the insured, undertakes to compensate the losses associated with the taken risk's occurrence, because of that insurance company for the assumption of the risk requires financial compensation. In this case the insurance services are based on the law of large numbers, evaluating the positive impact on the increase of the services volume for the insurance transaction side accepting the risk.

   c. Providing the insurance service, the insurer obligates to compensate to the insurance service's recipient losses caused by certain risk events, that have the nature of probability, therefore the main task for the insurance service value assessment is problems of cash flow compatibility in time when cash flow variation is lead by the probabilistic factors and dependence on capital market characteristics.

   d. Can be distinguished four basic conditions, determining the insurer's solvency: rates adequate to the incurred risks and obligations, technical suspensions' adequacy, asset selection and management,

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solvency reserve   size. Solvency reserve,   as   the   element   describing   the insurer's solvency   potential,   includes the   insurance company's financial   flows compatibility in long-term.

e. The   predominant viewpoint to insurance   services' cash   flows' assessment and insurance company's solvency calculation ignores the factor of market capacity, which can   be assessed looking   into   the   insurance activity through   the   prism of the economic logistic analysis. Market capacity specifying the level of capital existing   in   the   market with the   maximum potential   capital   in   the   market determines   capital accumulation rates and   nature. Based   on   the   provision, that the growing capital completion in the market, leads to the slower capital value gains, can   be   stated,   that   market   saturation factor should be   evaluated in   the insurance company's solvency assessments.

2. Analyzed possibilities of the economic logistic analysis' application to assess the insurance companies' solvency in the context of Solvency II, shows that:

a. Economic logistic analysis is based on the assumption that in real terms capital is usually not able to increase constantly for a long time to. Every population has it's   saturation level,   which defines   the   maximum   possible   size   of   the population, so the actual population growth rate depends not only on the internal population growth rate, but also on the saturation level of the population.

b. In   the   economic logistic   analysis capital accumulation is   assessed   through the prism of the logistic function, considering that the capital level approach to the capital saturation limit (market capacity) conditions the slowdown of capital capital growth, which signalizes about the approach to the maximal market's potential in the context of capital resources.

c. Economic logistic   analysis is   based   on   the provision   that the capital, regardless of its origin and accumulation nature, can not increase indefinitely. According   to this   principle assessing the   value   of insurance   contracts   the provision is followed that the periodic premium's size is calculated equalizing rent's payments (expected insurance benefits) current value with the cumulative insurance premiums 'current value, taking   into   account   the fact that   capital growth in the long-term perspective is characterized by a slower pace due to the

increased cumulative capital base and the higher ratio with capital saturation level.

d. In the framework of economic logistic analysis prepared logistic insurance companies' solvency management model conditions the following conclusions:

e. Economic logistic analysis is applied to the insurance companies' solvency assessment, excluding two subsystems of the procedures: the compatibility of capital flows, where are performed procedures of the harmonization of insurance benefits' and insurance companies' valuation and mutual harmonization, also the procedures of logistic capital accumulation calculations, where are carried out mathematical annuity and insurance contribution's size setting procedures.

f. Logistic insurance companies' solvency management model consists of three main structural parts: insurance company's solvency assessment, logistic capital management solutions and Solvency II provisions. In this model, the insurance payments' forecast is identified with the annuity amount, which corresponds to the expected insurance payments need, depending on the risk of insured events, insurance companies' demand is associated with two main markets characteristics: capital saturation limit and the capital cost rate, which is influenced respectively by the saturation risk and the capital market risk.

g. Logistic capital management solutions in the logistic insurance companies' solvency management model include the insurance company's solvency valuation function, taking into account the characteristics of insurance service and full structure of insurance contribution and also are inseparable from the Solvency II provisions, which define the principles and guidelines of mathematical methods application to the insurance company's solvency assessment. Realizing the logistic capital management solutions within the framework of economic logistic analysis is ensured the evaluation of market capacity characteristics in the activity of insurance services.

h. Logistic insurance companies' solvency management model shows the possibilities of economic logistic analysis' solutions'implementation in the insurance sector, focusing on the insurance companies' solvency assessment and allows to determine insurance company's solvency regarding individual

client, insurance type and all portfolio of the insurance company comparing the calculated need of insurance benefits with the actual capacity of the insurance company.

3. Carried out empirical study of the insurance companies' solvency management's, using the economic logistic analysis, practical applicability model shows that:

a. Capital saturation level's and insurance premium's connection's analysis in the case of life insurance, shows that as the probable maximal capital is growing in the market, insurance service gets more expensive due to the need to accumulate a larger sum during the period of contribution payment, which would meet the higher current value of the benefits. This leads to a situation that because of more sensitive benefits' reaction to the capital saturation level, the annual premium, as the capital saturation increases, has a tendency to increase.

b. As the fixed capital saturation level is increasing in the case of individual life insurance contract, the annual premium is changing more slowly, which indicates that when saturation reserve is larger, capital saturation level is less important while determining the contract value. This is in line with the economic logistic analysis' provision, stating that the market capital growth rates react more sensitive to the actual cumulated capital level, approaching the market saturation limit.

c. Using the logistic insurance companies' solvency management model for the determination of insurance company's solvency reserve, insurance company contracts are valued more carefully, with a lower risk tolerance – this statement is supported by the fact that in the case of logistic capital the existing insurance contract's value is higher than in the case of normal discounting, when the saturation factor isn't regarded.

d. Saturation level of capital can be regarded as an insurance company risk management tool, enabling to include into the calculation of the solvency margin the market factor. Such a measure enables the insurance company to quantify the insurance market situation, reacting to the economic cycles and expected market bubbles, and depending on the market situation form the solvency margin, corresponding to the calculated compulsory insurance company's solvency demand.

e. The evaluated insurance companies' solvency management's, using the logistic insurance companies' solvency management model, topicality in the economic point of view, allows to state that the insurance market capacity is an important factor determining the insurance company's financial flows, which has a significant impact on the solvency of insurance company. In this context, regarding the basic principles of Solvency II, it is highlighted the relevance of principles of insurance company's solvency assessment formulated on the basis of the economic logistic analysis.

REZIUMĖ

Tyrimo aktualumas. Vystantis draudimo sektoriui ir plečiantis teikiamų paslaugų asortimentui, draudimo įmonės neišvengiamai susiduria su vis įvairesnėmis savo veiklos rizikos formomis ir sudėtingesniu jų masto įvertinimu. Tai sąlygoja didėjančią draudimo įmonės rizikos, lemiančios mokumo galimybes, valdymo problemą. Draudimo įmonių rizikos vertinimo sudėtingumą lemia draudimo produktų kompleksiškumas ir neapibrėžtumas, ypatingai išryškėjantis ilgalaikio draudimo atvejais. Sudėtingi draudimo produktai, ypač ilgalaikiai, tokie kaip gyvybės draudimas, reikalauja įvertinti daug įvairių veiksnių norint tiksliai nusakyti šių produktų vertę ir tikėtinas draudimo įmonės pajamas bei išlaidas visu draudimo sutarties galiojimo laikotarpiu. Todėl nuolat ieškoma tobulesnių draudimo paslaugų įvertinimo metodų, leidžiančių tiksliau apibrėžti tikėtinus draudimo paslaugos pinigų srautus ir nustatyti draudėjui ir draudikui priimtiną paslaugos kainą, suderintą su teikiamos paslaugos rizika.

Vienas iš galimų būdų tiksliau įvertinti draudimo paslaugų riziką ir jos sąlygojamą paslaugos kainą, yra ekonominė logistinė analizė, pritaikyta draudimo sektoriui. Ekonominė logistinė analizė, apimanti logistinio kapitalo augimo ir rinkos kapitalo prisotinimo veiksnius, sukuria pagrindą ilgalaikių draudimo sutarčių rizikos vertinti, kuris atspindi tikėtiną tokios paslaugos sąnaudų lygį, todėl tikslinga ištirti jos pritaikymo draudimo sektoriuje galimybes ir naudojimo potencialą.

Tiriamoji problema. Kokią naudą duotų ekonominės logistinės analizės pritaikymas vertinant draudimo įmonių mokumą pagal Mokumas II nuostatas, orientuojantis į draudimo įmonės sutarčių vertės nustatymą, priklausomai nuo rizikos ir kapitalo veiksnių.

Darbo objektas – draudimo įmonių mokumo valdymas.

Darbo dalykas – draudimo įmonių mokumo valdymas ekonominės logistinės analizės pagrindu.

Darbo tikslas – išnagrinėti ekonominės logistinės analizės adaptavimo galimybes vertinant draudimo įmonių mokumą pagal Mokumas II nuostatas.

Darbo uždaviniai:

1. Identifikuoti svarbiausius draudimo įmonių mokumo valdymo teorinius

aspektus, aktualius vertinant Mokumas II poveikį draudimo įmonių veiklai.

2. Pateikti ekonominės logistinės analizės pritaikymo draudimo įmonių mokumui vertinti sprendimus Mokumas II kontekste.

3. Parengti logistinio draudimo įmonių mokumo valdymo modelį, pagrįstą ekonominės logistinės analizės principais.

4. Nustatyti logistinio draudimo įmonių mokumo valdymo modelio tinkamumą praktiniam naudojimui, remiantis empirinio tyrimo rezultatais.

Darbo struktūra. Darbą sudaro įvadas, trys dalys, išvados, literatūros sąrašas ir 1 priedas.

Pirmojoje darbo dalyje pateikiama draudimo įmonių mokumo valdymo teorinių aspektų analizė, kurioje aptariama draudimo įmonių mokumo samprata, draudimo įmonių kapitalo poreikio nustatymo sprendimai ir įvertinamas Mokumas II poveikis draudimo įmonių veiklai.

Antrojoje darbo dalyje tiriamas draudimo įmonių mokumo valdymas naudojant ekonominę logistinę analizę. Jį ištyrus parengiamas logistinio draudimo įmonių mokumo valdymo modelis.

Trečiojoje darbo dalyje pateikiami logistinio draudimo įmonių mokumo valdymo modelio pritaikymo praktikoje empirinio tyrimo rezultatai, kuriais pagrindžiamas praktinis parengto modelio aktualumas.

Darbo apimtis – 159 psl., literatūros sąraše yra 149 pozicijos, disertacijoje yra 15 lentelių ir 30 paveikslų.

Darbo rezultatų teorinė ir praktinė reikšmė. Mokslinį disertacijos reikšmingumą teoriniame lygmenyje nusako gauti rezultatai: (1) išnagrinėti ir susisteminti įvairių autorių požiūriai į draudimo paslaugų vertės nustatymo problemą, draudimo įmonių mokumo vertinimo principus, draudimo įmonių kapitalo poreikio nustatymo sprendimus ir Mokumas II poveikį draudimo įmonių veiklai, kurie leidžia konkretizuoti esminius draudimo veiklos ypatumus, susijusius su draudimo įmonių mokumo, kaip veiklos patikimumą rodančios charakteristikos, vertinimu, bei (2) parengtas logistinio draudimo įmonių mokumo valdymo modelis, kuriame pateikiami ekonominės logistinės analizės pritaikymo draudimo įmonių mokumo valdymui

sprendimai, apimantys logistinio kapitalo valdymo, draudimo įmonės mokumo vertinimo bei Mokumas II principinių nuostatų sritis.

Praktinis disertacijos reikšmingumas atsiskleidžia per pateiktus ekonominės logistinės analizės naudojimo draudimo įmonių mokumo valdymui Mokumas II kontekste sprendimus, leidžiančius draudimo įmonėms patikimiau įvertinti turimų draudimo sutarčių portfelio vertę, kuri lemia jų mokumo vertinimą. Atliktas logistinio draudimo įmonių mokumo valdymo modelio pritaikymo praktikoje tyrimas dviem kryptimis – nustatant prisotinimo kapitalo lygio ir draudimo premijos ryšį gyvybės draudimo atveju bei įvertinant logistinės kapitalo valdymo teorijos poveikį draudimo įmonių mokumo vertinimui – nubrėžia gaires draudimo įmonėms formuoti gyvybės draudimo paslaugų kainodarą ir šių paslaugų teikimo principus.

Darbo naujumas. Disertacijos mokslinį naujumą nusako šie aspektai:

- išnagrinėtos ekonominės logistinės analizės pritaikymo draudimo sektoriuje galimybės, pateikiant ir apibūdinant logistinio draudimo premijos kaupimo funkcijos sąveiką su ekonominio augimo modelio koncepcija;

- draudimo įmonių mokumo vertinimui pritaikytos ekonominės logistinės analizės nuostatos, kurios logistinio draudimo įmonių mokumo valdymo modelio pagrindu pritaikytos draudimo įmonių mokumo valdymui projekto Mokumas II kontekste.

Rezultatai. Vyraujantis požiūris į draudimo paslaugos pinigų srautų vertinimą bei draudimo įmonės mokumo skaičiavimą ignoruoja rinkos talpos veiksnį, kurį įvertinti galima į draudimo veiklą žvelgiant per ekonominės logistinės analizės prizmę. Rinkos talpa, nusakanti rinkoje esančio kapitalo lygį su maksimaliu potencialiu kapitalu rinkoje, apibrėžia kapitalo kaupimo tempus ir pobūdį. Remiantis nuostata, kad didėjantis kapitalo užpildymas rinkoje lemia lėtesnius kapitalo vertės prieaugius, galima teigti, kad į rinkos prisotinimo veiksnį turi būti atsižvelgiama vertinant draudimo įmonės mokumą.

Rinkos prisotinimo veiksnio vaidmenį draudimo įmonės mokumui leidžia įvertinti ekonominė logistinė analizė, kuri pagrįsta prielaida, kad realiomis sąlygomis kapitalas paprastai negali gana ilgą laiką didėti vienodai. Ekonominė logistinė analizė remiasi nuostata, kad kapitalas, nepriklausomai nuo jo kilmės ar kaupimo pobūdžio, negali didėti neribotai. Pagal šį principą vertinant draudimo sutarčių vertę laikomasi nuostatos, kad

periodinės premijos dydis apskaičiuojamas sulyginus rentos mokėjimų (numatomų draudimo išmokų) esamąją vertę su kaupiamųjų draudimo premijų esamąja verte atsižvelgiant į tai, kad kapitalo augimas ilgalaikėje perspektyvoje pasižymi vis lėtesniais tempais dėl didesnės kaupiamo kapitalo bazės ir didesnio jos santykio su prisotinimo kapitalo lygiu.

Remiantis ekonomine logistine analize parengtas logistinio draudimo įmonių mokumo valdymo modelis parodo ekonominės logistinės analizės sprendimų diegimo draudimo sektoriuje galimybes orientuojantis į draudimo įmonių mokumo vertinimą ir leidžia nustatyti draudimo įmonės mokumą atskiro kliento, draudimo rūšies ir viso draudimo įmonės portfelio atžvilgiu, lyginant apskaičiuotą draudimo išmokų poreikį su faktiniu draudimo įmonės pajėgumu.

Atliktas draudimo įmonių mokumo valdymo, naudojant ekonominę logistinę analizę, modelio pritaikymo praktikoje tyrimas leidžia teigti, kad draudimo rinkos talpa yra svarbus draudimo įmonės finansinius srautus lemiantis veiksnys, kuris paveikia ir draudimo įmonės mokumą. Šiame kontekste, atsižvelgiant į pagrindinius Mokumas II principus, išryškėja ekonominės logistinės analizės pagrindu suformuluotų logistinio draudimo įmonės mokumo vertinimo principų aktualumas.

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Kauno technologijos universitetas, Ekonomikos ir vadybos fakultetas	Draudimo ir bankininkystės studijų magistro laipsnis	2005
Kūno kultūros akademija, Edukologijos fakultetas	Sporto psichologijos bakalauras	2007

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Pedagoginė veikla		
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Lektorė	Vilniaus universitetas	2005- dabar

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