MYKOLAS ROMERIS UNIVERSITY
IN COOPERATION WITH
MIDDLESEX UNIVERSITY

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THE VALUATION OF OPERATIONAL RISK IN NON-LIFE INSURANCE COMPANIES

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VILNIUS, 2015

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INTRODUCTION

The relevance of the problem

Typically, the word "risk" has a negative association, although the risk can be seen as an opportunity to change, improve weak spots and eventually obtain a benefit of it. The risk can be the loss or unexpected changes, or *vice versa* – gain or progress – an option that is completely different from what we expect of a decision or action. An assurance, a sense of security and financial stability are the key things determined by many financial institutions.

Many authors (Linartas and Kavaliauskaitė, 2012; Karam 2014; Kraujelis *et al*., 2006) agree that operational risk existed longer than we know, but its concept has started to be interpreted only recently. Financial institutions have started to focus on operational risk and this is a relevant topic in the market as the exposure can result enormous losses and sometimes even failure. Given the potential for high losses, operational risk is one of the four risks in the determination of regulatory capital. The other three are market, credit and liquidity risks. Of these four risks, operational risk has been the least studied, although of recent, this situation is quickly changing (Jarrow, et. al., 2010).

In scientific literature (Sweeting, P., 2011; Moosa 2007) operational risk studies covers two issues: estimation of operational risk loss process using extreme value theory and the application of these estimates to the determination of economic capital. Dr. Linartas A, who brought valuable contribution in operational risk assessment, analyzes operational risk by capital adequacy requirements.

First of January, 2016 – exclusive date for operational risk valuation, as Solvency II Directive comes into force and this event turns a new page in a history of operational risk valuation in insurance companies.

Novelty of research

Since operational risk is listed as one of, the least investigated in all risk assessment portfolio, new studies make this field more developed and give a potential for more efficient risk management or such risk minimization.

Object of the research is operational risk in non - life insurance companies.

The aim of the research is to evaluate the operational risk in Lithuanian non – life insurance industry and analyze its links with solvency requirements.

The objectives of the research:

1. To analyze the theoretical aspects of the operational risk management.
2. To evaluate the importance/role of operational risk in insurance industry environment.
3. To present the methodology of the research – how operational risk can be evaluated;
4. To calculate the operational risk in Lithuanian non – life insurance companies;
5. To analyze the links between calculated operational risk and solvency requirements using hypothesis testing.

6. To investigate the Lithuanian insurance companies' preparation for Solvency II implementation regarding operational risk.

Based on the objectives of the research, were raised the following hypotheses:

H1. Lithuanian non – life insurance Company's market size depends on operational risk amount - the higher company's market share, the greater operational risk value;

H2. Calculated operational risk has a strong correlation with available solvency margin (ASM) and required solvency margin (RSM).

Eventually, the research will lead to an investigation about Lithuanian non – life insurance companies' preparation for Solvency II implementation progress.

The methods of research

Preparing the research, the following methods were used:

1. Analysis of scientific literature;
2. Systematization of financial data;
3. Mathematical calculations;
4. Graphical presentation of the data;
5. Correlation analysis.

The structure of research

In order to achieve the goals, set on objectives of the research, master thesis is divided into three parts:

The first part is theoretical – gives the global understanding of risk concept, follows the causes of operational risk and importance of proper risk management and ends with features of Lithuanian non –life insurance market.

Second chapter is designed to present the methodology of operational risk valuation – a significant part will be aligned to Solvency II Directive requirements; presented the formula for operational risk calculations as well as methods for further analysis.

In third part will be made the calculations of operation risk in Lithuanian non – life insurance companies and presented in comparison with current solvency requirements. Moreover, there was made an investigation on companies' preparation for Solvency II implementation (what is related with operational risk).

Finally, the master thesis will conclude with the summary and conclusions, considering both – theory analysis and investigations were made in a practical part.

1. OPERATIONAL RISK AND INSURANE: THEORETICAL ASPECTS

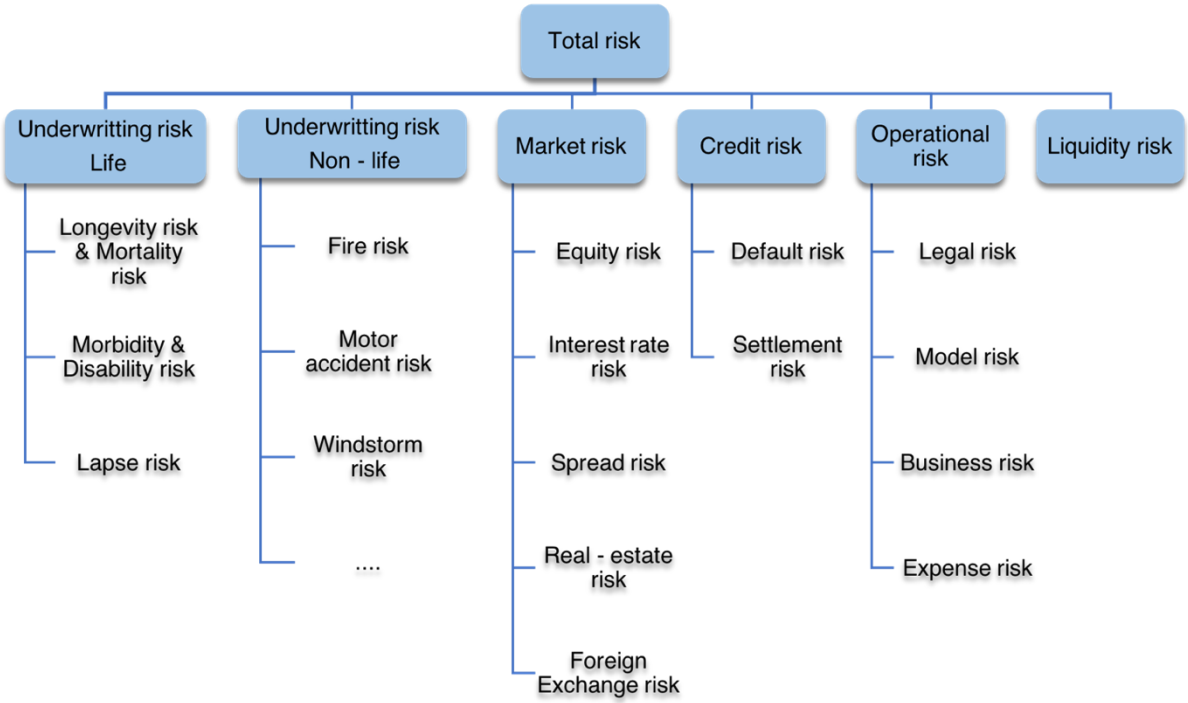
1.1. THE ESSENCE OF RISK MANAGEMENT

That risk and uncertainty became an inherent part of business and public life, agrees many authors of scientific articles (Stasytyte and Aleksiene, 2015; Tchankova, 2002; Buskeviciute and Leskeviciute 2008). Dynamic market relationships increase instability of the environment where public and business organizations work. As their goal is to keep high competitiveness, it usually requires business objects to start initiatives that may have different possible outputs. It comes to be obvious, that risk has to cover all aspects of organizational activities and must be included in all management levels. That is why risk management has become a part of the organization's activities and its main aim is to help all other management activities to reach organization's aims directly and efficiently. Risk management is a continuous process that depends directly on changes of the internal and external environment of the organization. In reality, the changes in the environment require continuous attention for identification and control of risks (Tchankova, 2002).

Financial risk management components are risk identification, the assessment, the monitoring and reporting and the control (Alexander, 2005). All components are equally valuable: correct risk identification ensures risk management effectiveness - if risk management do not succeed in identifying all possible losses or gains that challenge he organization, then these non – identified risks will become non – manageable; accurate risk assessment and the corresponding linkage to capital is a tool for increasing share- holder value; monitoring and reporting have the power to make decisions about the control of risks.

Risk management concerns the investigation of four significant risk of a loss to a firm or portfolio: market risk, credit risk, liquidity risk and operational risk (Jarrow, 2007). **Market risk** includes the risk of a loss due to unanticipated price movements in financial securities or asset values, and it includes price fluctuations due to equities, interest rates, commodities, or foreign currencies. **Credit risk** is the risk of loss due to default, and **liquidity risk** of a loss due to the inability to liquidate an asset of financial position at a reasonable price in a reasonable time. According to the Basel Committee revised report (Basel Committee on banking supervision, 2005), **operational risk** is defined as the risk of loss resulting from the inadequate or failed internal processes, people and systems of from external events. Beside named marked, credit, liquidity and operational risk, there is a couple more, which are specific to insurance industry: underwriting risk (which covers such risks like longevity & mortality, morbidity & disability and lapse) and underwriting risk non – life (motor, fire, windstorm etc. risks) (Figure 1).

Figure 1. Risk map



Source: CEA Solvency II Glossary, 2007

Up to now, financial econometric researches have been focused mainly on the assessment of market and credit risk, with the little work on other types if risk or on other risk management issues. But current trends in financial markets are changing the perception of the important risk. In particular, operational, business and systematic risks are all becoming more important for the shareholders of the large conglomerates that exist today and for their firm wide risk management functions, whose primary aim is to allocate internal resources efficiently.

Over past decades' financial institutions have experienced large loss events leading to big banking failures. Memorable examples such as the collapse of Barings bank, one of the oldest merchant banks, as a result of 1,4 billion USD loss by its chief Singapore trader and that caused to the failure of the whole organization; Allied Irish Banks lost his 759 m. USD in unfair trading – fraudulent activities by one trader who had failed to turn up for work; The Prudential Insurance Company, which was involved in the largest life insurance churning scam of the 1980s and early 1990s – the company had weak business controls, and this poor control environment led to reach record levels in scam; Nasdaq odd-eighths pricing scandal in 1994; losses at Daiwa Bank due to unauthorized bond trading. Insurers have also experienced significant operational loss events, including the 2 billion USD fines against Prudential Financial 1990 and 1,2 billion USD settlement by State Farm for using generic auto parts (Cummins and Embrechts, 2006). All these events have led regulators and industry to recognize the importance of risk management (Plunus *et al.*, 2012). The banking sector was the first who made actions in risk management system – Basel International Commercial Bank-

ing Supervision Committee (Basel Committee) set the bank's capital adequacy requirements and the calculation methodology. The capital adequacy ratio requirement for the commercial banks is to have a certain minimum amount of the capital to cover risky bank loans.

Following the good example of banking industry, European Commission has reviewed European Insurance industry regulations and supervisory mechanism and has developed Solvency Directive for insurance companies. The supervision function of this directive implementation has taken in their hands the European Insurance and Occupational Pensions Authority (EIOPA). The primarily idea of Solvency Directive concerns the amount of capital that European Union insurance companies must to hold and reduce risk of insolvency.

1.2. THE CONCEPT OF OPERATIONAL RISK

Studies of scientific literature show that many authors (Linartas and Kavaliauskaitė, 2012; Karam 2014; Kraujelis *et al*., 2006) unanimously agree with the statement that the operational risk existed longer than we know and is typical for all financial institutions however it started to be analyzed and emphasized as a separate field quite recently. Over the past few decades' operational risk become more complicated, damaging and hardly predictable. It is increasingly important in the management and corporate governance of insurance companies. The different operations and processes of these organizations increasingly have greater implications and interactions with the other risks they face, such as market or credit risks. Management and financial analysis of operational risk is a necessary activity for insurers, presenting opportunities for development and a major field of study on conceptual and practical issues, since the particularity and complexity involved in this type of risk (Martínez Torre Encisco and Hernandez Barros, 2012).

Operational risk management in scientific literature mostly analyzed as an issue of banking sector (Jobst, 2007; Kaishev *et al.,* 2008; Chavez – Demoulin *et al.,* 2006; Barakat *et al.,* 2014; Bardocia and Belloti, 2012; Gillet *et al.,* 2009), although there are some authors who study operational risk management in insurance industry (Manning and Gurney, 2006; Martínez Torre Encisco and Hernandez Barros, 2012) or financial sectors in general - altogether banking and insurance (Cummins, 2006; Petters *et al.,* 2011, Karam, 2014; Andersen *et al.,* 2012).

Different financial approaches describe operational risk in very similar way (see Table 1), but in this research we will stick to the Central Bank of Lithuania definition and follow their recommendations on operational risk management. The Bank of Lithuania from 2012 has started to monitor the financial situation of insurance companies registered in the Republic of Lithuania, controlling their compliance with the requirements of adequacy of technical provisions and their coverage by assets, solvency margin, guarantee fund, reinsurance, assesses efficiency of their internal control and risk management systems as well as the behavior of insurance companies in the market

with respect to users. This is also the bank of Lithuania duty to look for the insurance companies' preparation of Solvency II (the latest version of Solvency Directive, which will come into force from the beginning of next year, 2016) implementation.

Table 1. Definition of operational risk

Operational risk	Source
A risk to have financial losses due human, system, improper and/or non – implemented internal processes or due influence of external events	Central bank of Lithuania resolution No.74.
The risk of direct or indirect loss resulting from inadequate or failed internal processes, people and systems or from external events	Basel Committee on Banking Supervision
The risk of loss arising from inadequate or failed internal processes, or from personnel and systems, or from external events	Solvency II Glossary

Source: summarized by author

To facilitate risk identification and control, operational risk usually is separated into four categories (see Figure 2):

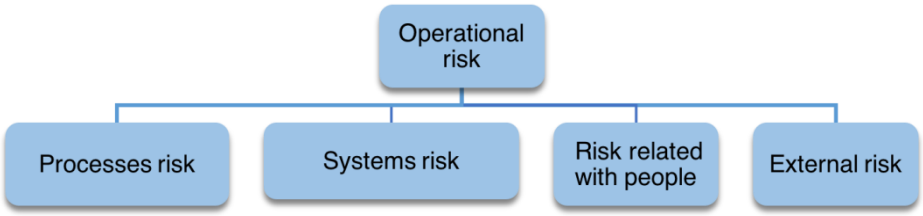
Processes risk – it is risk of (in) direct loss due improper or inappropriate internal processes;

Systems risk – risk of (in) direct loss due improper or failed company's IT infrastructure, including network, IT equipment, software, ties and their interactions;

Risk related to people – it is risk of (in) direct loss due company's employee and/or governance failures, illegal actions or inaction;

External risk – it is risk of (in) direct loss due events, which company cannot control or because events, which may have influence to external relationships.

Figure 2. Operational risk



Source: prepared by the author according Central Bank of Lithuania resolution No.74.

In order to manage operational risk in insurance company it has to be analyzed and determined major risk indicators and prepared operational risk scenarios. Preparing and analyzing operational risk scenarios it has to be taken into account the risk, related to major processes, employees, IT systems and internal events, which are mentioned above. Operational risk scenarios have to evaluate likely low probability and high influence events. Moreover, insurance companies have to determine operational risk identification, analysis and notification processes. Operational risk data has to be stored and monitored. Stored data must be at least as following:

- Short event (related with operation risk) description;
- Event date (if it is possible to define) and event registration date;
- Event duration;
- Name of insurance company's department, here operational risk event incurred;
- Causes of operational risk;
- Operational risk consequences;
- The amount of incurred or assessed potential losses;
- Actions have been taken after operation risk event registration;
- Duration of operational risk consequences removal;
- Other significant circumstances.

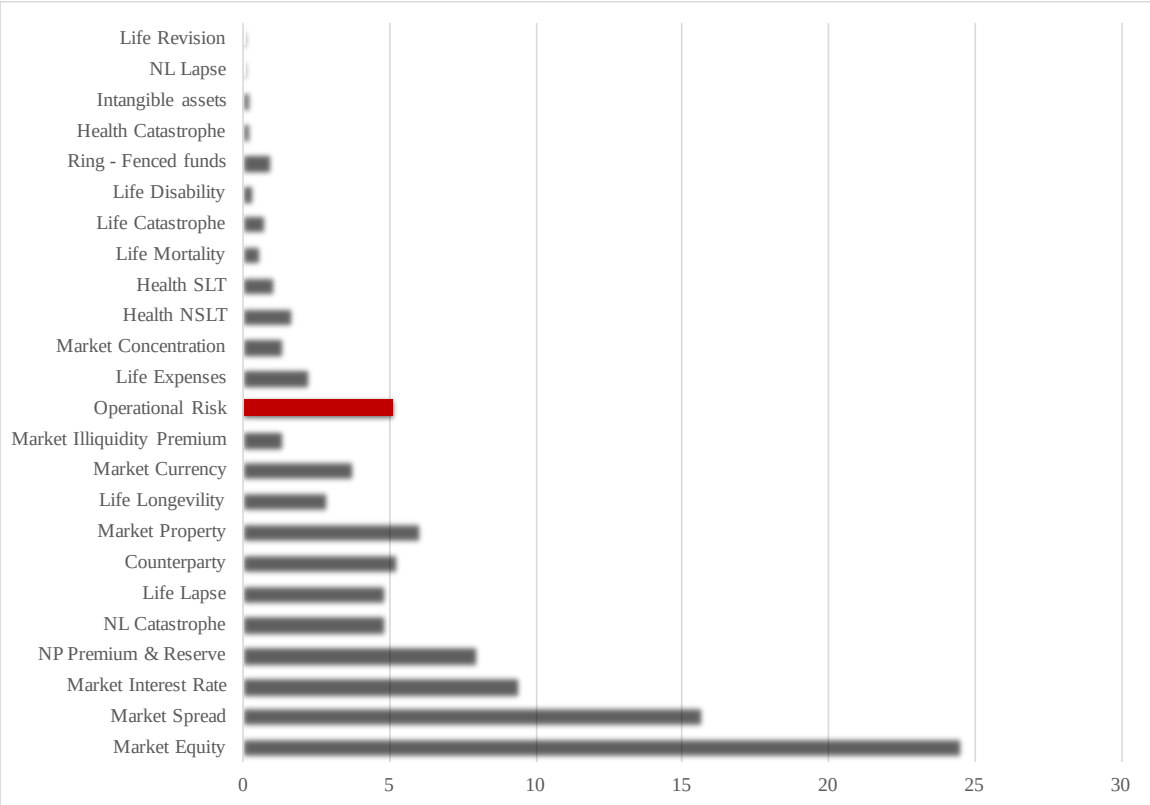
In insurance company operational risk is valued, typically to each product, activity, major process and systems, which insurance company considers as significant, including such areas as essential or important functions or activity transmission to service providers according to contract, new product or service installation, insurance company's IT system functioning. (Board of Central Bank Lithuania resolution No. 74, 2003).

In the other hand, there is Solvency II regulatory project for insurance companies, which provides a risk-based, economic-based and principle-based framework for the supervision of insurance undertakings. The Solvency II system is important if operational risk frames, because eventually operational risk was taken into consideration as a separate risk and the methodology of risk calculation is created in this document. In addition, it also acknowledges the main characteristics of the insurance sector by building upon them. In Solvency II, capital requirements are determined based on the risk profile of undertakings, as well as on the way in which such risks are managed, therefore providing the right incentives for sound risk management practices and enhanced transparency. To calculate the Solvency II capital requirement, which is defined at the overall Solvency Capital Requirements (SRC) level, the standard formula applies a modular bottom-up approach in which each of the underlying risk drivers is modeled using the same calibration as that set by the directive for the overall result.

According to EIOPA, reports how EU countries preparation for Solvency II goes on, we can find information about current situation and deeper analysis on operational risk. The Figure 3 shows that in general operational risk takes a small part of all risk assessment portfolio.

It might look and sound like a phenomenon, when huge potential losses or even failure arising from inappropriate operational risk management can occur, but in the same time it is at least 1/5 of all risk scope. Moreover, this is used to be a normal, taking into consideration the fact, that operational risk is not assumed, targeted to seek the benefit, but occurs itself, because of normal company's activity. That is why it is difficult to measure this risk and evaluate.

Figure 3. Weighting of the main risks in the SCR



Source: EIOPA report on QIS5 study for Solvency II, 2011

Previously mentioned facts about financial institution failures and Figure 3 are a solid illustration of why operational risk must be studied even more nowadays. It is important to identify main causes of operational risk and the measures of operational risk minimization or even the elimination.

1.3. THE MAIN CAUSES AFFECTING OPERATIONAL RISK

It is not enough just to know the concept of operational risk and how it is described in Directive or scientific literature. As we know already that worst can bring inefficient risk manage-

ment, it is crucial to start from the bottom and find the origin of the problem. A variety of sources explains the causes of operational risk in many different ways.

Probably the most common one is classification into internal and external contributing factors:

Internal factors are related with inadequate processes, failure of existing systems, inefficient server maintenance, manual errors and erroneous communication that occurs as a result of a huge workforce.

External factors – natural disasters, political disruption, weak financial policy of the state and criminal fraud.

Scientific literature (Sweeting 2011; Moosa, 2007) distinguish them as following (and this is more or less similar to previously mentioned):

- Employees, clients, suppliers and others illegal or wrong decisions;
- Advanced technologies, which are used in company: software, different management, control, accounting or other systems;
- Legal, tax base, market structural or changes in regulations requirements;
- Changes in reputation or wrong strategic decisions.

Other authors (Mitra *et al.,* 2015) analyze the causes in a different approach and says that the primary reasons are that companies use highly sophisticated technologies to manage operations nowadays. This typically increases the risk in operations and so the like hood of unpredictable losses. Moreover, businesses have increased their degree of reliance upon operational activities over time; hence they become increasingly vulnerable to operational risks.

In authors opinion, the literature on decision support systems are playing crucial roles reducing operational risk and has been well established, that proves such examples when the importance of operational risk was highlighted in e-commerce; or when the operational risk confronting procurement processes was investigated and decision support systems were proposed to model various operational risks that exist; discussions about the use of internet specific decision support systems in reducing operational risk facing companies in supply chain related risks; and finally, yield management decision support systems reduced operational losses but also improved workforce utilization. The potential explanation for the lack of decision support systems investment could be attributed to a lack of investment demand.

The shortfall in investment therefore suggests that the main reason is lack of understanding operational risk. This can be attributed to a number of key reasons: data issues, lack of operational risk techniques and a deficiently of operational risk or decision support system studies. Authors explain it by three reasons:

First, with respect to insufficient operational risk or decision support systems studies, the majority of literature on operational risk or decision support systems has been primary focused on developed markets.

Secondly, operational risk analysis is scare because there is typically insufficient data for these studies. The required data is frequently unavailable, either publicity or from proprietary databases, as the relevant data is not recorded. Moreover, current operational risk methods have been known to be highly restrictive in application due to their non-trivial data requirements.

Thirdly, there has been development of operational risk techniques in the past; hence, the examination of the impact of decision support systems upon companies has been practically non – existent.

In all previously mentioned methods, given that operational risk in forms typically not analyzed, comprehension of decision support systems in managing operational risk is impacted. The understanding is limited and the non – quantitative analysis of operational risk that undertaken has minimal insight. Furthermore, all of these methods typically focused upon analyzing the operational benefits arising from a single source, system or entity.

A vide range and complexity of above presented reasons why operational risk can occur, makes an illusion that it is not a final list. Going back to the fact, that operational risk analysis has started only recently, this is a solid foundation for the future investigations.

Since the causes of operational risk presence have been identified, further it is necessary to follow up them and discover the methods of potential risk minimization or even elimination.

1.4. THE MEASURES OF OPERATIONAL RISK MINIMISATION

Identifying and measuring risk as well as determining the scope and objectives are only the beginning of the operational risk management strategy. These steps represent a passive analysis of risk. It is then necessary to take, as well as active steps to mitigate and control risk. There are broad ranges of possible interventions depending on the ultimate goal, from avoiding risk completely to predicting and preventing risk or managing the losses associated with risk events to keep them within acceptable limits.

The measures for risk management in all financial institutions in general is the same, at least the basic principles are similar, difference is only in details and specify of the company. That proves the fact, that Solvency requirements were built on Basel Directive framework, which was established earlier. That is why in this chapter that causes theoretical point of view we will not split the measures into banking or insurance sectors on purpose and overview them altogether, but in practical part will stick to Solvency requirements. The definition of operational risk is originated in

the banking environment, although it has been accepted as a general definition by other enterprise sectors (Azvine *et al*, 2007).

Strong internal controls and governance is key thing to mitigating and controlling risk. Without an effective operational structure, an operational risk management program is doomed to fail. After having analyzed and categorized and planned and put in place appropriating governance structure, financial institutions can decide on how best to avoid, mitigate or transfer the risk. Here again, there are various options and approaches. Financial institutions have to decide on an acceptable level of loss and compare that within the expense of putting control mechanism in place. They also have to outline the risk management plans to regulators, who make regular but subjective assessments of the plans to determine their fitness and set appropriate capital charges.

Financial institutions may not be able to avoid risk altogether. At times, they may have to make a choice between keeping the risk and keeping the business line. At other times, bank may have to work with regulators and make assumptions for what is the right level of risk. They may also choose to transfer risk, often through the careful use of insurance or alternatives like bonds.

Even with all this planning and mitigating, financial institutions should have contingency plans in place. Contingency planning can help financial institutions better deal with disaster events if, or hen, they occur.

After setting scopes and objectives and identification, assessment, measurement and analysis of the operational risk it faces, the financial institutions is no ready to formulate and implement risk management actions aimed at risk mitigation and control. Depending on the results and findings from the three preceding steps, it can embark on interventions that may be grouped under following broad categories:

- Risk avoidance by reducing engagement in the activities that expose the bank to identified operational risk or existing them altogether;
- Factor management by modifying the operational environment in which loss events have been shown to arise;
- Loss prediction of the events that may cause future losses;
- Loss prevention by redesigning business activities and process to make a loss event less likely to occur in the future;
- Loss control by changing the casual paths by which high- impact events happen;
- Loss reduction by reducing the impact of a specific event;
- Contingency management of the company – wide aftermath following major loss events;
- Risk financing to ensure that the bank is able to finance the losses (Wiley, 2013).

It is almost impossible to measure operational risk quantify or statistically, but it is possible to evaluate qualitatively. As it was mentioned before, operational risk usually causes huge losses.

When managing operational risk, it is important to collect all available historical data, define problematic areas and possibility to decrease such risk. This can be done by using different tools:

- Self assessment – it is organization's self assessment when each division in different structure management level makes self assessment according to particular questionnaire;
- "Risk map" formation – operational risk is structured according divisions and functions. This helps to determine the sequence of further risk management elements/factors;
- major risk indicators – it is statistical data, which is collected and analyzed periodically, at least once per quarter (for example the number of attempts to break in computer);
- accounting tables – this tool helps to convert quantitative information to qualitative;
- indirect losses measurement – it is a possibility to use its historical loss data. It should consist of general holistic historical loss database.

Clear responsibility and duties separation, strong internal control, periodical special situations planning are key things essential for operational risk management. Operational risk can be decreased in different ways (Table 2):

Table 2. Operational risk control methods

Internal control method	External control methods
Function's separation (for example: person, who sign contract, cannot execute contract payment);	Confirmation (contract has to be confirmed by both counterparties);
Double check (for example: contract must be confirmed by both - dealer and accounting);	Cost verification (prices of the contract have to be checked through another, independent from contract issuers price source
Recalculation (for example: dealers calculated yield must be compare with risk management division calculations)	Authorization (has to be a list of allowed operations);
Caution system (for example: important dates, when transactions have to be made or contract ends, must be included in system, which reminds about coming event in advance);	Internal and external audit
Annex control (each contract annex has to be valuated as strictly as the contract itself)	

Source: prepared by author

Moving to more practical point of view how operational risk is managed in financial institutions nowadays, it is essential to talk about the requirement set for financial institutions - for banks Basel and for insurance - Solvency. As the purpose of this research is to evaluate operational risk on non – life insurance companies, we will stick more on Solvency requirements, set for insurance companies.

The latest version - Solvency II Directive (2009/138/EC) -, which was already mentioned, will take a significant part in this research. This directive probably the most important world leading standards for insurance companies, which takes a significant part of operational risk management, thus filling the absence of operational risk management methodology.

Audrius Linartas, Lithuanian Insurance Supervisory Commission Chairman Deputy is the one who has scored a meaningful contribution analyzing insurance company's financial stability. A. Linartas, PhD in Economics published more than 10 scientific articles about insurance liabilities, risk assessment and Solvency. His article "Insurers "Basel" - "Solvency II"" is exactly about the idea that capital adequacy requirements, which were implemented in banking sector adopting "Basel" is very similar to the requirements that came into force for insurance with Solvency. That Solvency II framework is very similar to the Basel II three-pillar system agrees and many others authors (Peters *et al*, 2010; Azvine *et al*, 2007; Van Laere and Baesens, 2010). Capital adequacy requirement by Solvency system is the most common risk minimization measure, especially in insurance industry. Minimal Solvency requirements are determined in whole European Union, but each country depending on their policy can make them even stricter than minimal standards. For example, in Lithuania these requirements are one of the highest to compare with other European Union countries. Lithuanian insurance industry is still developing, so higher standards for insurers delivers more guarantees for consumers.

Despite that, Solvency I system had some limitations – it was adapted for insurance market regulation, which existed before three decades, so did not take into account all innovations that happen in financial industry during this period. There is a lack of credit, liquidity risk analysis, did not taken into account such risk minimizing factors as derivatives, balance of portfolio risks, sufficiency of tariffs. For example – non – life insurance company according Solvency I requirements, signing contract for 100 EUR insurance premiums, has to pay 18 EUR of equity additionally. Seems reasonable initiative but in the other hand, this requirement can stop motivating insurance company to determine the risk assessment which meets contributions. For this reason, only the valuation of volume of insurance premiums may lead a situation when two insurance companies will be obligated to have the same stability performance guarantees in the capital, although one of them will be signed x10 more contracts than other one. Following this example, it can be concluded that the greater amount on policies in one company leads higher risk than in another and Solvency nei-

ther is nor reflected to this assessment. As insurance products are different – risk, the premium size is not always reliable measure. It does not matter what premium company will write in policy in the future – capital adequacy requirements will be applied depending on policy risk (Linartas, 2006).

However, the key issue why Solvency II is important in our case is the fact, that it's a first time operational risk was defined and included into solvency margin calculations. Following these recommendations, further we will evaluate the operational risk in non – life insurance companies.

1.5. THE FEATURES OF LITHUANIAN NON - LIFE INSURANCE INDUSTRY

To summarize the theoretical part, we will conclude with another part of the master topic - an overview of non – life insurance industry features in Lithuania – development, tendencies and market environment. Lithuanian non – life insurance industry is chosen on purpose, as the further operational risk, investigation will be based on local practice and results.

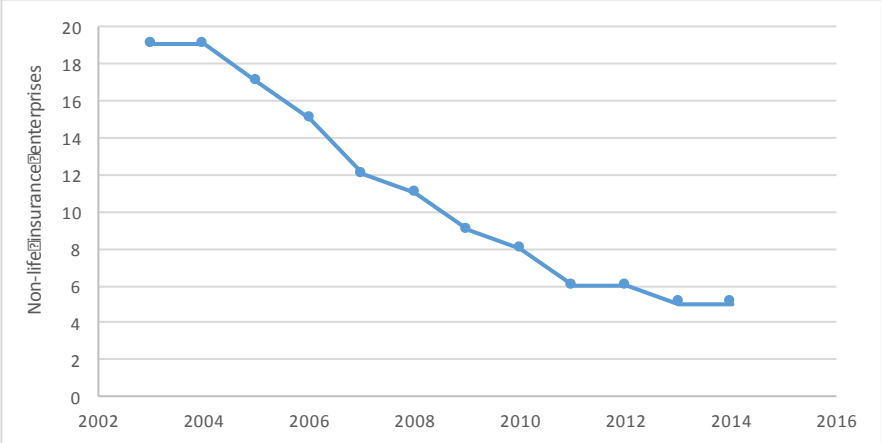
Insurance plays an important role in the global economy as it provides risk management capability not only in business, but also in casual world (Lezgovko and Lastauskas, 2008). The primary function of any insurance certainly is risk sharing. Where an event is unlikely to occur, but where it is happening would involve financial loss or burden, it will very often be possible to enter into a contract of insurance under which, in return for a premium, the insurer will undertake to identify the insure in respect of certain defined losses, either wholly or partly. The essential feature in this case is that there must be an inherent uncertainty of event happening or as to the moment of time at which it will occur or both. Moreover, it is also desirable that there should be no advantage to the insured in being able to influence the occurrence of the event.

Insurance contracts can be divided into two groups, namely **life** and **non – life.** In addition, the following research will focus on non – life insurance industry. **Non – life insurance** includes fire, household comprehensive, motor, accident, aviation, pecuniary liability, marine, "special perils", travel and various other categories.

Lithuanian non – life insurance sector is quite young – the development of it as a separate field has started only in 1996 07 10 when the Low of Insurance was adopted. The Low highlighted that insurance company cannot provide the services, which belongs to different insurance sectors. President of "Insurance and risk management institute", lect. Akeksandra Lezgovko, makes a comprehensive analysis of Lithuanian insurance market development. According to her surveys, today's insurance is quite different compared to its predecessor and this is mainly due technological changes, the needs of policyholders and insurers capacities. Despite that, Lithuanian insurance industry has a great potential for expansion and it is proved by low indexes of insurance development.

The insurance industry seems to be challenging recently as statistics in for example Lithuania shows that the number of non – life insurance companies has dropped down almost four times (Figure 4). In the 2003 Lithuania had 19 companies, by the end of 2013 there left only 5.

Figure 4. Number of financial and insurance enterprises (except for individual)



Source: Official statistics portal of Lithuania

The main reasons why an insurance company faces difficulties in the market might be inappropriate or insufficient operational risk management. The operational risk has relatively low percentage in solvency requirements to compare with other risks, but it losses can be one of the largest. This makes the operational risk unique and takes long and complex process of management.

The idea, that inappropriate risk management causes company's failure supports and some publications and Lithuania insurance market analysis (Linartas, 2003; Buskevicute and Leskeviciute, 2008).

The beginning of next year will open a new page in insurance activity history. The Bank of Lithuania has issued the regulations, implementing the EU Directive Solvency II. For insurers this means that financial situation will treated in a different way than now and more transparency. Since 2016 will came into force Solvency II and insurance company will have to calculate capital adequacy taking into account all the risk facing the company – not only security, but also market, credit and operational. Under new regulations, the insurance company will have to have sufficient assets to cover unexpected losses that might arise from catastrophes, depreciation of investment; imbalance between assets and liabilities, administrative costs or an increase of reinsurer's failure to carry our liabilities. Directive also identifies liabilities valuation principles, as well as what extent and quality must be the owns funds in case to fully cover capital requirements. Moreover, new requirements will cover a range of counter – cyclical measures to reduce the impact of fluctuations in the financial markets of the insurer's financial position. The requirements should encourage insurers to better manage risks, take preventive measures to avoid or minimize them, enable better allocation of capital and operate more efficiently.

The supervisory authority of the Solvency II regime will provide better measures to assess insurer's financial situation ant take appropriate and timely measures. On top of all that, insurance companies will have to disclosure more information – for both the Bank of Lithuania and the public. Under the directive, insurers will provide more detailed information about the business and its results, management system, risks, assets and liabilities, capital management and capital adequacy. For customers, before signing the contract, insurance company will have clearly disclosure the risks that are assumed by contract. Insurance companies will have to submit computational model with three different interest rates, chooses according to customers selected investment trends and riskiness.

Lithuanian publications (Paleckiene and Paleckas, 2013; Linartas and Kavaliauskaite, 2012; Lezgovko and Lastaukas, 2008) are full the Solvency II influences analysis for insurance industry. The pretty fair idea of these insights is that there is no doubt - no formula or *"dry"* requirements will not disclose the reality, so Solvency II should become the engine of innovation, which ensure better and more responsible risk management, searches of new and even more efficient methods and finally, Solvency II should become an integral insurers objective, aimed by insurers, regulators and public efforts.

2. THE METHODOLOGY OF OPERATIONAL RISK EVALUATION

2.1. THE DEVELOPMENT OF RISK AND CAPITAL REQUIREMENTS ESTABLISHMENT IN INSURANCE INDUSTRY

Insurance industry has learned its lessons from the Global Financial crisis on 2007/2008 – this period has showed how it is important to evaluate and determine the risk of financial institutions. European Insurance industry (in comparison with bank sector) managed to hold in the waves of crisis as insurance business model in general is different than banks – insurance industry made conclusions from 2001 – 2002-year crisis and established more striker risk and capital management systems (Leškevičiūtė, 2008).

The early beginning of operational risk valuation can be counted from 1973 when very first EU directives were issued for the solvency of insurance companies, under the First Non-Life Directive (73/239/EEC). Operational risk as such was not named in this Directive, but it was first Council Directive, issued by European Commission, on the coordination of laws, Regulations and administrative provisions relate to the taking-up and pursuit of the business of direct insurance other than life assurance. After that, it has been a long and sophisticated way until Solvency II, as we have it now, was established.

Analysis of operational risk valuation can be also started from the early 1970, when Solvency I framework has been effective, using a very simple model in the calculation of requirements for capital. There was nothing countable what could be resulted in the failure of many companies as well as in the lack of knowledge about new risks. That is why many countries established special regulations for preservation and supervision of the above-mentioned companies; therefore, there was a diversity of different regulative. Banking system had higher monitoring and development trends, especially in the emerging of Basel II, an idea to have something similar for the insurance industry own system, which was entitled by Solvency II.

Moving forward, after a couple decades, on mid. 1990 - the third generation of life (92/96/EEC) and non-life (92/49/EEC) Insurance Directives established the single market for insurance, and replaced the previous version. In 1998, in response to an increasingly complex financial services market and the growing likelihood of a true single market, the European Commission created a "framework for action" for financial services.

Lithuania's name in international stage came on 2004, right away after Lithuania joins European Union. Insurance Supervisory Authority of Lithuania (DPK), confirms capital adequacy calculation method for insurance companies.

Later on, 2007 07 10 European Commission confirms Solvency II directive project, on November CEIOPS issues QIS3 report and in the beginning of 2008 European Commission confirms Solvency I directive project, which became as Solvency I directive in 2009. In the end of 2009, in Strasbourg, it was adopted European Parliament and Board directive for insurance and reinsurance to start the business and execution has to be moved to national right on 2012 10 31. 2012 12 01 confirmed MGF requirement, and finally, on 2016 01 01 it is scheduled that Solvency II implementation will come into force (EU Regulations, 2015).

Constant development and changes of directives shows that this is important and changes always drive only to higher performance. Many authors analyzed and made researches based on comparison of Solvency requirements development. The most common comparison is Solvency II Directive *versus* Solvency II. Solvency II requirements are shown in Figure 5.

Solvency I system had some limitations – the system performs only warning function and did not manage to prevent some insurance companies' failures; Solvency I is not able to make an effective company's state analysis. European Commission has outlined the following drawbacks:

The risk is taken into account not sufficiently – current system does not include the valuation of credit, market and operational risk. System is not future –orientated, poor qualitative requirements, which are related to risk management, moreover, it was not required for supervisory authority to review these aspects. That leads that insurers do not have any stimulus to manage their risk, improve management and invest into it. Current system does not ensure proper and timely supervisory authority actions and does not create sustainable conditions allocate the capital. This means that current EU system does not protect insurers.

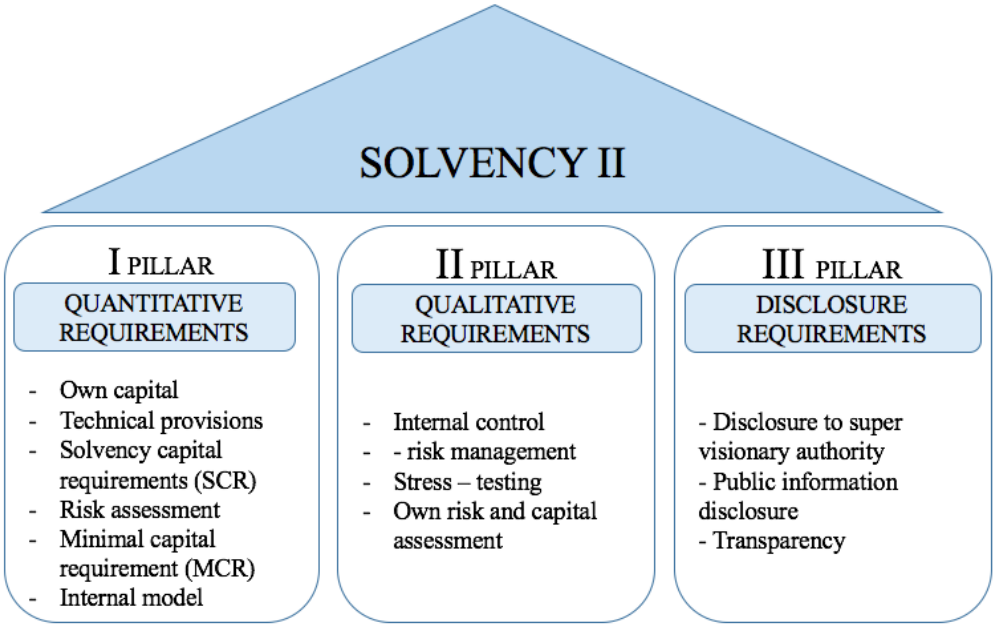
The proper singe market functioning constraint. Current EU system defines standards, which can be supplemented by national level rules. These additional rules perverts proper single insurance market functioning and damage it. For this reason, EU insurers expenses increases and EU competition is disturbed. In addition, it performs high supervision execution differences, and this is harmful for single market.

Group supervision is not sufficient. Current group supervision method does not reflect to group structure and organization more and more, because according to this method, most attention requires legal persons. Group structure becomes more centralized, because applied all companies risk management systems and consolidated main features. Group management and supervision discrepancy increase not only insurance group expenses, but also the danger, that particular group risk will be overlooked.

Lack of international and cross – sectorial convergence. New solvency requirements and valuation of technical provisions are being created based on economic risk method, which is very different from EU system. Lack of international and cross – sectorial convergence has a negative

impact on EU insurer's competiveness. Moreover, the lack of sectorial consistency also increases the possibilities of regulatory arbitrage.

Figure 5. Solvency II requirements



Source: made by author according EIOPA (2013)

Theoretically, it is possible that all EU members will define similar regulations to eliminate the drawbacks of current system, there are poor evident, that this could happen. Experience shows even the opposite. In case of higher harmony in EU level, it is necessary to take actions and replace current system. That is why above-mentioned and even much more limitations of current solvency system lead to higher standards and improvements, which now are established as Solvency II requirements. (European Commission, 2007).

It seems that Solvency II is an unstoppable process towards the achievement of a bigger goal of the insurance industry in the perfection of the methods of company management on risk-based method. The process of establishment of this modality was not easy and more time is required for its full implementation by the insurance industry.

2.2. THE CALCULATION OF OPERATIONAL RISK: FROM RISK TO CAPITAL

In Torre – Encisco M. I. M. and Barros R. H. (2012) opinion, there are not any measurement techniques or capital models in the worlds, which reduces operational risk by tem. This is done in cooperation with management establishment processes in companies. Moreover, such models help them to reduce capital requirements, ensuring that the money is being used in investments that are more profitable. Such exposure minimizes the risk and creates ability to generate future income. Authors say, that the problem lies in clarifying the rules for operational risk capitalization; it is con-

fusing to explain the operational risk types and proportion that fall into each category. It is important, that operational risk quantification and measurement is only a tool among others, in the establishment of a system or risk management program viable and complete.

According to EU Commission Delegated Regulation 2015/35, supplementing Directive 2009/138/EC of the European Parliament and of the Council on the taking up and pursuit of the business of Insurance and Reinsurance (Solvency II), the concept of operational risk of the standard formula captures the risk that arises from inadequate or failed internal processes, people or systems, or from external events in a factor-based calculation. For this purpose, appropriate volume measures to capture this risk, are taken into consideration - technical provisions, premiums earned during the previous twelve months, and expenses incurred during the previous twelve months are. The latter volume measure is relevant only for life insurance contracts where the risk is borne by the policyholder. In view of the fact that acquisition expenses are implemented heterogeneously in different insurance business models, these expenses should not be taken into account in the volume measure for expenses incurred during the previous 12 months. In order to ensure that the capital requirement for operational risk continues to meet the confidence level set out in Article 101 of Directive 2009/138/EC, the operational risk module should be reexamined as part of the Commission review of the methods, assumptions and standard parameters used when calculating the Solvency Capital Requirement with the standard formula, as referred to in recital. This review should in particular target life insurance contracts where the risk is borne by the policyholder.

The solvency and financial condition report shall include qualitative and quantitative information regarding the risk profile of the insurance or reinsurance undertaking, separately for the following categories of risk:

a) underwriting risk;
b) market risk;
c) credit risk;
d) liquidity risk;
e) operational risk;
f) other material risks.

Talking about risk management areas, and more specifically - operational risk management: actions to be taken by the insurance or reinsurance undertaking to assign clear responsibilities to regularly identify, document and monitor relevant operational risk exposures.

Significant novelty in Solvency II – changes of capital requirements for insurance companies. Currently capital requirement model is based SCR) and Minimum Capital Requirement (MCR) concept. Both requirements depend on risk quantity and are aligned to be calculated prospectively – this ensures that in case of financial situation reversal, relevant actions will be taken in

a timely manner. SCR calculation formula has 0, 05% probability for insurer to quit business – no often than 1 time from 200, once a year. In the same time, for MCR function 85% confidence level is applied. European Parliament and Council 2009 Directive 2009/138/EB set that MCR should consist not less than 25% and not more than 45% of SCR (see 1 formula):

$$0,25\ SCR \geq MRC \geq 0,45\ SCR \qquad [1]$$

Additionally, for MCR requirements applied so called absolute floor – 2, 2 MM. EUR for non –life insurance companies.

According to Lithuania Insurance Supervisory resolution (2004) "The Solvency margin calculation methods approval", standard solvency capital requirement formula consists of three major components:

$$SCR = BSCR + SCR_{op} + Adj \qquad [2]$$

where

BSCR = Basic Solvency Capital Requirement;

SCR_{op} = The capital requirement for operational risk;

Adj = adjustment for the risk absolving effect of technical provisions and deferred taxes.

To determine the BSCR, two steps are required:

1. Insurer combines the market, default and underwriting risk using the correlation matrix (3 Table):

Table 3. Market Risk Tail Correlation Matrix

i \ j	**Market Risk**	**Default Risk**	**Non-Life U/W Risk**	**Life U/W Risk**	**Health U/W Risk**
Market	1.00	0.25	0.25	0.25	0.25
Default	0.25	1.00	0.25	0.25	0.50
Non-Life	0.25	0.50	1.00	0.26	0.00
Life	0.25	0.25	0.00	1.00	0.00
Health	0.25	0.25	0.25	0.25	1.00

Source: CEIOP's Advice for Level 2 Implementing Measures on Solvency II (2010)

2. To the extent, the insurer includes the value of intangible assets in its capital; there is a risk charge equal to 80% of that value.

The Basic Solvency Capital Requirement (BSCR) is the sum of these two items as follows:

BSCR = Intangible assets capital + Square Root {sum over risk categories I, J of (Correlation $_{IJ}$* Required Capital $_I$*Required Capital $_J$)}. [3]

The Solvency Capital Requirement for operational risk (SCR_{op}) equals the minimum of:

a) 30% of BSCR, calculated as described above, and
b) the maximum of solvency capital required for operational risk associated with premium and technical provisions, where:

a. the premium based operational risk is (i) 3% of earned premium plus (ii) for an insurer whose earned premiums increase by more than 10% over the prior year, an additional 3% of the earned premium increase over 10%.
b. The technical provision based operational risk is 3% of technical provisions without risk margin.

Based on this, to calculate the capital requirement for the operational risk, it is used the following standard formula (see 4 formula):

$$SCR_{operational} = \min(0{,}3 \cdot BSCR; Op) + 0{,}25 \cdot Exp_{ul} \quad [4]$$

where:

(a) $BSCR$ denotes the Basic Solvency Capital Requirement;

(b) Op denotes the basic capital requirement for operational risk charge;

(c) Exp_{ul} denotes the amount of expenses incurred during the previous 12 months in respect of life insurance contracts where the investment risk is borne by policy holders.

The basic capital requirement for operational risk shall be calculated as follows:

$$Op = \max\left(Op_{premiums}; Op_{provisions}\right) \quad [5]$$

where:

$Op_{premiums}$ denotes the capital requirement for operational risks based on earned premiums;

$Op_{provisions}$ denotes the capital requirement for operational risks based on technical provisions.

The capital requirement for operational risks based on earned premiums shall be calculated (see 6 formula):

$$Op_{premiums} = \begin{cases} 0{,}04 \cdot \left(Earn_{life} - Earn_{life-ul}\right) + 0{,}03 \cdot Earn_{non-life} \\ +\max\left(0; 0{,}04 \cdot Earn_{life} - 1{,}2 \cdot pEarn_{life} - \left(Earn_{life-ul} - 1{,}2 \cdot pEarn_{life-ul}\right)\right) \\ +\max\left(0; 0{,}03 \cdot \left(Earn_{non-life} - 1{,}2 \cdot pEarn_{non-life}\right)\right) \end{cases}$$

[6]

where:

(a) $Earn_{life}$ denotes the premiums earned during the last 12 months for life insurance and reinsurance obligations, without deducting premiums for reinsurance contracts;

(b) $Earn_{life-ul}$ denotes the premiums earned during the last 12 months for life insurance and reinsurance obligations where the investment risk is borne by the policy holders without deducting premiums for reinsurance contracts;

(c) $Earn_{non-life}$ denotes the premiums earned during the last 12 months for non-life insurance and reinsurance obligations, without deducting premiums for reinsurance contracts;

(d) $pEarn_{life}$ denotes the premiums earned during the 12 months prior to the last 12 months for life insurance and reinsurance obligations, without deducting premiums for reinsurance contracts;
(e) $pEarn_{life-ul}$ denotes the premiums earned during the 12 months prior to the last 12 months for life insurance and reinsurance obligations where the investment risk is borne by the policy holders without deducting premiums for reinsurance contracts;
(f) $pEarn_{non-life}$ denotes the premium earned during the 12 months prior to the last 12 months for non-life insurance and reinsurance obligations, without deducting premiums for reinsurance contracts.

The capital requirement for operational risk based on technical provisions shall be calculated (7 formula):

$$Op_{provisions} = 0{,}0045 \cdot \max\left(0; TP_{life} - TP_{life-ul}\right) + 0{,}03 \cdot \max\left(0; TP_{non-life}\right) \qquad [7]$$

where:
(a) TP_{life} denotes the technical provisions for life insurance and reinsurance obligations;
(b)) $TP_{life-ul}$ denotes the technical provisions for life insurance obligations where the investment risk is borne by the policy holders;
(c)) $TP_{non-life}$ denotes the technical provisions for non-life insurance and reinsurance obligations. For the purposes of this paragraph, technical provisions shall not include the risk margin, and shall be calculated without deduction of recoverable from reinsurance contracts and special purpose vehicles.

The scope of this research relies on the capital requirements for non –life insurance companies. That is why, we eliminate all *life* variables and the formula we will be using for Operational risk calculations will be the following:

$$Op = \left(0{,}03 \times Earn_{non-life} + max\left(0; 0{,}03\left(Earn_{non-life} - 1{,}2 \times pEarn_{non-life}\right); \left(0{,}03 \times \max\left(0; TP_{non-life}\right)\right)\right)\right) \qquad [8]$$

The valuation of operational risk (calculations) further will be made based on 8 formula, which is subtracted specifically for non – life insurance companies.

2.3. THE METHODS OF OPERATION RISK VALUATION

Risk management helps to identify most risky areas and take appropriate decisions for future prognosis. In insurance activity first of all it is sold security and risk acceptance service – insurance. Here risk can materialize bringing financial losses or no. Insurance subject is person or legal entity, for who risk for uncertainty exist. In insurance policy it is clearly stated, what and for who have to

happen that insurance premium would be paid. High scoring risk management is beneficial to plan activity in the future, because let to express risk more precisely. Because of that, it is possible to predict, what losses it can bring the future.

Required capital adequacy can be measured in two ways: **calculated by standard formula** or using **internal company's risk management model** (chosen model have to be confirmed by supervisory institution). Forecasting shows that solvency margin, calculated by formula, will be higher than in internal model. Probability, that internal model will increase company's risk management, is higher than probability that risk management will be better using standard calculations, because formula hardly represents company's particularity. By choosing formula, situation will depend on how risk was managed until that time. If requirements were high, standard formula will not improve them, but if risk was not managed properly, overall risk management by using this formula, should get better (Buškevičiūtė and Leškevičiūtė 2008).

Internal company's risk management model. EIOPA does not give a formal definition of what an internal model is. Nevertheless, Internal Model is considered as insurance company's risk assessment system for general quantitative risk assessment and specific risk format reflection in solvency capital requirement (SRC) calculation. It is a company's choice – use internal model or standard formula.

Dr. Linartas A., in his PhD thesis has presented the assessment of insurance companies' financial stability applying early warning model. The aim of the research was to form the financial stability evaluation model, which could warn about insurance company's financial instability in advance. The practical application possibilities of this model were presented – how the model could be used in the fields of supervision of insurance undertakings in Solvency II implementation. Although, the proposed model is more for financially unstable companies, it might be applicable for stable companies as well, because the model allows to take a timely measure to reduce the possible effects of insurance market failure. This as a great example of internal model insurance companies can use.

In 2008, Buškevičiūtė E. and Leškevičiūtė A. made a survey about risk management in insurance companies in a preparation stage before Solvency II and the aim of this survey was to evaluate the possible effects of Solvency II on the activity of Lithuanian insurance market. One of the raised hypotheses was Lithuanian insurance companies will rather choose internal model than standard formula for operational risk evaluation. In addition, results showed ambiguous results. In Insurance Supervisory authority of Lithuania (DPK) opinion, internal model will invest only biggest insurance companies. In 2008, none of questioned company knew which model would choose, they were waiting for the recommendations from higher authorities, but all agreed that formula will not reflect company's specificity. Although formula reflects risks and this will improve risk manage-

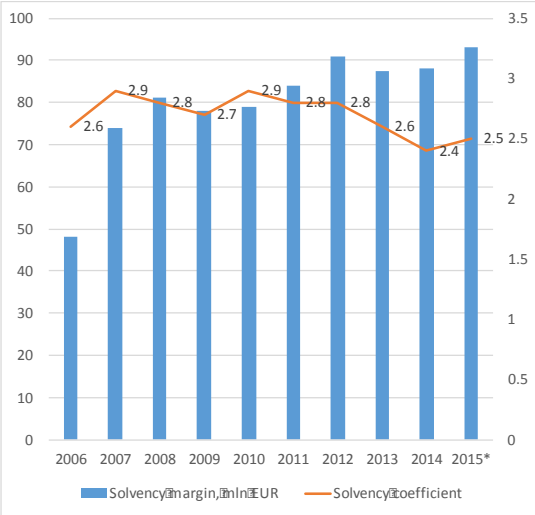
ment; formula is complex; for some risks (like catastrophe) unknown methodology; decision will be made based on quantitative impact study.

This was more than 7 years ago and now if we will look to financial statements which insurance companies provide each year, there is no information what assessment type companies are using now - it seems that many of them are still using standard calculation formula. This prediction is made based on fact, that none of insurance company has presented internal model calculation methodology yet. The fact, that right now is still preparation stage, should not be overlooked. That is why, only next years when Solvency II will come into force, will show which model companies will choose.

Calculation by standard formula. As EIOPA is explaining, the formula - based, calculations are used for sub-modules where a scenario-based approach was not considered as the most appropriate. Standard formula calculations allow capturing the risks, which are associated with new business expected to be written in the following 12 months. However, the effects of risk-mitigation techniques are more difficult to take account when using a formula-based calculation.

In general, many Lithuania's non life insurance companies' year – by – year states about their taintless solvency ratio: the biggest non life insurance company in Lithuania "Lietuvos Draudimas" publishes that last year (on 2014) their financial situation remained strong and stable – available solvency margin, which is 50,4 MM. EUR, exceeded 2,5 times required solvency margin; ERGO states that on 2014 solvency in their non – life insurance business has raised from 206 % to 219 % and recent years this is always pretty over minimal standard; PZU shows results about 2014 to be 106, 57 % (also over minimum required); the overall results of all non – life insurance industry in Lithuania shows that all insurance companies in Lithuania met the requirements about minimal solvency requirements (6 picture).

6 Figure. Companies' solvency store and solvency coefficient development



Source: "Lietuvos draudimo rinkos apžvalga 2015 1Q" issued by Lietuvos bankas

In order to assess the new Solvency II requirements on insurance company capital and solvency ratio calculations approach, since 2005 EU organizes quantitative impact studies. Five QIS studies were held already, and Lithuania has participated in all of them, except first one. In 2008 Lithuania has showed accumulated results that if capital requirements for our country will increase, for non – life insurance companies it would be 1,7 times higher. General solvency ratio would decrease from 2,3 to 2,1 for non life insurance companies. The minimal requirement for this coefficient is 1, so if solvency coefficient is more than 2, insurance companies financial state is valued as stable. 6 figure shows that solvency coefficient always was high – the lowest was last year – 2,4 – but sill this is high result.

Giving the fact that all non – life insurance companies in Lithuania have to show their capital adequacy ratios (and they actually do that, each quarter submitting results to Lithuania supervisory authority – "Lietuvos bankas"), it is not reasonable to recalculate this ratio once again, taking into consideration the fact that all necessary data for calculations is not free available. Of course, it might be calculated, but only making number of assumptions and final result might be or might be not the same as companies decelerates on their financial statements. Because of these factors, next chapter will be based on more on variables and their fluctuations – what influence on total result has changes of some factors.

2.4. THE SCOPE, TIME FRAMEWORK AND TECHNIQUES OF OPERATIONAL RISK CALCULATION AND VALUATION

The calculation of operational risk in this thesis in general will cover Lithuanian non - life insurance market. As it was mentioned before, current year (2015) in Lithuania operates 8 main market players (AB "Lietuvos Draudimas", ERGO Insurance SE Lithuanian branch, AAS „BTA Baltic Insurance Company" branch in Lithuania, Compensa Towarzystwo Ubezpieczeń S.A. Vienna Insurance Group Lithuanian branch, If P&C Insurance AS branch, Seesam Insurance AS Lithuanian branch, AAS "Gjensidige Baltic" Lithuanian branch and UAB DK "PZU Lietuva"). There are also some others like UAB DK "Lamantinas", Vereinigte Hagelversicherung VVaG branch and others, but their market share is not so significant and/or their activity is too specific - they offer crop insurance coverage, custom authorities and etc. Despite the quite wide range of insurance companies, which operates, is Lithuania (taking into consideration the total market share), not all companies are originated in Lithuania - they have branches in Lithuania or have foreign shareholders. This fact is worth to mention, because by collecting financial data from all non - life insurance companies it is noticeable that results are shown not only from activity in Lithuania, but from all group results.

The scope was chosen because of the data available - 6 of above mentioned insurance companies provide their each year's financial reports, so analysis will cover the following 6 insurance companies which at least operates in Lithuania - AB "Lietuvos Draudimas" , ERGO Insurance SE Lithuanian branch, If P&C Insurance AS branch, Seesam Insurance AS Lithuanian branch, AAS "Gjensidige Baltic" Lithuanian branch and UAB DK "PZU Lietuva". As their activity experience in Lithuania is not the same and issuing significant findings it is worth of take longer period than last three years. Considering Lithuania market share and the data available it was chosen to take the five years' period (from 2010 to 2014), analyze the results and make conclusions.

All above mentioned selected non - life insurance companies are Lithuanian branches or managed by foreign shareholders. This is important, because when publishing financial results, they usually do not split it to each countries activity, but provides the annual results of insurance activities by showing the general group results. That is definitely would have impact if the scope would be different - for example, focusing specifically only on Lithuanian market.

For operational risk valuation in this thesis, we will use the correlation analysis as well. The purpose of correlation analysis is to determine the relations between two or more variables. In our study important variables are:

1. Calculated operational risk value;
2. Market share of insurance company
3. Available solvency margin;
4. Estimated solvency margin.

Using paired correlation method, we will determine how strong correlation is between these variables.

4 Table. Correlation coefficient values scale

Very strong	Strong	Medium	Weak	Very weak	No correlation
-1	from -1 to -0,7	from -0,7 to -0,5	from -0,5 to -0,2	from -0,2 to 0	0
1	from 1 to 0,7	from 0,7 to 0,5	From 0,5 to 0,2	from 0,2 to 0	0

Correlation results might vary from 0 to ±1, were ±1 means very strong correlation, and 0 – no correlation at all. It is considered that correlation is strong if the result is between ±1 and ±0,7, medium - ±0,7 to ±0,5 and so on. In case of estimation the results, we will use correlation coefficient values scale, which is provided 4 table.

The equation for the correlation coefficient is the following:

$$Correl\ (X,Y) = \frac{\sum(x-X)(y-Y)}{\sqrt{\sum(x-X)^2 \sum(y-Y)^2}} \quad [9]$$

where:

X and Y are the average sample means, in our cases there will be made three analyses between:

1. X – calculated operational risk; Y – market share;
2. X – calculated operational risk; Y – available solvency margin;
3. X – calculated solvency margin; Y – estimated solvency margin.

This part presents the methodology will be used in the further investigations. The highlights of this part could be distinguished as follows:

- The scope of operational risk valuation in this thesis will cover 6 Lithuanian non – life insurance companies: "Lietuvos Draudimas", ERGO, PZU, If, Gjensidige and Seesam;
- Analysis will be made for the previous five years: from 2010 to 2014;
- For operational risk calculation will be used [8] formula;
- From obtained results correlation analysis will be made;
- Scientific literature analysis and investigations will lead to conclusions about the valuation of operational risk.

3. THE OPERATIONAL RISK VALUATION IN LITHUANIA NON - LIFE INSURANCE COMPANIES

3.1. THE HYPOTHESIS ANDCONCEPT OF VALUATION THE OPERATIONAL RISK

To summarize the theory data and information from the first chapter, with a methodology part in the second chapter, it might sound not like a surprise that operational risk valuation has a significant role in overall risk assessment process. If we look to total risk distribution and what part of it takes operational risk, purely statistically it is not a meaningful peace (depends on company but usually up to 1/5 from all risk distribution), but from the losses prospective it is one of the most characteristic and critical value. Let us think about an example when insurance company provides travel insurance for customers and in case of acute illness or accident, it is necessary to repatriate client to his home country. There are many different scenarios and success stories about happy end, but what if transportation of patient did not succeed and patient died during the flight. If such worst scenario would happen, this would be enormous blow for company's reputation and eventually can even end with company's collapse. Insurance is usually about the trust, and that is why operation risk, which covers risk, related to people, is so important.

As it was analysed before, there are many different ways how operational risk could be evaluated. Just to be more concentrated, we will distinguish to stay with one approach. So one of ways is to create company's own self-assessment model and another - to use standard risk calculation/valuation formula, which is provided in Solvency II requirements. In this research, we will stick with this widespread standard risk evaluation formula and operational risk considered to be evaluated through this method.

In case of proper operational risk evaluation from the different prospective, the following hypotheses were distinguished:

H1. Lithuanian non – life insurance Company's market size depends on operational risk amount - the higher company's market share, the greater operational risk value;

H2. Calculated operational risk has a strong correlation with available solvency margin (ASM) and required solvency margin (RSM);

and using the methods of data collection, processing the information and mathematical calculations, the conclusions will be accomplished. Finally, we will look in what is done already in preparation stage for Solvency II implementation.

3.2. THE LINKS BETWEEN OPERATIONAL RISK AND INSURANCE COMPANY'S MARKET SHARE

Probably it is likely to think, that the bigger company is, the greater amount of operational risk should be. If we will look to the basic formula [7] which is used for the operational risk calculation, we will see that the result depends on premiums earned this and previous year and technical provisions. So the higher these values, the greater total result. That is why the first hypothesis is about the operational risk value and market concentration. Lithuanian insurance market is quite interesting – here operates only foreign branches. That is why it is worth to look whatever or not this will have an impact on raised hypothesis.

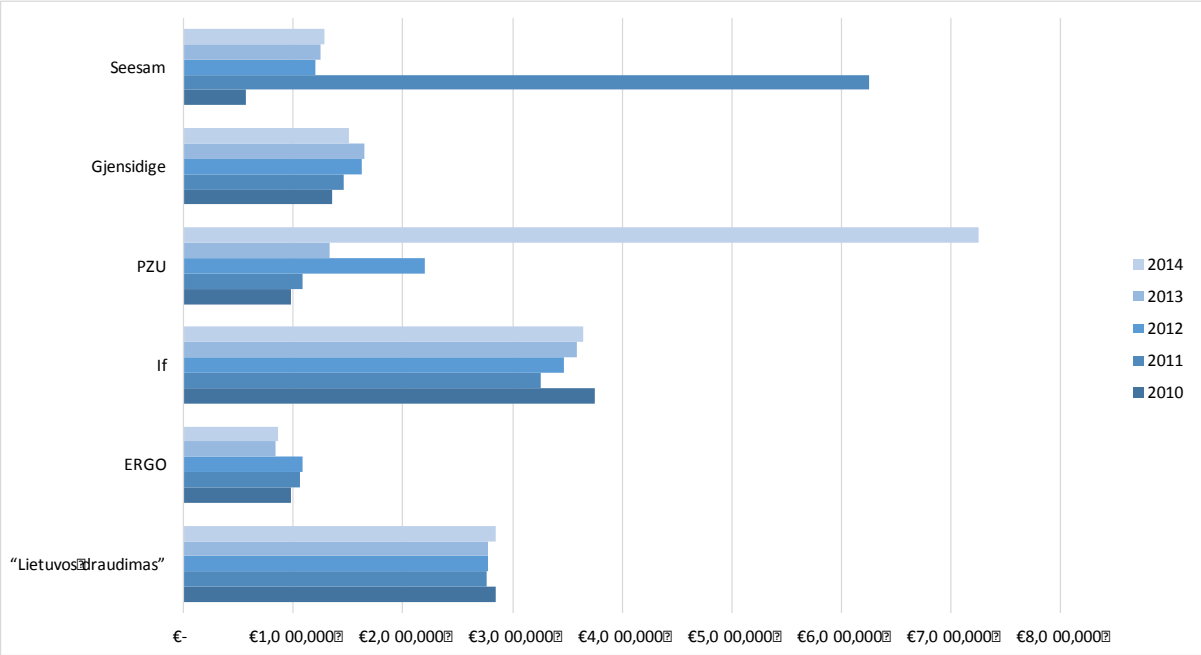
To define, whatever or not the operational risk value and market share has correlation, it is necessary to obtain two values – operational risk and market share.

For operational risk calculation were taken 6 non – life insurance companies and their financial results for the past 5 years. Using before mentioned [8] standard formula for operational risk calculation:

$$Op = (0{,}03 \times Earn_{non-life} + max(0; 0{,}03(Earn_{non-life} - 1{,}2 \times pEarn_{non-life}); (0{,}03 \times \max(0; TP_{non-life})) \quad [8]$$

and the following results (Figure 7) were obtained.

7 Figure. Operational risk values from 2010 to 2014



Source: made by author

All detailed calculations are provided in 1 - 2 Appendixes and here we will look only for summarized graphs.

Highlights from the 7 Figure: the chart shows the results of operational risk values during the past 5 years – from 2010 to 2014. As we see, values vary from minimal of € 567 082, 98 (Seesam 2010) up to €7 247 260,92 (PZU in 2014). In general, if we will look to each company separately, the values of operational risk each year - to - year are more or less stable. Absolute stability demonstrates "Lietuvos Draudimas" – there changes do not exceed a couple percentages, quite similar are Gjensidige, Other insurance companies -ERGO and IF – their results year – by – year vary up to 5%.

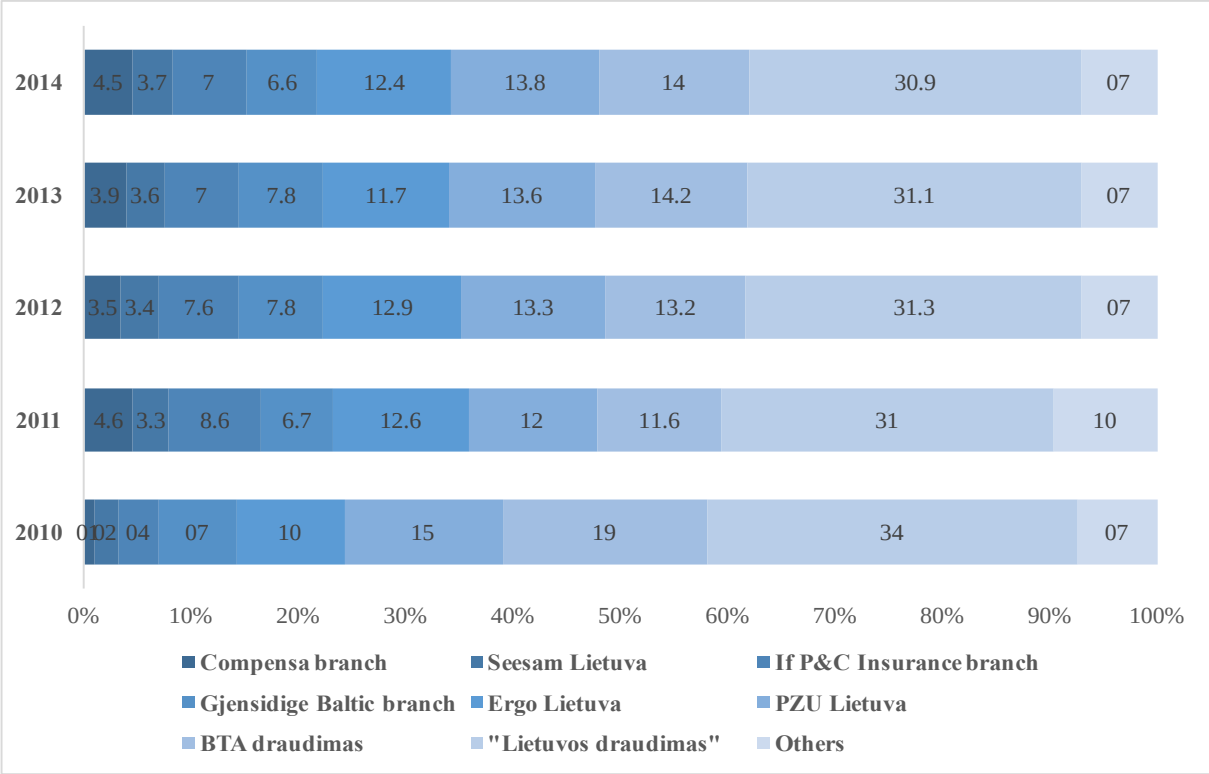
In the graph clearly noticeable, two "pranks" –Seesam in 2011 and PZU in 2014 – these years values significantly raised in comparison with other years and other insurance companies. If we will look to the market news, what happened for these companies and caused such anomalies, in 2011 Seesam had one significant resonant event – burned one large restaurant - "Karaliska kibinine". As explains Seesam it, in the end of the year this accident caused that Seesam covered 40% more damages than previous year. Probably the sharpest PZU news in 2014 is that due the strategy to expand in European Union, Poland insurance company PZU S.A. has bought "Lietuvos Draudimas" shares. Although in Lithuania operates only PZU branch, the total group results could have an impact to this deviation.

Accumulated results shows that the lowest operational risk is in ERGO insurance company, and the highest – in IF insurance company. So if we will follow up our H1 hypothesis that the higher value of operational risk, the greater company's market size, that means that in Lithuania the smallest market share overall has ERGO and the highest – IF. The TOP – 5 non – life insurance companies of operational risk value look like:

1. If
2. "Lietuvos Draudimas"
3. "Gjensidige"
4. PZU
5. Seesam

This only one part of the raised H1 hypothesis. Another part is statistics - what part of market share analyzed insurance companies took over the last past 5 years. The data was taken from "Lietuvos bankas" archives. The other, smaller insurance companies than we analyze in this research, were grouped into one and the following results (look 8 Figure) were established. More information that is detailed is provided in 3 Appendix and here again we see accumulated results.

8 Figure. Market share of non – life insurance companies in Lithuania from 2010 to 2014



Source: made by author

From 8 figure we can see that Lithuanian insurance market sharing 8 major market participants, and all together they cover more than 90% of total market. This tendency is very bright from 2010 and situation never changed. One more thing – each company more or less holds its position of market share, the changes during last year's reaches only 3-5%. This observation is equal to previous showed 7 Figure – during the past years there is no sharp movement of holding market share position. Absolute leader is "Lietuvos Draudimas".

Now if we would split all companies to one indicator – percentage of market share - our TOP-5 non – life insurance companies would be listed the following:

1. "Lietuvos Draudimas"
2. BTA;
3. PZU;
4. If;
5. Seesam.

To make a comparison more understandable, we will put our two lists of TOP - 5 into one table. The results are provided in 5 table.

5 Table. Operational risk vs. market size

TOP 5 of Operational risk	TOP 5 of Market share
1. "Lietuvos Draudimas" 2. BTA; 3. PZU; 4. If; 5. Seesam	1. If 2. "Lietuvos Draudimas" 3. "Gjensidige" 4. PZU 5. Seesam

Source: made by author

According to the results and purely statistically our H1 hypothesis is false – it is not true that the higher market share, the greater operational risk.

In this case, results can be seen in two ways. Usually the market size does correlate with operational risk value. The main reason why it cannot work in Lithuania case is that many insurance companies are not Lithuania – origin, usually they have foreign shareholders (If – Finland, ERGO – Estonia etc.) and here, in Lithuania, operates only their branches. In addition, because of that, many of them, provides group results in annual financial statements, and not separately branch results. However, as our aim is operational risk valuation, and not Lithuanian insurance market analysis, this is enough to deny H1 hypothesis.

9 Figure. Accumulated results of operational risk and market share

Source: made by author

The summary of H1 hypothesis is shown in 9 Figure.

On this basis, additional correlation analysis was made and the results showed the following (see table 6):

6 Table. The correlation between operational risk and market share

Operational risk and market share	CORREL
"Lietuvos draudimas"	0,56
ERGO	0,27
If	-0,86
PZU	0,17
Gjensidige	0,64
Seesam	0,17

Source: made by author

Calculations that are more detailed are provided in 4 Appendix.

The correlation analysis shows the same as previous investigation – we can neither confirm; neither deny the hypothesis. If insurance company shows the strongest correlation, Gjensidige and "Lietuvos Draudimas" – medium correlation, ERGO weak and the last ones – Seesam and PZU – poor correlation. One interesting thing here – the very weak correlation shows companies, who have non – normal jump of operational risk values (PZU 2014 and Seesam 2012). If we will eliminate them and put the average value instead, PZU correlation will be -0,099 and Seesam 0, 99.

This study has a limitation - all data taken from Lithuanian insurance companies financial statements despite the fact that not all of them provide only Lithuanian branch results. To sum up the results we have received and taking into consideration previously mentioned facts, we cannot deny the fact, that there are links between the operational risk amount and market share.

3.3. THE LINKS BETWEEN OPERATIONAL RISK AND SOLENCY MARGIN

Currently, Lithuanian insurance companies' solvency measurement is based on two indicators – Available Solvency Margin (ASM) and Required Solvency Margin (RSM) comparison. This is defined in Solvency I Directive.

Available Solvency Margin (ASM) shows the amount of capital, which can be used as marginal capital to fulfill the insurance companies' obligations. By using it, own capital together with other company's capital, which has own capital features, is decreased by intangible assets, next period expenses, delayed receivables, off – balance liabilities and other limited reliable asset size.

Required Solvency Margin (RSM) indicator shows potential amount of such liabilities, taking into consideration current insurance companies' activity measure. This indicator for non – life insurance companies are equal to higher amount from contributions and insurance benefits indicator, adjusted with reinsurance indicator.

Moreover, ASM indicator cannot be less than Guarantee Fund (GF), which now is not lower than 2,5 m. EUR, depending on non – life insurance companies' activity. In this case, requirement to maintain GF is an additional protector, which guarantees non –life insurance companies' stability at the beginning, when managing portfolio risk, due small insurance scope, cannot rely on big numbers principles (Linartas, 2003).

To evaluate operational risk and its impact on solvency, we need to follow [8] formula. The problem is that for BSCR calculation it is necessary to have NAV (Net Asset Value) size, which is available only from the scenarios, which are set in advance according different company's activity risks. In our case this information is not available according data protection (it is not possible to retrieve it from public annual financial statements companies are sharing), that is why instead of BSCR size in further part of study and hypothesis testing we will use statutory and currently calculated by insurance companies' solvency margin size.

The purpose of hypothesis H2 and correlation analysis is to determine the relations between two or more variables. In our study, important variables are calculated operational risk value, available solvency margin and estimated solvency margin. Using paired correlation method, we will determine how strong correlation is between them. Calculations are provided in 5 - 7 Appendixes, here we have a summary of studies were made.

First part of the raised hypothesis H2 is about Available Solvency Margin and its correlation with Operational risk. The obtained results are are provided in 7 table.

7 Table. Correlation between operational risk and available Solvency Margin

Available Solvency Margin and Operational risk of:	CORREL
"Lietuvos draudimas"	-0,07
ERGO	-0,96
IF	-0,61
PZU	0,92
Gjensidige	-0,91
Seesam	-0,76

Source: made by author

The correlation analysis shows, that results vary from -0,07 (poor correlation) to -0,96 (strong correlation). Despite that, the half - 3 of 6 presented non – life insurance companies has a strong correlation, 2 of them – medium, and only "Lietuvos draudimas" has a weak correlation.

From this point of view the conclusion could me made that Operational risk value has a negative correlation with available solvency margin. This shows that when the value of operational risk decreases, the available solvency margin increases and the positive correlation (in PZU case)

means that when the value of operational risk increases, available solvency margin decreases. In "Lietuvos draudimas" case the result near 0, that means that there is no correlation at all. The correlation between these two variables in no way shows causenes – this is only the prove dependance between these two numbers.

Next part of our raised H2 hyphothesis, is operational risk versus estimated solvency margin. Estimated solvency margin is also one of the figure, which insurance companies currently have provide in their financial reports. The Table Nr. 8 shows the results of correlation analysis between these two variables.

8 Table. Correlation between operational risk and Estimated Solvency margin

Estimated Solvency Margin and Operational risk of:	CORREL
"Lietuvos draudimas"	0,41
ERGO	-0,88
IF	-0,62
PZU	0,97
Gjensidige	0,15
Seesam	0,15

Source: made by author

In this case, the situation is slightly different to compare with the previous one. Results vary from 0, 97 (very strong correlation) to 0, 15 (weak correlation). Here again, we can see some examples of negative correlation, and some results are very close to zero.

Although strong correlation shows two of six companies results (33, 3%), other four are in the range of medium to weak. This suggests that there is very limited correlation between operational risk value and estimated solvency margin. If we would look separately to each insurance company, we will notice that PZU and ERGO has a strong correlation in both cases, and medium correlation has IF insurance companies. Other ones do not have any relationship (for example Gjensidige has strong correlation in ASM, but very weak in ESM).

To sum up, we can conclude that the results we have received are quite doubtful. From this point of view, the question could be raised - if available solvency margin and estimated solvency margin are appropriate indicators for company's solvency measurement. This mean that current solvency measurement according Solvency I methodology is not efficient and new Solvency II indicators can fix it in the near future.

3.4. THE ASSESSMENT OF NON – LIFE INSURANCE COMPANIES' RISK CONTROL INSTRUMENTS

In order to figure out if Lithuanian insurance companies are ready for Solvency II implementation, the following 6 sections will provide a summary of "Lietuvos Draudimas", ERGO, PZU, If, Gjensidige and Seesam insurance companies risk control and management tolls, companies are using already.

"Lietuvos Draudimas" risk control management

Currently in-published "Lietuvos Draudimas" financial statements, company do not exclude operational risk as such in a separate section. Company provides general financial and insurance risk management policy, which includes the most important risk management fields:

1. Insurance risk
2. Claim delay risk
3. Interruption risk
4. Mortality risk
5. Financial risk
6. Interest rates risk
7. Concentration risk
8. Credit risk
9. Liquidity risk
10. Pricing risk

Technical provisions, claim regulation, major events, insurance risk administration expenses are discussed at Risk and requirements compliance committee. For risk, management is responsible legal, compliance and risk management department.

ERGO risk control management

Operational risk in ERGO insurance company is also under control s a separate risk. Operational risk is managed through the **internal control system**. The company has identified, analyzed and assessed both company-wide risks and the risks inherent in its significant processes including IT risks. There are measures in place for improving risk control and for mitigating risks. The company's internal control and risk management systems deal with both risks arising from everyday operations as well as compliance and financial reporting risks. The model adopted by the company allows identifying risks that are common to different departments and processes. Operational risks are identified, analyzed and assessed on a regular basis.

To mitigate personnel risk, the company has established **guidelines for avoiding conflicts**

of interest. In addition, a system of powers and authorities, segregation of duties, internal regulations and random checks of business transactions, counteract corporate misconduct.

Due to extensive reliance on the IT systems, many IT risks such as system malfunctions and failures, loss of data and external system attacks, threaten the company. IT risks are mitigated by preventive measures such as **emergency planning, backup solutions and access controls.**

To mitigate the risks resulting from business interruption, the company has adopted **business continuity plans**, which include instructions on how to act as well as alternative and recovery procedures for emergency and crisis situations.

Legal and regulatory changes including changes in supervision regulations may have a strong impact on the insurance business. Every change entails both threats and opportunities. Therefore, legal and regulatory changes are monitored on an ongoing basis. To mitigate the risks, the company participates in the Estonian Insurance Association and its subsidiary bodies.

To increase the organization's risk awareness, the company includes in risk management specialists from different departments. The policy of improving risk recognition and awareness and establishing an appropriate risk culture is consistently enforced. The company's approach is that it is important to learn from mistakes and to accept them as development opportunities.

IF risk control management

If has operational risk management system. The responsibility to identify, evaluate, control and mitigate operational risks lies within the line organization. The Company identifies operational risks through different processes:

- **Operational and Compliance Risk Assessment process:** self-assessments identifying operational risks are performed quarterly. Identified risks are assessed from a like hood and impact perspective. The control status for each risk is assessed where a traffic light system is used: Green – good control of risk, Yellow – attention required, Red – attention required immediately. The most severe risks with control status yellow or red are reported quarterly also to the Operational Risk Committee of the If Group;
- **Trend analyses** are performed on a yearly basis, during which the most important trends affecting the insurance industry are identified and the effects on the Company are assessed. In this process, the most severe external operational risks are identified;
- Incidents are reported via a **web-based system**. The reported incidents are received by the line organization in order to perform analyses.

The continuity of operational risk management is secured through the Operational Risk coordinators activities on Business Units level and the Chief Risk Coordinator activities on Company level.

The Business Units ensure that they have the resources and tools in place to report, as required, to the Company's Chief Risk Coordinator. The Chief Risk Coordinator works across all business units, evaluating and supporting the units in their work to identify, assess, mitigate and monitor all risks. The Company's Chief Risk Coordinator quarterly provides the Management Board and If Group Operational Risk Committee (ORC) with a risk report. The ORC of If Group coordinates the operational risk process and ensures its continuity. The committee's task is to provide opinions, advice and recommendations to the Own Risk and Assessment Committee (ORSAC) and report the current operational risk status.

In order to manage operational risk, the Company has approved a number of **different steering documents:** Operational Risk Policy, Contingency Plans, Security Policy, Outsourcing Policy, Complaints Handling Policy, Claims Handling Policy, and other steering documents related to different parts of the organization. These documents are being reviewed and up dated at least yearly. In addition to this the Company has detailed processes and guidelines in order to manage possible external and internal frauds. Internal training on ethical rules and guidelines is always on going.

In the Company, legal risk, which is included in the definition of operational risk, is defined as changes in law or regulation, a truly unpredictable legal development, and defective documentation/transactions. The Legal Unit is responsible for identifying legal risks within the Company. In addition, the Legal Unit is responsible for being updated on legislation, case law and products in relation to the insurance business. The Company's Chief Risk Coordinator quarterly provides the Management Board and the ORC with a risk report.

PZU risk control management

In PZU, risk management policy operational risk is excluded. The risk management is ensured under the following way:

1. The initial control measures, implemented in process organization stage and constantly valuated by companies' management;
2. The company has internal audit service to ensure the control of business process;
3. In order to optimize the organization of the process, the company has started implementation of advanced information system.

Gjensidige risk control management

The company has approved a risk management and internal control policies. The documents describe the main risk management, internal control principles and share of responsibilities. Risk management in Company has two key issues: do not take higher risk, company can manage and create value for customers and shareholders.

Each year company's Board reviews the most important risk areas and internal control instruments.

Board responsibilities:

- To ensure quick and effective establishment of risk management and internal control processes;
- To ensure that these processes are properly established, implemented and enforced. Also to discuss on compliance and risk management reports, which are submitted by director of the Board;
- To ensure that the risk management and internal control are integrated into company's strategy and business process;

Director's responsibilities:

- To ensure that company's risk management and internal control would be properly implemented, monitored and documented. Also to provide instructions and guidance on quick company's risk management and internal control settings.

Company risk control positions are determined by three-defense lines principle. The company has centralized risk control positions, which are independent from operating acidities. In addition, there are independent internal fraud audit functions.

Seesam risk control instruments

The company regards legal risk as part of its operational risk.

Implementation and enforcement of the company's operational risk policies is the responsibility of company's management board. In the company's everyday operation, this responsibility is assigned to heads of departments and functions. Seesam maps its operational risks and conducts threat assessments across the Baltics on a regular basis at least one a year.

Seesam's business operations are highly dependent on information technology and IT systems. Partly, IT solutions have been outsourced. Seesam pays close attention to the security of this databases and endeavors to prevent risk that may result from viruses or system malfunctions or failures. The company has adopted business continuity and disaster recovery plans for it IT systems.

Seesam has established clear outsourcing rules and, in order to mitigate business continuity risk, has adopted a Business Continuity Plan (BCP) developed in partnership with the parent company's risk management specialists. In planning nosiness continuity activities, it is considered the three main threats faced by contemporary companies: something might happen to staff, or there might be an extensive failure in the IT systems. According to the BCP plan, when a threat occurs, crisis committee will be formed, which will be responsible for commencing the planned activities and disseminating information about the situation. Business continuity is tested according BCP testing

plan and BCP is revised and updated as and when necessary.

Summary of non – life insurance companies risk control management

From the beginning of the next year Lithuanian insurance companies will start to live in a new rhythm – Solvency II Directive will start functioning. The implementation of those changes suddenly is not possible, so majority of homework – both in The Central Bank of Lithuania and insurance companies - is almost done – says ERGO Insurance Director Saulius Jokubaitis. To verify this fact, we have reviewed the biggest Lithuanian non – life insurance companies' rapports about current risk management strategy. The focus is on operational risk management and the summary of this investigation is provided in 10 Table.

Table 10. Operational risk management in insurance companies

	LIETUVOS DRAUDIMAS	ERGO	If	PZU	GJENSIDIGE	SEESAM
Operational risk is segregated	no	yes	yes	yes	no	yes
Internal control system	yes	yes	yes	yes	yes	n/a
Resposible body for risk management	Legal, compliance and risk management departament	Involved risk management specialists from different departaments	Legal unit	Company's management body	Board and Director	Management Board
Threat assesments	n/a	n/a	quarterly	periodically	each year	once a year
IT risk management	n/a	Emergency planning, backup solutions and access controls	n/a	n/a	n/a	Disaster recovery plans
Continuity risk	n/a	Business continuity plan	Operational risk coordinators on Bussiness level and Chief Risk Coordinator	Businees continuity plan	n/a	Business Continuity Plan (BCP)

Source: summarized by author

The summary shows that majority of companies monitor operational risk as a separate risk already. Fact that in other companies' operational risk is not separated, does not mean that company does not manage it already; due privacy policy, some data might be unknown, and at this preparation phase, it is not required to publish such information.

All companies have internal control system (internal fraud management, internal audit or other control tools) and responsible body. Threat assessment is made periodically, many companies take into consideration IT and continuity risk management and have done some plans or scenarios based on possible backup.

In summary we can say that it seems Lithuanian insurance market has done its homework properly – many requirements are implemented are being done already.

CONCLUSIONS

This research provides the financial characterization of operational risk. This characterization originates in the scientific literature and mathematical calculations, which in combination with financial results lead to evaluation of operational risk. The results of literature analysis and valuation of operational risk in Lithuanian non – life insurance companies showed the following:

1. Operational risk is one of the most important risks of all scope of risks (liquidity, credit and market risks) because inefficient or inappropriate risk operational risk management causes huge financial losses.
2. Operational risk is probably the area where methodology is least developed. Some companies are attempting to develop stochastic operational risk models while others are using simple formula, an approach that has also been favored by some regulators. Operational risk requires further research and there is a possibility to refer to work done in other related industries.
3. Exclusive feature of operational risk – this type risk is not assumed, targeted to seek the benefit, but occurs itself, because of normal company's activity. That is why it is difficult to measure this risk and evaluate.
4. The scientific literature analysis showed that many analyses were made regarding solvency in banking sector. This sector was very first who made conclusions on global financial crisis and past failures of biggest banks and have started to look for a ways that financial stability and risk management could be measured. This is how Basel system was created; following this concept, insurance industry adopted Solvency directive for insurance companies.
5. Despite the fact, that Solvency implementation in insurance industry has exclusively positive impact both for insurers and for policyholders, one thing still missing in this system. Solvency is only about rapports making – provide the information about the current situation and solvency margin. Insurance companies still do not have guidelines of actions should be taken if indicators are not good or how to improve them. There could be a methodology of *best practice*, how to reach desirable numbers in the future.
6. It is definitely precious that Solvency II finally will take into account operational risk. However, in the same time it is important do not forget, that insurance company's solvency is measured by a combination of different risk and not only by this particular indicator.
7. In thesis, the operational risk was calculated for six Lithuanian non – life insurance companies for 2010-2014 time and results were compared with current solvency requirements.
8. One of raised hypothesis - the higher market share, the greater operational risk value is - was not declined. The data limitations did not allow analyze properly the correlation between these two variables, however operational risk amount and market share have connection.

9. Other hypothesis was more declined than confirmed – study showed doubtful correlation between operational risk and available solvency margin (ASM) and required solvency margin (RSM). Currently used Solvency I methodology errors for solvency measurement can be fixed together with Solvency II implementation.
10. Finally, the last investigation was dedicated to the preparation of Solvency II implementation on operational risk management aspect. The analysis of Lithuanian insurance companies risk management showed that many companies have implemented the legal operational risk requirements, regarding IT, internal control and business continuity risk management already.

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ANNOTATION

Master thesis covers operational risk valuation approach in non – life insurance companies. Scientific literature review and many other publications disclosed operational risk exist longer than we know, but as a separate field started to be evaluated only recently. The precedent given was worldwide known events of many financial institutions failure due inefficient risk management, as some of the risks were not taking into consideration at all and global financial crisis. Operational risk as such is not targeted seeking the benefit, but occurs itself, because of normal company's activity. That makes it specific and difficult to measure and evaluate. These facts led to establishment of guidelines for such risk management – vey first was banking sector with Basel system and according to this example, Solvency II Directive was developed. Solvency II created a methodology how operational risk should be measured calculated. Using Solvency II guidelines for operational risk valuation, it was calculated the Lithuanian non – life insurance market operational risk value and made an analysis of this indicator correlation with current solvency requirements such as available solvency margin and required solvency margin.

Key words: operational risk, Solvency II, non –life insurance, Lithuanian non – life insurance, risk management

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SUMMARY

Effective risk management and financial stability are key figures insurance company is seeking nowadays. Many authors (Linartas and Kavaliauskaitė, 2012; Karam 2014; Kraujelis *et al*., 2006, Tchankova, 2002; Buskeviciute and Leskeviciute 2008) in their studies point out the importance of operational risk evaluation. Make operational risk features, such as complicated evaluation, unpredictability and much more faces to the fact that further investigations should still. Financial institution failures during the past decades and global financial crisis showed the importance of proper and complex risk management. Banking sector was the first who created requirements and following this example an insurance industry will open a new page in a history, because from 2016 will come into force Solvency II requirements, set for all insurance companies. Based on these requirements, there are methodologies how operational risk shall be calculated and evaluated.

Based on these recommendations, operational risk in Lithuanian non –life insurance companies were calculated in this thesis and results were compared in different approaches. Analysis has showed that the market share insurance company takes place in Lithuania *should* have a links with the amount of operational risk. In this case, we cannot make a comparison between Lithuanian insurance companies, because of data limitations - the financial results companies are providing in annual financial reports, not always branch results, quite often it it whole group results. Secondly, currently used Solvency I methodology for solvency measurement is not efficient - the amount of operational risk and Available Solvency Margin (ASM) with Required Solvency Margin (RSM) have a negative correlation. Finally, the analysis of Lithuanian insurance companies risk management showed that companies have implemented the majority of legal requirements for operational risk already. These findings lead to conclusion that Lithuanian insurance market has high standards, which help to ensure constant financial stability.

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APPENDIXES

1 APPENDIX. OPERATIONAL RISK CALCULATION FROM 2010 TO 2014

	2010	2011	2012	2013	2014
"Lietuvos draudimas"	€ 2 851 156,41	€ 2 768 143,14	€ 2 776 318,66	€ 2 771 438,81	€ 2 851 178,05
Earn	€ 97 013 369,73	€ 95 128 778,96	€ 102 390 620,66	€ 113 068 863,53	€ 117 064 973,35
pEarn	€ 115 810 730,13	€ 97 013 369,73	€ 95 128 778,96	€ 102 390 620,66	€ 113 068 863,53
TP	€ 95 038 546,98	€ 92 271 437,96	€ 92 543 955,34	€ 92 381 293,73	€ 95 039 268,42
ERGO	€ 981 140,06	€ 1 059 135,82	€ 1 087 947,59	€ 841 420,43	€ 867 051,47
Earn	€ 32 902 325,65	€ 35 837 202,56	€ 40 852 420,35	€ 29 605 534,06	€ 28 283 582,60
pEarn	€ 43 427 905,47	€ 32 902 325,65	€ 35 837 202,56	€ 40 852 420,35	€ 29 605 534,06
TP	€ 32 704 668,67	€ 35 304 527,34	€ 36 264 919,78	€ 28 047 347,66	€ 28 901 715,71
If*	€ 3 753 869,40	€ 3 253 110,00	€ 3 472 950,00	€ 3 582 750,00	€ 3 644 640,00
Earn	€ 109 286 657,00	€ 110 034 638,00	€ 110 955 000,00	€112 876 000,00	€118 647 000,00
pEarn	€ 136 451 812,20	€ 109 286 657,00	€ 110 034 638,00	€110 955 000,00	€112 876 000,00
TP	€ 125 128 979,90	€ 108 437 000,00	€ 115 765 000,00	€119 425 000,00	€121 488 000,00
PZU	€ 980 168,31	€ 1 083 546,76	€ 2 200 515,24	€ 1 333 482,19	€ 7 247 260,92
Earn	€ 34 646 386,99	€ 33 284 109,13	€ 40 914 025,43	€ 46 554 037,30	€ 61 273 889,02
pEarn	€ 41 632 328,26	€ 34 646 386,99	€ 33 284 109,13	€ 40 914 025,43	€ 46 554 037,30
TP	€ 32 672 276,99	€ 36 118 225,50	€ 40 579 549,35	€ 44 449 406,28	€ 75 268 542,34
Gjensidige	€ 1 355 376,52	€ 1 467 129,35	€ 1 626 648,18	€ 1 644 576,44	€ 1 512 330,00
Earn	€ 55 466 624,20	€ 51 202 259,30	€ 57 965 197,70	€ 65 154 999,45	€ 62 303 000,00
pEarn	€ 75 756 862,30	€ 55 466 624,20	€ 51 202 259,30	€ 57 965 197,70	€ 65 154 999,45
TP	€ 45 179 217,40	€ 48 904 311,60	€ 54 221 606,08	€ 54 819 214,80	€ 50 411 000,00
Seesam	€ 567 082,98	€ 6 254 576,93	€ 1 200 000,00	€ 1 248 000,00	€ 1 287 000,00
Earn	€ 26 434 030,05	€ 36 869 333,00	€ 43 757 561,00	€ 49 327 753,00	€ 52 411 132,00
pEarn	€ 28 834 541,90	€ 26 434 030,05	€ 36 869 333,00	€ 43 757 561,00	€ 49 327 753,00
TP	€ 18 902 766,00	€ 39 100 000,00	€ 40 000 000,00	€ 41 600 000,00	€ 42 900 000,00
Compensa*	€ 7 225 070,06	€ 78 383 583,09	€ 10 587 432,38	€ 11 391 151,57	€ 9 201 574 893,49
Earn	€ 73 139 709,30	€ 161 311 877,91	€ 184 221 343,02	€ 182 104 122,09	€ 9 145 728 000,00
pEarn	€ 72 183 598,84	€ 73 139 709,30	€ 161 311 877,91	€ 184 221 343,02	€ 182 104 122,09
TP	€ 240 835 668,60	€ 300 078 523,26	€ 352 914 412,79	€ 379 705 052,33	n/a

2 APPENDIX.: OPERATIONAL RISK CALCULATION FROM 2010 TO 2014 (SOURCES)

	"Lietuvos draudimas"	ERGO	If	PZU	Gjensidige	Seesam
2010	http://www.ld.lt/sites/default/files/uploads/LD%2BMetine%2Bataskaita_2010m.pdf	http://www.ergo.lt/files/ataskaitos/2010/ERGO%20Lietuva%20SAA%202010%20Lt.pdf	https://www.if.lt/web/lt/SiteCollectionDocuments/Finansines%20ataskaitos/If_Annual_Report_2010.pdf	https://www.pzu.lt/lt-lt/apie-mus/financial-info?mediaId=bcf64ca2-44f7-428c-b70b-0dee82bb6d41	http://gjensidige.lt/files/Finansinės%20ataskaitos/Gjensidige_2010_ENG_druka_EN-LT%20EB_RED_galutinis.pdf	https://www.seesam.ee/financial-results/l6v8xncdwd.pdf
2011	http://www.ld.lt/sites/default/files/uploads/LD%2Bmetine%2Bataskaita%2Buz%2B2011.pdf	http://www.ergo.lt/files/ERGO%20Lietuva%202011%20metine.pdf	https://www.if.lt/web/lt/SiteCollectionDocuments/Finansines%20ataskaitos/IF-Annual-report-2011.pdf	https://www.pzu.lt/lt-lt/apie-mus/financial-info?mediaId=4d251488-432e-4965-845f-b073f630122b	http://gjensidige.lt/files/Finansinės%20ataskaitos/Gjensidige_2011_ENG_final_with-signature_EN-LT%20EB_RED.pdf	https://www.seesam.ee/financial-results/6hisokbpio.pdf
2012	http://www.ld.lt/sites/default/files/uploads/Metine%2Bataskaita%2Buz%2B2012%2Bmetus%282%29.pdf	http://www.ergo.lt/files/ADB%20ERGO%20Lietuva%20SAA%202012%20LT.pdf	https://www.if.lt/web/lt/SiteCollectionDocuments/Finansines%20ataskaitos/If-Annual-Report-2012.pdf	https://www.pzu.lt/lt-lt/apie-mus/financial-info?mediaId=064c3153-3238-4e7f-9d07-a3509035e513	http://gjensidige.lt/files/Finansinės%20ataskaitos/Finansine%20ataskaita%202012LT_RED.pdf	https://www.seesam.ee/financial-results/22g8hri6e6.pdf
2013	http://www.ld.lt/sites/default/files/uploads/LD%20metine%20ataskaita%20uz%202013%20metus.pdf	http://www.ergo.lt/files/ERGO%20Insurance%20SE%20annual%20report%202013.pdf	https://www.if.lt/web/lt/SiteCollectionDocuments/Finansines%20ataskaitos/If-Annual-Report-2013.pdf	https://www.pzu.lt/lt-lt/apie-mus/financial-info?mediaId=f2ca0453-8053-48d4-a8d8-4c00bf537a30	http://gjensidige.lt/files/Dokumentai/2013_Gjensidige_finansine_ataskaita.pdf	https://www.seesam.ee/financial-results/n2mtm76le4.pdf
2014	http://www.ld.lt/sites/default/files/uploads/Metine-ataskaita-2014-f.pdf	http://www.ergo.lt/files/ERGO_Insurance_SE_Annual%20report_2014.pdf	https://www.if.lt/web/lt/SiteCollectionDocuments/Finansines%20ataskaitos/If-Annual-Report-2014.pdf	https://www.pzu.lt/lt-lt/apie-mus/financial-info?mediaId=de81d15d-2da9-4142-9019-ca149cd2ebb4	-	https://www.seesam.lt/uploads/files/Financial_reports/FinansineAtaskaita_2014m_full_web.pdf

3 APPENDIX. NON – LIFE INSURANCE COMPANIES' MARKET SHARE BY WRITTEN PREMIUMS FROM 2006 TO 2015

No.	Non-life insurance companie's market share by written premiums	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
1.	Vereinigte Hagelversicherung VVaG branch	0,0	0,0	0,0	0,0	0,0	2,8	1,0	1,1	1,1	2,3
2.	Compensa branch	0,0	0,0	0,0	0,0	0,9	4,6	3,5	3,9	4,5	4,4
3.	Seesam Lietuva	1,1	2,0	2,3	2,2	2,3	3,3	3,4	3,6	3,7	3,2
4.	Industrijos garantas	1,4	1,8	1,6	2,1	2,8	n/a	n/a	n/a	n/a	n/a
5.	If P&C Insurance branch	0,0	0,0	0,0	3,6	3,9	8,6	7,6	7,0	7,0	7,6
6.	Lamantinas	4,0	3,9	4,3	4,1	4,2	1,1	1,1	n/a	n/a	n/a
7.	Gjensidige Baltic branch	0,0	3,7	3,9	8,2	7,2	6,7	7,8	7,8	6,6	6,3
8.	Ergo Lietuva	8,6	9,0	11,6	9,8	10,1	12,6	12,9	11,7	12,4	12,6
9.	PZU Lietuva	11,3	11,9	13,6	14,4	14,7	12,0	13,3	13,6	13,8	13,0
10.	BTA draudimas	10,7	18,0	14,1	18,9	19,2	11,6	13,2	14,2	14,0	13,4
11.	"Lietuvos draudimas"	29,0	31,3	32,2	35,5	34,4	31,0	31,3	31,1	30,9	30,3
12.	Others	35,3	20,1	18,0	7,0	7,1	5,7	4,9	6,0	6,0	6,9
	TOTAL:	64,7	79,9	82,0	96,6	96,7	94,3	95,1	94	94	93,1
		100,0	100,0	100,0	100,0	100,0	100,0	100,0	100,0	100,0	100,0

Source: www.lb.lt

4 APPENDIX. THE CORRELATION BETWEEN CALCULATED OPEARTIONAL RISK AND NON – LIFE INSURANCE COMPANIES' MARKET SHARE

	2010	2011	2012	2013	2014	CORREL
"Lietuvos draudimas"	2851156,41	2768143,14	2776318,66	2771438,81	2851178,05	0,559880364
	34,43	31,00	31,30	31,10	30,90	
ERGO	981140,06	1059135,82	1087947,59	841420,43	867051,47	0,273918901
	10,11	12,60	12,90	11,70	12,40	
If	3753869,40	3253110,00	3472950,00	3582750,00	3644640,00	-0,864060166
	3,86	8,60	7,60	7,00	7,00	
PZU	980168,31	1083546,76	2200515,24	1333482,19	7247260,92	0,166331748
	14,67	12,00	13,30	13,60	13,80	
Gjensidige	1355376,52	1467129,35	1626648,18	1644576,44	1512330,00	0,642155399
	7,16	6,70	7,80	7,80	6,60	
Seesam	582711,98	6254576,93	1200000,00	1248000,00	1287000,00	0,170533332
	2,25	3,30	3,40	3,60	3,70	

5 APPENDIX. CORRELATION ANALYSIS – ESTIMATED SOLVENCY MARGIN

"Lietuvos draudimas"	2010	2011	2012	2013	2014	CORREL
Estimated Solvency Margin	€18 628 606,64	€17 408 503,53	€18 378 245,77	€20 031 046,40	€20 325 218,08	0,406598492
	€ 2 851 156,41	€ 2 768 143,14	€ 2 776 318,66	€ 2 771 438,81	€ 2 851 178,05	
ERGO						
Estimated Solvency Margin	€ 6 425 833,53	€ 7 441 085,50	€ 8 107 545,18	€16 817 806,00	€17 215 597,00	-0,884643371
	€ 981 140,06	€ 1 059 135,82	€ 1 087 947,59	€ 841 420,43	€ 867 051,47	
IF						
Estimated Solvency Margin	€ 24 017,17	€21 008 000,00	€21 008 000,00	€21 008 000,00	€21 008 000,00	-0,622982622
	€ 3 753 869,40	€ 3 253 110,00	€ 3 472 950,00	€ 3 582 750,00	€ 3 644 640,00	
PZU						
Estimated Solvency Margin	€ 6 337 860,87	€ 6 545 973,70	€ 8 350 806,01	€ 9 362 908,94	€16 778 942,89	0,969378517
	€ 980 168,31	€ 1 083 546,76	€ 2 200 515,24	€ 1 333 482,19	€ 7 247 260,92	
Gjensidige						
Estimated Solvency Margin	€11 250 651,07	€12 010 464,87	€11 262 034,05	€11 774 268,07	€11 346 000,00	0,145307484
	€ 1 355 376,52	€ 1 467 129,35	€ 1 626 648,18	€ 1 644 576,44	€ 1 512 330,00	
Seesam						
Estimated Solvency Margin	€ 6 302 345,00	€ 8 239 616,00	€ 8 218 007,00	€ 8 720 858,00	€ 9 431 917,00	0,148775212
	€ 567 082,98	€ 6 254 576,93	€ 1 200 000,00	€ 1 248 000,00	€ 1 287 000,00	

Type equation here.

6 APPENDIX. CORRELATION ANALYSIS – AVAILABLE SOLVENCY MARGIN

"Lietuvos draudimas"	2010	2011	2012	2013	2014	CORREL
Available Solvency Margin	€47 241 302,42	€ 43 192 817,42	€54 332 361,56	€51 927 235,58	€ 50 331 070,73	-0,071972184
	€ 2 851 156,41	€ 2 768 143,14	€ 2 776 318,66	€ 2 771 438,81	€ 2 851 178,05	
ERGO						
Available Solvency Margin	€17 342 084,97	€ 15 873 781,86	€14 331 884,56	€34 583 794,00	€ 35 603 976,00	-0,958192428
	€ 981 140,06	€ 1 059 135,82	€ 1 087 947,59	€ 841 420,43	€ 867 051,47	
IF						
Available Solvency Margin	€ 86 549,15	€107 167 000,00	€88 295 000,00	€92 514 000,00	€113 598 000,00	-0,609510909
	€ 3 753 869,40	€ 3 253 110,00	€ 3 472 950,00	€ 3 582 750,00	€ 3 644 640,00	
PZU						
Available Solvency Margin	€10 261 590,30	€ 7 905 782,84	€ 9 210 429,22	€11 494 873,15	€ 17 882 073,39	0,920440943
	€ 980 168,31	€ 1 083 546,76	€ 2 200 515,24	€ 1 333 482,19	€ 7 247 260,92	
Gjensidige						
Available Solvency Margin	€13 007 898,33	€ 13 007 898,33	€12 349 108,47	€11 987 698,91	€ 12 524 000,00	-0,911080082
	€ 1 355 376,52	€ 1 467 129,35	€ 1 626 648,18	€ 1 644 576,44	€ 1 512 330,00	
Seesam						
Available Solvency Margin	€30 556 044,00	€ 24 527 302,00	€29 821 059,00	€32 484 684,00	€ 36 387 199,00	-0,764133326
	€ 567 082,98	€ 6 254 576,93	€ 1 200 000,00	€ 1 248 000,00	€ 1 287 000,00	

6 APPENDIX. TOTAL AVAILABLE AND ESTIMATED SOLVENCY MARGIN

"Lietuvos draudimas"	2010	2011	2012	2013	2014
Available Solvency Margi	€ 47 241 302,42	€ 43 192 817,42	€ 54 332 361,56	€ 51 927 235,58	€ 50 331 070,73
Estimated Solvency Margi	€ 18 628 606,64	€ 17 408 503,53	€ 18 378 245,77	€ 20 031 046,40	€ 20 325 218,08
ERGO					
Available Solvency Margi	€ 17 342 084,97	€ 15 873 781,86	€ 14 331 884,56	€ 34 583 794,00	€ 35 603 976,00
Estimated Solvency Margi	€ 6 425 833,53	€ 7 441 085,50	€ 8 107 545,18	€ 16 817 806,00	€ 17 215 597,00
IF					
Available Solvency Margi	€ 86 549,15	€ 107 167 000,00	€ 88 295 000,00	€ 92 514 000,00	€ 113 598 000,00
Estimated Solvency Margi	€ 24 017,17	€ 21 008 000,00	€ 21 008 000,00	€ 21 008 000,00	€ 21 008 000,00
PZU					
Available Solvency Margi	€ 10 261 590,30	€ 7 905 782,84	€ 9 210 429,22	€ 11 494 873,15	€ 17 882 073,39
Estimated Solvency Margi	€ 6 337 860,87	€ 6 545 973,70	€ 8 350 806,01	€ 9 362 908,94	€ 16 778 942,89
Gjensidige					
Available Solvency Margi	€ 13 007 898,33	€ 13 007 898,33	€ 12 349 108,47	€ 11 987 698,91	€ 12 524 000,00
Estimated Solvency Margi	€ 11 250 651,07	€ 12 010 464,87	€ 11 262 034,05	€ 11 774 268,07	€ 11 346 000,00
Seesam					
Available Solvency Margi	€ 30 556 044,00	€ 24 527 302,00	€ 29 821 059,00	€ 32 484 684,00	€ 36 387 199,00
Estimated Solvency Margi	€ 6 302 345,00	€ 8 239 616,00	€ 8 218 007,00	€ 8 720 858,00	€ 9 431 917,00
TOTAL	2010	2011	2012	2013	2014
Available Solvency Margi	€ 118 495 469,18	€ 211 674 582,45	€ 208 339 842,81	€ 234 992 285,63	€ 266 326 319,11
Estimated Solvency Margi	€ 48 969 314,27	€ 72 653 643,60	€ 75 324 638,01	€ 87 714 887,41	€ 96 105 674,97
Operational risk	€ 7 637 637,27	€ 13 117 498,86	€ 9 588 061,01	€ 8 650 229,06	€ 14 558 282,40