MAIN RISKS IN THE LITHUANIAN BANKING SECTOR: ANALYSIS AND EVALUATION

Filomena Jasevičienė[*], Vaida Valiulienė

Vilnius University, Lithuania

Abstract. *There are a number of different financial market institutions such as banks, credit unions, leasing and insurance companies, as well as capital market players in Lithuania. The bank sector makes the largest part of the financial market (more than 80%). Thus, the bank sector has a considerable influence on the country's economy. Banks are not specialized in Lithuania, i.e. they are universal banks which seek to provide quite a wide range of financial services. The successful performance of a bank mostly depends on how it succeeds to manage the risks. The problems of risk management are becoming an object of exceptional attention while enhancing the variety of analysed risks as well as developing the investigation instruments both in the whole world and in Lithuania. Loans make the largest part of bank assets. So, the loan risk management is one of the most important guarantees of safe banking. To manage effectively the bank credit risk, it should be adequately evaluated.*

Key words: *banks, credit risk, credit risk management, credit quality, non-performing loans*

Introduction

The financial sector is a part of the Lithuanian economy. In order to be an effective financial sector, it has to invest national and foreign savings into productive industrial and service spheres which can enhance the scope and quality of production and services in the country. In this way the financial sector influences the rise of the gross domestic product of the country. Nowadays, it is widely accepted that the development of the financial sector influences the rate of the country's economic growth.

What does an efficient financial system mean? Specialists have not come to a mutual agreement on the acceptable methodology of how to evaluate the efficiency of a financial system. Theoretically, an efficient financial sector should provide favourable conditions for enterprises to acquire the necessary financial resources on time and for investors to reach the adequate profitability of investments. What is more, the financial sector efficiency evaluating index has to reflect the competitiveness of a financial system as well as the expenditures of financial transactions that are necessary to sustain the country's financial sector. It is very difficult to set such a ratio even in very advanced economies having reliable and long-term statistical data bases.

* Corresponding author.
Finance Department, Faculty of Economics, Vilnius University, Sauletekio Ave. 9., LT-10222, Vilnius, Lithuania; e-mail: filomenaak@gmail.com

Various relative ratios are being calculated (bank deposits / GDP, bank assets / GDP, market capitalization of securities / GDP, ROE, ROA, etc.), which show the part of the financial system in the whole economy of a country. There is not enough theoretical substantiation for such relative indexes used as financial system efficiency measures. However, in the meantime, they are accepted as standard indexes allowing to compare the financial systems of different countries. The development of a financial system is a time-consuming process: people who work in the financial intermediaries have to gain experience, financial enterprises must earn public confidence, an adequate technological infrastructure of the financial sector has to be created. Besides, in order to function smoothly, the financial sector needs an effective legal system which would allow concluding various types of agreements and making the parties meet their engagements (Martinaitytė et al.).

Money and loan capital markets are the stimuli of the economy, they contribute to the economic expansion (Koslowski, 2011). Universal banking systems not only perform capital investments, but also are the arbitrators of those investments which perform the search of alternative investments, give advice for the customers on where it is better to invest with the minimum probable risk (Boatright, 1995).

Professional risk management is one of the main guarantees of a stable bank performance. Different authors demonstrate a varying understanding of risk in a commercial bank. Some sources state that risk is a probability of losses resulting from the unforeseen impact of both external and internal factors affecting the bank.

By rendering financial services to the public, commercial banks create added value for their shareholders. In order to attain this goal, the resources available and the risks arising have to be managed in the most effective way. Banks handle financial resources entrusted by deposit-holders and invest them, striving to earn the maximum profit obtainable at an acceptable level of risk. Many different methods exist to manage every type of risk. When it comes to risk management, commercial banks have to consolidate risk management, creating a uniform process since all risks and methods of risk management are interrelated.

One of the main objectives of a bank is to choose the best ratio of the risk level and profitability. In banking, risk usually implies a threat that the bank might lose some of its resources, income, run higher costs whilst performing some of its financial operations. However, taking risks in the business of a bank does not always entail losses. An efficient risk management in a bank could provide the backbone for a successful business of the bank. Every bank faces different risks in the process of its operation.

In this article, particular attention is paid to the management of the main bank risk, which is the credit risk. One of the main factors that influence the level of credit risk is the credit quality. The dynamics of its indicators show not only the potential loss of assets, trends of the indicators allow us to assess how stable the bank will remain in

the future. Moreover, the calculation and publication of quality indicators allow us to compare banks and partly decide about their reliability.

Theoretical aspects of banking

There are a number of different financial market institutions such as banks, credit unions, capital market players, leasing and insurance companies in Lithuania. In the recent years, the banks' share has accounted for more than 80 % of the financial sector (Fig.1).

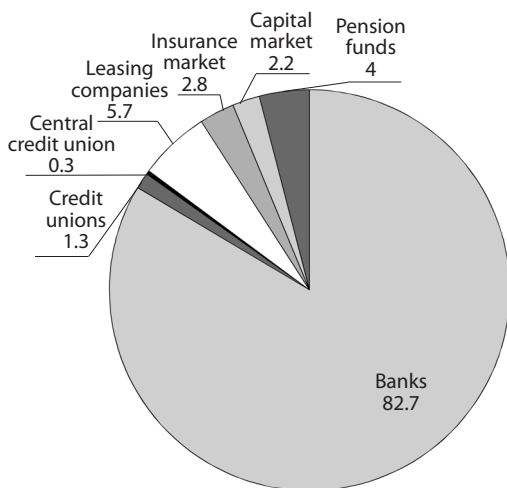The provision of deposits and loan products normally distinguishes banks from other types of financial firms. Deposit products pay out money on demand or after some notice. Deposits are *liabilities* for banks, which must be managed if the bank is to maximise the profit. Likewise, they manage the *assets* created by lending. Thus, the core activity is to act as *intermediaries* between depositors and borrowers. Other financial institutions, such as stockbrokers, are also intermediaries between buyers and sellers of shares, but it is the taking of deposits and the granting of loans that singles out a bank, although many offer other financial services (Heffeman, 2005).

FIG. 1. **Structure of the financial sector**

Source: Authors's calculations. Statistical data, 2012.

Banks seek to provide a wide range of financial services: accepting deposits and other repayable funds, lending (including mortgages), financial lease (leasing), payment services, investment services, emission of electronic money, foreign money exchange, acting as financial intermediaries (agents), etc. In banking, as well as in other enterprises, everything is based on relationships: relationships of a bank with customers, employees, business partners and the state. Business success depends on the businessmen's morality on the basis of which they gain market confidence (Koslowski, 2011).

It is stated in the Law on the Banks of the Republic of Lithuania that a bank is a credit institution which is established in the Republic of Lithuania and has a license to practise in receiving deposits or other repayable funds from non-professional market participants and in lending them as well as taking on associated risks and responsibilities. Deposits and loan products generally distinguish banks from other types of financial firms.

An important role of banks is financial intermediation. Financial intermediation (agent practice) is an activity when, on behalf and benefit of one or more financial

institutions, deposits and other repayable funds are taken, lent, other financial services provided, as well as insurance mediation activities given by financial institutions, except for the administration of insured events. It is important that banks would pay money to the depositors on time as it is stated in the agreements. Moreover, it is essential to manage assets formed by borrowing properly. Thus, the main role of banks is to act as intermediaries between savers and borrowers. Other financial institutions, such as stockbrokers, are also intermediaries between buyers and sellers; however, the acceptance of deposits and granting of loans differentiates a bank from other financial institutions which may offer also other financial services (Hefferman, 2005).

Intermediation costs include administration and other operational costs related to products and services offered by a bank. A bank, in agreement with its customers, can set prices of its products (services). By setting higher prices, a bank can obtain a higher profit. Unlike other enterprises and individual lenders, banks have rather good databases, access to sensitive information, i.e. have a possibility to assess the balances of current and potential debtors. Thus, banks have a certain advantage in comparison with the other enterprises that can provide lending services.

A bank, acting as an intermediary and setting lower lending rates, has an opportunity to expand the scope of its services. However, if the bank increases the cost of loans, some corporations may find cheaper ways to raise the necessary funds, i.e. issue bonds or other securities. Nevertheless, corporations tend to use bank loans, because a loan agreement acts as a signal to other financial market participants and suppliers that the borrower is in a reasonably good financial condition and is creditworthy (Choudhry, 2012).

A very important service of a banking business is to offer a reasonable liquidity to its clients. Depositors, creditors, and borrowers should be offered various liquidity preferences (Heffernan, 2005). Clients expect to be able to withdraw deposits from current accounts at any time. Typically, enterprises in the business sector prefer to borrow money and repay it in accordance with the planned timetable. However, in investment projects, it is important to evaluate the return on investment when it can be implemented within a few years after the investment has been made. When solving liquidity problems, a bank can meet its customers' requirements after a fine has been imposed, i.e. terminate the fixed-term deposit agreement and replace it by a demand deposit.

The financial crisis started in 2008. According to many economists, it was not only an economic crisis, but also a crisis of ethics. Greed and disregard for risks exceeded the limits, banks underestimated their capacity to take on limited risks and faced serious solvency problems which were solved by making governmental money interventions; monetary means were used. It is obvious that banks and other financial institutions failed to follow their neatly written codes of ethics.

Banks have become more cautious and began to assess risks more seriously after the financial crisis, but the structural reforms that could ensure that the financial crisis

would not be repeated have not been very apparent. The principles of bank ethics have not changed. According to N. Roubini, "too big to fail and too big to be saved", it can be concluded that in the future we are going to have an even greater dependence on the financial giants whose failure may cause extremely dire consequences.

Development of banking

There are 8 commercial banks and 12 foreign branches operating in Lithuania. All of the banks are universal and provide services indicated in the Law on Financial Institutions.

It is worth noting that the number of banks was biggest in 1993 (27 banks), and it was getting smaller until 1997 (12 banks) (Fig. 2). Meanwhile, the first foreign branch was established in 1997. The number of banks has remained the same in the recent years. There was the same number of licensed banks (9) and foreign bank branches (8) at the beginning of both 2009 and 2010.
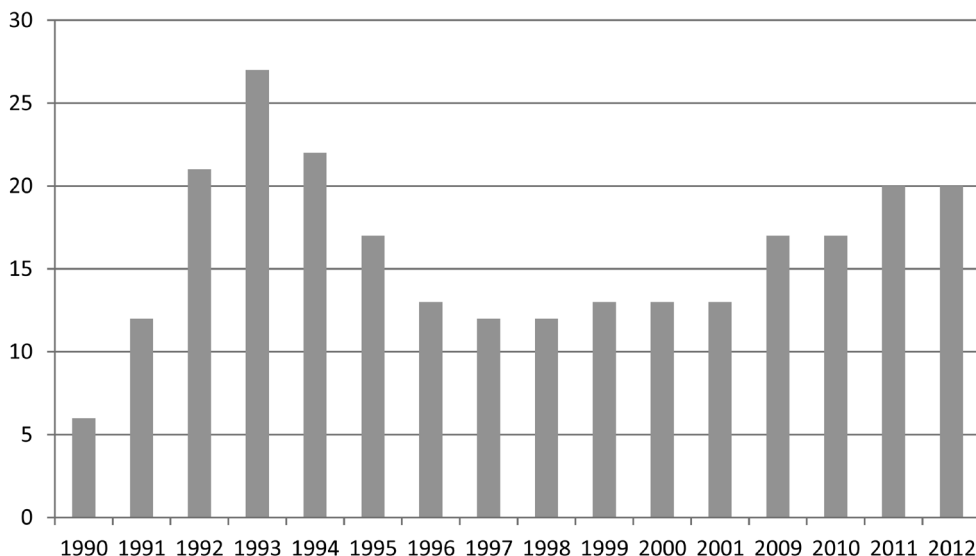
FIG 2. **Number of the banks (foreign branches included) in Lithuania**

Made by authors. *Source*: Bank of Lithuania.

The impact of the global financial crisis of 2008 was felt in Lithuania as in all other countries. However, many experts predicted that the direct impact of the crisis on the Lithuanian financial system would not be substantial, because Lithuanian banks were not closely related to the U.S. financial institutions and the country's financial market was quite small. After some loss of property due to financial crisis, the bank sector is now reactivating. As one can see in Fig. 3, the main bank indicators stabilized, some of them even slightly decreased.
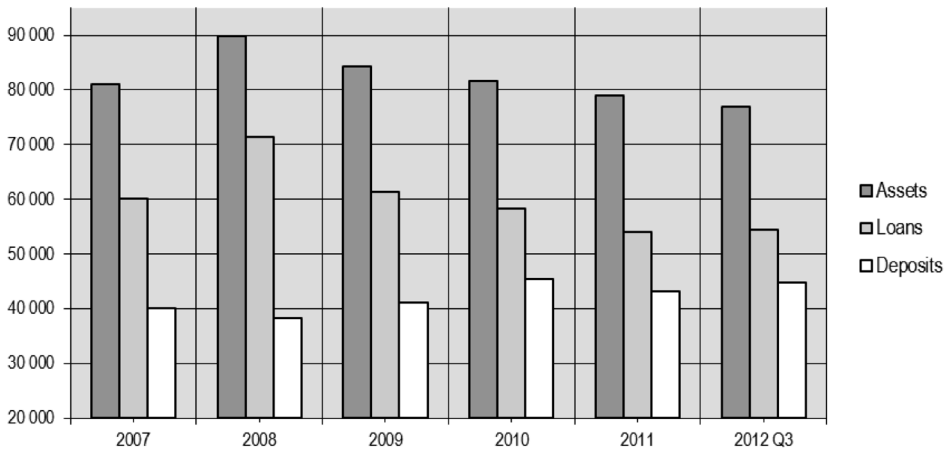
LTL million

FIG. 3. **Main bank performance indicators.**

Source: Bank of Lithuania.

As Fig. 3 shows, on 1 January 2012, the property of banks was 78993 million Litas, which is by 12 percent less than in 2008 when the highest point was reached. Respectively, loans decreased by 25 percent and comprised 53933 million Litas, whereas deposits in 2011 increased by 13 percent as compared to 2008 and reached 43174 million Litas. In the three quarters of 2012, the property decreased by 2.6 percent, and loans and deposits increased by 0.6 and 3.9 percent, respectively.

Analysis and assessment of bank risks

Bank risk is the main factor of the bank's value. Even though the risk is very undesirable, it is unavoidable in bank practice. In banking (and not only), a financial operation is considered to be risky if its efficiency is undetermined; for example, the result is not quite evident when making the transaction. It should be emphasized that the higher the risk, the bigger the possible loss; thus, in banking, it is very important to assess the risks and to be able to control them. These abilities are the key of finance management in efficient banking.

A bank has to maintain the level of risk in order to be able to fulfil the normatives limiting the risks at any time; the normatives are set by the Bank of Lithuania. The practice of commercial banks and the competition stimulate to take on more risks and seek bigger profits, whereas the Central Bank seeks to control the banks' practice as much as possible and to decrease the risk of their practice.

The financial risk of a bank is the risk related to the macroeconomic environment parameters and its changes. Financial risk embraces interest rates, liquidity, credit, foreign currency and market risks.

The process of risk management includes the quantitative and qualitative principles of risk evaluation; the principles are adjusted to each other. The goal of the qualitative analysis is to define the factors of the market, to set the conditions in which the risk asserts. Quantitative analysis means the assessment of various risk ranges in numbers. This task is very complex; several methods are used to deal with it. The most popular ones are statistical, expert, and analytical. In various sources, a great variety of classifications of banking risks could be found. This should not be surprising, since it is difficult to put the risks into firm definitions as every author makes a different emphasis.

G. Kancerevyčius (2009) notes that risk asserts when the probabilities of various possible results are known whereas indeterminancy asserts when various probabilities of various possible results are unknown. This is how risk differs from indeterminacy. One of the main goals of business is the choice of an appropriate proportion of risk and profitability. The higher the taken risk, the bigger profit is expected.

Taking on too big risks might mean that a company would not reach its goals in the market, lose part of its resources, fail to reach the desired level of service sales, earn less profit and experience an unexpected damage, i.e. risk has a negative shade.

Thus, in accordance with the analysis of literature sources, a conclusion could be drawn that risk is a probability which shows that real profitability will be different than expected. The bigger this probability, the higher is the risk. However, risk should not be considered as an indicator of big losses only. It is possible to earn additional profit when additional risk is taken. The higher the risk, the bigger profit could be earned. To conclude, the definition of risk in economics might be understood not only as a probability of losses, but also as a possibility to act in undetermined conditions and, when a higher risk is taken, to earn a bigger profit.

A commercial bank while providing financial services produces added value to its shareholders. To reach this goal, the most efficient way of managing the owned resources and the possible risk should be found. Banks manage resources provided by shareholders and invest these resources, aiming at the biggest possible profit when the risk level is agreeable (Valvonis, 2006). There are a lot of different methods to control different kinds of risk. In managing the risks, a commercial bank has to unite risk managing into one integral process, because all kinds of risk and their managing methods are interrelated. To conclude, the bank risks have been discussed and defined by various authors, and it can be claimed that the main risks are credit, market, liquidity, operational, concentration, and others (Fig. 4).

Analysing the problems of risk management in enterprises, the general stages of a risk management cycle should be defined first. Several authors define quite similar risk management cycles (Fig. 5).

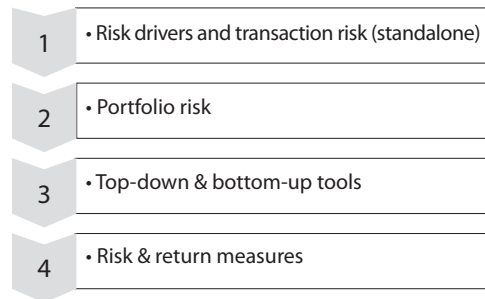The basic structure within each risk addresses four major modules as shown in Fig. 6.

The basic blocks, I and II, are determined by the source of risk. The two other blocks, III and IV, are transversal to all risks.
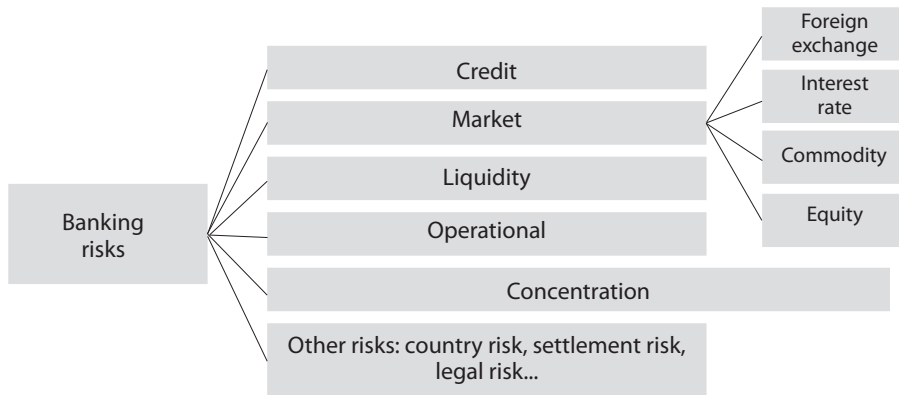
FIG. 4. Structure of bank risks

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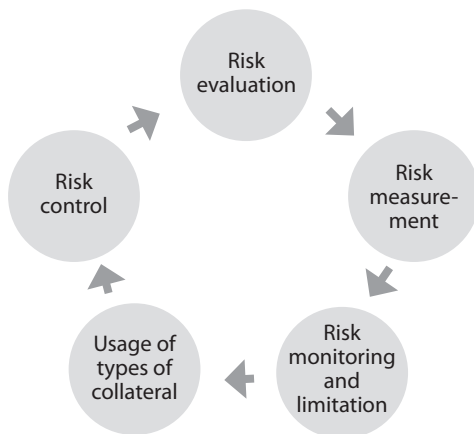
FIG. 5. Risk management cycle

Compiled by authors.

**FIG. 6. The building block structure of risk models**

Source: Bessis, 2002.

Credit risk and the influence of loan portfolio quality on credit risk

Loans make the main share (approximately 70%) of property in banks. Thus, credit risk is most important in banks. When it is not managed, it may evolve into a liquidity and insolvency risk. In this article, the credit risk and its impact to the banks will be discussed.

Credit risk is the probability that one side of transaction will not be capable to pay back according to the way stated in the contract.

Joel Bessis defines credit risk as a category of damage, which might occur due to the debtor's incapability to apply the undertakings stated in the contract or due to the reverse of the debtor's quality of creditworthiness. This simple definition holds several kinds of
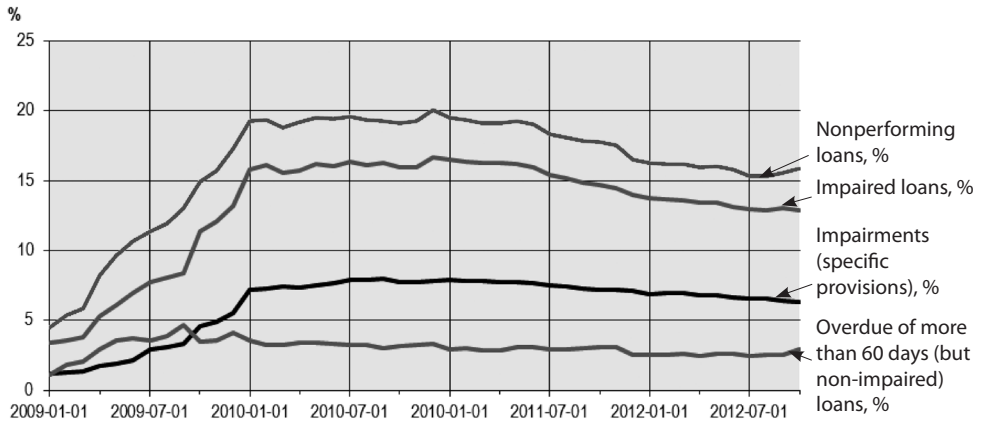
FIG. 7. Loan quality indicators

Source: Bank of Lithuania.

risk. The "quantity" of risk is equal to the credit sum provided to the debtor. The risk's "quality" is evoked by the probability of the debtor's incapability to apply the contract undertakings, as well as measures of credit security, which would decrease the damage in case of the debtor's insolvency. Thus, even in case of the debtor's insolvency, the bank would still be able to get back parts of the loan. Incapability to apply the undertakings is the extent of probability and the amount that would be possible to get back in case the debtor suspends the loan repayment and the interest paying is not known in advance. Credit risk is characterized by indicators of loan quality. In Lithuanian banks, the main indicators used to determine the quality of loans are shown in Fig. 7.

It can be seen that loan quality indicators maintain the tendency of improvement, even if it is not that large. At the end of the second quarter of 2012, expenses for specific provisions and loan portfolio proportion comprised 6.6 percent. In July 1, 2012, the other indicators of loan quality were as follows: the proportion of the loan overdue for more than 60 days, but still maintaining its value and loan portfolio 2.4 percent, the proportion of the non-performing loan and loan portfolio 15.4 percent.

In credit risk, the focus is more on transactions (Bessis, 2002).

''If you don't have some bad loans, you are not in the business.''(Choundry, 2012).

The assessment of credit risk, as mentioned above, starts from assessing the risk of the loan and the debtor. The risk of the loan and the debtor is revealed by the compound parts of credit risk such as the probability of default (PD), loss given default (LGD), and exposure at default (EAD). When lending money, banks take on the credit risk, a possibility of having the damage, e.g., loss of the loaned resources and interest. It cannot be claimed in advance whether the bank will have such a damage. The possibility of having a damage is assessed as the probability of failing to apply the undertakings.

The Bank of Lithuania has defined that:

- probability of default (PD) is a probability that the debtor will not apply the undertakings in the period of one year;
- loss – economic loss, taking into account the impact of discount and significant direct and indirect expenses for debt recovery;
- loss given default (LGD) – the proportion (expressed in percent) of the loss due to the debtor's failure to apply the undertaking and value of the position, which appears when undertakings are not applied;
- exposure at default (EAD) – the amount of a balance sheet items of bank or non-balance claims included in the banking book at the day of failing to apply the undertakings.

If the debtor does not follow the obligations, it equals 1, and if he / she does, it equals 0. In other cases (if a debtor follows obligations when the period for it has not yet expired), the probability of default is somewhere between 0 and 1. However, it is not enough to assess the possibility to experience a loss: the amount of the probable loss should be assessed as well. The probable loss is directly proportional to the amount of loaned resources and inversely proportional to the amount of loan security and quality. Thus, other two compounds of credit risk are relevant as well: the amount of the loan when undertakings are not applied (EAD), and the loss experienced when undertakings are not applied (LGD); it is usually calculated as the share of the loan in case undertakings are not applied. When the EAD indicator is multiplied by the LGD indicator, we get the sum of the ultimate loss, which appears when the debtor fails to apply the undertaking. The product of this sum and PD shows the probable loss. The probable damage of the loan is often identified with special suspensions.

The product of this sum and PD shows the probable loss of the loan. The probable loss is often identified with specific provisions for the loan. However, these two ranges differ. Mathematically, the probable loss might be defined as follows (Bluhm et al., 2003):

$$\tilde{L} = EAD \cdot LGD \cdot L, \ \text{when } L = \left\{ \frac{1, \text{ at probability } PD}{0, \text{ at probability } 1 - PD} \right\},$$

$$EL = E(\tilde{L}) = EAD \cdot LGD \cdot E(L) = EAD \cdot LGD \cdot PD,$$

$\tilde{L}$ – loss of the loan; L – failing to apply the undertakings ($L = 1$) or applying the undertakings ($L = 0$);
EL – probable loss; $E(x)$ – average of random value x.

However, it is not enough for the bank to assess the probable loss only. The actual loss might appear to be bigger than expected (when the credit risk is assessed inaccurately, when the economic conditions change and for other reasons), and then the bank faces risk. The risk to experience a bigger loss than expected is usually assessed as a standard

deviation of the loss or as a mate of value at risk. Unexpected loss is calculated by the formula

$$UL = \sqrt{D(\widetilde{L})} = \sqrt{D(EAD \cdot LGD \cdot L} = EAD \cdot LGD \cdot \sqrt{D(L)} =$$
$$= EAD \cdot LGD \cdot \sqrt{PD \cdot (1 - PD)},$$

here: UL – unexpected loss; $D(x)$ – random value dispersion,
σ – quantile risk value (Kurth, Tasche, 2002), and

$$VaR_{\sigma} = q(\sigma),$$

here $q(\sigma)$ – the σ queue quantile of a respective measure (according to the new capital agreement, σ equals 99.9 percent).

Subject to the application of specific treatments, the risk-weighted exposure amounts for corporates, institutions, central governments and central banks shall be calculated according to the following formulae:

risk-weighted exposure amount = RW · exposure value,

where the risk weight RW is defined as
(i) if PD = 0, RW shall be 0;
(ii) if PD = 1, i.e. for defaulted exposures:
    – where institutions apply the LGD values, RW shall be 0;
    – where institutions use their own estimates of LGDs, RW shall be

$$RW = \max\{0, 12.5 \cdot (LGD \cdot ELBE)\}$$

(EU Regulation, 2012).

Risk management and monitoring prosess

Credit risk management requires from bank employees constant attention and the control of credit quality, content, structure of portfolio, and credit usage. The main way to decrease credit risk is a suitable and well-organised credit monitoring. It is noted in scientific sources that M. Snyder was the first to use this term in 1974. The term "to monitor" means to control, to examine, and to check regularly.

Bank risk management is a process during which, seeking the goal of the bank and according to the attitude and policy of the bank, the risk of bank practice is being planned, analysed, assessed, and controlled,

Figure 8 gives a stylised view of the centralised risk management function in a bank. We see that business lines originate various risk exposures, and these are overseen, monitored, and managed by the risk function.

An effiecient system of credit risk management should be installed in a bank. Such system should embrace the credit risk management strategy, lending policy, credit risk

Risk management	
Senior management	
(Board)	
Risk culture	
Return targets and guidelines	
Risk management	
Bank – wide risk monitoring and compliance with limits	
ALM	Asset Liability Committee
Interest-rate and liquidity risk	

Risk origination				
Credit risk	**Market risk**	**Interest rate risk**	**Liquidity risk**	**Operational risk**
Investment bank		Corporate bank		Private bank

FIG. 8. **Centralised bank risk management, overseeing bank business lines**
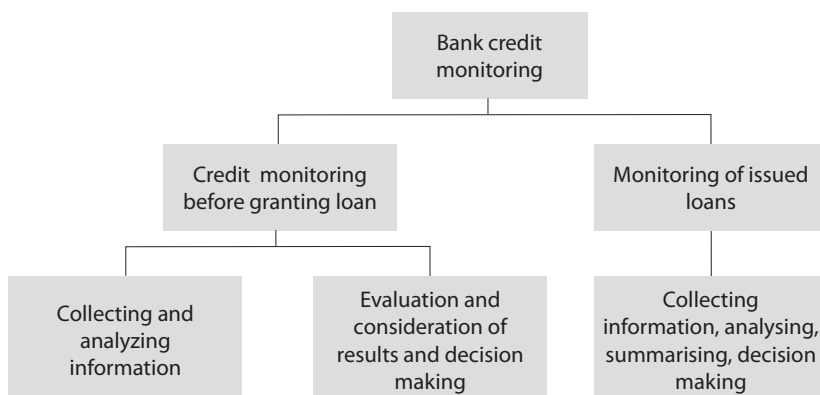
Source: Choudhry, 2012, 2010.

FIG. 9. **Bank credit monitoring scheme**

Source: compiled by authors.

limiting system, other measures and procedures of risk management as well as the internal control of credit risk management and internal audit.

As one can see in Figure 9, credit risk monitoring in banks consists of two parts: credit risk monitoring before and after the loan is provided.

A bank gathers detailed information about a loan receiver. While assessing the debtors' and/or positions' credit risk and putting it to the risk categories (ranges, risk groups), a bank has to apply suitable, clearly defined and documented criteria. This should be also done in cases when the bank's credit risk is disposed to other persons due to the transaction of replacement with securities or / and insurance. The bank should pay attention to the financial state of the debtor, his / her capabilities to repay the loan, and,

when necessary, to the received ensuring object or ensuring object's flow. While assessing the credit risk of enterprises when the sum of the position is significant (according to the bank), the bank should also assess:

- the situation of the economic sphere to which the debtor belongs. Attention also should be paid to the relation between specific factors of this economic sphere and factors of general macroeconomic situation, the debtor's position in the market (the part occupied in the market, its competitors, suppliers, customers, etc.);
- the structure of the debtor's property and management (shareholders, leadership, organizational structure, etc.);
- the quality of accounting (for instance, to examine whether there are some negative remarks in the auditor's conclusions in the past few years).

Assessing the credit risk of a person, the bank should pay attention to:

- the debtor's capabilities to apply the undertakings related to the position;
- the property of the debtor (product of saving, bank accounts, etc.);
- the debtor's stability and reliability (education, family status, period of working in the present workplace, external and / or internal information on the debtor's delayed repayments, whether the debtor owns or rents his / her living place, etc.);
- the economical conditions and / or other circumstances that might influence the position's repayment.

As mentioned before, credit risk management embraces the decision making process both before and after providing the credit, as well the whole process of controlling and report composing. The decision making process starts with loan application assessment and extends to receiving the decision made by the loan committee. The decision to provide or not to provide the loan is made upon considering various factors such as the financial features of the enterprise, its position in the market, the competence of enterprise leadership, etc. After the loan has been provided, repayments of the customer are monitored, and if some deviations from the loan repayment schedule appear, regulatory measures are taken. The key difference is the implementation of risk measures. Risks are invisible and intangible uncertainties which might materialize into future losses, while earnings are a standard output of reporting systems complying with established accounting standards. Such differences create a bias towards an asymmetric view of risk and return, making it more difficult to strike the right balance between the both. Characterizing the risk–return profile of transactions and of portfolios is a key procedure for implementing risk-driven processes. The innovation of new best practices consists of plugging new risk–return measures into risk management processes, enriching them and leveraging with more balanced views of profitability and risks. New risk measures interact with risk processes. Vertical processes address the relationship between global goals and business decisions. The bottom-up and top-down processes of risk management allow the 'top' level to set up global guidelines conveyed to business lines. Simultaneously, periodical reporting
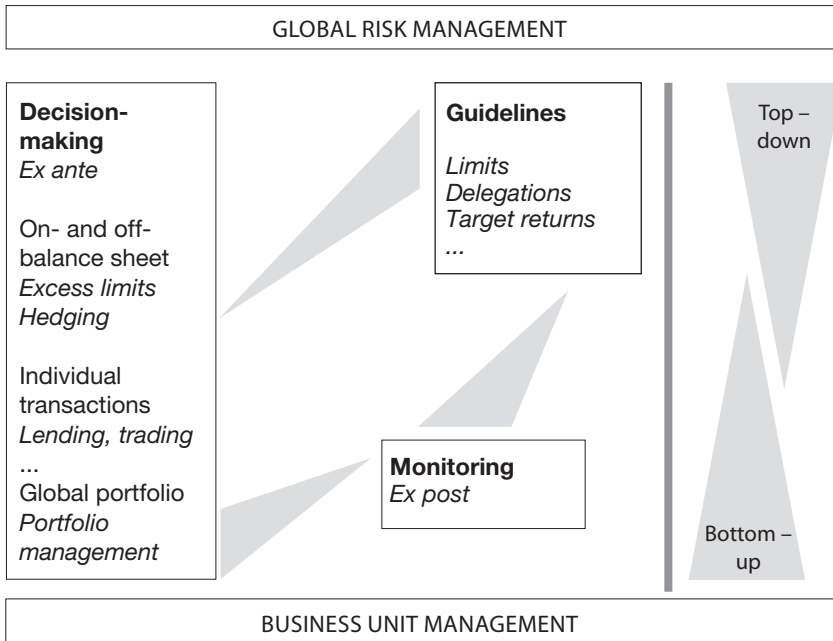
FIG. 10. The three basic building blocks of risk management processes

Source: Bessis, 2002.

from the business levels to the top allows to detect the deviations from guidelines, such as excess limits; also it allows the corrective actions to be taken while comparing the projected versus the actual achievements. Transversal processes address the risk and return management at 'horizontal' levels, such as the level of individual transactions, at the very bottom of the management 'pyramid', at the intermediate business line levels, as well as at the bank's top level, for comparing risk and return measures to profitability target and risk limits. There are three basic horizontal processes: setting up risk–return guidelines and benchmarks; risk–return decision-making ('*ex ante* perspective'); risk–return monitoring ('*ex post* perspective').

Putting together these two views could produce a chart as in Fig. 10, which shows how the vertical and transversal dimensions interact. Risk models contribute to all processes, because they provide them with better and richer measures of risk, making them comparable to income, and because they allow banks to enrich the processes using new tools such as risk-adjusted performance or valuing the risk reduction effects of altering the portfolio structure. Figure 10 illustrates how the models provide the risk–return measures feeding transversal and vertical processes.

The business policy deals with dimensions other than risk and return. Attaching risk and returns to transactions and portfolios is not enough, if we cannot convert these views into the two basic dimensions of the business policy, which are products and

markets. This requires a third type of the process – reconciling the risk and return view with the product–market view. For the business purposes, it is usual to segment the risk management process across business lines, products, and markets. The product–market matrices provide a synthetic business view of the bank.

Quantitative analysis of the level of factors influencing non-performing loans in 2008–2012 in Lithuania

The economic situation in Lithuania in 2008–2012 has lead to the assumption that the country's loan portfolio quality is mainly influenced by the economic situation in the country, i.e. by macroeconomic and microeconomic factors. When analysing the impact of the factors, the chosen factors were gross domestic product, earnings, wage, unemployment, inflation, the growth of loan portfolio, interest rates (in euro), the amount of estate transactions, and the cost of real estate. A multivariate linear regression model was formed to determine and evaluate the macroeconomic and microeconomic factors that influenced the level of non-performing loans. The analysed data on the relative indicators were collected from the databases of the Department of Statistics, the Bank of Lithuania, and the Centre of Registers. The authors used quarterly data from 2008 to 2012 in the analysis. The ratio of non-performing loans to the total loan portfolio was selected as a loan quality measure and as a dependent variable. In accordance with the opinion of different authors concerning the factors affecting the loan quality, eight macroeconomic and microeconomic (banking and real estate market level) indicators were selected: gross domestic product, earnings, unemployment, inflation, loan portfolio growth, interest rates in euros, real estate transactions, and real estate price indicators (Table 1). After the pair correlation analysis has been performed, two macroeconomic (inflation and unemployment rate) and two microeconomic (interest rates in euros and real estate prices) indicators were selected.

Testing the significance of pair correlations

Four macroeconomic indicators – gross domestic product, inflation, unemployment rate, and earnings – were selected at the initial stage of the investigation. Also, four microeconomic (banking and real estate market level) indicators – loan portfolio growth, interest rates in euros, real estate transactions, and real estate prices – were evaluated.

The pair correlation of non-performing loans and selected economic indicators has shown that there is a linear correlation between the banking sector loan quality and the macroeconomic situation in the country as well as the microeconomic factors. In order to determine the strength of the interdependence, the correlation coefficient R was used. As the calculations show, there is a linear interdependence between non-performing loans and macroeconomic factors: unemployment rate (positive correlation, correlation

TABLE 1. **The set of analysed indicators**

Non-performing loans Commercial banks' non-performing loans and total loan portfolio ratio compared with the corresponding quarter of the previous year, percent	
1.	**GDP** Average annual growth of the gross domestic product compared with the corresponding quarter of the previous year, percent.
2.	**Inflation** Average annual inflation according to the harmonized consumer price index compared with the corresponding quarter of the previous year, percent.
3.	**Unemployment rate** Unemployment and labour force ratio, compared with the corresponding quarter of the previous year, percent.
4.	**Earnings** Real earnings index compared with the corresponding quarter of the previous year, percent.
5.	**Loan portfolio** Annual average of loans given to the bank clients, compared with the corresponding quarter of the previous year, percent.
6.	**Interest rates** Nominal interest rates (in euros) of new loans given to nonfinancial corporations and households, quaterly average, percent.
7.	**Real estate transactions** Number of real estate transactions at the end of the quarter, thousands of units.
8.	**Real estate prices** Real estate price annual changes, compared with the corresponding quarter of the previous year, percent.

Source: composed by the authors according to the data of the Bank of Lithuania, the Lithuanian Department of Statistics, and the Centre of Registers.

TABLE 2. **Results of the pair correlation between non-performing loans and macroeconomic indicators**

	GDP	Unemployment	Earnings	Inflation
Non-performing loans	$R = -0.08$	$R = 0.98$	$R = -0.95$	$R = -0.95$

Source: authors' calculations.

coefficient 0.98), earnings (negative correlation, –0.95), and inflation rate (negative correlation, –0.95). The results of the calculations are presented in Table 2.

The pair correlation of non-performing loans and selected microeconomic indicators has shown that a linear correlation exists between the loan quality and the microeconomic factors, i.e. the bank loan politics and the situation in the real estate industry. In order to determine the strengths of the interdependence, the correlation coefficient R was used. As the calculations show, there is a linear interdependence between non-performing loans and loan portfolio growth (a strong negative correlation, the correlation coefficient

TABLE 3. **Pair correlation between non-performing loans and microeconomic indicators**

	Loan portfolio growth	Interest rates in euro	Real estate transactions	Real estate prices
Non-performing loans	R = – 0.95	R = – 0.94	R = – 0.45	R = – 0.53

Source: authors' calculations.

–0.95), interest rates in euros (a strong negative correlation, –0.94), the number of real estate transactions (negative correlation, –0.45), and real estate prices (negative correlation, –0.53). Results of the calculations are presented in Table 3.

The analysis has shown that the level of non-performing loans was influenced by the level of the unemployment rate, earnings, inflation, loan portfolio growth, interest rates in euros, and partially by the shift in real estate prices. According to Glogowski (2008), the unemployment and earnings rates influence the solvency of debtors. In accordance with this, the unemployment rate with a higher pair correlation coefficient was chosen. What is more, the rate of loan portfolio growth was not included into the further analysis as, according to Fainstein (2011), the influence of loan portfolio growth on non-performing loans is getting stronger only after a certain period of time and follows the initial stage of the worsening economic conditions. Thus, for the further analysis, the authors selected four indicators: inflation, unemployment rate, interest rates in euro, and real estate prices.

Multivariate linear regression model

The selected ratios were further analysed in a multivariate linear regression model constructed by the authors. It pursued to verify the suitability of the selected variables. The analysed variables were as follows: y – banking sector non-performing loans, $x1$ – average annual inflation according to the harmonized consumer price index, $x2$ – unemployment rate, $x3$ – interest rates in euros, $x4$ – change in real estate prices. Analysed period: 2008–2011, second quarter. Data on the indicators are presented in Table 4.

In order to ascertain that the suitable variables were selected for constructing the model, the authors verified the significance of pair and partial correlations. The calculated pair correlation coefficients:

$r_{yx_1} = -0.95;$ $r_{yx_2} = 0.98;$ $r_{yx_3} = -0.94;$ $r_{yx_4} = -0.53;$

$r_{x_1 x_2} = -0.95;$ $r_{x_1 x_3} = 0.93;$ $r_{x_1 x_4} = 0.62;$

$r_{x_2 x_3} = -0.94;$ $r_{x_2 x_4} = -0.59;$

$r_{x_3 x_4} = 0.59.$

TABLE 4. Indicators of the banking sector non-performing loans and analysed economic indicators

Eil. nr.	y	x_1	x_2	x_3	x_4
1	1.1	10.6	4.9	5.9	26.7
2	2.4	12.1	4.5	6.2	16.7
3	2.6	11.7	5.9	6.5	4.2
4	4.6	9.3	7.9	6.5	0.2
5	8.2	8.7	11.9	5.3	-24.,0
6	11.3	5.2	13.6	4.5	-33.7
7	14.9	2.8	13.8	4.2	-33.1
8	19.3	1.4	15.6	4.3	-34.6
9	19.2	-0.3	18.1	4.2	-21.2
10	19.6	0.7	18.3	4.1	-10.1
11	19.1	1.8	17.8	4.1	-11.7
12	19.7	3.1	17.1	4.0	-4.7
13	19.1	3.3	17.2	4.2	1.4
14	18.4	4.8	15.6	4.5	-1.9

Source: authors' calculations according to the data of the Bank of Lithuania, the Lithuanian Department of Statistics, and the Centre of Registers.

The significance of the calculated pair correlation coefficients was checked by means of Student's criterion:

$$\frac{|r|}{\sigma_r} > t_{\alpha;\ n-m-1},$$

$$t_{0.05;14-5-1} = 2.31.$$

The smallest pair correlation coefficient $r = -0.53$. After the significance of the smallest pair correlation coefficient had been verified, it was proven that the smallest pair correlation coefficient was not significant:

$$\sigma_{r_{x_2 x_4}} = \frac{\sqrt{1-0.53^2}}{\sqrt{14-2}} = 0.237,$$

$$\frac{|0.53|}{0.237} = 2.16 < 2.31.$$

The second smallest pair correlation coefficient $r = 0.59$. After the second smallest pair correlation coefficient had been verified, it was found to be significant; this showed that all the rest pair correlation coefficients were significant:

$$\sigma_{r_{x_2 x_4}} = \frac{\sqrt{1-0.59^2}}{\sqrt{14-2}} = 0.233,$$

$$\frac{|0.59|}{0.22} = 2.53 > 2.31.$$

During the partial correlation analysis of the selected variables, partial correlation coefficients between input variables x_i and x_j were calculated. Results of the calculations are presented in Table 13. All the pair correlation coefficients were found to be not significant (smaller than the Student distribution value), except for one value. This proves that there is no close interrelation between the input variables, i.e. the interrelation of the two variables is not being influenced by other variables, and none of them should be deleted.

The partial correlation coefficients were calculated according to the following formula:

$$\rho_{ij} = \frac{R_{ij}}{\sqrt{R_{ii} \cdot R_{jj}}},$$

here R_{ij}, R_{ii}, R_{jj} – algebraic extensions of matrix R elements r_{ij}, r_{ii}, r_{jj}.

The significance of the partial correlation coefficients was verified by Student's criterion:

$$\left|\rho_{ij}\right| > \frac{t_{\alpha;n-m-1}}{\sqrt{t_{\alpha;n-m-1} + n - m - 1}},$$

here m – the number of analysed correlation coefficients.

TABLE 5. **Partial correlation of the banking sector non-performing loans**

Variables	Cross correlation	Partial correlation	Mean	Student's t-distribution
X1X2	–0.95	–0.59	2.33	2.26
X1X3	0.93	–0.35	1.19	2.26
X1X4	0.62	0.20	0.66	2.26
X2X3	–0.94	–0.48	1.71	2.26
X2X4	–0.59	–0.03	0.11	2.26
X3X4	0.59	0.06	0.20	2.26

Source: authors' calculations according to the data of the Bank of Lithuania, the Lithuanian Department of Statistics, and the Centre of Registers.

Linear interdependence between non-performing loans of the commercial banking sector and the independent variables selected by the authors was proved by the results of the linear regression analysis (see Table 6). After the linear regression analysis model had been applied, Pearson correlation coefficient R = 0,98 and determination coefficient R² = 0,97 of the variables y and x were calculated. The multivariate correlation and determination coefficients of the constructed linear regression model are statistically significant; the regression model explains 97 percent of variation.

The independent variables x_1, x_2, x_3 and x_4 of the regression equation provide quite an exact prognosis of the variable y alteration. However, because of the short sequences,

these results allow to state only approximately that the increased level of non-performing loans was for the biggest part influenced by the inflation and unemployment rate as well as by the interest rates in euro and real estate prices in the country. Also, the significance of other factors for the level of analysed loans cannot be omitted, even though they were not included in this analysis.

After the regression analysis, the regression equation was constructed. According to it, the level of banking sector non-performing loans (y) can be forecasted on the basis of the country's forecasted inflation level (x_1), unemployment rate (x_2), interest rates in euro (x_3), and real estate price (x_4) indexes (see Table 6).

TABLE 6. **Results of the banking sector non-performing loan regression analysis**

	Results of regression analysis
Regression equation	$yi = 8.27 - 0.39\,x_1 + 0.98\,x_2 - 1.19\,x_3 + 0.04\,x_4$
Determination coefficient (R^2)	0.966241456
Multiple correlation coefficient (R)	0.982975816
Corrected determination coefficient (Adj. R^2)	0.951237658

Source: Authors' calculations, according to the data of the Bank of Lithuania, the Lithuanian Department of Statistics and the Centre of Registers.

In order to check how exactly the bank sector level of non-performing loans can be calculated employing the constructed multivariate regression model, the values of the variables from the period under analysis were inserted into the regression equation. The regression residues show the difference between actual data (y value) and the ones calculated after the regression model. The residues of the regression model are distributed around 0 (see Fig. 10). This proves that the model adequately describes the selected data set.
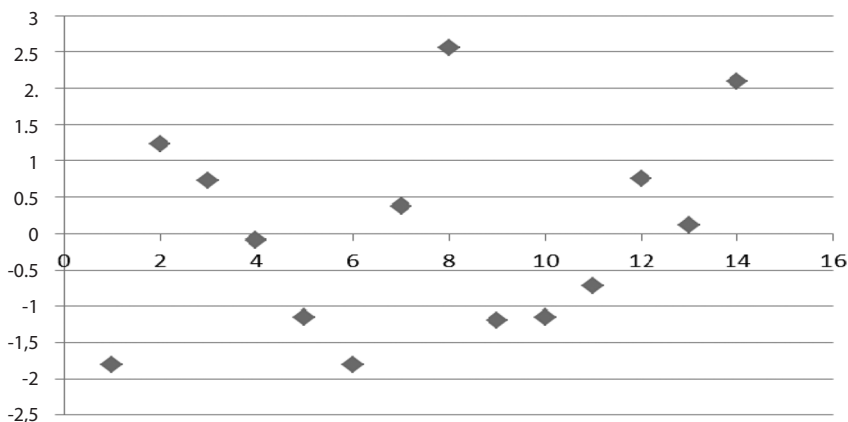

FIG. 11. **Distribution of residues**

Source: authors' calculations.

In conclusion, the independent variables x_1, x_2, x_3 and x_4 quite exactly prognosticate the variation of the variable y in the constructed regression model. Thus, it can be stated that in the period under analysis the rise of non-performing loans was mainly influenced by the rise of the unemployment rate and the fall of real estate prices.

Conclusions

It is worth noting that the number of banks was biggest in 1993 (27 banks), and it was getting smaller until 1997 (12 banks). Meanwhile, the first foreign branch was established in 1997. The number of banks remained the same in the recent years. There were 8 commercial banks holding a license of the Bank of Lithuania and 12 foreign bank branches in 2012. This brings us to another feature of the Lithuanian banking system – the dependence on foreign banks, particularly Scandinavian ones. Foreign banks were holding 87.7% of the share capital of the country's banking system at the end of 2011.

The impact of the global financial crisis of 2008 was felt in Lithuania as in all other countries. However, many experts predicted that the direct impact of the crisis on Lithuania's financial system would not be substantial, because Lithuanian banks were not closely related to the U.S. financial institutions, the country's financial market was quite small, and neither shares nor bonds were significant investment sources. In addition, most of the banking market was controlled by Scandinavian banks and the global crisis was relatively small and short-lived in these countries; this fact also had some positive effect on the Lithuanian banking system.

However, the *indirect* impact of the crisis came through the rise of interest rates in global markets. Because of the decline in the production and consumption level in Europe, Lithuania faced a drop in export volumes. Banks became more cautious and started assessing the risks more seriously after the financial crisis. Actually, the structural reforms that could ensure that the financial crisis will not be repeated are not very apparent.

The volume of risk in banking and its management not only influences the stability of banking, but also can determine its continuity. It should be emphasized that the bigger the risks, the higher the potential losses. Therefore, it is very important to evaluate the risks and to be able to manage them in banking. This is considered to be the corner-stone of the modern efficient banking.

Loans make the biggest part of bank assets (~70%). Thus, credit risk is the main risk in banking. If not properly managed, it can turn into a liquidity and insolvency risk. Credit risk management requires from bank employees constant attention to credit quality and composition, portfolio structure, and the control of credit handling.

The authors have performed a research of loan quality dynamics in Lithuania and analysed the main economic indicators that influenced the number of non-performing loans in 2008–2012. The economic situation in Lithuania in 2008–2012 has lead to the assumption that the country's loan portfolio quality is mainly influenced by the economic

situation in the country, i.e. by macroeconomic and microeconomic factors. The influence of economic factors was analyzed according to the multivariate linear regression model constructed by the authors. The research has shown that during the period under analysis, the loan quality was mainly influenced by the rise in unemployment rate and the fall of real estate prices.

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