

## Stress Testing of Credit Risk Lithuania Banks under Simulated Economical Crisis Environment Conditions

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The quality of bank loan portfolios and the incurred credit risk loss is determined by the development of the economy of the country as well as the financial state of the debtors. With loans accounting for the largest share of the assets of Lithuanian banks, the credit risk is the main individual source of risk. With the current recession of the world economy and the respective situation in Lithuania, when the economy of the country started to recede at the end of 2008, it is obvious that in the future the processes of development of economy of Lithuania will surely be a major influence on the credit risk and results of activities of the bank system of the country, therefore evaluation of this effect under current conditions becomes critical. The importance of research of the influence of macroeconomic processes on the sorts of risks incurred by the bank sector is also proved by the abundance of theoretical research. Testing of the credit risk of the Lithuanian bank sector upon change of risk factors is carried out combining the models used in research performed by M. Sorge (2004), M. A. Segoviano Basurto, P. Padilla (2007) and other scientists. The research covers five phases: the first phase – modeling of macroeconomic scenarios performing an analysis of the current macroeconomic situation of the country, analyzing expert evaluations and establishing the main risk factors. During the second phase indicators describing the quality of bank loan portfolio are evaluated performing an evaluation of the current quality of loan portfolio and calculating the probability of default according to loan sectors. The third phase covers the establishment of macroeconomic indicators influencing the change of the probability of default and the net profit of banks by selecting macroeconomic indicators that can influence the change of the probability of default according to loan sectors and the net profit of banks, by eliminating the seasonal fluctuations of the selected indicators, by evaluating correlation between macroeconomic indicators and the probability of default as well as the net profit, by defining the parameters of explanatory macroeconomic variables, by employing the model of linear regression and verifying reliability. The fourth phase is the research of the influence of macroeconomic scenarios on the credit risk of the bank sector by providing a prognosis of explanatory macroeconomic variables under the formulated macroeconomic scenarios and evaluating the influence of the macroeconomic scenarios on the probability of default according to loan sectors and the net profit of banks. The research is completed with a prognosis of the reserves accumulated by banks for

covering the probable losses on the basis of different scenarios: scenario 1– expensive loans, i.e. the rate of interest for loans in litas remains very high, scenario 2 – dropping real estate prices. Evaluation of the credit risk of the bank sector combining the models created by M. Sorge (2004) & M. A. Segoviano Basurto, P. Padilla (2007) helps to raise the most relevant questions of the macroeconomic state for the current period, and the integration of the analysis of the indicators of financial stability into the critical testing of the bank system and drawing up of macroeconomic prognosis helps to form an efficient future activity strategy for the bank sector or an individual financial institution. The results of the research showed that in case the macroeconomics of the country develops according to scenario 2 the Lithuanian bank system would face deficit of capital for covering the probable losses, therefore the banks of the country should accumulate more capital in order to be able to avoid such risk in the future.

Keywords: bank sector, credit risk, indicators of financial stability, critical testing.

### Introduction

During the last decades the financial markets of the world became more interdependent. The processes in the financial market benefited both the national economics of countries and individual investors and savers, but at the same time they changed the structure of the markets creating new types of risks for the market players. Due to these reasons in the last decade the influence of financial markets of the world manifesting through globalization processes and influencing the stability of financial systems of countries became the object of scientific research. A. Tornell, F. Westermann (2002) established that if a country liberalizes the financial market, a credit boom starts, and it can cause a financial crisis, short-term recession of economy or a rather lengthy period of post-crisis credit rating. In the opinion of E. Martinaityte (2008) with the current world financial crisis and recession of economy it is obvious that financial globalization is becoming an important factor of instability of markets and increases the undesirable risk of economic recession. Thus the situation of the world economy today leads the scientists to analyze the circumstances of the formation of a negative phenomenon – crisis – caused by financial markets as well as the measures, which would help to avoid such crises or at least help to reduce their negative effect on the economies of countries and the bank sector, especially

when the main risks of the bank sector arise due to the increased tension related to the situation of liquidity in the world markets, and also due to possible sudden decline of the quality of loan portfolios. The importance of financial crises and their effect on the economies of the countries is also shown by scientific research (Bordo, M. D. and Eichengreen, B. (2002); Laeven, L. and Valencia, F. (2008); Leika, M. (2008); Ingves, S. and Lind, G. (1996); Dahlheim, B. & Nedersjo, G. (1993); Martinaityte, E. (2008); Ramanauskas, T. (2005); Viotti, S. (2000)). Therefore upon evaluating the complex processes taking place in the world economies lately, it is very important to forecast the manifestations of possible crises in advance as well as to what extent they are going to affect the financial system of the country, and especially the bank sector, and form respective strategies, which would help to avoid huge financial losses, incurred when liquidating the consequences of crises. D. T. Llewellyn (2000) states that the majority of financial crises took place after a sudden and risky growth of real estate prices. He is also seconded by C. Borio, P. Lowe (2002), who maintain that periods of increase of bank crediting, growing real estate prices and high level of investment almost always cause problems to the financial system. C. Cottarelli, G. dell'Araccia, and I. Vladkova-Hollar (2003), P. Hilbers, I. Otker – Robe, C. Pazarbasoglu, G. Johnsen (2005) summarized the experience of the banks of Middle and Eastern Europe and some Balkan states in relation to a rapid growth of crediting and established that many of the countries witnessed credit growth booms from the beginning of this decade, and their beginning actually coincided with the improved prospects of economic growth and increase of the income of the country, reduction of interest rates, financial liberalization and structural changes in the bank sector, active participation of foreign banks in the financial market. The correlation of growing economy and the bank sector in Lithuania are analyzed by A. Lakstutiene, A. Vasiliauskaite, S. Leitoniene (2006), M. Strumickas, L. Valanciene (2006), A. Lakstutiene (2008), Macerinskiene, Ivaskeviciute (2008), & T. Ramanauskas (2005) who observed that the growth of economy is more rapid due to increased bank crediting during the high period, and with the business cycle transiting into the slow down phase credit rating cases become more common, the credit risk undertaken by banks becomes obvious, the interest rate increases, and this has a negative effect not only on the development of economy, but it can also cause a financial crisis, the probability of which increases in a case of inadequate evaluation of credit risk.

A number of econometric models have been created for solving financial stability problems, according to historical data they allow to evaluate the direct relation between the key macroeconomic phenomena and certain risk parameters, such as indicators of financial stability. M. Sorge (2004) argues that testing of the financial market under unfavourable conditions may be possible, when every bank system and time as well as certain indicators defining the crisis (special provisions for bank loans, problem loans or their write-off) are evaluated as a typical, directly related, historically formed vector function of macroeconomic indicators (GDP, inflation, interest rates and debt level). E. Hanschel and P. Monnin (2003) created a compound index of stability of the Swiss bank system,

which was composed by combining bank balance deviations from the trend and indicators of financial instability of the market. H. Kalirai and M. Scheicher (2002) evaluated the regression of timelines of special provisions for bank loans in Austria as a function, the variables of which was a wide set of macroeconomic indicators. M. Drehmann, G. Hoggarth, A. Logan and I. Zicchino (2004) created a simpler method using the vector autoregression (VAR) model expressing the vector of external variables. They concentrated on the relation between loan write-offs (evaluating the loans to households and companies both together and separately) and the volume of production, inflation of retail trade prices and real estate prices, nominal short-term interest rate and the actual currency rate in Great Britain. In their research J. Delgado and J. Saurina (2004) employed cointegration methods in order to establish both short-term and long-term relation between special provisions for loans and problem loans and certain macroeconomic activity indicators, unemployment, interest rates, and debt. The stability of commercial and savings banks was analyzed separately, problem loans were also analyzed separately for the household and company sectors. In some of the researches the analysis of timelines also covers the section of different sectors. For bank system sensitivity research in reduced form models scientists employed either the regular data from the general bank system at world proportion (J. A. Bikker, H. Hu (2002), J. Pesola (2001), M. Cavallo, G. Majnoni (2002), L. Laeven, G. Majnoni (2003)) or from individual banks in every country (K. Carling, T. Jacobsen, J. Linde, K. Roszbach (2003); V. Salas, J. Saurina (2002); D. Pain, J. Vesala (2004), S. Gerlach, W. Peng, C. Shu (2003)). When the key dependent variables are special provisions for loans, problem loans or profitability indicators (e.g. net revenue from interest), scientists suggest using both static and dynamic models, while combining indicators defining bank specifics as specifying variables to macroeconomic indicators. The inclusion of the sector section allows to evaluate the possible effect on financial institutions, which differ in their size, level of diversification of loans or experience in managing problem loans, at the moment of change of business cycles. V. Oung (2004) supplemented the macroeconomic model of Banque de France (Mascotte) in order to evaluate the effect of critical scenarios for several different periods (in the span of 2 years) on certain bank profitability and stability indicators, where a dynamic regular data method was used to establish the volume of problem loans and revenue from interest. The critical testing model suggested by M. A. Segoviano Basurto & P. Padilla (2007) allows forecasting the changes of bank capital during the set period due to changes of different risk factors, such as interest rates, currency rates or real estate prices. It is used to establish whether the capital of the bank is sufficient to withstand the possible shocks of economic development and absorb losses. This method also allows evaluating the dynamics of risk for the bank system in order to calculate the need for additional capital in the future. To evaluate the effect of both demand and offer crisis on the stability of the bank system S. Evjen, A. Lund, K. Morka, K. Nordal, J. Svendsen (2003) employed the model of the Central bank of Norway RIMINI. Bank losses due to loans are forecasted on the

basis of a function, composed of such variables as the ability of the household and company sectors to pay interest for bank loans. Macroeconomic analysis is integrated employing the microeconomic evaluation model (SEBRA), which helps to evaluate the probability of default by using factual and prognostic bank balance data. According to market operation principles the managers of every financial institution evaluate their assets and liabilities differently under different critical scenarios. Testing under unfavourable conditions may be carried out both at the level of individual banks and the financial system of the whole country. Commercial banks usually perform such testing regularly in order to establish sufficiency of capital. Testing is also widely employed by central banks and supervising institutions in order to establish the possible biggest threats to the bank system of the whole country in advance and obtain a quantitative assessment of their possible effect. The Bank of Lithuania is no exception, it carried out liquidity and credit risk testing under unfavourable conditions with respect to three largest Lithuanian banks in 2008 according to the model of M. A. Segoviano Basurto & P. Padilla (2007).

Upon performing an analysis of critical testing methods M. Sorge (2004) established that while differently modeling the change of certain economic indicators (prices, interest rates, foreign currency rates, growth of GDP, etc.), the relative probable distribution of losses is also evaluated differently. Furthermore, upon summarizing all possible relative probable distributions of losses a certain risk value measure, used to evaluate sensitivity of financial institutions to different types of risks, is obtained, therefore the integrated forecasting method suggested by M. Sorge (2004) broadens the methods of forecasting the indicators of financial stability. Thus, the integration of the analysis of the indicators of financial stability and macroeconomic forecasting into critical testing may lead to the formation of a very effective future activity strategy of the financial sector or an individual financial institution. The analysis of the indicators of financial stability may help to evaluate the probability of the formation of an unfavorable economic situation in the future, and critical testing may help to evaluate the possible negative effect of such an unfavorable situation on the stability of the financial system. Therefore **the objective of this article** is to evaluate the credit risk of the Lithuanian bank sector and forecast the bank reserve for covering the probable losses under different risk factors.

**Research methodology** - systemic analysis of scientific literature, logical comparative and mathematical statistical analysis methods.

## Research methodology

Upon change of risk factors critical testing of the credit risk of the Lithuanian bank sector is carried out on the basis of models used by M. Sorge (2004), M. A. Segoviano Basurto, P. Padilla (2007) and other scientists in their researches. Bank credit risk is tested in order to evaluate bank losses and the ability to cover them, provided banks absorb the consequences of established macroeconomic shocks.

The main phases of the research are the following:

### 1. Scenario modeling under different risk factors:

- 1.1. Analysis of the current macroeconomic situation in the country.
- 1.2. Analysis of expert evaluations.
- 1.3. Establishment of the main risk factors.
- 1.4. Modeling of possible scenarios.

### 2. Evaluation of the indicators defining the quality of bank loan portfolio:

- 2.1. Evaluation of the current quality of loan portfolio.
- 2.2. Calculation of the probability of default according to loan sectors.

### 3. Establishment of macroeconomic indicators influencing the change of the probability of default and bank net profit:

- 3.1. Selection of macroeconomic indicators that can have a possible influence on the change of the probability of default according to loan sectors and bank net profit.
- 3.2. Elimination of seasonal fluctuations of the selected indicators.
- 3.3. Evaluation of the correlation between macroeconomic indicators and probability of default and net profit and selection of most correlating macroeconomic indicators.
- 3.4. Establishment of parameters of explanatory macroeconomic variables using the linear regression model.
- 3.5. Evaluation of reliability of the use of linear regression equations for forecasting the probability of default and net profit.

### 4. Research of the influence of the scenarios on the credit risk of the bank sector:

- 4.1. Prognosis of explanatory macroeconomic variables according to formulated macroeconomic scenarios;
- 4.2. Evaluation of the influence of macroeconomic scenarios on the probability of default according to loan sectors and bank net profit.

### 5. Forecasting of the bank reserve for covering probable losses under different risk factors.

Under different risk factors the parameters necessary for critical testing calculated on the basis of quarterly data – from the first quarter of 2001 to the fourth quarter of 2008 – of the Lithuanian bank sector and macroeconomic indicators of the country. In order to evaluate the possible scenarios of future development of Lithuanian economy analysis of development of Lithuanian economy during a past period is performed, scenarios of development of the economy of the country are modeled on the basis of the performed analysis and evaluations of economy experts.

To evaluate the influence of formulated scenarios of development of Lithuanian economy on the bank credit risk evaluation of the quality of the current loan portfolio is carried out and indicators for evaluation of the probability of default for bank loans are established. In the calculations of the probability of default made by the Bank of Lithuania the bank loan portfolio is divided into three sectors taking into account the most risky and largest loan groups: the first – *loans to business clients*; the second – *mortgage loans*; and the third – *consumer loans*. The probability of default is also evaluated for these loan sectors in the research.

In order to select the main macroeconomic variables influencing the dynamics of the probability of default coefficients of correlation between macroeconomic variables and the probability of default according to sectors

and bank net profit is calculated. Taking into account the calculated correlation coefficients the main macroeconomic variables explaining the dynamics of the probability of default according to loan sectors and bank net profit are selected. Employing the linear regression model based on the smallest square method parameters of explanatory variables are evaluated. The influence of the macroeconomic variables on the quality and profitability of bank loan portfolio is evaluated with respect to prospects for two years, i. e. until the end of 2010.

After composing the regression model it is necessary to analyze whether this model is well suited for the available data, therefore it is verified whether preconditions for analysis are not violated. Multiple correlation coefficient, determination coefficient and adjusted determination coefficient, reliability -  $R^2 \geq 0,25$  are used for verifying the suitability of the linear regression model.

After providing a forecast of the probabilities of default according to loan sectors and bank net profit, the scope of probable losses of banks are calculated for the period in question. The probable losses of the loan portfolio are equal to the sum of the probable losses of the loans in it and is calculated:

$$EL = \sum_{n=1}^N [PoD_n \times EX_n \times LGD_n] \quad (1)$$

where: EL – the probable losses of the loan portfolio, N – the number of loans in the loan portfolio, PoD – the probability of default, EX – the loan position, LGD – the proportion of losses due to default of the debtor and the value of position in case of default (the Bank of Lithuania, 2008).

Special provisions formed by banks and profit are considered the sources for covering the probable losses, thus the results of credit risk testing under unfavorable conditions are analyzed comparing them to the net profit and special provisions accumulated by banks at the end of 2008. This allows us to make conclusions about the ability of banks to cover the losses incurred due to provided loans as well as to evaluate the sensitivity of the bank sector under different risk factors.

### Establishment of risk factors

In order to evaluate the possible scenarios of the development of Lithuanian economy in the future the analysis of the development of Lithuanian economy in the past has been performed. It showed that in 2000 – 2008 the real GDP was growing constantly, in 2003 its growth even amounted to 10.2 per cent. Inflation in the country started increasing from 2004 and in 2008 it reached the highest level during 1997 – 2008. During the I-III quarters of 2008 Lithuanian economy was moving along the “soft landing” trajectory, but the fourth quarter was the turning point and the economy of the country entered recession phase. Taking into account the updated statistics for the fourth quarter of 2008, the Bank of Lithuania forecasts that the GDP of the country will decrease by 15.6 per cent in 2009 and by 4.5 per cent in 2010. The growth of the loan portfolio of Lithuanian banks during the last eight years was also very rapid, especially in 2003 – 2007, when the

volume of loans grew by the average 47.7 per cent annually. The growth of the volume of loans was stimulated by less strict conditions for the provision of bank credits and the reduction of the interest rates for loans.

Rapid growth of borrowing from 2003 also caused the growth of real estate prices in the country. Housing prices in Lithuania started growing very rapidly in the second half of 2004 and reached the highest point in the II quarter of 2008, when the housing prices were even 4.5 times higher than in 1998. Thus, namely the reduction of interest rates for loans and growth of crediting conditioned the appearance of real estate speculations and overvalue thereof. Development of the loan portfolio and the growth of real estate prices in 2008 was stopped by the world financial crisis that reached Lithuania, declining quality of loans and growing risk of provision of new loans. The first factor determined the growth of the price of attracting credit resources to commercial banks, while the second and third factors affected the volumes of loans provided by banks and the interest margin applied to debtors. The analysis of the economy of the country and the credit system shows that *high interest rates* and *dropping real estate prices* are the main risks that can have a negative influence on the stability of the financial sector at the moment. Therefore taking into account the scenarios presented by the Bank of Lithuania, the macroeconomic situation in the country and the opinions of experts, critical testing of the credit risk of the bank sector are performed under two possible scenarios:

**Scenario 1.** Tension continues in global and Lithuanian financial markets. The liquidity of money markets remains low due to increased uncertainty and high risk premiums make borrowing more expensive – *interest rates for loans in litas remain very high*. The consequences of rumors about devaluation of litas manifest in the increasing tendency of companies and households to deposit savings in foreign currencies and borrow in the national currency. Upon regulating the open euro position the banks are forced to raise the interest rates for litas to attract more deposits in litas, and to act contrary to make the conditions for borrowing in litas less attractive. In 2009 the interest for loans in litas amounted to about 9 per cent, in 2010 – to about 8 per cent. The created real GDP in 2009 drops by 12 per cent due to high interest rates, and by 4.5 per cent in 2010. The decline of the real estate prices in 2009 remains similar to 2008 – about 20 per cent, and prices become more stable in 2010.

**Scenario 2.** More expensive borrowing and the processes in the real estate markets of neighbouring Latvia and Estonia also correct the real estate prices in Lithuania – real estate prices drop by almost 30 per cent in 2009, the prices are a little more stable in 2010. The dropping prices of real estate have a big negative effect on credit flows – in 2009 bank loan portfolio decreases by 5.0 per cent, and remains unchanged in 2010. The real economy is affected through private consumption, which in 2009 is lower by 20.0 per cent, and by 9.0 per cent in 2010. The real GDP is lower by 18.0 per cent in 2009, and 6.0 per cent in 2010.

## Evaluation of indicators defining the quality of the loan portfolio

Such indicators as the share of non-performing loans or losses due to depreciation of bank loans (hereinafter referred to as special provisions) in relation to the loan portfolio are used to define the quality of the loan portfolio. This produces the probability of default – the probability that the debtor will fail to fulfill the obligations in one year.

Non-performing loans in Lithuania are defined as loans, the periodical payments of which are delayed for over 60 days. The principles for establishing special provisions are based on the current financial state of debtors and the ability to repay the loan, thus the special provisions of banks are the expression of the current undertaken credit risk and losses. The non-performing loans and special provisions of the Lithuanian bank system are provided in Table 1.

Table 1

Non-performing loans and special provisions of the Lithuanian bank system

Sector	2006 quarter I	2006 quarter III	2007 quarter I	2007 quarter III	2008 quarter I
<i>Non-performing loans in comparison to the respective loan portfolio, per cent</i>					
Loans to business clients	0.93	1.20	1.05	1.05	1.25
Mortgage loans	0.50	0.60	0.55	0.60	0.75
Consumer loans	1.55	1.65	1.75	1.89	1.65
All loans	0.85	1.05	0.90	0.88	1.10
<i>Special provisions in comparison to the respective portfolio of non-performing loans, per cent</i>					
Loans to business clients	118.0	93.0	96.0	93.0	75.0
Mortgage loans	41.0	35.0	40.0	44.0	40.0
Consumer loans	113.0	95.0	81.0	83.0	78.0
All loans	108.0	88.0	90.0	85.0	73.0

Source: composed by the authors on the basis of the data from the Bank of Lithuania

At the end of 2007 non-performing loans to *business clients* accounted for about three quarters of all non-performing loans. The quality of loans to *households* was better than the common average of the loans of the system. This was mostly determined by high and rather stable quality mortgage loans to households. Compared to other loans the quality of *consumer loans* was a little worse: in 2007 the share of consumer loans, the periodical payments of which were delayed for over 60 days, fluctuated from 1.7 to 1.9 per cent, and at the end of the first quarter of 2008 accounted for 1.7 per cent. Covering of the probable losses with special provisions corresponded to the general quality of the loan portfolio segment, i. e. relatively lower depreciation losses were characteristic to higher quality loan portfolio segments. Thus, the relation of special provisions for mortgage loans and non-performing loans is much lower than for other loan portfolio segments.

Probabilities of default according to loan sectors are evaluated as the relation of special provisions and the respective loan portfolio. The dynamics of the calculated probabilities of default according to loan sectors in 2001 – 2008 are provided in Figures 1 and 2.

The probability of default for loans to business clients and mortgage loans (Fig. 1) until the quarter III of 2002 was of a very similar level, which means also of similar risk, but later the loans to business clients became more risky, and the risk difference between loans to business clients and mortgage loans continued to increase. In 2003 – 2008 the probabilities of default for mortgage loans and loans to business clients were rather stable and fluctuated respectively about 0.3 per cent and 1.2 per cent. At the end of 2008 a tendency of slight growth of the probability of default for mortgage loans and a significant growth of the probability of default for loans to business clients is noticed.

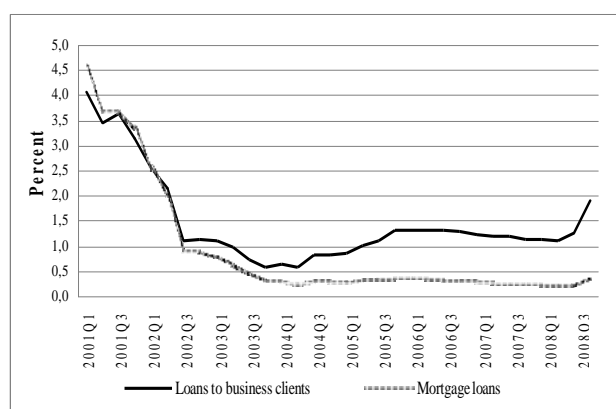


Figure 1. Probability of default calculated for loans to business clients and mortgage loans for 2001 – 2008.

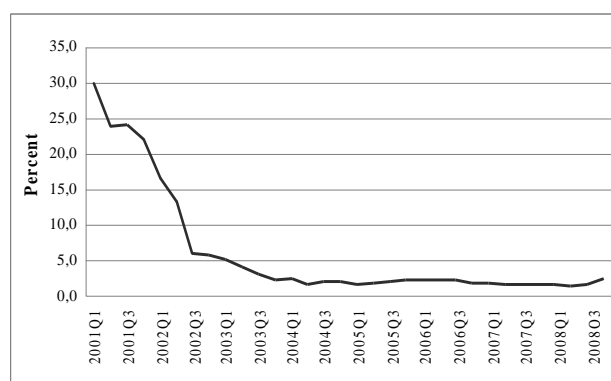


Figure 2. Probability of default calculated to consumer loans for 2001 – 2008.

Consumer loans were the most risky during the whole reference period, though their probability of default fluctuated insignificantly in 2003 – 2008 and on average was about 2.3 per cent. As in other loan sectors at the end of 2008 an insignificant growth of risk is observed.

## Establishment of indicators influencing the change of probability of default and net profit

Upon evaluating the probability of default for loans to business clients, mortgage loans and consumer loans during the reference period, it is important to analyze what macroeconomic indicators have the biggest influence on their change. Taking into account the macroeconomic variables that can influence the change of bank risk as distinguished by M. A. Segoviano Basurto and P. Padilla (2007) as well as the data provided by the Department of Statistics of Lithuania, eleven macroeconomic variables were selected for the evaluation of the reserve of Lithuanian banks for covering the probable losses (Table 2). In order to select the macroeconomic indicators (independent variables) that have the biggest influence on the probability of default according to loan sectors and bank net profit (dependent variables) correlation coefficients

of dependent and independent variables were calculated. Such macroeconomic variables as GDP, household consumer spending, export and import of goods and services, bank net profit are characterized by seasonness, therefore in order to make a more exact evaluation of the correlation between macroeconomic variables and probabilities of default according to sectors using the method of centered moving average, seasonal fluctuations in the data of GDP, household consumption spending and bank net profit are eliminated. Correlation coefficients of macroeconomic variables and probability of default as well as net profit are provided in Table 2.

After the selection of the main explanatory variables of the probability of default and net profit regression equations are composed. The parameters of the linear regression equations for probability of default according to loan sectors and bank net profit are provided in Table 3.

Table 2

Correlation coefficients of macroeconomic variables and probability of default (PoD) and net profit

		Dependent variables			
		PoD of loans to business clients	PoD of mortgage loans	PoD of consumer loans	Net profit
Independent variables	GDP	-0.360	-0.595	-0.597	0.972
	Household consumption	-0.384	-0.616	-0.617	0.966
	Unemployment	0.586	0.778	0.781	-0.861
	Housing prices	-0.290	-0.536	-0.538	0.963
	Net salary	-0.264	-0.500	-0.501	0.965
	Loan portfolio	-0.274	-0.522	-0.523	0.969
	Interest for loans	0.740	0.644	0.646	0.169
	Export	-0.341	-0.587	-0.589	0.940
	Import	-0.332	-0.580	-0.582	0.959
	Inflation	-0.057	-0.294	-0.296	0.861
	TUI	-0.341	-0.584	-0.586	0.963

Table 3

Parameters of linear regression equations

Variables	Coef.	PoD of loans to business clients	PoD of mortgage loans	PoD of consumer loans	Net profit
Fixed coefficient	$b_0$	4.02764	3.35540	20.78437	-735.46289
GDP	$b_n$	-0.00054	-0.00052	-0.00333	0.02869
Household consumption (NŪV)		-0.00014	-0.00006	-0.00038	-0.01318
Housing prices (GBK)					0.46394
Net salary (DU)					0.56653
Loan portfolio (PA)					-0.00887
Unemployment (ND)		-0.02485	-0.01832	-0.08549	
Loan interest (PP)		0.46853	0.55713	3.60745	
Export (EKS)		0.00039	0.00024	0.00152	
TUI		0.00012	0.00009	0.00060	0.00929

Regression equations are composed according to the data provided in Table 3. In order to evaluate the suitability of the composed regression equations for forecasting probability of default according to loan sectors and bank net profit - multiple correlation, determination and adjusted determination coefficients are calculated (Table 4).

Independent variables have a big influence both on the probability of default for the loans to business clients,

mortgage or consumer loans and the net profit, as in all these cases the multiple correlation coefficient exceeds 0.9. The values of the adjusted determination coefficient are slightly lower than those of the simple determination coefficient, but they are quite high (they significantly exceed the required limit of 0.25). Thus, the composed regression equations are suitable for forecasting probability of default according to loan sectors and bank net profit.

Table 4

Parameters of reliability of linear regression equations

Coefficients	PoD of loans to business clients	PoD of mortgage loans	PoD of consumer loans	Net profit
Multiple correlation ( <i>Multiple R</i> )	0.905	0.938	0.940	0.977
Determination ( <i>R Square</i> )	0.820	0.880	0.883	0.955
Adjusted determination ( <i>Adjusted R Square</i> )	0.776	0.852	0.855	0.944

## Research of the influence of the scenarios on the credit risk of the bank sector

The composed linear regression equations are used for forecasting probability of default according to loan sectors and bank net profit according to the modeled macroeconomic testing scenarios in Tables 5 and 6). In the case of the first

macroeconomic scenario high interest rates for loans in litas were considered the main source of risk. Though it can be seen from the data provided in Table 5 that the interest is decreasing in comparison to the last quarter, but taking into account the fact that it was even 10.1 per cent at the end of 2008, it still remains high.

Table 5

**Factual data for quarter IV of 2008 of the main macroeconomic variables influencing the probabilities of default and net profit, probability of default and net profit and prognosis for 2009 – 2010 according to scenario 1**

Indicator	2008		2009				2010			
	IV q	I q	II q	III q	IV q	I q	II q	III q	IV q	
GDP, million LTL	25,099.8	21,690.2	22,444.6	22,698.7	22,087.8	20,714.1	21,434.6	21,677.3	21,093.9	
Household consumption, million LTL	16,143.2	14,877.8	14,705.2	14,659.6	14,254.4	13,598.3	13,440.6	13,398.9	13,028.5	
Level of unemployment, per cent	7.9	7.9	9.7	11.9	14.5	16.0	15.2	13.5	11.5	
Interest, per cent	10.1	9.5	9.0	8.5	8.0	8.0	7.9	7.7	7.5	
Export, million LTL	13,841.7	9,817.4	11,997.5	12,251.6	11,765.4	10,111.9	12,357.4	12,619.2	12,118.4	
TUI, million LTL	33,921.8	31,484.6	29,910.3	28,414.8	26,994.1	26,994.1	26,994.1	26,994.1	26,994.1	
Housing price index	482.1	458.0	435.1	413.3	392.7	392.7	392.7	392.7	392.7	
Net salary, LTL	1,773.1	1,773.1	1,719.9	1,668.3	1,631.3	1,615.0	1,598.8	1,582.8	1,566.0	
Loans, million LTL	71,120.7	68,874.9	67,920.4	70,791.2	72,114.1	63,586.3	67,920.4	70,791.2	72,114.1	
<i>PoD of loans to business clients, per cent</i>	1.90	2.12	2.12	1.62	1.35	1.50	1.98	1.91	2.03	
<i>PoD of mortgage loans, per cent</i>	0.37	1.59	1.27	0.74	0.51	0.84	0.97	0.83	0.96	
<i>Consumer loans, per cent</i>	2.57	10.39	8.36	5.04	3.60	5.78	6.56	5.59	6.36	
<b>Net profit, million LTL</b>	596.7	588.87	565.88	495.09	427.41	463.09	438.22	411.20	378.06	

In the case of the second macroeconomic scenario rapid drop of real estate prices is the main source of risk (Table 6). In 2009 real estate prices would be 20 per cent lower every quarter than the prices of the respective quarter

of the previous year. In 2010 the drop of real estate prices would slow down and would amount to 9 per cent as compared to the respective quarter of 2009.

Table 6

**Factual data for quarter IV of 2008 of the main macroeconomic variables influencing the probabilities of default and net profit, probability of default and net profit and prognosis for 2009 – 2010 according to scenario 2**

Indicator	2008		2009				2010			
	IV q	I q	II q	III q	IV q	I q	II q	III q	IV q	
GDP, million LTL	25,099.8	20,211.3	20,914.3	21,151.1	20,581.8	18,998.6	19,659.4	19,882.0	19,346.9	
Household consumption, million LTL	16,143.2	13,479.3	13,323.0	13,281.7	12,914.5	12,266.1	12,123.9	12,086.3	11,752.2	
Level of unemployment, per cent	7.9	7.9	10.3	13.4	17.4	17.9	17.0	15.3	13.8	
Interest, per cent	10.1	8.2	8.3	8.4	8.5	8.3	8.2	8.1	8.0	
Export, million LTL	13,841.7	9,817.4	11,715.2	11,963.3	11,488.6	9,817.4	11,715.2	11,963.3	11,488.6	
TUI, million LTL	33,921.8	31,484.6	28,965.8	26,648.5	24,516.7	24,516.7	24,516.7	24,516.7	24,516.7	
Housing price index	482.1	443.5	408.0	375.4	345.4	345.4	345.4	345.4	345.4	
Net salary, LTL	1,773.1	1,773.1	1,684.4	1,617.1	1,552.4	1,536.9	1,521.5	1,506.3	1,491.2	
Loans, million LTL	71,120.7	68,874.9	61,128.3	63,712.1	64,902.7	57,227.6	61,128.3	63,712.1	64,902.7	
<i>PoD of loans to business clients, per cent</i>	1.90	2.50	2.57	2.24	2.11	2.29	2.67	2.65	2.79	
<i>PoD of mortgage loans, per cent</i>	0.37	1.73	1.60	1.32	1.30	1.65	1.73	1.65	1.81	
<i>Consumer loans, per cent</i>	2.57	11.15	10.41	8.72	8.77	10.98	11.43	10.87	11.83	
<b>Net profit, million LTL</b>	596.7	558.16	559.06	468.64	376.21	398.65	376.16	351.49	321.44	

During the research it was established that in the case of the second macroeconomic scenario the probability of default of loans to business clients exceeds the values obtained in the case of the first scenario by over 0.5 per cent. Thus we can state that the risk of dropping housing prices has a bigger influence on the probabilities of default of loans to business clients than high interest rates for borrowing. A different tendency is characteristic to the change of probability of default for mortgage and consumer loans during the analyzed period. In this case the first macroeconomic scenario, when the interest rates for loans in litas remains very high, has a bigger influence on the change of probability of default for mortgage and consumer loans.

The biggest leap of probabilities of default both in case of mortgage and consumer loans takes place in the first quarter of 2009, when the forecasted macroeconomic indicators are much worse than at the end of 2008. No significant growth of the probability of default is noticed during the remaining period of forecasting: in the case of mortgage loans it balances around 1.6 per cent, in the case of consumer loans the probability of default is much higher and hovers around 10.5 per cent. However, in the case of the second macroeconomic scenario the probability of default for mortgage loans during the period of forecasting is about 0.6 per cent lower than when forecasting according to the first macroeconomic scenario; the difference between

scenario 2 and 1 with respect to the forecasted probability of default for consumer loans is higher and averages 4.0 per cent.

In order to evaluate the influence of the probable growth of the probability of default for bank loans on the indicators of bank activities prognosis of bank net profit for 2009-2010 was also presented. In 2008 as well as during the period of forecasting bank net profit starts to decrease and at the end of the period it amounts to just about 300 million litas (almost 3 times less than in 2007). Dropping real estate prices (scenario 2) during the period of forecasting would have a bigger influence on decreasing bank net profit than high interest rates for loans in litas (scenario 1). It should be noted that different changes of economic activities are closely interrelated, for example high interest rates reduce the demand for real estate and can influence real estate prices. Due to this reason, provided rising interest rates are accompanied with

dropping real estate prices (though maybe to a lesser extent than during this testing), the negative effect on bank profit would manifest itself due to both factors.

### Forecasting of the reserve of Lithuanian banks for covering the probable losses under different risk factors

Banks cover the probable losses by establishing respective interest rates and evaluating depreciation of the value of loans. Taking that into account the fact that special provisions formed by banks and profit were considered the sources for covering the probable losses, credit risk is analyzed comparing the obtained results to the net profit accumulated by banks and special provisions at the end of 2008. This allows to make conclusions about the ability of banks to cover the losses incurred due to provided loans (Tables 7 and 8).

Table 7

Evaluation of the ability of Lithuanian banks to cover losses due to loans according to *scenario 1*

Indicators	2008	2009				2010			
	IV q	I q	II q	III q	IV q	I q	II q	III q	IV q
PoD of loans to business clients, per cent		2.12	2.12	1.62	1.35	1.50	1.98	1.91	2.03
PoD of mortgage loans, per cent		1.59	1.27	0.74	0.51	0.84	0.97	0.83	0.96
PoD of consumer loans, per cent		10.39	8.36	5.04	3.60	5.78	6.56	5.59	6.36
<b>Probable losses, million LTL</b>		<b>863.4</b>	<b>766.0</b>	<b>549.1</b>	<b>436.6</b>	<b>497.7</b>	<b>660.7</b>	<b>631.8</b>	<b>706.2</b>
Business clients, million LTL		424.8	419.2	334.3	283.0	277.3	391.5	392.6	426.6
Mortgage, million LTL		192.1	151.1	92.0	64.2	93.9	115.6	102.8	121.5
Consumer, million LTL		246.5	195.7	122.8	89.4	126.6	153.6	136.4	158.1
<b>Net profit, million LTL</b>	<b>867.3</b>	<b>588.9</b>	<b>565.9</b>	<b>495.1</b>	<b>427.4</b>	<b>463.1</b>	<b>438.2</b>	<b>411.2</b>	<b>378.1</b>
<b>Special provisions, million LTL</b>	<b>870.9</b>								
<b>RESERVE, million LTL</b>	<b>1,738.2</b>	<b>1,463.7</b>	<b>1,263.5</b>	<b>1,209.5</b>	<b>1,200.4</b>	<b>1,165.8</b>	<b>943.3</b>	<b>722.7</b>	<b>394.5</b>

Probable bank losses according to loan sectors are calculated according to formula 1 multiplying the volume of the respective loan portfolio (million litas) by its probability of default (per cent) and losses due to default

(per cent). No information is available about losses due to default of the debtor, therefore this research is based on the assumption of M. A. Segoviano Basurto, P. Padilla (2007) (based on Basel II directives) that this ratio is 50 per cent.

Table 8

Evaluation of the ability of Lithuanian banks to cover losses due to loans according to *scenario 2*

Indicators	2008	2009				2010			
	IV q	I q	II q	III q	IV q	I q	II q	III q	IV q
PoD of loans to business clients, per cent		2.50	2.57	2.24	2.11	2.29	2.67	2.65	2.79
PoD of mortgage loans, per cent		1.73	1.60	1.32	1.30	1.65	1.73	1.65	1.81
PoD of consumer loans, per cent		11.15	10.41	8.72	8.77	10.98	11.43	10.87	11.83
<b>Probable losses, million LTL</b>		<b>974.0</b>	<b>941.5</b>	<b>837.0</b>	<b>824.0</b>	<b>847.4</b>	<b>1,000.1</b>	<b>1,014.1</b>	<b>1,106.3</b>
Business clients, million LTL		501.3	508.2	461.4	441.7	423.6	527.4	545.1	584.7
Mortgage, million LTL		208.1	189.8	162.9	164.3	183.3	205.1	203.9	227.7
Consumer, million LTL		264.6	243.5	212.7	218.0	240.5	267.6	265.2	293.8
<b>Net profit, million LTL</b>	<b>867.3</b>	<b>558.2</b>	<b>559.1</b>	<b>468.6</b>	<b>376.2</b>	<b>398.6</b>	<b>376.2</b>	<b>351.5</b>	<b>321.4</b>
<b>Special provisions, million LTL</b>	<b>870.9</b>								
<b>RESERVE, million LTL</b>	<b>1,738.2</b>	<b>1,322.4</b>	<b>939.9</b>	<b>571.5</b>	<b>123.8</b>	<b>-325.0</b>	<b>-948.9</b>	<b>-1,611.5</b>	<b>-2,396.3</b>

From the provided results on the reserve accumulated by banks for covering the probable losses it is seen that in the case of scenario 1 the reserve for covering the probable losses would be sufficient for the whole period of forecasting, however, in case of macroeconomic changed under scenario 2 the accumulated reserve would become insufficient in the first quarter of 2010.

Thus, taking into account the obtained results of evaluation of the credit risk for the Lithuanian bank sector, we can conclude that the first scenario of development of macroeconomics of the country, when high interest rates for

loans in litas are considered the main source of risk, would not have such a big influence on the credit risk of the bank system and the accumulated bank reserve for covering probable losses would be sufficient. According to formulated assumptions of the development of the economy of the country, rapid drop of real estate prices (scenario 2) would affect the results of activity of the bank system in such a way that the probable losses incurred by banks due to provided loans would exceed the reserve accumulated by banks for covering such losses. Thus in the case of the second macroeconomic scenario banks would

face shortage of capital for covering the losses due to provided loans – the credit risk for banks would increase drastically.

Taking into account the obtained results of testing of Lithuanian economy under unfavourable conditions and based on the main aim of the testing under unfavourable conditions distinguished in theoretical research – to establish the size of losses and evaluate the sufficiency of capital of the bank system for covering those losses – it can be stated that provided the macro economy of the country develops under scenario 2, the Lithuanian bank system would face shortage of capital for covering losses. Thus, the banks of the country should accumulate more capital to be able to avoid such risk in the future.

## Conclusions

1. Critical testing of credit risk of the bank sector combining the models created by M. Sorge (2004), M. A. Segoviano Basurto, P. Padilla (2007) and other scientists and integrating the analysis of financial stability indicators into the critical testing of the bank system and drawing up of macroeconomic forecasts helps to form an effective bank sector activity strategy.
2. The obtained research results show that in 2003 – 2008 the probability of default for the bank loan portfolio fluctuated very insignificantly, and consumer loans were the riskiest according to loan sectors (average probability of default was about 2.3 per cent), loans to business clients were less risky (average probability of default was 1.2 per cent), and mortgage loans were the least risky (average probability of default was 0.3 per cent).
3. After identifying the main sources of risk during the research – high interest rate for loans in litas (scenario 1) and dropping real estate prices (scenario 2) it was established that the risk of growth of prices for housing (scenario 2) has a bigger influence on the growth of the probability of default for loans to business clients than high interest for borrowing (scenario 1): the difference of the probabilities of default being about 0.5 per cent. A different tendency is characteristic to the probabilities of default for mortgage and consumer loans: scenario 1, when the interest rates for loans in litas remain high, has a bigger influence (respective differences amount to 4.0 and 0.6 per cent).
4. The forecasted net profit of banks at the end of 2010 amounts to about 300 million litas (almost 3 times less than in 2007), and dropping real estate prices has a bigger influence on the decrease of the net profit of banks than high interest rates for loans in litas: in the case of scenario 2 the net profit is about 9.5 per cent smaller.
5. It was established that in the case of the first scenario, when high interest rates for loans in litas are considered the main source of risk, the reserve accumulated by banks would be sufficient for covering the probable losses (at the end of the period it would be about 394.5 million litas). Rapid drop of real estate prices (scenario 2) would have a much bigger influence on the results of activities of the bank system – the probable losses incurred by banks due to provided loans would exceed

the reserve accumulated by banks for covering such losses by even 2,396.3 million litas.

6. Based on the main aim of the critical testing of credit risk under changing risk factors distinguished in theoretical research – to establish the size of losses and evaluate the reserve of Lithuanian banks for covering the probable losses – it can be stated that provided the macroeconomy of the country develops under scenario 2 the Lithuanian bank system would face shortage of capital for covering losses, therefore the banks of the country should accumulate more capital to be able to avoid such risk in the future.

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**Lietuvos bankų sektoriaus kredito rizikos kritinis testavimas ekonominio sunkmečio kuriamoje aplinkoje**

Santrauka

Atviros ekonomikos sąlygomis veikiančių valstybių, tarp jų ir Lietuvos, bankinės sistemos stabilumas daugiausia priklauso nuo pasaulinės ekonomikos ir finansų rinkų būklės. Vykstantys procesai finansų rinkose buvo labai naudingi tiek šalių nacionalinei ekonomikai, tiek ir atskiriems investuotojams bei taupytojams, tačiau kartu ji pakeitė

rinkų struktūrą sukurdamas naujas rizikos rūšis rinkos dalyviams. Taigi šiandieninė pasaulio ekonomikos situacija verčia mokslininkus susimąstyti apie finansų rinkų sukeliama neigiamą reiškinį – krizių – susiformavimo aplinkybes ir priemones, kurios padėtų šių krizių išvengti ar bent jau sumažinti jų sukeliama neigiamą poveikį šalių ekonomikoms ir bankiniam sektoriui, juo labiau, kad pagrindinės rizikos bankiniam sektoriui kyla dėl padidėjusios įtampos, susijusios su likvidumo situacija pasaulio rinkose, taip pat dėl galimo staigesnio paskolų portfelio kokybės pablogėjimo. Finansinių krizių ir jų poveikio šalių ekonomikoms vertinimo svarbą įrodo ir moksliniai tyrimai (M. D. Bordo, B. Eichengreen (2002), L. Laeven, F. Valencia (2008), M. Leika (2008), S. Ingves, G. Lind (1996), B. Dahlheim, G. Nedersjo (1993), E. Martinaitytė (2008), T. Ramanauskas (2005), A. Lakštutienė (2008), Mačerinskienė, L. Ivaškevičiūtė (2008), S. Viotti (2000), C. Cottarelli ir kt. (2003), P. Hilbers ir kt. (2005)). D. T. Llewellyn (2000) atkreipia dėmesį, kad daugelis finansinių krizių vyko staigiai ir rizikingai pakilus turto kainoms. Tam pritaria ir C. Borio, P. Lowe (2002). Jie nurodo, kad bankų kredito didėjimo, kylančių turto kainų ir aukšto investicijų lygio laikotarpiai beveik visada sukelia finansų sistemos problemų. Esant dabartiniam pasaulio ekonomikos lėtėjimui ir atitinkamai situacijai Lietuvoje, kai šalies ekonomiką 2008 m. pabaigoje ištiko recesija, akivaizdu, kad Lietuvos ekonomikos vystymosi procesai ateityje labai stipriai paveiks šalies bankų sistemos kredito riziką ir veiklos rezultatus. Taigi įvertinti šį poveikį dabartinėmis sąlygomis yra labai svarbu.

Finansinio stabilumo problemoms spęsti sukurta nemažai ekonometrinių modelių, kurie, remiantis istoriniais duomenimis, leidžia įvertinti tiesioginį ryšį tarp esminių makroekonominių reiškinų ir tam tikrų rizikos matų, tokių kaip finansinio stabilumo rodikliai. M. Sorge (2004) teigia, kad finansų rinkos testavimas nepalankiomis sąlygomis gali būti įmanomas tada, kai kiekviena bankų sistema ir laikas, tam tikri krizę nusakantys rodikliai (paprastai tai bankų specialieji atidėjimai paskoloms, probleminės paskolos ar jų nurašymai) yra įvertinami kaip tipinė tiesiogiai susijusių makroekonominių rodiklių (BVP, infliacija, palūkanų normos ir įsiskolinimo lygis) istoriškai susiklostanti vektorius funkcija. J. Delgado ir J. Saurina (2004) savo tyrimuose taikė kointegravimo metodus, siekdami nustatyti tiek trumpojo laikotarpio, tiek ilgojo laikotarpio ryšį tarp specialiųjų atidėjimų paskoloms bei probleminių paskolų ir tam tikrų makroekonominio aktyvumo indikatorių, nedarbo, palūkanų normų, įsiskolinimo. Kita tyrimų dalis laiko eilučių analizėje skirta ir skirtingų sektorių pjūviui. Mokslininkai, atlikdami bankų sistemos jautrumo tyrimus, redukuotosios formos modeliuose naudojo arba bendros bankų sistemos pasauliniu mastu (J. A. Bikker, H. Hu (2002), J. Pesola (2001), M. Cavallo, G. Majnoni (2002), L. Laeven, G. Majnoni (2003)), arba individualių bankų vienoje šalyje (K. Carling, T. Jacobsen, J. Linde, K. Roszbach (2003); V. Salas, J. Saurina (2002); D. Pain, J. Vesala (2004), S. Gerlach, W. Peng, C. Shu (2003)) reguliariuosius duomenis. Kai esminiai priklausomieji kintamieji yra specialieji atidėjimai paskoloms, probleminės paskolos ar pelningumo rodikliai (pvz., grynosios įplaukos iš palūkanų), mokslininkai siūlo naudoti tiek statinius, tiek dinaminis modelius. Taip pat prie makroekonominių rodiklių kaip patikslinantis kintamieji yra priskiriami banko specifika nusakantys rodikliai. Sektoriaus pjūvio įtraukimas leidžia įvertinti, koks poveikis gali būti padarytas finansinės institucijoms, kurios skiriasi savo dydžiu, paskolų diversifikacijos lygiu ar patirties gausa valdant problemines paskolas, vykstant verslo ciklų pasikeitimams. S. Evjen, A. Lund, K. Morka, K. Nordal, J. Svendsen (2003), siekdami įvertinti tiek paklausos, tiek pasiūlos krizių poveikį bankinės sistemos stabilumui, panaudojo Norvegijos centrinio banko RIMINI modelį. M. A. Segoviano Basurto ir P. Padilla (2007) pasiūlytas kritinio testavimo modelis leidžia prognozuoti, kaip pasikeis bankų kapitalas per nustatytą laikotarpį pasikeitus įvairiems rizikos veiksniams: palūkanų normoms, valiutų kursui ar nekilnojamojo turto kainoms. Taip nustatoma, ar banko turimas kapitalas yra pakankamas išverti galimus ekonominės raidos sukrėtimus ir absorbuoti nuostolius. Taip pat šiuo metodu įvertinama bankų sistemos rizikos dinamika, leidžianti apskaičiuoti papildomo kapitalo poreikį ateityje. M. Sorge (2004), atlikęs kritinio testavimo metodų analizę, nustatė, kad skirtingai modeliuojant tam tikrų ekonominių rodiklių (kainų, palūkanų normų, užsienio valiutų kursų, BVP augimo ir kt.) kitimą, nuostolių sąlyginis tikimybinis pasiskirstymas vertinamas vis kitai. Be to, apibendrinus visus galimus nuostolių sąlyginius tikimybinius pasiskirstymus, gaunamas tam tikras rizikos vertės matas, kuris naudojamas finansų institucijos jautrumo skirtingoms rizikos rūšims įvertinti. Vadinas, kritiniam testavimui priskiriant finansinio stabilumo indikatorių analizę ir makroekonominių prognozių sudarymą, galima suformuoti labai veiksmingą finansų sektoriaus ar atskiros finansų institucijos ateities veiklos politiką. Finansinio stabilumo indikatorių analizę gali padėti įvertinti nepalankios ekonominės situacijos

susiformavimo tikimybę ateityje, o kritinis testavimas – įvertinti galima šios nepalankios situacijos neigiamą poveikį finansų sistemos stabilumui. Todėl **šio straipsnio tikslas** – įvertinti Lietuvos bankinio sektoriaus kredito riziką ir prognozuoti bankų rezervą tikėtiniems nuostoliams padengti, esant skirtingiems rizikos veiksniams.

Bankų paskolų portfelio kokybę ir patiriamus kredito rizikos nuostolius lemia šalies ekonomikos raida ir skolininkų finansinė būklė. Suteiktoms paskoloms sudarant didžiąją dalį Lietuvos bankų turto, kredito rizika yra svarbiausias individualus rizikos šaltinis. Makroekonominių procentų poveikio bankų sektoriaus patiriamoms rizikos rūšims tyrimo svarbą atskleidžia ir teorinių tyrimų gausa. Lietuvos bankų sistemos kredito rizikos testavimo nepalankiomis sąlygomis metodologija buvo suformuota remiantis M. Sorge (2004), M. A. Segoviano Basurto, P. Padilla (2007) teoriniuose tyrimuose naudojamais testavimo modeliais. Tyrimui atlikti buvo suformuluota tyrimo metodologija ir išskirti pagrindiniai tyrimo etapai bei gauti rezultatai:

1. *Makroekonominių scenarijų modeliavimas*, kuris paremtas esamos makroekonominės situacijos šalyje analize, ekspertų vertinimų analize ir pagrindinių rizikos veiksnių nustatymu. Pirmojo etapo rezultatas - suformuoti du šalies ekonomikos vystymosi 2009 – 2010 m. scenarijai, kuriuose išskirti pagrindiniai rizikos šaltiniai: aukšta paskolų litais palūkanų norma (1 scenarijus) ir ryški nekilnojamo turto kainų korekcija (2 scenarijus).

2. Bankų paskolų portfelio kokybę apibūdinančių rodiklių apskaičiavimas, kuriam pasiekti apskaičiuotos nemokumo tikimybės pagal paskolų sektorius ir įvertinta esama bankų paskolų portfelio kokybė. Gauti rezultatai parodė, kad 2003 – 2008 m. bankų paskolų portfelio nemokumo tikimybės svyravo labai nedaug, o rizikingiausios pagal paskolų sektorius buvo vartojamosios paskolos (vidutinė nemokumo tikimybė apie 2,3 proc.), mažiau rizikingos - paskolos verslo klientams (vidutinė nemokumo tikimybė 1,2 proc.), o paskolos būstui įsigyti buvo mažiausiai rizikingos (vidutinė nemokumo tikimybė 0,3 proc.).

3. Nustatyti pagrindiniai nemokumo tikimybės pagal paskolų sektorius ir bankų grynąjį pelną darantys įtaką makroekonominei rodikliai ir sudarytos tiesinės regresijos lygtys, kuriomis pasinaudojus galima atlikti nemokumo tikimybių ir grynojo pelno prognozes.

4. Atlikta paskolų nemokumo tikimybių ir grynojo pelno prognozė, kurios rezultatai parodė, kad būsto kainų didėjimo rizika (2 scenarijus) daro didesnę įtaką verslo klientų paskolų nemokumo tikimybių didėjimui nei didelės skolinimosi palūkanos (1 scenarijus): nemokumo tikimybių skirtumas - apie 0,5 proc. punkto. Kitokia tendencija būdinga būsto ir vartojamųjų paskolų nemokumo tikimybėms: 1 scenarijus, (paskolų litais palūkanų norma ir toliau lieka labai didelė) daro didesnę įtaką (skirtumai atitinkamai siekia 4,0 ir 0,6 proc. punkto). Prognozuojamas bankų grynasis pelnas 2010 m. pabaigoje siekia tik apie 300 mln. litų (beveik 3 kartus mažiau nei 2007 m.), o nekilnojamojo turto kainų kritimas daro didesnę įtaką bankų grynojo pelno sumažėjimui nei didelė paskolų litais palūkanų norma: 2 scenarijaus atveju grynasis pelnas apie 9,5 proc. mažesnis.

5. Atliktas bankų sukaupto rezervo tikėtiniems nuostoliams padengti prognozavimas, remiantis skirtingais scenarijais. Jis parodė, kad esant 1-ajam scenarijui (pagrindiniu rizikos šaltiniu laikoma didelė paskolų litais palūkanų norma) bankų sukaupto rezervo tikėtiniems nuostoliams padengti pakaktų - laikotarpio pabaigoje jis siektų 394,5 mln. lt. Spartus nekilnojamo turto kainų kritimas (2 scenarijus) gerokai stipriau paveiktų bankų sistemos veiklos rezultatus - bankų patiriami tikėtini nuostoliai dėl suteiktų paskolų net 2396,3 mln. lt. viršytų bankų sukauptą rezervą šiems nuostoliams padengti.

Remiantis teoriniuose tyrimuose išskiriamu pagrindiniu kredito rizikos kritinio testavimo, keičiantis rizikos veiksniams, tikslu – nustatyti nuostolių dydį ir įvertinti Lietuvos bankų rezervą tikėtiniems nuostoliams padengti – galima teigti, kad šalies makroekonomikai plėtojantis pagal 2-ąjį scenarijų Lietuvos bankų sistema susidurtų su kapitalo trūkumu savo nuostoliams padengti, todėl šalies bankai turėtų suformuoti didesnę kapitalą, norint ateityje šios rizikos išvengti. Bankinio sektoriaus kredito rizikos kritinis testavimas, sujungiant M. Sorge (2004), M. A. Segoviano Basurto, P. Padilla (2007) ir kitų mokslininkų sukurtus modelius ir priskiriant finansinio stabilumo indikatorių analizę kritiniam bankinės sistemos testavimui ir makroekonominių prognozių sudarymui padeda suformuoti veiksmingą bankinio sektoriaus veiklos politiką.

Raktažodžiai: bankų sektorius, kredito rizika, finansinio stabilumo indikatoriai, kritinis testavimas.

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