
MODELLING OF SYSTEMIC RISK OF BANKING SECTOR

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Abstract

Purpose – to evaluate the general networking and simulation approaches of modelling of systemic risk and the financial contagion and their ability to assess the banking sector resilience in the case of external economic shocks and collapse of idiosyncratic financial institutions.

Design/methodology/approach – a general overview of research papers presenting concepts and methodologies of assessment of systemic risk of the banking sector.

Findings – limitations of the networking approach and possible ways to improve modelling of systemic risk. The network approach cannot explain the causes of initial default of bank. On the other hand, assumptions made on LGD and interbank exposures are very strong. These features are important limitations of network and simulation approaches.

Research limitations/implications – the application of reviewed methods in the case of Lithuanian banking sector falls, however, due to the lack of exhaustive data. On the other hand, until now, applied methods for systemic risk due to the lack of data have been limited. Also, because of this reason, there are difficulties to create adequate dynamic assessment for systemic risk models. Therefore, in assessing systemic risk of the banking sector, the same problem remains: is it possible to parameterize the financial crisis, its spread and speed and

other characteristics according to quantitative methods. Knowing the liquidity, credit risk and other standards set in Basel Accords, it is also not enough to properly manage the systemic risk of the whole banking sector because for the proper activity of the banking sector not only characteristics related to capital requirements have influence on it, but also external (mostly the macroeconomic, political) factors.

Practical implications – determination of the explicit connection based on quantitative methods determining the systemic risk of the banking sector would be exact and objective assessment and useful not only for the banking executives providing business trends, identifying potential sources of risk in the near future, but also for the rest part of society, both ordinary citizens and entrepreneurs with current accounts and deposits in banks.

Originality/value – in essence, modelling of the systemic risk and analysis of instability causes of the banking sector applying reliable quantitative methods in Lithuania are not sufficiently developed. Researchers in other countries have established that a high threat of systemic risk is concentrated in the interbank market; many researches have been done to assess this risk, however, problems related to assessment of systemic risk and application of models always occur. The most common problem is the lack of information and assumptions, and constantly changing economic environment: emerging (or which may arise) new types of transactions, the new banking regulatory conditions and other financial innovations. First, whether the country's banking business is so dependent on each other to create the threat of the systemic risk between banks' assets and liabilities. Second, the banking sectors of the Baltic states are essentially controlled by large foreign banking groups, so there is no doubt that the international financial groups' liquidity problems could spill over to other banks in the Baltic states. On the other hand, a question remains essentially and completely unexplored: how and why such problems could spill over in the Baltic Sea region countries? Also, little attention has been paid to the reliability of interbank payment systems and to the analysis of this object as a potential source of systemic risk.

Keywords: banking sector, interbank market, systemic risk.

Research type: literature review, general review.

1. Introduction

The last financial crisis has exposed the impact of globalization on the financial sector. The financial crisis has caused the creditworthiness and liquidity problems in money market, and dramatic decline in the capital market affected essential sectors of the economy. These problems have a direct impact on the banking system's reliability, on the need to more rigorous monitor and to evaluate the systemic risk of financial sector. This type of research has been missing in Lithuania, there have been extremely rare individual efforts to carry it out, and in general, there has been done not much in this area. On the other hand, in other countries, there are empirical assessments of systemic risk of banking sector mostly based on a credit risk, i.e. on insolvency of a particular bank. Banking networking and simulation methods are widely applied in such assessments.

So far, there have been many attempts to carry out such research, but it has been mostly limited to available data of commercial banks on their exposures in the interbank market. Banking networking and simulation methods are easily interpreted by economists, it shows clearly the structure of banking sector, helps to identify sources of systemic risk and evaluate the threat of contagion from one financial institution to another. However, it also has a number of shortcomings. Assets structures and quantitatively described external factors (their shocks) on the first banking default and on a whole banking system are not enough explored due to the lack of data (because defaults of banks are rare events, especially in Central Europe due the historical reasons). This type of research relies on the application of predetermined mathematical models, which require a strong (i.e. limiting the investigation) assumptions mostly made for assets structure, banking sector reticence, etc.

This article aims to review typical features of networking methods and potential possibilities for their application. It is expected that it will stimulate a more active interest of Lithuanian academic community and financial supervisory authority in this area.

2. Classic models for financial stability analysis

Networking in the banking sector. Banking network approach means the modelling of systemic risk in the banking sector or their connections in the interbank market by the liabilities between banks applying elements of graph theory. In these cases, when the banking system of a country is divided into several segments (e.g. the largest banks, i.e. money centres, medium banks, regional/cooperative savings banks), in the general graph the subgraphs are distinguished. The most important criteria of vulnerability of any bank depending on the financial crisis contagion are as follows:

1. The number of interbank relationships;
2. The volume of interbank exposures;
3. The distance to the remaining participants of the interbank market (measured by the number of financial intermediaries, it can be weighed in a net volume);
4. A systemic relevance of counterparties;
5. The position (distance) in an interbank market (network).

According to the empirical studies of many countries (see Boss *et al.* (2004), Müller (2003), etc.), the centralization of the interbank market is more concentrated by creditors rather than debtors. Contrary to the biggest debtors (i.e., money centres), the largest creditors (in the Baltic States they are Scandinavian banks) are not always important partners of the interbank market. Therefore, the relevance of the debtor bank and the importance of the creditor bank in the interbank market are not positively correlated.

The problem of the financial crisis spreading as the consequences of macroeconomic shocks was analysed by Elsinger *et al.* (2002) and others. These authors analysed how business cycle changes, interest rates, exchange rate and stock market shocks would affect the insolvency of banking sector. In each scenario, banks gain and lose, and this may affect payment flows between banks or net exposure of bank due to credit risk

and market risk. Such empirical research could be determined as a model of assets and liabilities of banks related to risk management techniques.

A typical cause of occurrence and contagion of the financial crisis in developing economies can be depositors' panic and shifted shocks to settlements inside the banking system considering the strategic banks and depositors interaction (see Lubloy, 2004). So, it is important to investigate the "starting" crisis behaviour of experienced banks in the interbank market according to the reaction of all depositors on the banking system suffered economic shocks.

In analysing the changes of systemic risk and contagion from one financial institution to another, it is important to identify three main sources of risk: the behaviour of debtor banks, creditor banks and intermediaries banks, because the probability of default of one bank depends on its exposure in another defaulting bank. Therefore, it is important to find an answer to the following question: how does deposit size of creditor bank impact the probability of default of pre-set debtor bank? In other words, it is appropriate to determine whether the interbank market can reduce the effect of spread of the financial crisis. Moreover, the higher bank's exposure in another defaulting bank, the greater probability that depositors prematurely withdraw their deposits (see Furfine, 1999, 2001). In addition, the dual nature of interbank market is disclosed: a creditor bank can decrease the risk contagion of the financial crisis or can increase liquidity risk of a debtor bank.

The interbank market not only transfers the initial shock, but it also reduces the general liquidity of system, thereby increasing the overall fragility of the banking system. The influence of capital structure of financial market agents (bank governors and depositors) defining the fragility of the banking system is important. On the other hand, the remaining banks without directly affecting the activities of debtor bank may do a negative indirect impact on the banking crisis. In addition, the financial system crisis can result from concentration of exposures of individual institutions or collapse of any financial institution resulted from common factors of all market participations (for more details, see Sahel and Vesala, 2001). Financial market prices and macroeconomic conditions represent key factors, which may affect all institutions.

A group of models based on bank networking is applied for the research of systemic risk in banking sector applying the general network theory. These models are based on the concept that banking system can be treated as a network, in which each bank is a node, whereas asset and liabilities make edges (i.e., exposures) of this network. One of the most important banking system network notions is its centralization; it means the influence and significance of a particular bank in banking system, i.e., systemic relevance. Systemic relevance of any bank can be measured applying the so-called centrality indices. In and out degree centrality indices of i th bank are defined as the following:

$$C_{in}(i) = \frac{\sum_{j \in N(i)} (j, i)}{n-1}, \quad C_{out}(i) = \frac{\sum_{j \in N(i)} (i, j)}{n-1}, \quad C_{in}^{(1)}(i), C_{out}(i) \in [0, 1], \quad i = 1, 2, \dots, n \quad , \quad (1)$$

where (i, j) denotes the financial claim of i th bank to j th and, reciprocally, (j, i) means the financial liabilities of i th bank to j th, $i, j = 1, 2, \dots, n$, $i \neq j$. $N(i)$ is the collection of

all remaining banks¹ that have linkages with *i*th, $i = 1, 2, \dots, n$ banks and satisfying the following condition:

$$|N(i)| \begin{cases} = n - 1, & \text{if the interbank market is complete} \\ \leq n - 1 & \text{if the interbank market is incomplete} \end{cases}, \quad i, j = 1, 2, \dots, n. \quad (2)$$

In-closeness centrality of *i*th credit institution is given by the following:

$$I(i) = \frac{n - 1}{\sum_{j \in N(i)} d(i, j)}, \quad I(i) \in [0, 1], \quad i = 1, 2, \dots, n, \quad (3)$$

where $I(i) = \frac{n - 1}{\sum_{j \in N(i)} d(i, j)}$, $I(i) \in [0, 1]$, $i = 1, 2, \dots, n$, is the distance between two banks, measured by the number of interbank linkages that are needed to reach *i*th credit institution from *j*th bank, $i, j = 1, 2, \dots, n$, $i \neq j$ or may be measured applying another node of graph numerical characteristics. So far, there has been no created universal and acceptable in many cases value of systemic relevance of a bank. Therefore, in this case, the application of different measures can be justified, as it takes into account different aspects of systemic relevance, e.g., these indices may also be applied in estimating the concentration of the banking system (in various aspects) level, since there is a relationship between liquidity and solvency of individual financial institutions, while their exposures are significantly concentrated. The main issue of investigating the banking system in this way is the following: how would be affected the banking system and its stability, i.e. interbank network, if one or several points of such network would be eliminated, i.e. failed any of banks or some of them at the same time (e.g., Boss *et al.* (2004) analysed Austrian banking sectors, Upper and Worms (2002) investigated German banking system, Wells (2004) researched United Kingdom’s banking system, Degryse and Nguyen (2004) studied Belgian banking system). Also, such researches have been carried out in other countries. A similar methodology and a similar type of data were applied in these researches. These investigations are based on the balanced sheets of banks, as much as possible adding this data by specific information about the exposures in other banks (usually information on large exposures in other banks are required to be submitted by banks in some countries) or making certain assumptions about the distribution of interbank deposits and other interbank liabilities in the banking system.

Upper and Worms (2002) concluded that the impact of the spread of the financial crisis has a limited scope, however, it is possible. The work of these authors showed that in such research value of loss given default, LGD, i.e. which part of the assets in another bank is truly lost, is extremely important. They showed that if the LGD value is 100%, financial crisis will affect a major part of the German banking system (2800 of 3246). In addition, the LGD reduced up to 75% value would influence the spread of the financial crisis insolvency problems in 2444 banks (i.e. only a small part of the

1 There are *n* such collections of counterparties in interbank market having different systemic relevance.

banking sector measured by assets) less than 100% of the LGD. The critical LGD value of the German banking system is 40-45%, and lower LGD values would lead that the problem of the spread of the financial crisis in the German banking system would be quite limited. In addition, it is difficult to model the LGD itself, since it is an indicator related to confidential information and should be treated as a consequence of specific asset structure of each bank. Therefore, the worst case scenario of systemic risk in this paper is analysed under assumption that the LGD is the same and constant in the whole banking sector.

Boss *et al.* (2004) in their paper tried to model the financial crisis risk of the Austrian banking system applying results from general network theory. The asymmetry of relationships inherent to the Austrian interbank market was taken into account of the model (there are very few financial institutions with many interbank linkages, whereas there are many with only a few links). In this paper, Boss *et al.* (2004) used data set of the Austrian central bank collected by surveys from banks. The system of mutual credit relations between financial institutions can be viewed as a network, defined in graph theory terms, and it is the main element of the model for the risk contagion of the financial crisis. The authors revealed that the interbank market structure is distributed according to the exponential law. It means that there are very few banks with many interbank linkages, whereas there are many with only a few links. This feature of asymmetry of interbank market is favourable in order to maintain the stability of the banking system in unexpected relationships between the bank's break-up. It means that according to the fixed exposures of banks, the Austrian banking system is relatively robust with respect to domino effects, which may be caused by default of single financial institution. In this paper, Boss *et al.* (2004) established that scales of different exponential functions are related to different banking sectors of the whole interbank market. Otherwise, this model gives possibility to eliminate a large class of unrealistic types of networks, which are discussed in another scientific literature. On the other hand, in this case, the concept "too big to fail" is overestimated.

Müller (2003) assessed the impact of the financial crisis on the Swiss interbank market. In this case, the risk of the financial contagion is understood as a threat that small shocks exchange and weaken a significant part of the financial system, i.e. in this case, the spread of the financial crisis is interpreted not as a result of a chain reaction of banks, but as the number of failures of banks set at any point in time. To assess the risk of the financial crisis and the banking system's inherent instability, in this article two methods were applied: similarly to the case of the Austrian interbank market, elements of banks networks theory and simulation of the financial crisis (similar to testing under unfavourable conditions on individual banks), i.e. recursive algorithms. Such choice of methodologies is justified by the fact that the graph theory applications oriented to the interbank market relationships and simulation methodology more emphasizes the importance of individual banks' insolvency. The Swiss National Bank covered the quarterly interbank market data of about three hundred Swiss and foreign banks to assess their systemic relevance and systemic risk. Two different channels of the financial contagion are indicated:

1. The financial crisis of the interbank market may occur due to the impact of accessible information for market participants. A bank having the liquidity problems may arouse suspicions of their difficulties for creditors of other banks, which assets structure is similar.
2. The financial contagion may spread to other financial institutions through direct connection – interbank markets and payment systems.

Wells (2004) investigated British banking system on the basis of 2002 year data and showed that the financial crisis spread options are rather exceptional. Even if it is not regained, all the losses of the amount of assets, only 4 of the 33 cases, the insolvency of a single bank may trigger other banks. In addition, banks with insolvency problems represent only a small part of the banking system. However, the results can be changed a little if matrix of assets and liabilities of interbank market (see formula (4)) are added with more precise data, i.e. information on a particular high volume of bank assets held in other banks. The threat of the spread of the financial contagion would then increase; however, the banks with insolvency problems will represent only a small part of the banking system assets. On the other hand, it shows that the results are impacted by the accuracy of the information, because the entropy minimization procedure, giving uniform distribution of assets between banks and liabilities structure, has an impact on determination of the threat of the financial crisis spread.

Degryse and Nguyen (2004) carried out the study on the basis of 1992-2002 banks' financial statements. These authors concluded that the possibilities of the spread of the financial crisis in Belgian banking sector within a decade decreased and at the end of the study (in 2002) were quite limited. As in previous studies, the financial crisis spread of the banking system depends on assumptions about LGD values. On the other hand, the investigation of the Belgian banking system revealed that in some periods the financial crisis could spread to as many as 11 steps (domino effect), so the hypothesis that the spread of the financial crisis of the banking system should be analysed within a certain period instead a single reporting date.

Lubloy's (2004) study in respect of the Hungarian banking system is unique, as Hungarian central bank collects information about the executed transactions of interbank system denominated in the national currency (forint). For this reason, the author chose 50-day period and studied the particular structure of the Hungarian banking system's assets and liabilities without doing strong theoretical assumptions about its distribution. This research revealed that due to the underdeveloped Hungarian interbank market, the threat of the spread of the financial contagion is of a moderate level. Moreover, the consequences would also be limited.

The main shortcoming of this methodology is that the structure of assets managed by banks is not taken into account in these empirical assessments. The exposures of liquidity and the initial cause of bank's insolvency depend on this structure. On the other hand, the accuracy of the network approach is strongly dependent on the quality of used data. Such evaluation has been carried out in the Baltic states, but it has not been developed further (see Valužis and Židulina, 2010).

Simulation approach. To assess the systemic relevance of an individual bank and the impact of the structure of bank relationships on the stability of the banking system,

the banking network techniques may be combined with the financial crisis simulations. Additional evaluation of systemic risk applying network approach could be carried out using Monte Carlo simulation. In order to assess the resilience of the banking system to the collapse of one bank, this situation is simulated and monitored whether it affects the rest of the sector. Such approach gives an opportunity to assess inherent instability of the banking system. In this case, the instability of the banking sector is treated as a function, depending on the following factors:

- The structure of the interbank connections;
- The liquidity of the whole banking system;
- Capital (usually Tier-1) of the banks.

This is not a consequence of the bank's failure. This latent instability can be two-fold: on the one hand, this may be just that what is aimed to find out; on the other hand, it may worsen the results when the crisis of the individual bank is simulated and its impact on other banks is assessed. The assessment of systemic risk simulation methodology is done in three steps:

1. Channel of exposures. To assess the relevance of banking system and its exposure in respect of aggregate, the bankruptcy situation of the banking system is simulated $n > 1$.
2. Identification of the systemic risk with recursively algorithm. The most important applications of this algorithm are the strict separation of insolvency and illiquidity and the inclusion of credit lines. The algorithm identifies the illiquid and insolvent banks, as the financial crisis channels on the assumption that they cannot use the credit lines.
3. Channel of the exposures and credit lines. In this case, illiquid but solvent banks have opportunity to borrow using credit lines from other banks.

Researches of the spread of the financial crisis in the banking sector are based on such treating of the banking system as a network of net interbank exposures. The set of net exposures between banks are defined as a square (not necessarily symmetric) matrix (see formula (4)), in which the main diagonal is filled with zeros. The sum of elements of columns of this matrix means the liabilities of any bank for participants of interbank market, and the sum of elements of rows of this matrix show assets of any bank holding in the accounts of the interbank market participants. The entropy minimization procedure is applied to evaluate the accuracy of the data. Let's suppose that N is a number of functioning banks in a country. Any bank of the system may keep a certain part of its funds in another bank. So, x_{ij} denotes assets (funds in correspondent accounts, one night deposits, other deposits, loans, etc.) of i th bank ($i = 1, \dots, N$) in j th bank ($j = 1, \dots, N$). Moreover, the bank cannot lend itself, so the interbank market exposures in matrix X^* have the form as follows:

$$X^* = \begin{matrix} & & & & \sum_j & \\ & 0 & \cdots & x^*_{1j} & \cdots & x^*_{1N} & a_1 \\ & \vdots & \ddots & \vdots & \ddots & \vdots & \vdots \\ x^*_{i1} & \cdots & 0 & \cdots & x^*_{iN} & a_i \\ \vdots & \ddots & \vdots & \ddots & \vdots & \vdots & \vdots \\ x^*_{N1} & \cdots & x^*_{Nj} & \cdots & 0 & a_N \end{matrix} \cdot \quad (4)$$

$$\sum_i \quad l_1 \quad \cdots \quad l_j \quad \cdots \quad l_N$$

It should be noted that if foreign banks make a strong impact to the banking sector (banks lend significant sums to local banks), then the matrix is no longer square (e.g., see Degryse and Nguyen, 2004). To evaluate unknown elements of this matrix, it is necessary to solve the problem with N^2 unknown and $2N$ known values, according to the condition $a_i = \sum_j x_{ij}$ and $l_j = \sum_i x_{ij}$. In general, the model can be expressed as follows (using Restricted Additive Schwarz algorithm):

$$x^*_{ij} = \begin{cases} 0 & \text{if } \forall i = j \\ a_i l_j & \text{if } i \neq j \end{cases} \quad (2)$$

The main drawback of this approach is the assumption that exposures are independent Tier-1 capital of the bank is the primary source of the bank’s resources, so its loss is actually a sudden large-scale negative consequence for the bank. The authors of similar researches define the spread of financial crisis by the following formula:

$$\sum_j \theta x_{ij} > c_i, \quad (5)$$

where c_i refers to the Tier-1 capital of bank i and θ refers to the loss rate. The LGD for the i th bank failure is expressed as a relative part of the net exposures and held constant throughout the banking sector. The assumptions in the analysed models mean that the loss rate is fixed, as in practice it is difficult to obtain a reliable estimate. Also, a domino effect in the banking system, i.e. as already defaulted next bank with the first bank would affect the rest of the banking system, is studied using the following formula:

$$\sum_{ij} \theta (x_{kj} + x_{ki}) > c_k, \quad (6)$$

where c_k refers to the Tier-1 capital of k th bank. Such models have limitations due to the used data and the lack of flexibility. Therefore, it is possible to improve these models by making assumptions that the data are dynamical, i.e. depending on the time.

In order to estimate the systemic risk, the default intensity approach can be applied in simulation techniques. Schoenmaker (1998) analysed the U.S. banking system risk from 1880 to 1936, i.e. when the banking system was not regulated. It is shown empirically that in deregulated banking system contagion risk has a greater impact than in other business sectors. Since time series are composed by the non-negative natural numbers expressing the amount of defaulted banks in a certain period, the estimates of the method of least squares discussed and applied in other models of the financial crisis contagion are not adequate. Therefore, to test the risk of contagion, autoregressive Poisson model is selected. As a standard Poisson process assumes that the banking failures are independent and that the number of failures of banks (i.e. one parameter of Poisson process) is constant during a certain period, although in practice the probability of bank's collapse changes over time, this method has been improved (similarly done in Lancaster (1990) model, in which the assumption is made that the parameter of the Poisson process depends on time). In addition, the systemic risk, i.e. multiple defaults of bank's factors, should be analysed as the consequence of macroeconomic factors: GDP fall, inflation, interest rates and exchange rates, etc. (see Elsinger *et al.* (2002)). The assumption is that the banks' failures are independent, meaning that the risk of the spread of the financial crisis does not exist in the banking system, which is contrary to the formulation of the problem and the definition of systemic risk. To remedy this shortcoming, it is assumed that the failure of the first bank is a random process; the second bank's collapse is further amended again and interpreted as the first default. Shephard (1995) suggested the generalization of autoregressive Poisson processes involving previous (latent) data to a logarithmic scale to eliminate the effect of independent random variables. The result of this generalization is shown in an analytical formula, which is expressed as follows:

$$z(y_t) = \beta x_t' + \sum_{j=1}^p \gamma_j z(y_{t-j}) + \frac{y_t - \lambda_t}{\lambda_t} + \varepsilon_t, \quad (7)$$

where ε_t – noise of model, y_t – number of defaulted banks in t -jth period, x_t' – vector of macroeconomic variables, λ_t – parameter of the Poisson process, representing the approximation of default intensity $z(y_t)$ and describing the dependence of the bank failures on macroeconomic factors and bank failures in the previous periods. The parameters of this regression γ_j , $j = 1, 2, \dots, p$ and β may be treated as the (lagged) number of the bank collapses of the previous t -jth period, macroeconomic factors and elasticity coefficients of the number of the bank collapses of the t -jth period. On the other hand, there is a problem of data compatibility: for modelling of the banking financial crisis contagion, daily, weekly and monthly data are needed, and macroeconomic data are presented on a monthly, quarterly, semi-annual or annual basis. Therefore, in such cases, macroeconomic variables are changed to proxy variables.

Empirical data of the years 1865-1940 showed that the bank failure rate from 1865 to 1920 was almost stable and since 1920 it began to increase. The analysis of the model shows a strong dependence of the banking collapse of macroeconomic factors. As expected, in 1920-1936, the bank failure rate and stock prices were negatively correlated

processes. In addition, the correlation between interest rates and bank failure rate was also negative. It is also stated that during the Great Depression bank failure rate increased not only due to its dependence of macro-economic factors, but also due to the financial crisis.

Modelling method of the U.S. banks bankruptcy data of 1875-1914 by the least squares, Grossman (1993) found an even smaller effect of the financial crisis contagion than the author of this article. In another work, Hasan and Dwyer (1994) applied probit regression for the date of 1837-1863. In this paper, different effects of crisis contagion were got for the banks of different states.

On the other hand, in order to summarize these models, conditional probabilities and conditional means can be applied, based on available data and clarifying the formulation of the problem. It is likely that on the basis of precise information more accurate bank failure loss would be, bankruptcy probability estimates.

Data used. In order to test the risk of contagion, the data from balance sheets, other financial statements and other aggregate and confidential information about the exposures of financial institution to the rest of the banking sector are used in the modelling of systemic risk. Therefore, the analysing information about the asset structure and its changes are quite complicated. One of the main problems when performing empirical researches is how to determine the particular structure of banks' assets/liabilities from the consolidated balance sheet data (i.e., how adequately disaggregate the summarized information), because the information about the particular exposures are confidential and of limited availability even to supervisory institutions. For this reason, the authors of many empirical researches apply entropy optimization procedure of data.

3. Conclusions

The application of networking and simulation methods in order to identify the main sources of systemic risk is based not only on expert assessments. Banking networking techniques can be helpful in assessing the systemic risk of the banking sector and the potential collapse of the banking scenario performing the test of the whole financial system in adverse conditions; though sufficiently it does not explain the primary cause of the collapse of banks that should be assessed by the fundamental analysis for asset structure and the evaluation of macroeconomic conditions. The lack of data limits the application and the accuracy of these methods. On the other hand, assumptions made on the LGD and interbank exposures are very strong. These features are important limitations of network and simulation approaches. However, applying these methods, the highly detailed assessment of systemic risk of the banking sector is possible. The assessments of the systemic risk are performed even in Central and Eastern European regions. Such studies are missing in Lithuania, especially limiting the expert opinion that the supervisory institutions of the Scandinavian countries reliably monitor the financial institutions having a great influence operating in the Baltic states.

However, the development of such research is severely restricted by the confidentiality of information related to bank secrecy. On the other hand, the problem of the general creditor in the region and the impact of quantified assessed panic or another adverse behaviour toward debtors have not yet been sufficiently explored. These studies, as in many cases, are limited by the confidentiality of information and the lack of competence of supervisory institutions.

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BANKŲ SEKTORIAUS SISTEMINĖS RIZIKOS VERTINIMO MODELIAVIMAS

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Santrauka. *Bankų tinklaveikos metodai gali būti naudingi vertinant bankų sektoriaus sisteminę riziką ir potencialius bankų žlugimo scenarijus atliekant visos finansų sistemos testavimą nepalankiomis sąlygomis, nors pakankamai ir nepaaiškina pradinių bankų žlugimo priežasčių. Šių metodų pritaikomumą ir tikslumą apriboja išsamių duomenų trūkumas. Tačiau juos taikant kartu su simuliacijos metodais galima išsamiai įvertinti bankų sektoriaus būklę sisteminės rizikos požiūriu. Net ir Centrinės bei Rytų Europos regione yra atlikti sisteminės rizikos vertinimai. Lietuvoje trūksta tokių tyrimų, iš esmės apsiribojama vien tik ekspertine nuomone, kad Skandinavijos šalių priežiūros institucijos patikimai prižiūri didelę įtaką turinčias finansų institucijas, veikiančias Baltijos šalyse. Tinklaveikos ir simuliacijos metodų taikymas siekiant nustatyti pagrindinius sisteminės rizikos šaltinius suteikia mokliškai pagrįstus, o ne tik ekspertinius vertinimus. Tačiau tokių tyrimų plėtrą stipriai riboja informacijos konfidencialumas, susijęs su bankų paslapties išsaugojimu. Kita vertus, dar nėra pakankamai išnagrinėta bendro kreditoriaus regione problema ir kiekybiškai įvertinama jų panikos ar kitokios nepalankios skolininkams elgsenos įtaka. Šiuos kiekybinius tyrimus, kaip ir daugeliu atveju, riboja informacijos konfidencialumas ir trūkumas bei nepakankamos kompetencijos priežiūros institucijose.*

Raktiniai žodžiai: *bankų sektorius, tarpbankinė rinka, sisteminė rizika.*