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STRUCTURAL-FUNCTIONAL ANALYSIS AS INNOVATION IN PUBLIC GOVERNANCE (CASE OF BANKING SUPERVISION)

Abstract. *Innovative banking supervision methods associated with the study of business models and the risk profile of banks are the top priorities. The European Banking Authority considers the business model as a set of tools and methods to organize work, generate profits, and sustain growth. For the first time, the European Central Bank introduced the assessment of the viability of business models and profitability factors as a supervisory priority. Appropriate mathematical tools are needed to identify business models and assess bank risks. It is necessary to use specific supervisory approaches and adequate measures of influence for different business models of banks. It is proposed to distribute jars to separate homogeneous structural-functional groups. Structural and functional analysis of the banking system is a special method for analysing qualitative changes through quantitative indicators of bank reports. Comparison of structural characteristics with previous reporting periods allows you to set changes for each group of banks, the relationship between groups. The basis of the analysis is the observation of the location and trajectory of each bank on the self-organized map Kohonen. Neighbouring banks on the map have similar characteristics of financial stability. The method allows considering a significant number of indicators for the formation of homogeneous groups of banks. A recent survey shows a reduction in banks in the central part of the map, which does not have significant deviations from the average characteristics of assets, liabilities, income and expenses. At the same time, banks with a high share of current resources are growing. Current resources do not provide the necessary sources for the development of bank loans. An important modern trend in the development of the banking services market is the growth of a group of banks that place assets in government securities. The activities of a large number of banks are associated with currency risks.*
Keywords: structural and functional analysis, indicators of the financial system, business models of banks, self-organizing map.

Introduction. The ongoing public governance requires the transformation to the innovation development model. It could be achieved through the application of adequate methodology and technology of public governance. Besides, the transformation of government system should guarantee the effective reaction of government on the complicated economic development, modernization, automatization and digitalization of economic activities.

The structural and functional analysis is a modern method of the complex system which focus on the systematically analysis objects' management, researching of the its state with using the huge quantity of indicators and minimization of possible uncontrolled risks. This method allows comparing the characteristics of the homogeneous objects and indicating the spheres of dangerous risks for urgent regulatory activities. It should be noticed, that the structural a functional analysis become the most popular in the bank supervision sphere. Today, the SREP (Supervisory Review and Evaluation Process) analysis model has become very popular in Europe. This model is a developed and revised version of the ICAAP (Internal Capital Adequacy Assessment Process). ICAAP was created in the framework of Pillar II and

directed to researching internal procedures and processes in the bank in order to determine the level of capital adequacy in the long-run to cover all possible risks.

The SREP analysis is based on nine interrelated areas of analysis [1]:

1. The classification of financial institutions (banks) according to the results of cluster analysis.
2. Monitoring of key indicators.
3. Analysis of the business model.
4. Assessment of internal management and system of control (ICS).
5. Capital risks and adequacy (ICAAP).
6. Liquidity risks and adequacy.
7. Summarizing total assessment.
8. Definition and communication of regulatory measures.
9. Early intervention of supervision.

The European Banking Authority considers the business model as a set of tools and methods to organize work, generate profits, and sustain growth. For the first time, the European Central Bank introduced the assessment of the viability of business models and profitability factors as a supervisory priority for 2015 [2].

Each business model consists of a specific set of components, depending on the company's major long-term goals. Such an approach has been proposed by the European Banking Authority in 2014 and introduced into the European Banking Supervision System at the end of 2015.

According to the "Guidelines on common procedures and methodologies for the supervisory review and evaluation process (SREP) and supervisory stress testing" of EBA all institutions were categorized by the competent authorities into the following categories, depending on the size of the institution, it's internal structure and organization, the scope, nature and complexity of activities [1]:

1. Category 1 includes global systemically significant institutions (G-SIIs) and other systemically significant institutions (O-SIIs)).
2. Category 2 includes large and medium institutions (except the institutions from Category 1) that work on the domestic market or have a significant part of cross-border activities and operating in several business areas and also offer financial and credit products for retail and corporate clients.
3. Category 3 includes medium and small institutions (except the institutions from Category 1 and 2) that operate entirely in the domestic market and in a limited range of business areas.
4. Category 4 includes small banks that cannot be categorized as above.

The analysis of the business model involves determining the degree of profitability of the bank in the short term and the possibility of maintaining the strategic stability of the bank in the long run. Such an analysis is based on a prior assessment of the market situation, the development of banking business areas and products. Thus, competent authorities have the opportunity to obtain information about the macroeconomic development of the market, strategic intentions of its participants and assess the business environment of the organization. Analysis of the bank's business model means the use of both quantitative and qualitative indicators. Quantitative indicators characterize the main indicators of the bank's activities and its "risk appetite" compared with similar groups of banks. Qualitative indicators characterize the effectiveness of the existing system of management, financial and strategic planning in the bank. Thus, competent authorities determine the viability of a business model, taking into account past analysis results and identified shortcomings [1].

So, the SREP analysis is a common methodology that guarantees objective and consistent control on the individual basis of the financial state and financial steadiness of the bank in connection with its chosen business model and the formed risk profile.

The National Bank of Ukraine has already taken resolute steps in this direction. It was reflected in the Regulation On the Organization of Risk Management System in Banks and Bank Groups of Ukraine that

based on principles of the Basel Committee on Banking Supervision and follows the best international practices. To this end, the NBU Board issued Resolution No. 64 on 11 June 2018 [3].

The document defines the main objectives and principles of risk management, establishes requirements for the organization of a comprehensive, adequate and effective risk management system based on the development of a risk-tolerance declaration, the determination of the overall size of risk appetite, the establishment of risk limits and determination of risk-profile of the bank based on its business model [4]. Taking into account the amount of the work to be done by the banks in order to implement the Regulation, the NBU expects gradual implementation to be finished by April 2020.

The Regulation on the Organization and Conduct of Inspections was amended with the Resolution of the Board of the NBU No 47 on May 2, 2018 [5], which take into consideration the guidelines of the European Banking Authority (EBA) on the organization of a "Common procedures and methodologies for the supervisory review and evaluation process (SREP) and supervisory stress testing".

The estimate with using SREP methodology based on four main components [6]:

1.   Business model analysis. Such an analysis involves assessing the viability of the business model of the bank (ability to generate an acceptable level of income over the next 12 months) and determining the sustainability of bank's development strategy (ability to generate an acceptable level of income for at least the next 3 years).

2.   Assessment of internal governance. It provides an assessment of the effectiveness of corporate culture, risk-taking culture, organizational structure and functioning of risk management system, internal control system and general corporate governance system.

3.   Assessment of risks to capital and adequacy of capital. It involves determining the capital adequacy (its size and structure) to cover the main types of risks in the bank's activities over the next 12 months.

4.   Assessment of risks to liquidity and adequacy of liquidity. It provides an assessment of possible liquidity and funding risks and their management systems.

The NBU offers the following classification of business models of the banks within the SREP analysis [6]:

1.   Universal business-model. This model is characterized by a significant share of operations with legal entities, individuals, interbank operations and transactions with other participants in the financial market in the structure of assets and liabilities.

2.   Retail business-model. This model is characterized by a significant share of operations with individuals in the structure of assets and liabilities.

3.   Corporate business-model. This model is characterized by a significant part of the credit operations with legal entities in the structure of assets and the borrowed funds from legal entities in the structure of liabilities.

4.   Corporate business-model with retail financing. This model is characterized by a significant part of the lending transactions with legal entities in the structure of assets and borrowed funds from individuals in the structure of liabilities.

5.   Business-model of limited credit intermediation. This model is characterized by a small share of loans granted to legal entities and individuals, which is no more than 30%. The significant part of loans is granted to a limited number of partners or active operations are financed with the bank's own funds.

In our opinion, such a classification does not take into account the peculiarities of Ukraine's sovereign risks and the specific characteristics of banks. To construct business models of banks in specific financial market conditions, we propose using modern methods of processing large amounts of reporting information.

Recent research and publications analysis. The researchers have not developed a common approach to defining the concept of "business model of an enterprise" yet. Although there are numerous

substantiations of such an approach to the analysis of their activities, the main principles of the organization, etc. For example, Alexander Osterwalder & Yves Pigneur believes "The business model can best be described through nine basic building blocks that show the logic of how a company intends to make money: customer segments, value propositions, channels, customer relationships, revenue streams, key resources, key activities, key partnerships, cost structure". The nine business model building blocks form the basis for a handy tool, which we call the Business Model Canvas [7].

H. Chesbrough and R.S. Rosenbloom substantiate the direct connection of the business model with the creation of value at the enterprises. Moreover, in their opinion, the business model captures a portion of that value. Business models are summarized into six simple components, there are "market segment, value proposition, value chain structure, competitive strategy, revenue streams and cost structure" [8].

In the electronic encyclopaedia "Investopedia" stated that a business model is a company's plan for how it will generate revenues and make a profit. It explains what products or services the business plans to manufacture and market, and how it plans to do so, including what expenses it will incur [9]. However, in our opinion, the above interpretations are too narrow and don't disclose the whole range of interconnections and components that define a particular business model of the company's work.

The concept of "bank business model" is also controversial among scholars, experts and bankers. In some cases, the term is considered in a very narrow sense, only as a model of income and operating activities, but in some, it is understood too broadly, as a general bank management strategy. A group of scholars led by Rym Ayadi, Emrah Arbak, Willem Pieter de Groen have identified in their works the main business models of banks in Europe, the directions and nature of their changes under the influence of the financial crisis of 2008-2009. In addition, researchers have proven that the chosen business model has a significant influence on the level of bank stability on the impact of destructive factors of the internal and external environment and crisis phenomena. Also, in their research, scholars confirm the thesis that analysis of business models of banks allows all participants in the financial market to obtain information on the nature and extent of the risks in their activities, as well as to get an understanding of the amount of systemic risk throughout the economic cycle [10–13]. Belgian economists Frederik Mergaerts and Rudi Vander Vennet point out that the business model reflects the bank's strategic choices related to the asset, liability, capital and income structure. According to scientists, important characteristics of the structure of assets are the loan portfolio, the quality of loans, the volume of investments. The structure of the bank's liabilities are disclosed in the client's funds and the risk of loss of financing. The structure of incomes is disclosed in their diversification and capital in the ratio between the volume of equity and assets [14]. So, to determine the business model of the bank the approach similar to the CAMELSO rating is used. It should be noted that this approach is some limited since attention is only given to risks analysis and their management.

Modestas Tomkus deepened the study of business models of banks in his works. Circumstance attention was paid to the issue of creating of economic value by the banks. In his opinion, the main purpose of any bank is to carry out the most optimal financial activity. The banking business model concept reviewed in his study defined as "a representation of a set of components utilised to outperform the competition and to achieve optimal profit in a financial market where a similar product strategy is used". M. Tomkus notes that the development of a business model allows to manage the three most important processes in the bank's work: attracting the necessary resources for the conduct of activities, placement of funds in loans to generate income, awareness and risk taking [15]. Yener Altunbas, Simone Manganelli and David Marques-Ibanez in their works point out the connection between the chosen business model and the risk of bank's collapse. The structure of financing and incomes in the chosen business model are the risk-generating components. For example, dependence on borrowed funds (deposit funds) reduces the probability of a risk, while wholesale funding increases it. However, it should be taken into account that this situation is not typical and may have different effects on different banks [16].

According to some researchers, banks with a more diversified incomes structure are more secured in times of crisis shocks, as the higher level of diversification increases their resilience to the effects of destabilizing factors. The volume of received non-interest income in the total income is important since their formation are connected not only with payment of services but also with trading in the market by financial and currency instruments, underwriting or securitization. The structure of costs also has a significant impact on the riskiness of a business model. The results of some studies confirm the thesis that economically ineffective banks are closer to the risk of default [17]. At the same time, some researchers pay attention to the size of the bank. Thus, large system banks are considered to be less stable, since it is difficult for them to quickly adapt to the constantly changing conditions of the internal and external environment. However, they are considered to have a higher level of sustainability in the long run. The ownership structure and corporate governance also have a considerable impact on the bank's risk profile [17]. It should be noted that today most models for determining business models of banks are based on the conduct of cluster analysis. But the volume of variables, the analysed period, the degree of detail, the number of cluster groups are significantly different in various studies.

Research results. A detailed description of the method can be found in the article [18]: «In the process of studying the structure of the banking system of Ukraine, we formulated the idea of expediency and the possibility of isolating homogeneous groups of banks that are close:
  – according to the structure of the main aggregates of assets, liabilities, income and expenses;
  – priority in the provision of services;
  – on the level and structure of the main types of bank risks;
  – response to external shocks»

Homogeneous groups of banks received the names structural-functional groups (SFG).

For analysis, published quarterly bank reports are used. On the basis of balance indicators, 31 structural indicators for each bank are calculated. Indicators include the share of key components of assets, liabilities, income and expenses. The method allows you to merge the values into a large database. Groups are displayed on the Kohonen self-organized map (SOC). Banks with lots of common features are on the map nearby. The greatest difference in many features is the banks with the largest distance. Homogeneous groups are formed from similar banks. We call these groups SFG. Formation of the SFG depends on the values of all structural indicators that are considered simultaneously. The current state of the banking system can be estimated by examining the size and characteristics of the SFG. The methodology allows assessing the current state of individual groups and individual banks.

The geographical location of banks on the SOC and the position change trajectory allow us to draw conclusions about the financial stability, business model and risk profile of banks. The best place is the banks in the centre of the map. Banks in the corners of the SOC have significant features. «Even if the functional specialization, accompanied by the corresponding structural imbalance, gives the bank certain temporary advantages, its consequence is necessary to increase the vulnerability of the bank to the influence of negative external factors, the inability to dynamically adapt to the transformational changes in the market. This conclusion was confirmed by a significant number of banks that lost their financial stability during financial and economic crises» [18]. Construction of structural-functional groups is carried out as a standardized procedure for calculating structural indicators, construction of SOC, interpretation of results. Comparing the structure of the map in different periods, you can identify the persistent features of SFG. The SOC analysis provides a convenient visual representation of large datasets.

Viscovery software is used to construct the SOC. The description of the procedure can be found in the article [18]: «The input is as shown in Table 1.

Structural-functional analysis study is conducted quarterly and consists of 5 stages:
  – calculation of system indicators for the reporting of all operating banks to reporting date, supplementing the database and building a SOC.

– analysis of the obtained clusters, comparing the structure of the map with the previous, estimating the average values of the system indicators for each cluster, the combination of separate close clusters in the SFG;

– investigation of changes in the characteristics of SFG, their position on the SOC and the size, interpretation of changes at the macro level;

– investigation of changes in the characteristics of each bank, its trajectory on the SOC, interpretation of changes;

– summarizing the state of the banking system, business models of banks.

Table 1 – Structure input for self-organized Kohonen maps

Reporting date	Banks	Structural indicators		
Date 1	Bank 1			
	Bank 2			
	Bank …			
Date 2	Bank 1			
	Bank 2			
	Bank …			
…				

The choice of structural indicators is aimed at identifying the main characteristics of the business models of banks. The adequate allocation of banks to groups depends on the selection of the most important structural and functional characteristics. Structural indicators should include key groups of assets and liabilities, take into account the main sources of profit, specialization in the market of banking services. The list of structural indicators is presented in Table 2.

Table 2 – Selection of structural indicators for the formation of a self-organizing Kohonen map in order of decreasing the influence on the topology

№	CI	Content
1	2	3
1	A-s	Ranking number by asset size
2	VCA	Share of foreign currency assets in total assets
3	SAUI	Share of foreign currency corporate loans in assets
4	CA	Balance sheet equity ratio
5	ROA	Return on assets
6	RA	The ratio of credit risk provisions to assets
7	VR	The ratio of expenses for the formation of credit risk provisions for assets
8	VA	The ratio of administrative expenses for assets
9	PM	Net interest margin
10	SPUP	Share of current funds of legal entities in liabilities
11	SPUN	Share of legal entities funds in national currency in liabilities
12	SPUS	Share of fixed funds of legal entities in liabilities
13	SPUI	Share of legal entities funds in foreign currency in liabilities
14	SPFN	Share of funds individuals in national currency in liabilities
15	SPFS	Share of time funds of individuals in liabilities
16	SPFI	Share of funds individuals in foreign currency in liabilities
17	SPFP	Share of current funds of individuals in liabilities
18	SPMN	The share of interbank loans of national currency in liabilities
19	SAUN	Share of national currency corporate loans in assets

Tabl 1

1	2	3
20	SPMI	The share of interbank loans of foreign currency in liabilities
21	SAFI	Share of consumer loans of foreign currency in assets
22	SAFN	Share of consumer loans of national currency in assets
23	KD	The ratio of commission income to assets
24	VL	The ratio of the gap between assets and liabilities in foreign currency to total assets
25	TD	The ratio of trade income to assets
26	SAMN	The share of interbank loans in national currency in assets
27	SAMI	The share of interbank loans in foreign currency in assets
28	SAV	Share of highly liquid assets in assets
29	PD	Return on interest-bearing assets
30	PV	Value of interest obligations
31	SAC	Share of securities in assets

The main approaches to the analysis of SFG have presented in the article [18]: "The selected system of criteria allows you to compare the main structural parameters: the level of capitalization, quality and constituent assets, liabilities, features of interest policy, revenue management, expenditure. The SOC also simulates the level of the financial stability of each bank, the trajectory of moving it between groups and assessing the relationship with these groups. The system indicator allows groups to group according to the characteristics of the main risks of loss of financial stability that are relevant to the implementation of supervisory procedures». The Kohonen self-organized map is presented in Figure 1. The map is based on data from 01/01/2009 to 01/07/2018.
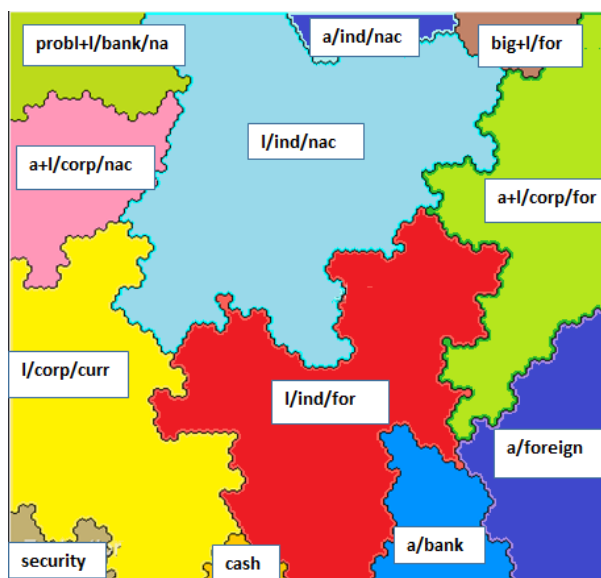

Figure 1 Distribution of banks by self-organized card Kohonen as of 01.07.2018

The centre of the map is made up of small banks without any essential features. The SFG l/ind/nac usually has a large number of banks. The share of individuals' funds in national currency in liabilities is significant. There is a frequent migration between the banks of the group l/ind/nac and l/ind/for. Small

banks do not have a stable balance structure. The research shows a reduction in the number of banks in the central part of the map during the crisis. The left part of the map is taken by banks with a large share of funds in national currency in liabilities and assets. Banks on the right side of the card have a high share of foreign currency in liabilities and assets. The top part of the card is taken by banks with a large share of loans in assets. The group security in the lower part of the SOC has an increased share of securities in assets. Securities consist of bonds of an internal state loan (OVDP). The group a/bank/for has an increased share of interbank foreign currency assets. In the group cash, a significant part of assets is held by cash and funds on a correspondent account.

Formation of SFG and the allocation of banks take into account all 31 structural indicators at the same time. Table 3 shows the number of banks in different SFG and the total assets of each group.

Table 3 – The initial distribution of banks between clusters and structural-functional groups as at 01/07/2018

Group	Number of banks	Assets, mln. UAH.	Comment	Term of the stay
l/ind/nac	10	11 327,6	small banks with individual national currency deposits	constantly
l/ind/nac	6	5 191,6		temporarily
l/ind/for	3	3 755,2	small banks with individual foreign currency deposits	constantly
l/ind/for	3	3 165,0		temporarily
l/corp/curr	10	197 547,3	banks with current funds of legal entities in liabilities	constantly
l/corp/curr	10	158 499,5		temporarily
security	6	41 844,3	banks with securities in assets	constantly
security	5	4 750,6		temporarily
a/ind/nac	3	9 864,5	banks with consumer loans of national currency in assets	constantly
probl+l/bank/nac	3	9 729,8	banks with unstable financial status	temporarily
big+l/for	3	634 835,4	large banks with foreign currency liabilities	constantly
a+l/corp/for	14	134 062,9	banks with foreign currency corporate funds assets and liabilities	constantly
a+l/corp/for	2	41 180,7		temporarily
a/foreign	2	39 376,0	large banks with foreign currency assets	constantly
a/bank/for	3	11 876,5	banks with banking funds in foreign currency in assets	constantly
	83	1 307 006,9		

Banks are divided among 10 structural-functional groups. Some banks belong to the group for a long time. These banks have the signs «constantly» in the last column of Table 3. Other banks, with signs «temporarily», have moved to their group recently. The characteristics of such banks are volatile. Now we propose to consider the features of each SFG.

Group l/ind/nac consists of 10 banks with constant characteristics and 6 banks with a changing path on the map. A year ago, the group consisted of 25 banks. Banks are owned by Ukrainian shareholders, attract resources in the individual market and provide small loans. Similar characteristics have banks of group l/ind/for. When attracted funds in foreign currency are increasing, there is migration from group l/ind/nac to l/ind/for. Together, two groups from the central part of the map include 22 banks or 26% of the total. The aggregate assets of these banks make up only 1.5% of the total.

Our research has shown that many large banks have recently joined the group l/corp/curr. The

resource base of these banks is formed on the current funds of corporations. Now the group consists of 20 banks. The aggregate assets of banks in group I/corp/curr make up 27% of the total. The group includes banks with both Ukrainian and foreign capital. After the elimination of 100 banks in 2014-2016, term funds of the banking system were significantly reduced. Current resources do not provide the necessary sources for the development of bank loans. Banks with a high proportion of current funds have increased currency risks.

An important modern trend in the development of the banking market is the growth of a group of banks that place assets in government securities. Such banks are part of the SFG security. The group includes banks with both Ukrainian and foreign capital. The aggregate assets of these banks make up 4% of the total. The concentration of bank assets in OVDP also does not contribute to the development of lending in Ukraine. For many years, the group of banks specializing in the issuance of individual loans is separated in the Ukrainian market. By 2011 the group a/ind included large banks with foreign capital. In 2011, individual loans in foreign currency were banned in Ukraine. The group a/ind/nac now includes 3 banks. The aggregate assets of these banks make up 0.8% of the total. Banks have high commission income and administrative expenses. The loan portfolio of banks is not qualitative.

Particular attention is required for group probl+I/bank/nac analysis. Banks in this group have a loss-making result and higher credit risks. In the crisis period of 2010, almost half of the banks of Ukraine came to this group. The group probl+I/bank/nac is currently small. Banks are in group probl+I/bank/nac for a short time. A high proportion of liabilities to banks testifies to liquidity problems. After the elimination of weak banks, the group probl did not have large volumes.

Separated group big + I / consists the largest state-owned banks of Ukraine. The three banks in this group are too large to fail. The aggregate assets of these banks make up 49% of the total. Banks have an increased share of liabilities in foreign currency. In the assets of banks, a large share is made up of government securities. The loans of this group have high risks.

The volatile exchange rate of the national currency leads to significant risks for the banking system of Ukraine. A significant number of banks went to group a+I/corp/for with a high share of assets and liabilities of corporate funds in foreign currency. The group includes powerful banks with national and foreign capital. The aggregate assets of these banks make up 13% of the total. The group a/foreign has two large banks, which have a high share of foreign currency assets. The aggregate assets of these banks make up 3% of the total. Banks of the respective groups have increased currency risks. Such groups tend to grow. The group of medium-sized banks a/bank/for attracts funds from residents of Ukraine and provides interbank loans in foreign currency. Distribution of banks to groups is based only on the values of structural indicators and does not depend on the decision of the researcher. The group topology reflects the specifics of the distribution of banks in the banking market over a period of time. The resulting distribution differs from that used by the National Bank of Ukraine. Specific volumes and composition of the group can be clearly explained and substantiated. Each SOC characterizes systemic changes in financial stability in the banking sector by assessing the position and size of the SFG. The trajectory of each bank on the map describes changes in the individual characteristics of financial stability.

Conclusions. Modern financial markets have a complex structure, characterized by a variety of risks that can be broadcasted and disseminated through participants across the economy. Without satisfactory regulation, banking and other financial services markets become a source of financial shocks. For the information processing of large data sets, it is necessary to use traditional statistical tools. The values of dynamic series of large dimensions accumulated over a long period of time have hidden internal regularities, the identification of which requires adequate mathematical approaches. It is proposed to use SOM to analyse business models of Ukrainian banks.

The SFG method greatly simplifies and formalizes procedures for assessing the financial stability of banks in the supervisory system. The SFG method is intended to identify significant changes in the banking

system and take the necessary regulatory measures. The SFG method allows us to evaluate the business model and simulate the strategy of banks in the form of trajectories on the SOC, to investigate the causes of the changes, to compare with the dynamics of other banks. A recent survey shows a reduction in banks in the central part of the map, which does not have significant deviations from the average characteristics of assets, liabilities, income and expenses. At the same time, banks with a high share of current resources are growing. Current resources do not provide the necessary sources for the development of bank loans. An important modern trend in the development of the banking services market is the growth of a group of banks that place assets in government securities. The concentration of bank assets in OVDP also does not contribute to the development of lending in Ukraine. The separate group formed from the largest state banks of Ukraine. The three banks in this group are too large to fail. In the assets of banks, a large share is made up of government securities. Credit portfolios have high risks. The open currency position of banks shows high risks. The proposed groups of banks reflect the peculiarities of the risks of the modern banking system in Ukraine. The risks are related to the reduction of lending, the replacement of loans with government securities. The resource base of individual groups of banks is formed on the basis of current funds. Powerful banks have a high share of assets and liabilities in foreign currency.

References

1. SREP (supervisory review and evaluation process): Blessing or curse? Available at: https://www.bankinghub.eu.
2. Recent trends in euro area banks' business models and implications for banking sector stability (2016). Financial Stability Review. Available at: https://www.ecb.europa.eu/pub/pdf/other/sfcfinancialstabilityreview201605.en.pdf?ecb712f83f124c11f45abe4e48cac2d0.
3. National Bank of Ukraine, NBU (2018). The Resolution of the NBU No. 64, 11 June 2018. Available at: https://bank.gov.ua/document/download?docId=71600453.
4. National Bank of Ukraine, NBU (2018). NBU Introduces New Requirements to Risk Management System Organization in Banks. Available at: https://bank.gov.ua.
5. National Bank of Ukraine, NBU (2018). The Resolution of the NBU No 47, May 2, 2018. Available at: http://zakon.rada.gov.ua/laws/show/z0703-01.
6. National Bank of Ukraine, NBU (2018). An analysis of business models of banks within the Supervisory review and evaluation process (SREP). Available at: https://bank.gov.ua/doccatalog/document?id=69900832.
7. Osterwalder, A., Pigneur, Y. (2009). Business Model Generation. Available at: http://radio.shabanali.com/business-model-generation-osterwalder.pdf.
8. Chesbrough H., Rosenbloom R.S. (2002). The role of the business models capturing value from innovation: evidence from Xerox Corporation's technology spin-off companies. Industrial and Corporate Change, Jun 2002, 11, 3. Available at: http://www.sem.tsinghua.edu.cn/semcms_com_www/upload/home/store/2008/7/3/2969.pdf.
9. Investopedia. (n. d.). Available at: http://www.investopedia.com.
10. Ayadi R. and De Groen W. Pieter (2014). Banking Business Models Monitor 2014: Europe, Journal of CEPS Paperbacks. Available at: https://ssrn.com/abstract=2510323.
11. Ayadi R. et al. (2015). Banking business model monitor 2015: Europe. Centre for European Policy Studies and International Observatory on Financial Services Cooperatives. Available at: https://ssrn.com/c abstract=2784334.
12. Ayadi R., Arbak E. and De Groen W. Pieter (2014). Business Models in European Banking: A Pre-and Post-Crisis Screening, Center for European Policy Studies. Available at: http://rymayadi.com/wp-content/uploads/2014/11/Business-Models-in-European-Banking.pdf.
13. Ayadi R. Arbak E. and De Groen W. Pieter (2012). Regulation of European Banks and Business Models: Towards a New Paradigm? Centre for European Policy Studies, Forth-coming. Available at: https://ssrn.com/abstract=2098974.
14. Mergaerts, F., Vennet, R. V. (2015). Business models and bank performance. A long-term perspective. 4th EBA Policy Research Workshop. Available at: https://www.eba.europa.eu/documents/10180/1018121/Mergaerts%2C%20Vander+Vennet+-+Business+models+and+bank+performance.+A+long+term+perspective+-+Paper.pdf.
15. Tomkus, M. (2014). Identifying Business Models of Banks: Analysis of Biggest Banks from Europe and the United States of America. Aarhus: Business and Social Sciences. Available at: http://pure.au.dk/portal-asb-student/files/69715984/be_apendixu.pdf.
16. Altunbas, Y., Manganelli, S., Marques-Ibanez, D. (2011). Bank risk during the financial crisis: do business models matter? Available at: https://www.ecb.europa.eu/pub/pdf/scpwps/ecbwp1394.pdf.

17. Lyubich O., Bortnikov H., Panasenko H. (2016). Analysis business model of state banks in Ukraine, Finance of Ukraine, 10, 7-38.

18. Elena Zarutska. Structural-functional analysis of the Ukraine banking system // Financial Markets, Institutions and Risks, Volume 2, Issue 1, 2018. Pages: 79-96 DOI: 10.21272/fmir.2(1).79-96.2018.

19. European Central Bank, ECB (2014). Guide to banking supervision. Available at: https://www.bankingsupervision.europa.eu/ecb/pub/pdf/ssmguidebankingsupervision201411.en.pdf?807838fa2a8bb958749f411c432d1f3e.

20. European Central Bank, ECB (2017). SSM SREP Methodology Booklet. Available at: https://www.bankingsupervision.europa.eu/ecb/pub/pdf/ssm.srep_methodology_booklet_2017.en.pdf?508ca0e386f9b91369820bc927863456.

21. Basel Committee on Banking Supervision, BCBS (2000). Principles for the Management of Credit Risk. Available at: http://www.bis.org/publ/bcbs75.pdf.

22. Basel Committee on Banking Supervision, BCBS (2008). Principles for sound liquidity risk management and supervision. Available at: http://www.bis.org/publ/bcbs144.pdf.

23. National Bank of Ukraine, NBU (2018). Shock Contagion, Asset Quality and Lending Behavior. Available at: https://bank.gov.ua/doccatalog/document?id=62899125.

24. National Bank of Ukraine, NBU (2017). Secular Stagnation: Policy Options and the Cyclical Sensitivity in Estimates of Potential Output. Available at: https://bank.gov.ua/doccatalog/document?id=48800101.

25. Kohonen, T. (2001). Self-Organizing Maps. Berlin Heidelberg: Springer-Verlag.

26. Kohonen, T (2013). Essentials of the self-organizing map. Neural Networks, 37, 52-65.

27. Severin. E. (2010). Self-organizing maps in corporate finance: Quantitative and qualitative analysis of debt and leasing, Neurocomputing, 73 (10-12), 2061-2067.

28. AghaeiRad, A., Chen, N. and Ribeiro, B. (2017). Improve credit scoring using transfer of learned knowledge from self-organizing map, Neural Computing & Applications, 28 (6), 1329-1342.

29. Tkac, M. and Verner, R. (2015). Artificial neural networks in business: Two decades of research, Applied Soft Computing, 38, 788-804.

30. Sarlin, P and Peltonen, T. (2013). Mapping the state of financial stability» Journal Of International Financial Markets Institutions & Money, 26, 46-76.

31. Severin, E (2012). Forecasting financial failure using a Kohonen map: A comparative study to improve model stability over time» European Journal Of Operational Research, 221 (2), 378-396.

32. Rutherford, M.W. (2016). Proposing a Financial Legitimacy Threshold in Emerging Ventures: A Multi-Method Investigation. Group & Organization Management, 41, (6), 751-785.

33. Koc, Elcin K et al. (2014). Efficient adaptive regression spline algorithms based on mapping approach with a case study on finance. Journal Of Global Optimization, 60(1), 103-120.

34. Jarvinen, J., Linnakangas, J (2012) Firm Capabilities in the Finnish Forest Cluster: Comparisons Based on Self-Organizing Map. Silva Fennica, 46(1), 131-150.

35. Lin, W.Y., Hu, Y.H. and Tsai, C.F. (2012). «Machine Learning in Financial Crisis Prediction: A Survey». Ieee Transactions On Systems Man And Cybernetics Part C-Applications And Reviews, 42(4), 421-436.

36. Hsu, C.M. (2012). A hybrid procedure for stock price prediction by integrating self-organizing map and genetic programming, Expert Systems With Applications, 38(11), 14026-14036.

37. Beltratti, A. and Stulz, R.M., (2012). The credit crisis around the globe: Why did some banks perform better? Journal of Financial Economics, 105(1), 1-17.

38. Huang, X., Zhou H. and Zhu H. (2011). Systemic Risk Contributions, Federal Reserve Board Finance and Economics Discussion Series 2011-08.

39. Drehmann, M. and Tarashev, N. (2011). Systemic Importance: Some Simple Indicators, Bank for International Settlements Quarterly Review, Bank for International Settlements, March.

40. Brownlees, C.T. and Engle R.F. (2010). Volatility, Correlation and Tails for Systemic Risk Measurement. Available at SSRN: http://ssrn.com/abstract=1611229.

41. Boot, A. and Thakor, A.V. (2010). The Accelerating Integration of Banks and Markets and its Implications for Regulation, in A. Berger, P. Molyneux and J. Wilson (eds.), The Oxford Handbook of Banking, 58-90.

42. Bekaert, G., Ehrmann, M., Fratzscher, M. and Mehl, A. (2011). Global Crises and Equity Market Contagion. Available at: http://ssrn.com/abstract=1856881.

43. Acharya, V., Cooley T., Richardson M. and Walter I. (2010). Manufacturing Tail Risk: A Perspective on the Financial Crisis of 2007-09, Foundations and Trends in Finance, 4, 247-325.

44. Berger, A. and Bouwman C. (2010). How Does Capital Affect Bank Performance During Financial Crises? Wharton Financial Institutions Center Working Paper, 11-22.

45. De Jonghe, O. (2010). Back to the Basics in Banking? A Micro-analysis of Banking System Stability, Journal of Financial Intermediation, 19(3), 387-417.

46. Maddaloni, A. and Peydró J.L. (2011). Bank Risk Taking, Securitization, Supervision, and Low Interest Rates: Evidence from Lending Standards, Review of Financial Studies, 24(6), 2121-2165.

47. Baele, L., De Jonghe, O., and Vander Vennet, R. (2007). Does the stock market value bank diversification? Journal of Banking and Finance, 31(7), 1999-2023.

48. Hasan, I., Lozano-Vivas, A. and Pastor, J.T. (2001). European bank performance beyond country borders: what really matters? European Finance Review, 5(2), 141-165.

49. Billio, M., Getmansky, M., Lo, A.W. and Pelizzon, L. (2012). Econometric measures of connectedness and systemic risk in the finance and insurance sectors, Journal of Financial Economics, 104(3), 535-559.

50. Brandt, M.W., Brav, A., Graham, J. and Kumar, A. (2010). The idiosyncratic volatility puzzle: time trend or speculative episodes? Review of Financial Studies, 23(2), 863-899.

51. Coughlan, J., Shale, E. and Dyson, R. (2010). Including the customer in efficiency analysis: evidence of a hybrid relational-transactional approach", International Journal of Bank Marketing, 28(2), 136-149.

52. Greenwood, R., Landier, A. and Thesmar, D. (2015). Vulnerable banks, Journal of Financial Economics, 115(3), 471-485.

53. Hays, F., de Lurgio, S. and Gilbert, A. (2009). Efficiency ratios and community bank performance, Journal of Finance and Accountancy, 1(1), 1-15.

54. Paleologo, G., Elisseeff, A. and Antonini, G. (2010). Subagging for credit scoring models", European Journal of Operational Research, 201(2), 490-499.

55. Petersen, M. (2009). Estimating standard errors in finance panel data sets: comparing approaches, Review of Financial Studies, 22(1), 435-480.

56. Pistol, G. (2010). The role and importance of the strategic planning in bank marketing", Annals of Spiru Haret University. Economic Series, 1(2), 153-161.

57. Zheng, D., Zhang, Y. and Wen, L. (2012). The credibility models with time changeable effects, Journal of Jiangxi Normal University: Natural Science Edition, 36(1), 249-252.

58. Köhler M. (2015). Which banks are more risky? The impact of business models on bank stability, Journal of Financial Stability, 16, 195-212.

59. Khmarskyi V. Relation between marketing expenses and bank's financial position: Ukrainian reality / V. Khmarskyi, R. Pavlov // Benchmarking: An International Journal. – 2017. – Vol. 24, Iss. 4. – P. 903–933. doi:10.1108/BIJ-02-2016-0026.

60. Laeven L. (2013)/ Corporate governance: What's special about banks? Annual Review of Financial Economics, 5, 63-92.

61. Roengpitya, R. (2014). Bank business models, Bank for International Settlements. Available at: http://www.imf.org/external/pubs/ft/sdn/2014/sdn1404.pdf.

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Структурно-функціональний аналіз як інновація в державному управлінні (на прикладі банківського нагляду)

Сучасні інноваційні методи банківського нагляду пов'язані із дослідженням бізнес-моделей та профілем ризиків банків. European Banking Authority розглядає бізнес-модель як набір засобів та методів для організації роботи, отримання прибутку та стабільного зростання. Європейський центральний банк першим запровадив оцінку життєздатності бізнес-моделей і факторів рентабельності як наглядовий пріоритет. Для ідентифікації бізнес-моделей та оцінки ризиків банків необхідний адекватний математичний інструментарій. Для різних бізнес-моделей банків необхідні специфічні наглядові підходи та адекватні заходи впливу. Пропонується розподілити банки на окремі однорідні структурно-функціональні групи. Структурно-функціональний аналіз є інноваційним методом якісного аналізу структурних змін у порівнянні з попередніми звітними періодами за допомогою кількісних індикаторів, визначенням конкретних характеристик кожної групи банків, взаємозв'язку між групами та місцем кожного банку в групі. Оцінку фінансової стійкості кожного банку пропонується провести на основі аналізу його положення та траєкторії на самоорганізаційній карті Кохонена. Важливою перевагою методу є можливість розглянути значну кількість показників для формування однорідних груп банків. Дослідження останніх років демонструє скорочення банків, які не мають суттєвих відхилень від середніх характеристик активів, пасивів, доходів та витрат та розташовані у центральної частині карти. У той же час, зростають групи банків із підвищеною часткою поточних ресурсів. Відсутність строкових ресурсів суттєво ускладнює розвиток кредитування. Важливою сучасною тенденцією розвитку ринку банківських послуг є зростання групи банків, що розміщують активи у державні цінні папери. Концентрація банківських активів у ОВДП також не сприяє розвитку кредитування в Україні. Діяльність великої кількості банків пов'язана з валютними ризиками.

Ключові слова: структурно-функціональний аналіз, показники фінансової системи, бізнес-модель банку, самоорганізаційна карта.