“Assessment of the banking system financial stability based on the differential approach”

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ASSESSMENT OF THE BANKING SYSTEM FINANCIAL STABILITY BASED ON THE DIFFERENTIAL APPROACH

Abstract

In this paper, the banking system financial stability is assessed based on the differential approach. The differential approach provides for taking into account the specificity of the banking system structural organization (from the standpoint of the central bank and the second-level banks) and the sets of financial stability indicators, different in terms of their structure, and their volatility measures, according to this approach.

The banking system financial stability is assessed based on the two groups of indicators: the first one characterizes the central bank financial stability (indicators of gross international reserves, effectiveness of monetary policy and foreign exchange regulation, ability to create favorable conditions in order to ensure the effectiveness of the banking sector); the second one defines the financial stability level for state banks, banks with private and foreign capital (indicators of the capital adequacy, liquidity, structure of assets and liabilities, effectiveness of the activity, financial risks). The differences between the sets of financial stability indicators for different groups of banks and the expediency of taking them into account during the assessment are revealed and substantiated according to the results of using the principal components method.

The developed procedure of assessing the banking system financial stability provides for: constructing the banking system financial stability index (by multiplicative convolution of central bank financial stability subindex and three banks' financial stability subindices); defining its high, medium and low level according to its quantitative values (according to interval scales, developed according to the rule "3σ"; interpreting the assessment results based on the scenario analysis, which is based on taking into account the dynamic change of the financial stability index during the analyzed period and allows to identify the state of the banking system (stable, conventionally stable or critical).

The banking system financial stability assessment procedure based on the differential approach is tested based on the statistical data of the central bank and financial indicators of Ukrainian banks during the period 2009–2017 through the lens of quarterly reports.

Keywords financial stability, banking system, differential approach, central bank, banking sector, volatility

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INTRODUCTION

The consequences of the 2008–2009 global financial crisis forced the regulatory agencies of all the developed countries to revise the existing mechanisms of banking regulation and supervision. Thus, according to the Basel Committee recommendations, recently new, stricter requirements to the capital amount and liquidity requirements are being intensively implemented, transition to risk-oriented concept of banking supervision still continues, banks' stress-testing procedures are actively realized, including the systemically important, which are given a special status in the context of generating the systemic risk. Such a transformation of the banking supervision and regulation architecture is oriented towards ensuring the banking systems stability

and creating the "safety cushion" in case of their destabilization. In the conditions of cyclicality of their development for predicting the banking crises, no less significant become the issues of financial stability assessment and monitoring, which is the analytical ground for implementing the instruments of regulatory influence from the side of central banks.

Today the financial stabilization of Ukrainian banking system is very necessary, as the changes, which occurred during the last 4 years, show that not only the large number of banks lost their ability to counteract the shocks, but also the central bank failed to predict such a situation and create the favorable conditions in order to stabilize their state and effectively perform their functions. Thus, according to the data of the National Bank of Ukraine (2013–2017), during the period 2014–2017, 98 banks have been stripped of their license, in comparison to 2013, the number of banks' structural subdivisions decreased by half (from 19,290 to 9,489), the historically record amount of the banking system losses (UAH 158,481 billion) was registered. Besides, during the period 2014–2017, the discount rate of the National Bank of Ukraine was quite versatile and changed in the range from 9.5% to 30%, and in the 4th quarter, the balance of foreign exchange interventions reached its minimum value during the last 10 years and was USD -4,569.7 billion. From the standpoint of the current state of Ukrainian banking system and importance of timely detection of the threats of losing its stability, these very facts are decisive for substantiating the expediency of improving the existing approaches to assessing the financial stability from the point of view of comprehensiveness.

That's why, if there exists specificity of assessing the financial stability of the separate structural elements of the banking system, there appears the need for performing it based on the differential approach, which is defined as the aim of the paper.

Taking into account the essence of the differential approach, which focuses on the differences of the parts of the whole, first, the banking system financial stability is proposed to be assessed from the standpoint of the financial stability of its institutions. Second, the existence of specific peculiarities in corporate governance and business models of modern banks is the ground for proposing the hypothesis about the differentiation of qualitative and quantitative nature of the financial stability indicators for state banks, banks with foreign and private capital. Third, it provides for taking into account the differentiation criterion for differentiating the significance of financial stability indicators according to the levels of their volatility.

1. LITERATURE REVIEW

1.1. Banking system financial stability indicators

The issues of assessing the banking system financial stability were studied in the works of many researchers, and the analysis of the existing studies on the corresponding direction shows the multivariance of the viewpoints on structuring and listing of financial stability indicator. Herewith, notwithstanding the existence of scientific discussions on the differences between the concepts "financial stability" and "financial sustainability" of the banking system, the analysis of the existing assessment methods showed that the sustainability indicators and the stability indicators are almost identical. Based on generalization of the existing scientific works, it was found that macroeconomic and macrofinancial indicators and parameters of the banking system state are most often used as the banking system financial stability indicators.

Among the macroindicators in the studies on defining the banking system financial stability and the probability of banking crises (which lead to the decreased level of it), the most frequently met are: the indicators related to lending and value of assets (Kaminsky & Reinhart, 1999; Gonzales-Hermosillo, 1999; Borio & Lowe, 2002; Baranovskyi, 2009; Alessi & Detken, 2011; Drehmann et al., 2011; Kuznietsova & Kovalenko, 2012; Swamy, 2013; Duca & Peltonen, 2013; Crowe

et al., 2013; Laina et al., 2015; G. Caranovic & B. Caranovic, 2015; Kyiak, 2016; Lesyk, 2017); the indicators, which reflect the GDP growth (Demirguc-Kunt & Detragiache, 1998; Kaminsky & Reinhart, 1999; Gonzales-Hermosillo, 1999; Baranovskyi, 2009; Alessi & Detken, 2011; Kuznietsova & Kovalenko, 2012; Dovgan 2012; Swamy, 2013; Duca & Peltonen, 2013; Kozlov, 2014; Laina et al., 2015; G. Caranovic & B. Caranovic, 2015; Kyiak, 2016; Lesyk, 2017); monetary aggregates and money turnover indicators (Demirguc-Kunt & Detragiache, 1998; Kaminsky & Reinhart, 1999; Alessi & Detken, 2011; Kuznietsova & Kovalenko, 2012; Kyiak, 2016; Lesyk, 2017).

Within the approaches to assessing the banking system financial stability, macroeconomic and macrofinancial indicators are to a greater extent used in conjunction with the banking system state indicators. Thus, Swamy (2013) combines the macroindicators (the growth rate of the loans, given to the private sector by the banks, savings to GDP ratio, investment to GDP ratio) with the banking sector financial sustainability indicators (regulatory capital to risk-weighted assets ratio, nonperforming assets, collateral to nonperforming assets ratio, return on assets and return on equity). Based on Kiyak's (2016) proposal, the main indicators of the banking system financial stability are capital adequacy, discount rate of the central bank, money supply, GDP, annual change of consumer price index, financial resources of the Deposit Guarantee Fund, commercial banks refinancing volume, assets, own equity, liabilities, funds of individuals, loans granted. G. Caranovic and B. Caranovic (2015) evaluate the banking system financial stability based on the financial development, financial vulnerability, financial sustainability and global economic climate indicators. Dovgan (2012) includes macroeconomic and macrofinancial parameters, indicators of banking institutions activity and functioning of the real sector into the complex indicator of the risk of losing the banking system financial sustainability. Kuznetsova and Kovalenko (2012) divide the banking system financial sustainability indicators in the following groups: crisis situations emergence and anti-crisis actions indicators, banking system financial security indicators, risk indicators, banking system financial sustainability aggregate indicators and normative legal acts effectiveness indicators. In order to assess the banking system financial stability, Lesyk (2017) uses the indicators of the credit and financial interaction intensiveness at the interbank market, the effectiveness of the banking system functions realization, structural changes and financial imbalances and assessment of the systemic banks activity.

The separate group of approaches to assessing the banking system financial stability according to the parameters of the banking system state should include the ones, which to a greater extent are based on banks financial stability indicators. Thus, within the approach, developed by Jahn and Kick (2012), the banking system stability aggregate indicator consists of three components, which describe the situation in the banking system: individual banking institutions assessment indicators, credit spread and stock index for the banking sector. Bobyl (2011), Filippova (2012), Chmutova and Biliaieva (2015) calculate the banking system financial sustainability (stability) aggregate indicator based on the group of coefficients: capital adequacy, assets (loan portfolio) quality, income and profitability (performance), liquidity (Bobyl, 2011; Filippova, 2012); capital adequacy, liquidity, business activity and performance (Chmutova & Biliaieva, 2015).

Apart from the list of the banking system financial stability indicators, the approaches to its assessment differ in terms of the ways of assessing the results: based on partial indicators; based on synthetic indicators, which are calculated by convoluting the partial ones.

1.2. Structural organization of the banking system in the context of the differential approach to assessing its financial stability

The inability of the banking system to absorb the crisis trends and not allow for their escalation. That's why it is important not only to obtain general information about the level of the banking system financial stability, but also to define weak links, whose functioning worsens its state and prevents the continuous and effective realization of general functions. Using the differential approach

makes it possible to overcome the deficiencies of the existing methods for assessing the banking system financial stability, which do not take into account the corresponding aspects. According to this approach, the banking system financial stability is defined taking into account its structural organization.

The issue concerning the banking system structure is quite debatable. It is due to the different views of scientists on the possibility of including the non-banking financial institutions into its structural elements. That's why, two approaches concerning its solution can be defined: the first approach is traditional and provides for investigating the banking system from the standpoint of the central bank and banks (Edwards,1993; Khalova, 1999; Dziubliuk, 2002; Kovalenko, 2010; Bhaskar, 2014); the second one combines the non-banking financial institutions with the main components of the banking system (Burzynska, 2009; Behr & Schmidt, 2004; Turner et al., 2012; Mungai, 2013; Khailuk, 2014; Hasanaj & Shala, 2017). The differentiation of such approaches is the consequence of different fundamental theories development in the banking sphere. According to credit creation theory of banking, banks are considered as financial intermediaries, which attract the deposits for granting the loans; the fractional reserve theory of banking stipulates that every separate bank is a financial intermediary without powers for making money, but as a whole the banking system is able to make money in the process of multiple deposit expansion; according to financial intermediation theory, banks are practically identical with other financial intermediaries (Werner, 2016).

The majority of the representatives of the first approach stress that non-banking financial institutions and the banking system are separate subsystems of the financial system of the country. The analytical studies of the IMF (International Monetary Fund, 2014) and European Commission (European Commission, 2012) specialists are based on the similar findings. Dzibliuk is of the quite critical opinion about the inclusion of the non-banking financial institutions into the elements of the banking system and stresses that it is illegal and incorrect to combine banks and para-banks within the banking system. Under such circumstances, there takes place artificial expansion of the banking system frames, which in this case equates it to the credit one. When analyzing the differences between banks and non-banking financial institutions, Edwards (1993) stresses that through the demand deposits, banks take part in creating "liquidity" and are relevant to money supply; no banking institution ensures the identical combination of the services package, given by the banks. When investigating internal organization of the banking system based on the standard variant, the authors' study will be based on the statement that according to the differential approach, if the central bank and second-level banks are stable, the system is stable as well.

Using the criterion of differentiation in the theoretical and empirical studies of the banking system state, its components and the issue about its relationship with other financial parameters is quite widespread. Bouvatier et al. (2012) have analyzed the relationship of the banking system structure with the procyclical nature of bank lending. Gomis-Porqueras and Benoit (2007) studied the effect of different market structures in the banking system on the loan disbursement processes. Hoxha (2013) found the relationship between the banking sector structure and production potential of enterprises. Košak and Čok analyzed the dependence of the banks' profitability level on the type of their residence. Nikiel and Opiela (2002) define the need for assessing the banking system based on different groups of banks and note that foreign banks are more effective in comparison to state banks and banks with private capital.

As the evolution of the banking systems of different countries of the world took place as a result of the influence of the big number of factors, their internal organization is characterized by certain peculiarities. This to a greater extent concerns the banking sector structure. Thus, for example, Chinese banking sector is quite segmented and represented by the following groups of banks: big and other commercial banks, state banks, cooperative banks and foreign banks (Burzynska, 2009). In Germany, the banking sector is three-component and combines private commercial banks, state (savings) and cooperative banks (Krahnen & Schmidt, 2004). The Japanese banking sector includes state banks, regional, cooperative and Shinkin banks (Liu & Wilsonb, 2013). The struc-

ture of Iceland's banking sector, which includes commercial and savings banks, is simple from the point of view of differentiation.

The differences in the structural division of the banking sector elements are the obstacle for developing the universal approach to assessing the banking system financial stability according to its structural components, which can be adapted in different countries. It is possible to solve this problem by tracking the relationship between the banks' business models and their ability to keep stable in the conditions of the financial stress (Liu & Wilsonb, 2011; Gleissle, 2014; Ayadi et al., 2016; Deutsche Bundesbank Monthly Report, 2015). Herewith, one of the important factors affecting the formation of banks' business models is the structure of their property, which in turn can be differentiated according to the criterion of bank capital origin (state, private and foreign).

2. METHODS

The proposed procedure of assessing the banking system financial stability based on the differential approach provides for taking into account:

1. the peculiarities of its structural organization, which is a ground for defining the Banking System Financial Stability Index (*BSFSI*) based on the multiplicative convolution of four sub-indexes:

$$BSFSI = CBFS^{a_1} \cdot GBFS^{a_2} \cdot FBFS^{a_3} \cdot PBFS^{a_4}, \quad (1)$$

where *CBFS* – sub-index of the central bank financial stability; *GBFS* – sub-index of the state banks financial stability; *FBFS* – sub-index of the banks with foreign capital financial stability; *PBFS* – sub-index of the banks with private capital financial stability; a_1, a_2, a_3, a_4 – weighted coefficients for each of the sub-indexes.

2. the differences between the sets of financial stability indicators for different groups of banks;

3. the level of volatility of the values of separate indicators and the banking system financial stability sub-indexes, which are used for defining their weighted coefficients and are take into account in the process of consolidated evaluation.

The **first stage** of realizing the assessment procedure is formation of the set of indicators according to the defined sub-indexes. The level of central bank financial stability is stipulated to be measured according to the following parameters: amount of gross international reserves, inflation index, official exchange rate, ratio of weighted average refinancing rate to weighted average rate on bank loans in the national currency, granted to non-financial corporations.

The list of second-level banks financial stability indicators is stipulated to be formed using the principal components method. This method refers to the factor analysis methods and be reducing the features without losing their informativity allows to confirm or deny the hypothesis on the differentiation of the state banks and banks with foreign and private capital financial stability parameters. In order to substantiate the number of the principal components, Kaiser criterion is used (the own numbers of the components must be greater than 1), and the content of the most informative indicators is defined taking into account their loadings on the chosen components. The primary list of banks' financial stability indicators, which are tested by the factor analysis for the suitability for use (in the software product Statistica 8.0), is unified in the following groups: capital adequacy, liquidity, assets and liabilities structure, activity effectiveness. Apart from the mentioned groups of indicators, it is considered necessary to also take into account the financial risks indicators, for which it is inappropriate to expand the factor analysis procedure described above. It is explained by the fact that excluding the indicators of assessing the separate financial risks from the sample contradicts the concept of risk-oriented banking supervision, directed towards the large-scale evaluation of the banking activity risks. The corresponding idea on the importance of complex consideration of financial risks indicators in the process of assessing the banks' financial stability was also developed in the work by Chmutova and Kharytonova (2017), which focuses on the risks, subject to quantitative measurement. This approach is taken as a

basis for assessing the risk component, which is extended by the indicator, which shows the share of currency deposits in bank liabilities and allows to assess the level of its currency risk.

The **second stage** of the procedure of assessing the banking system financial stability is the quantitative assessment of its state (according to formula 1). The separate *BSFSI* components are calculated using the taxonomy method (Pljuta, 1980). In order to obtain a generalized estimation according to sub-indexes *GBFS*, *FBFS* and *PBFS*, average geometric means of taxonomic indicators of the banks' financial stability assessment, which are included in each of the groups. During the assessment, attention must also be paid to the following aspects. First, the banking system is considered financially stable during the certain time t_2, if main bank of the country and second-level banks are financially stable at the multitude of the separate time intervals t_1, where t_2 is the multitude of hours t_1. Second, for the quantitative assessment using the method of taxonomy according to the separate banks' financial stability sub-indexes, it is reasonable to exclude the objects of observations, financial indicators of which worsen the conditions of ensuring the sample uniformity and distort the evaluation results. Third, when building the *BSFSI*, the levels of some indicators and sub-indexes volatility are defined according to variation coefficients. Their rating is formed according to the calculated variation indicators, and the corresponding weighted coefficients $\left(\sum a_i = 1\right)$ are calculated using the Fishburn criterion (Fishburn, 1970):

$$a_i = \frac{2\cdot(n-i+1)}{n\cdot(n+1)}, \qquad (2)$$

where n – total number of ranged indicators; i – indicator range.

The weighted coefficients for central bank, state banks, banks with foreign and private capital financial stability indicators must be entered into the matrix of their standardized values when building each of the corresponding sub-indexes. The coefficient of the significance for the sub-indexes is taken into account in the process of their multiplicative convolution for building the *BSFSI*.

At the **third stage** of the procedure, the assessment results are qualitatively interpreted, which provides for the ratio of the quantitative values of the calculated sub-indexes to the banking system financial stability index with the quality levels – high (H), middle (M) and low (L), which are defined according to the interval scales, built according to the rule "3σ". The method of the interval scales development is based on defining the statistical characteristics of the differentiation of the values of the obtained synthetic indicators: arithmetic mean, median, mode, mean squared deviation, asymmetry coefficient. According to the rule "3σ", if the value of the asymmetry coefficient is less than |0.5| (asymmetry can be neglected), the scale has the following range of values:

$$\bar{x} - 3\cdot\sigma; \bar{x} + 3\cdot\sigma, \qquad (3)$$

where $\bar{x}$ – arithmetic mean; σ – mean squared deviation.

In case of significant asymmetry, the median is considered the reference point and adjustment coefficient is used (formulae 4-5 with right-side and left-side asymmetry, respectively):

$$Me - 3\cdot\sigma\cdot k; Me + 3\cdot\sigma\cdot(k+1), \qquad (4)$$

$$Me - 3\cdot\sigma\cdot(k+1); Me + 3\cdot\sigma\cdot k, \qquad (5)$$

where Me – median; k – adjustment coefficient (calculated according to the method, presented in the work by Zinchenko (2007)).

It is proposed to form a unified interval scale for comparing the average levels of financial stability of the banks of different groups. The ranges of values for the unified scale are defined based on the statistic parameters of the differentiation of the corresponding synthetic indicators.

At the **fourth stage** of the assessment of the banking system financial stability, it is stipulated to analyze the dynamic change of the calculated synthetic indicators according to their quality levels taking into account the time criterion. It is reasonable to use the basis of the scenario approach in order to solve this task. Using the scenario approach allows to track the transformation of the banking system states from the point of view of its financial stability in the time (from initial to final) according to the realistic, optimistic and pessimistic scenario of the events development (Table 1).

Table 1. Scenarios of the development of events concerning the change of quality levels of the banking system financial stability

Source: Authors' proposals.

Scenarios of the development of events	No.	I quarter	II quarter	III quarter	IV quarter	State of the banking system from the point of view of its financial stability for the period
		Level of BSFSI at the beginning of the period	Levels of BSFSI during the transition periods (different combinations are possible)		Level of BSFSI at the end of the period	
Realistic	1.1	L	→		M	Conditionally stable
	1.2	M	→		L	Unstable/crisis
	1.3	M	→		H	Stable (if the value of BSFSI in the IV quarter is higher than the average annual and no crisis tendencies were found in the transition periods)
		M	→		H	Conditionally stable (if the value of BSFSI in the IV quarter is lower than the average annual and/or crisis tendencies were found in the transition periods)
	1.4	H	→		M	Conditionally stable (if the value of BSFSI in the IV quarter is lower than the average annual and/or crisis tendencies were found in the transition periods)
		H	→		M	Stable (if the value of BSFSI in the IV quarter is higher than the average annual and no crisis tendencies were found in the transition periods)
	1.5	H	→		H	Stable
	1.6	M	→		M	Conditionally stable
	1.7	L	→		L	Unstable/crisis
Optimistic	2	L	→		H	Conditionally stable
Pessimistic	3	H	→		L	Unstable/crisis

Note: L – low, M – middle, H – high levels of *BSFSI*.

The results of the assessment based on the central bank and banks' financial stability sub-indexes are recommended to be interpreted according to the same scheme. It allows to find the most unstable institutional elements of the banking system and the sources of the risks spread.

3. RESULTS

According to the described stages of assessment of the banking system financial stability, the primary task during its realization is to form the indicative environment, which takes into account functional loading of the central bank and the peculiarities of the second-level banks activity. Thus, using the principal components method, the hypothesis about the existence of the differences among the financial stability indicators for assessing the state banks and bank with foreign and private capital (which operated in Ukraine during the period 2009–2017) was confirmed, the most informative indicators for each of the groups were specified (Table 2).

Similar calculations were performed for each of the analyzed groups of banks in order to refine the composition of the most informative indicators of liquidity, structure of assets and liabilities and activity effectiveness.

According to the data in Table 2, it can be concluded that, according to the loadings on the chosen components, among the capital adequacy indicators for assessing the banks' financial stability, it is reasonable to use the following: financial independence coefficient – for state banks; financial independence and reliability coefficients – for banks with foreign capital; financial independence, reliability, own capital security and capital multiplier

Table 2. Results of using the principal components method for defining the most informative indicators of capital adequacy for assessing the financial stability of different groups of banks

Source: Calculated by the authors.

Principal component	Principal component own value	General dispersion share, %	Loading on the components			
			Financial independence coefficient	Reliability coefficient	Own equity security coefficient	Capital multiplier
State banks						
1	1.588901	39.72254	0.775511	0.624633	–0.594765	–0.623438
2	1.320669	33.01672	–0.524732	–0.586579	–0.603820	–0.580216
Banks with foreign capital						
1	1.787319	44.68297	0.787566	0.548704	–0.626617	–0.687992
2	1.077324	26.93310	–0.301406	–0.719023	–0.524925	–0.440384
Banks with private capital						
1	1.902524	47.56309	–0.936085	–0.895732	–0.184688	0.435689
2	1.452975	36.32438	–0.199386	–0.334238	0.858074	–0.751807

– for banks with private capital. The list of the substantiated banks' financial stability indicators and central bank financial stability assessment parameters (together they form the separate components of *BSFSI*), their weighted coefficients, which are stipulated by the differential approach, are given in Table 3.

Weighted coefficients, calculated according to the indicators of variation of the banking system fi-

Table 3. Information support of the banking system financial stability integral assessment according to the differential approach

Sub-index	Directions of assessment and the respective indicators		Weighted coefficients	
			Indicators	Sub-indexes
CBFS	Gross international reserves stability	Gross international reserves amount	0.3	0.4
	Monetary policy effectiveness	Inflation index	0.1	
	Currency regulation effectiveness	Official exchange rate	0.4	
	Ability of the central bank to create favorable conditions for ensuring the banking sector effectiveness	Ratio of weighted average refinancing rate to weighted average rate on bank loans in the national currency, granted to non-financial corporations	0.2	
GBFS	Capital adequacy	Financial independence coefficient	0.048	0.3
	Liquidity	Resource liquidity coefficient	0.024	
		Overall liquidity coefficient	0.019	
		High-liquidity assets to working assets ratio	0.043	
		General liquidity coefficient	0.071	
	Structure of assets and liabilities	Capacity utilization rate	0.029	
		Income-producing assets to general assets ratio	0.014	
		Share of raised funds in liabilities	0.005	
		Level of term deposits in liabilities	0.033	
	Activity effectiveness	General profitability level	0.086	
		Coefficient of performance	0.057	
		Spending activities profitability	0.095	
		Risk-free costs coverage coefficient	0.062	
		Commission income to interest income ratio	0.067	
	Financial risks	Instant liquidity coefficient	0.076	
		Net interest margin	0.090	
		Share of impairment reserves in the credit portfolio	0.052	
		Share of securities impairment reserves in the securities portfolio	0.081	
		Resource base instability coefficient	0.010	
		Share of currency deposits in liabilities	0.038	

Table 3 (cont.). Information support of the banking system financial stability integral assessment according to the differential approach

Sub-index	Directions of assessment and the respective indicators		Weighted coefficients	
			Indicators	Sub-indexes
FBFS	Capital adequacy	Financial independence coefficient	0.016	0.2
		Reliability coefficient	0.011	
	Liquidity	Resource liquidity coefficient	0.068	
		Overall liquidity coefficient	0.079	
		General profitability level	0.047	
	Structure of assets and liabilities	Capacity utilization rate	0.084	
		Income-producing assets to general assets ratio	0.089	
		Level of term deposits in liabilities	0.058	
	Activity effectiveness	General profitability level	0.095	
		Coefficient of performance	0.053	
		Return on capital	0.100	
		Risk-free costs coverage coefficient	0.032	
		Commission income to interest income ratio	0.021	
	Financial risks	Instant liquidity coefficient	0.037	
		Net interest margin	0.026	
		Share of impairment reserves in the credit portfolio	0.042	
		Share of securities impairment reserves in the securities portfolio	0.005	
		Resource base instability coefficient	0.074	
		Share of currency deposits in liabilities	0.063	
PBFS	Capital adequacy	Financial independence coefficient	0.069	0.1
		Reliability coefficient	0.082	
		Own capital security coefficient	0.074	
		Capital multiplier	0.026	
	Liquidity	Resource liquidity coefficient	0.052	
		Overall liquidity coefficient	0.039	
		General profitability level	0.035	
		Granted loans to attracted deposits ratio	0.078	
	Structure of assets and liabilities	Capacity utilization rate	0.009	
		Income-producing assets to general assets ratio	0.004	
		Share of raised funds in liabilities	0.013	
	Activity effectiveness	General profitability level	0.091	
		Coefficient of performance	0.061	
		Risk-free costs coverage coefficient	0.043	
		Commission income to interest income ratio	0.065	
	Financial risks	Instant liquidity coefficient	0.087	
		Net interest margin	0.056	
		Share of impairment reserves in the credit portfolio	0.048	
		Share of securities impairment reserves in the securities portfolio	0.030	
		Resource base instability coefficient	0.017	
		Share of currency deposits in liabilities	0.022	

Note: calculated by the authors according to formula 2 based on the ranks of financial stability indicators and sub-indexes (ranks of indicators are defined based on the calculated coefficients of their variation: the higher the level of parameter variation, the higher its rank and, correspondingly, the weighted coefficient).

Table 4. Parameters of differentiating the values of the banking system financial stability synthetic indicators and the interval scales, formed according to them

Synthetic indicator	Arithmetic mean	Median	Mode	Mean squared deviation	Asymmetry coefficient	Interval scales
Banks' financial stability sub-index	0.597	0.614	0.644	0.07	–0.67	H ∈ [0; 0539]; H ∈ [0; 0.539]; C ∈ (0.539; 0.616]; B ∈ (0.616; 1]
NBU financial stability sub-index	0.465	0.565	0.699	0.234	–0.997	H ∈ [0; 0.300] C ∈ (0.300;0.595] B ∈ (0.595; 1]
Banking system financial stability index	0.516	0.559	0.619	0.121	–0.851	H ∈ [0; 0.425] C ∈ (0.425;0.577] B ∈ (0.577; 1]

Note: Calculated by the authors (interval scales are built using the formula 5 based on the represented parameters of the differentiation of the values of the banking system financial stability synthetic indicators).

nancial stability, provide the information support for integral assessment of its level and monitoring of banking risks both from the side of the banks themselves and the supervision authority. It was found that according to the volatility of the indicators' values, it is necessary to strengthen the control on such financial risks of the analyzed groups of the Ukrainian banks: liquidity, interest rate and investment risks – for state banks; resource base instability, currency and credit – for banks with foreign capital; liquidity, interest rate and credit – for banks with private capital.

The results of the Ukrainian banking system financial stability integral assessment (Table 5) are interpreted using the built interval scales (Table 4).

Comparing the quantitative values of *BSFSI* and its components during the period 2009–2017 allows to make the following conclusions. The consequences of the global financial crisis in Ukraine were late. That's why, at the expense of effective NBU policy and readiness of banks with foreign and private capital for absorbing them helped to constrain and partly neutralize the negative tendencies in 2009. Based on this, when comparing with the value of *BSFSI* for the last 13 quarters, in 2009, the banking system state can be characterized as conditionally stable. It is confirmed by the corresponding results of interpreting the assessment results according to the scenario approach.

The worst BSFSI value was registered in the I-II quarters of 2015 (0.280 and 0.290, respectively), and the stable trend towards the decrease of its quantitative level falls on the beginning of 2014 with the gradual reduction to the crisis phase, whereof the IV quarter of 2014 can be considered a reference point.

Notwithstanding the fact that the period 2016–2017 witnessed the increase of the banks' financial stability sub-indexes values (as a result of cleaning the banking system from insolvent financial institutions), the BSFSI level was defined as low. Such situation is explained by, for the corresponding period, inability of NBU to stabilize the situation after the crisis of trust to banking system in the period 2014–2015, which predetermined its chronic nature. That's why, with the use of multiplicative form of generalizing measurement function, the low NBU financial stability sub-index values most affected the results of banking system financial stability assessment for the last 8 quarters. But it must be noted that 2017 witnesses the positive trend of *BSFSI* growth, and its quantitative values are approaching to the middle level, which is a sign of the gradual stabilization of the situation. Based on the defined conformities of the change of the banking system states from the standpoint of financial stability, the cyclical nature of its development is analytically confirmed. The processes of banks' migration between the groups were found. The mean values of the financial stability synthetic indicators prove that the banks with foreign capital are the most resistant to the effect of destabilizing factors.

Table 5. Results of assessing the Ukrainian banking system financial stability based on the differential approach during the period 2009–2017

Source: Calculated by the authors.

Quarters per years	Qualitative and quantitative levels of the banking system financial stability synthetic indicators										Banking system state from the standpoint of financial stability during the year
	CBFS		GBFS		FBFS		PBFS		BSFSI		
2009_I	0.593	M	0.650	H	0.628	H	0.594	M	0.617	H	H → M (0.532 < 0.586) Conditionally stable
2009_II	0.575	M	0.617	H	0.627	H	0.616	M	0.602	H	
2009_III	0.608	H	0.551	M	0.619	H	0.605	M	0.592	H	
2009_IV	0.602	H	0.413	L	0.586	M	0.569	M	0.532	M	
2010_I	0.558	M	0.254	L	0.637	H	0.603	M	0.456	M	M → H (0.650 → 0.582) Stable
2010_II	0.680	H	0.448	L	0.611	M	0.623	H	0.582	H	
2010_III	0.738	H	0.523	L	0.644	H	0.659	H	0.640	H	
2010_IV	0.753	H	0.536	L	0.641	H	0.659	H	0.650	H	
2011_I	0.776	H	0.608	M	0.636	H	0.634	H	0.679	H	H → H Stable
2011_II	0.795	H	0.402	L	0.616	M	0.629	H	0.602	H	
2011_III	0.779	H	0.564	M	0.662	H	0.643	H	0.672	H	
2011_ IV	0.726	H	0.556	M	0.659	H	0.623	H	0.647	H	
2012_I	0.719	H	0.541	M	0.675	H	0.606	M	0.641	H	H → H Stable
2012_II	0.693	H	0.630	H	0.696	H	0.593	M	0.664	H	
2012_III	0.696	H	0.653	H	0.698	H	0.639	H	0.677	H	
2012_IV	0.606	H	0.634	H	0.581	M	0.635	H	0.612	H	
2013_I	0.606	H	0.628	H	0.628	H	0.588	M	0.615	H	H → H Stable
2013_II	0.576	M	0.637	H	0.627	H	0.624	H	0.609	H	
2013_III	0.549	M	0.626	H	0.679	H	0.609	M	0.602	H	
2013_IV	0.525	M	0.657	H	0.691	H	0.637	H	0.605	H	
2014_I	0.420	M	0.629	H	0.663	H	0.581	M	0.537	M	M → L Unstable/crisis
2014_II	0.416	M	0.630	H	0.640	H	0.579	M	0.531	M	
2014_III	0.381	M	0.593	M	0.636	H	0.619	H	0.506	M	
2014_IV	0.194	L	0.507	L	0.612	M	0.579	M	0.363	L	
2015_I	0.130	L	0.441	L	0.481	L	0.529	L	0.280	L	L → L Unstable/crisis
2015_II	0.105	L	0.554	M	0.608	M	0.557	M	0.290	L	
2015_III	0.160	L	0.563	M	0.545	L	0.527	L	0.336	L	
2015_IV	0.206	L	0.502	L	0.616	M	0.612	M	0.373	L	
2016_I	0.145	L	0.565	M	0.605	M	0.571	M	0.333	L	L → L Unstable/crisis
2016_II	0.188	L	0.564	M	0.656	H	0.592	M	0.376	L	
2016_III	0.210	L	0.555	M	0.603	M	0.620	H	0.386	L	
2016_IV	0.185	L	0.549	M	0.651	H	0.650	H	0.373	L	
2017_I	0.172	L	0.580	M	0.639	H	0.575	M	0.363	L	L → L Unstable/crisis
2017_II	0.222	L	0.581	M	0.604	M	0.610	M	0.401	L	
2017_III	0.239	L	0.579	M	0.629	H	0.619	H	0.416	L	
2017_IV	0.226	L	0.592	M	0.611	M	0.616	M	0.407	L	

CONCLUSION

The procedure of assessing the banking system financial stability based on the differential approach provides for using the criterion of differentiation to assessing its separate elements, content and level of financial stability indicators volatility.

Taking into account the criterion of differentiation, the information basis for assessing the banking system financial stability is presented by the indicators, which are unified within the following directions: gross international reserves stability, monetary policy effectiveness, currency regulation ef-

fectiveness, ability of the central bank to create favorable conditions for ensuring the banking sector effectiveness; capital adequacy, liquidity, structure of assets and liabilities, activity effectiveness and banks' financial risks.

The process of the financial stability integral assessment and interpretation of its results unifies the following stages: multiplicative convolution of the four components of the synthetic indicator (central bank financial stability sub-index, state banks financial stability sub-index and banks with foreign and private capital financial stability sub-indexes); correspondence of the quantitative values of the calculated sub-indexes and the general index to high, middle and low qualitative levels; defining the banking system state (stable, conditionally stable or crisis) based on the analysis of the dynamic changes of the levels of the index of its financial stability assessment in course of time (from initial to final).

Using the presented proposals concerning the banking system financial stability assessment based on the differential approach allows to: holistically and objectively assess the ability of the banking system to resist the negative effect of external and internal factors and neutralize the crisis trends; monitor and predict the central bank and second-level banks financial stability level, correct the policy concerning ensuring its sustainability in course of time.

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