“Risk-oriented integral assessment of the Ukrainian banks effectiveness”

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ARTICLE INFO	Mariya Rubakha, Lesia Tkachyk, Olha Zamaslo and Olesya Irshak (2019). Risk-oriented integral assessment of the Ukrainian banks effectiveness. *Banks and Bank Systems*, *14*(3), 121-139. doi:10.21511/bbs.14(3).2019.11
DOI	http://dx.doi.org/10.21511/bbs.14(3).2019.11
RELEASED ON	Tuesday, 24 September 2019
RECEIVED ON	Saturday, 15 June 2019
ACCEPTED ON	Wednesday, 18 September 2019

JOURNAL	"Banks and Bank Systems"
ISSN PRINT	1816-7403
ISSN ONLINE	1991-7074
PUBLISHER	LLC “Consulting Publishing Company “Business Perspectives”
FOUNDER	LLC “Consulting Publishing Company “Business Perspectives”

NUMBER OF REFERENCES	NUMBER OF FIGURES	NUMBER OF TABLES
42	2	9

BUSINESS PERSPECTIVES

LLC "CPC "Business Perspectives"
Hryhorii Skovoroda lane, 10,
Sumy, 40022, Ukraine

www.businessperspectives.org

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RISK-ORIENTED INTEGRAL ASSESSMENT OF THE UKRAINIAN BANKS EFFECTIVENESS

Abstract

Ensuring efficiency improvement of banks is a priority task for Ukrainian banking system at the stage of creating the developed financial sector of economy. The study of a bank performance, which takes into account a risk factor of banking business, is particularly relevant due to the need to ensure competitiveness and stability of both individual banks and the banking system as a whole.

The aim of this article is to develop a methodology for integral evaluation of the Ukrainian banks according to the efficiency and risk criteria. Ratio analysis, mathematical methods, comparison and grouping, synthesis, table, matrix and graphic methods make the methodological basis of the research. The object of the analysis is the activities of Ukrainian banks.

The study was conducted to elaborate a method for risk-oriented integral estimation of efficiency of the banks functioning. One can state that high efficiency and low risk of a bank's work do not depend on the volume of assets, equity and profit for Ukrainian banks.

The analysis made it possible to evaluate the strategies for the development of Ukrainian banks. The vast majority of Ukrainian banks have chosen a moderate strategy in the context of balancing the efficiency and riskiness of their activities.

According to the results of factor analysis using Raiffeisen Bank Aval as an example, the main factors of gross profit growth were determined as increase in bank profitability and expansion of its active operations volume relative to its own capital.

Keywords integral indicator, ratio analysis, efficiency, risk, factor analysis, strategy of a bank

JEL Classification C13, G21

Received on: 15th of June, 2019
Accepted on: 18th of September, 2019

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INTRODUCTION

In an environment driven by accelerated processes of international integration, globalization of financial markets and frequent economic upheavals, finding the most effective ways to manage banking institutions becomes a particularly relevant issue. Increased competition in the financial sector forces banks to foster their competitiveness while balancing between direct efficiency and riskiness of their activities. Maintaining an economically justified balance between these values, a bank can develop dynamically in the long run and counteract a variety of crisis phenomena. That is why elaborating an approach to integral assessment of a bank through the prism of efficiency and risk indicators, as well as analysis of factors influencing them became the subject of the current study.

1. LITERATURE REVIEW

Efficiency of banking business is one of the most important issues of modern banking management. The problems of finding

international criteria to evaluate the country's banking system efficiency are researched by Kazarenkova and Kolmykova (2016). Banks' efficiency in transition economies in Central and Eastern Europe and the effect of geographical location on banking are researched by Degl'Innocenti et al. (2017). Many studies focus on the banking business effectiveness in periods of crisis (Schoenmaker, 2017). Bremus and Fratzscher (2015), Cerutti and Claessens (2017) study the impact of crisis on the structural change in cross-border banking and international banks, cross-border and local affiliates' lending.

The impact of business models, bank size and capital on the banking activity riskiness are also researched (Köhler, 2015; Laeven et al., 2016; Maudos, 2017).

Spokeviciute et al. (2019) explore the activity of less efficient banks as compared to more efficient ones during financial crises in the USA. Ertürk (2016), Cohen et al. (2014) analyzed post-crisis regulatory reform initiatives and their impact on efficiency and risks of banking institutions. Financial globalization and deglobalization in banking business are studied by Kleymenova et al. (2016), Claessens (2017), and McCauley et al. (2019).

The relationship between capitalization strategies, systemic risk in the banking sector and banks' corporate governance are researched by Anginer et al. (2016, 2018).

Different methods that are used in operational activity and financial indicators in private banks are compared (G. Sharma & D. Sharma, 2017).

Tan and Floros study the interplay between the level of competition, risk and efficiency using a sample of Chinese commercial banks. According to the research of banks in China, those banks that have higher levels of credit risk have lower levels of cost efficiency (Tan & Floros, 2019).

In general, the notion of effectiveness can be interpreted with regard to the following two approaches: the effectiveness of any activity is measured as a ratio of the results obtained (income) to the resources spent on this activity (expenditure); effectiveness that serves as a socio-economic measure and reflects the influence of the human factor (organization of work, employee competence, management structure, etc.) on the results achieved (Tolchin, 2007). The advantage of the first approach is the use of clear numerical indicators that can be calculated from existing accounting and reporting information, while the second involves the use of not only economic indicators but also social ones, etc., that are more qualitative and acquire a numerical expression through applying the expert evaluation method (Dzhonmurodova & Pohorielova, 2017).

In the scientific literature, there are many methods for determining the effectiveness of banking activities (Kungu, 2014). Based on this, the definition of this indicator is quite versatile.

Thus, Buriak (2010) understands by the efficiency of banks as "its ability to achieve its goals through optimal use of resources while taking into account not only the microeconomic but also the macroeconomic function of banks in a market economy". Among the indicators that will affect the efficiency of the bank, the author allocates income and expenses. However, he does not provide a coherent and precise methodological approach to determining this efficiency.

Ieris (2014) measures efficiency through the prism of managing cash flows as the most important economic category in the activities of banks, while still taking the indicators of profitability as the basis.

Rybalka (2007) offers a systematic approach to assessing the efficiency of banking in the triple dimension of "profitability – riskiness – reliability". The advantage of this approach is in taking into account, in addition to the profitability indicators, other factors that affect the activities of the bank. This approach is considered more complete, because the mechanical increase of profitability is not always justified in terms of risks.

http://dx.doi.org/10.21511/bbs.14(3).2019.11

In general, while studying this issue, most researchers focus on the indicators of profitability (Vivchar, 2016). Thus, it is necessary to develop and justify an integral approach to assessing bank efficiency, taking into account various indicators of the bank activity as well as the importance and priority of profitability indicators as a central economic measure of financial performance, and the indicators of the banking activity riskiness.

2. AIMS

The aim of the article is to develop an integral approach to assessing activities of banks that covers performance and risk indicators and to find reserves for increasing their profitability and reducing risk based on factor analysis.

3. METHODS

Analysis of the theoretical background of bank activity effectiveness and ways to evaluate it, abstraction and generalization, as well as induction and deduction methods are used.

The ratio analysis is the basis for elaborating a methodology to calculate the integral indicator of banks activity. The synthesis method, matrix, graphical and tabular methods were used to demonstrate the results of the integral evaluation. Analyzing the research results of the banking system of Ukraine in the context of banks' activity efficiency and riskiness, method of comparison and grouping was used.

The method of chain substitutions is used in factor analysis of gross profit and reserves of Ukrainian banks. The method consists in successive replacement of basic amount of the factor's influence with its analyzed value, provided that the values of other factors remain unchanged. In deterministic multiplicative factor system, total change of analyzed value is a function of the variables. Change of factor value influenced by different variables is calculated by the algorithm (Table 1). The determined result is compared with the previous one and the degree of influence of the analyzed factor is calculated.

Algorithm of the method of chain substitutions (Seredynska et al., 2010).

$$y = f(x_1 \cdot x_2 \cdot x_3) = x_1 \cdot x_2 \cdot x_3,$$

$$\Delta y = y_1 - y_0 = x_1^1 \cdot x_2^1 \cdot x_3^1 - x_1^0 \cdot x_2^0 \cdot x_3^0,$$

$$\Delta y_{(x_1)} = y_1 - y_0 = x_1^1 \cdot x_2^0 \cdot x_3^0 - x_1^0 \cdot x_2^0 \cdot x_3^0 = x_1^1 \cdot x_2^0 \cdot x_3^0 - y_0,$$

$$\Delta y_{(x_2)} = y_1 - y_0 = x_1^1 \cdot x_2^1 \cdot x_3^0 - x_1^1 \cdot x_2^0 \cdot x_3^0,$$

$$\Delta y_{(x_3)} = y_1 - y_0 = x_1^1 \cdot x_2^1 \cdot x_3^1 - x_1^1 \cdot x_2^1 \cdot x_3^0 = y_1 - x_1^1 \cdot x_2^1 \cdot x_3^0,$$

$$\Delta y = \Delta y_{(x_1)} + \Delta y_{(x_2)} + \Delta y_{(x_3)}.$$

To ensure the efficient functioning of the bank, the proper organization of analytical work is first necessary, the results of which is the basis for making operational management decisions. Complex of the efficiency and risks indicators of a bank's activities, summed up by the appropriate method, is a basis for its integral assessment.

Comprehensive evaluations of bank performance are based primarily on the definition of an integral indicator (Packer, 2011; Mihajlovic, 2009). The variation of these techniques depends on which activity indicators are taken into account, how wide their spectrum is and what weight indices are assigned to the coefficient. The question about the number of factors that are taken into account remains open, the opinions of researchers and experts are very polar: some suggest to take only a minimum number of baseline factors, others recommend to use as many coefficients as possible. The results of the assesment are usually reflected in the points and indices.

The article suggests a method for integral assessment of banking activity based on efficiency and riskiness criteria, which is reasonably easy to apply and is accessible to all users, because it involves the use of public information. The coefficients taken into account fully reflect the financial status of banks, the structure of

incomes and expenses, and the efficiency and riskiness of their activities.

Given the quantitative performance indicators of the bank in the integral assessment, it is also necessary to take into account the risks associated with lack of equity capital (Kolesnik, 2011). This is due to the peculiarities of the banking business, which is vulnerable to various economic fluctuations and largely based on trust due to possible risks. In addition, banks in their pursuit to increase profit may not pay enough attention to risk management and thus, in the long run, not be able to ensure stable activity and formulate stress testing practices (Basel Committee on Banking Supervision, 2019).

Therefore, to form a balanced assessment of the bank's activities it is necessary to take into account, along with performance indicators, quality indicators of the capital-resource base and the adequacy of the reserve formation (Horshc, 2018). In the group of coefficients for evaluating the efficiency of a bank, the indicators that can be used to estimate the revenue and expenditure structure, profitability of the bank, its activity and efficiency of the allocation of resources in active operations are prevailing (Table 1).

The group of risk assessment coefficients of the bank's operations makes it possible to estimate the amount of reserves and, accordingly, the risks of both lending and securities transactions in the total assets portfolio. Also, this group of indicators is focused on assessing the liabilities structure, equity capital adequacy and risks of credit and deposit activity (Table 2).

All the coefficients for evaluating the bank's performance suggested in the methodology combine the periodic performance indicators of the bank, that is, the indicators calculated for the

Table 1. Indicators of effectiveness in the bank activities assessment

Source: Compiled by the authors.

	Indicator	Calculation mechanism
K_{se1}	The coefficient of net interest margin	The ratio of net interest margin to total assets
K_{se2}	The coefficient of net trade margin	The ratio of net trade margin to total assets
K_{se3}	The coefficient of return on equity capital	Net profit to equity ratio
K_{se4}	The commission income ratio	The ratio of commission income to total revenues
K_{se5}	The interest income ratio	The ratio of interest income to total revenues
K_{se6}	The coefficient of the credit-investment activity	The ratio of the amount of loans and securities provided in the bank's portfolio to the total assets of the bank
K_{se7}	The efficiency of using assets of the bank	The ratio of total income and aggregate assets
K_{se8}	The return on assets	The ratio of gross profit to total assets of the bank
K_{se9}	The return on revenue	The ratio of gross profit to the total income of the bank
K_{se10}	The return on costs	The ratio of gross profit to the bank's expenses
K_{se11}	The coefficient of coverage of the bank's total expenses	The ratio of total income to total costs
K_{de12}	The coefficient of administrative costs	The ratio of administrative costs to total costs
K_{se13}	The multiplier effect of equity capital	The ratio of total assets of the bank to equity

Table 2. Indicators of risk in the bank activities assessment

Source: Compiled by the authors.

	Indicator	Calculation mechanism
K_{sr1}	Coefficient of credit risk coverage	The ratio of reserves for impairment of loans in relation to the amount of loans issued
K_{sr2}	Coverage ratio of securities transactions	The ratio of reserves for impairment of securities in relation to the securities portfolio of a bank
K_{sr3}	Coverage ratio of bank assets	The ratio of reserves in relation to the amount of assets of a bank
K_{sr4}	The ratio of liabilities in the equity of a bank	Ratio of liabilities to equity
K_{sr5}	The coefficient of deposit activity	The ratio of deposits to total liabilities
K_{sr6}	The coefficient of financial leverage of a bank	The ratio of total assets to total liabilities of a bank
K_{sr7}	Risk factor of credit and deposit activity	The ratio of interest expense to interest income

http://dx.doi.org/10.21511/bbs.14(3).2019.11

relevant period (income, expenses, profit), and instantaneous rates, the absolute size of which is calculated at the appropriate time in accordance with the balance sheet (assets, capital) (Baranovskyi, 2014).

Formation of the integral assessment of bank's activities involves a ratio analysis of banks in the context of the two above-mentioned groups of indicators. When assessing efficiency or risks of a bank's activity with one or another indicator, it should be noted that among them there are those whose "best" values are close to the maximum (stimulants, K_{se}), and those whose "best" values come close to a minimum (disincentives, K_{de}). The "best" indicator value is considered in terms of risk efficiency. If the coefficient is in the group of risk indicators, then one can accept it as a stimulant or disincentive, based on how it characterizes the risk (stimulants in this group have growth rates which indicate an increase in risk). If the coefficient is from another group, then it belongs to stimulants or disincentives, depending on growth or decrease in efficiency.

For stimulants the following is true:

$$K_{se} \to \max. \tag{1}$$

For disincentives:

$$K_{de} \to \min. \tag{2}$$

For example, when the profitability indicators increase, they reflect higher efficiency of the bank activity and banks are trying to minimize indicators that take into account the cost ratios.

In terms of risk, indicators that reflect a tendency to increase in reserves show a rising risk of bank operations (Bruns, 2008).

In this case, a generalized estimation S_j for each group of indices for the analysis of the bank's efficiency and riskiness is calculated using the formula:

$$S_j = \sum_{i=1}^{n} A_{ij} K_{sij} - A_{ij} K_{dij}, \tag{3}$$

where A_{ij} is a weight (value) of the i-th financial indicator for the j-th group; K_{sij} is a calculated value of the i-th financial indicator-stimulant for the j-th group; K_{dij} is a calculated value of the i-th financial indicator-disincentive for the j-th group.

Taking into account the weight (value) of coefficients, a summary result of the performance indicators S_e will take the form:

$$\begin{aligned} S_e = {} & K_{se3j} + K_{se8j} + K_{se9j} + K_{se10j} + K_{se13j} + \\ & +0.75 \cdot (K_{se6j} + K_{se7j} + K_{se11j}) + \\ & +0.5 \cdot (K_{se1j} + K_{se2j} + K_{se4j} + K_{se5j}) - \\ & -0.75 \cdot K_{de12j}. \end{aligned} \tag{4}$$

Integral estimation for the risk indicators S_r, taking into account the weight of the indices, will take the form:

$$\begin{aligned} S_r = {} & (K_{sr3j} + K_{sr4j} + K_{sr5j}) + \\ & +0.75 \cdot (K_{sr1j} + K_{sr2j} + K_{sr7j}) + \\ & +0.5 \cdot K_{sr6j}. \end{aligned} \tag{5}$$

The final integral estimation (II – integral indicator) of the bank activity is calculated as follows:

$$II = S_e - S_r. \tag{6}$$

Thus, this methodology gives a summary evaluation of the bank's performance and a general risk assessment of its activity by calculating the difference between aggregate indicators of stimulants and disincentives, and shows a comprehensive assessment of banking activity as the difference between a generalizing assessment of effectiveness and a generalizing risk assessment.

4. RESULTS

The proposed methodology has been used to assess performance of Ukrainian banks operating in 2018 and to analyze their integral assessment. All bank reporting data was received and summarized on the basis of consolidated data of the National Bank of Ukraine, the following are 20 banks with the best integral assessment with the separate groups for indicators of efficiency and risks (Tables 3-4).

Table 3. Generalized efficiency of banks

Source: Calculated by the authors based on financial reporting of banks (National Bank of Ukraine, 2017).

Bank	K_{se1}	K_{se2}	K_{se3}	K_{se4}	K_{se5}	K_{se6}	K_{se7}	K_{se8}	K_{se9}	K_{se10}	K_{se11}	K_{de12}	K_{se13}	S_e
PJSC "BANK ALIANS"	0.0635	0.0387	0.2294	0.2171	0.3565	0.8989	0.2191	0.1039	0.4743	0.9024	1.9024	0.3366	2.6817	6.7426
PJSC "SITIBANK"	0.0602	0.004	0.1963	0.0687	1.2021	0.8758	0.0801	0.0313	0.3911	0.6423	1.6423	0.1355	10.427	14.202
PJSC "A-BANK"	0.1582	0.0818	0.2824	0.3249	0.9314	0.923	0.2735	0.054	0.1975	0.246	1.246	0.2087	6.5526	9.756
PJSC "IDEIA BANK"	0.221	0.0354	0.2801	0.1638	1.2729	0.8842	0.2666	0.0415	0.1557	0.1845	1.1845	0.1429	8.4549	11.608
PJSC "INH BANK UKRAINE"	0.0821	–0.005	0.0319	0.0869	1.2398	0.9863	0.0893	0.0164	0.1839	0.2254	1.2254	0.156	2.6568	5.4253
PJSC "BANK "HRANT"	0.0982	0.0233	0.0376	0.2064	1.022	0.8515	0.1293	0.0278	0.2149	0.2737	1.2737	0.2795	2.3176	5.0279
JSC "UKRSYBBANK"	0.09	–0.001	0.1578	0.0745	0.9703	0.8317	0.1063	0.0261	0.2453	0.325	1.325	0.3171	8.3598	11.14
PJSC "BANK "YUNISON"	0.1315	0.0385	0.1203	0.2406	0.7346	0.6156	0.1791	0.0467	0.2608	0.3528	1.3528	0.3513	2.5796	5.28
PJSC "BANK 3/4"	0.0576	0.007	0.064	0.0946	0.5583	0.8108	0.1311	0.0382	0.2916	0.4116	1.4116	0.4772	2.055	4.6264
PJSC "KREDI AGRIKOL БАНК"	0.073	0.0109	0.0858	0.1856	1.0938	0.9099	0.0937	0.0169	0.1803	0.2199	1.2199	0.246	9.481	12.149
PJSC "KRYSTALBANK"	0.0772	0.024	0.1044	0.1843	0.6486	0.7975	0.1462	0.0316	0.2162	0.2758	1.2758	0.4066	4.4872	6.942
JSC "RAIFFEIZEN BANK AVAL"	0.0802	0.0365	0.0365	0.4285	0.7851	0.6573	0.1244	0.0222	0.1785	0.2174	1.2174	0.1914	6.6126	9.088
PJSC"KREDOBANK"	0.0756	0.0272	0.0386	0.3067	0.9737	0.8725	0.1094	0.0105	0.0962	0.1064	1.1064	0.214	9.5163	11.865
PJSC "BANK AVANHARD"	0.0489	0.0079	–0.022	0.1096	1.2102	0.9782	0.0774	0.0112	0.1444	0.1688	1.1688	0.2124	4.3553	6.8551
PJSC "JSB "RADABANK"	0.096	0.0267	0.0459	0.2695	1.016	0.8895	0.1301	0.0128	0.0984	0.1092	1.1092	0.2542	4.6053	6.9817
JSC "OTP BANK"	0.0653	0.0309	0.0693	0.3419	0.9441	0.8808	0.1078	0.015	0.1393	0.1618	1.1618	0.2215	8.4572	10.98
PJSC "VERNUM BANK"	0.1186	0.0422	0.0034	0.286	1.0003	0.8877	0.1617	0.0013	0.0082	0.0083	1.0083	0.2504	2.3893	4.4896
PJSC "ASVIO BANK"	0.1105	0.0135	–0.014	0.1281	1.259	0.7913	0.1274	0.0067	0.0529	0.0558	1.0558	0.2765	2.55	4.681
PJSC "AP BANK"	0.0778	0.0332	–0.008	0.2975	0.8255	0.9254	0.1149	–0.004	–0.034	–0.033	0.9673	0.3931	2.0018	3.7516
PJSC "EUROPROMBANK"	0.1241	0.0064	0.0282	0.0592	1.4787	0.9392	0.1435	0.0137	0.0956	0.1057	1.1057	0.0927	2.0763	4.7253

Note: S_e is calculated by the authors according to formulas (3)-(4).

Table 4. Generalized risk assessment and integral assessment of the banks' activities

Source: Calculated by the authors based on financial reporting of banks (National Bank of Ukraine, 2017).

Bank	K_{sr1}	K_{sr2}	K_{sr3}	K_{sr4}	K_{sr5}	K_{sr6}	K_{sr7}	S_r	II
PJSC "BANK ALIANS"	–0.0483	–0.1822	–0.0678	1.6817	0.5927	1.5946	0.1875	3.453	3.2896
PJSC "SITIBANK"	–0.0161	0	–0.0047	9.4267	0.8889	1.1061	0.375	11.167	3.0354
PJSC "A-BANK"	–0.1697	0	–0.2131	5.5526	0.8166	1.1801	0.3791	7.584	2.172
PJSC "IDEIA BANK"	–0.2851	0	–0.2126	7.4549	0.8275	1.1341	0.3486	9.5373	2.0703
PJSC "INH BANK UKRAINE"	–0.0836	0	–0.0597	1.6568	0.6032	1.6036	0.2584	3.3779	2.0474
PJSC "BANK "HRANT"	–0.0517	0	–0.0402	1.3176	0.5517	1.759	0.2573	3.0206	2.0072
JSC "UKRSYBBANK"	–0.2856	0	–0.139	7.3598	0.7696	1.1359	0.1279	9.1465	1.9934
PJSC "BANK "YUNISON"	–0.5418	0	–0.3708	1.5796	0.1386	1.6331	4E–05	3.3119	1.9681
PJSC "BANK 3/4"	–0.0137	0	–0.0082	1.055	0.493	1.9479	0.2136	2.7007	1.9258
PJSC "KREDI AGRIKOL БАНК"	–0.1222	0	–0.0769	8.481	0.8078	1.1179	0.2884	10.233	1.9162
PJSC "KRYSTALBANK"	–0.0838	0	–0.0278	3.4872	0.746	1.2868	0.1862	5.1069	1.8351
JSC "RAIFFEIZEN BANK AVAL"	–0.1854	0	–0.099	5.6126	0.7485	1.1782	0.1792	7.3227	1.7653
PJSC"KREDOBANK"	–0.105	–0.0071	–0.0603	8.5163	0.8546	1.1174	0.2901	10.292	1.5736
PJSC "BANK AVANHARD"	–0.1127	–0.0091	–0.0727	3.3553	0.7556	1.298	0.4784	5.2828	1.5723
PJSC "JSB "RADABANK"	–0.1783	0	–0.0961	3.6053	0.7622	1.2774	0.274	5.4415	1.5402
JSC "OTP BANK"	–0.3488	–0.0033	–0.2047	7.4572	0.8472	1.1341	0.3583	9.609	1.3714
PJSC "VERNUM BANK"	–0.1211	0	–0.1163	1.3893	0.4976	1.7198	0.2664	3.1538	1.3358
PJSC "ASVIO BANK"	–0.1254	0	–0.0725	1.55	0.5899	1.6452	0.3111	3.3622	1.3188
PJSC "AP BANK"	–0.0225	0	–0.0072	1.0018	0.2808	1.9982	0.1792	2.4402	1.3114
PJSC "EUROPROMBANK"	–0.3575	0	–0.3109	1.0763	0.5	1.9291	0.4153	3.4313	1.2941

Note: S_r is calculated by the authors according to formulas (3), (5). Integral indicator is calculated by the authors according to formula (6).

http://dx.doi.org/10.21511/bbs.14(3).2019.11

Table 5. Indicators of banks activity

Source: Calculated by the authors on the basis of financial reporting of banks (National Bank of Ukraine, 2017).

Bank	Total assets	Profit before income tax	Equity capital	II
PJSC "BANK ALIANS"	777,264.0494	80,780.2256	289,843.6799	3.289605
PJSC "SITIBANK"	19,001,050.7	595,305.3348	1,822,352.083	3.035424
PJSC "A-BANK"	4,499,644.893	243,010.0338	686,692.4402	2.172014
PJSC "IDEIA BANK"	3,579,591.099	148,607.5479	423,372.7537	2.070267
PJSC "INH BANK UKRAINE"	9,971,217.27	163,816.7822	3,753,101.775	2.047412
PJSC "BANK "HRANT"	1,299,930.34	36,126.45059	560,893.3299	2.007212
JSC "UKRSYBBANK"	46,576,671.66	1,214,544.82	5,571,497.869	1.9934
PJSC "BANK "YUNISON"	553,959.5413	25,872.51689	214,744.4046	1.968128
PJSC "BANK 3/4"	1,145,564.367	43,789.41376	557,447.0946	1.925789
PJSC "KREDI AGRIKOL БАНК"	30,946,061.68	522,940.062	3,264,003.073	1.916196
PJSC "KRYSTALBANK"	1,182,758.055	37,386.51695	263,583.7557	1.835149
JSC "RAIFFEIZEN BANK AVAL"	72,108,061.28	1,601,295.097	10,904,637.62	1.765335
PJSC"KREDOBANK"	14,307,667.57	150,459.5841	1,503,495.581	1.573622
PJSC "BANK AVANHARD"	1,355,105.988	15,159.25255	311,139.9582	1.572323
PJSC "JSB "RADABANK"	1,162,658.675	14,893.5093	252,461.3992	1.540182
JSC "OTP BANK"	29,822,400.12	447,826.9132	3,526,261.624	1.371428
PJSC "VERNUM BANK"	443,444.6816	590.72326	185,597.521	1.335793
PJSC "ASVIO BANK"	991,078.1451	6,676.71015	388,665.6615	1.318765
PJSC "AP BANK"	578,605.3223	–2,244.65356	289,040.137	1.311411
PJSC "EUROPROMBANK"	641,627.3595	8,800.99514	309,028.8255	1.294086

Note: Integral indicator is calculated by the authors according to formula (6) based on calculations in Tables 3-4.

Analyzing the integral assessment of Ukrainian banks and individual data in Table 5 (aggregate assets, equity and profits), one can state that efficiency of a bank does not depend on the scale of its activities. This indicates that proper management, a balanced structure of assets and liabilities of the bank, the quality of capital, and not its size, cost-effective credit and investment activities provide an efficient and low-risk work of the bank (Rahman, 2017).

This approach to determining the integral indicator of a bank's activity allows for assessing the balance of banking activity in the context of these two criteria and determining strategy for the bank development. Based on the final assessments of efficiency and risk of a bank's activities, one can talk about a development strategy chosen by a bank and the quality of management in financial institution, taking into account a balance of these two aspects.

Results of the risk and performance group estimates allow a bank to be placed in a two-dimensional coordinate system and determine its development strategy. The matrix of a bank's development strategy is shown in Figure 1.

Thus, position of a bank on the matrix shows strategic direction of the institution's development and availability of reserves for stable functioning over the next few years. Thus, banks that have reached positive values of the efficiency indicator and have risk indicators that do not exceed the average level in the banking system can be considered banks with a moderate development strategy. They have a fairly sensible policy to increase efficiency and minimize risks. Banks with an aggressive strategy with higher than average risk ratings in the banking system and positive performance indicators improve efficiency by increasing revenues and expanding the portfolio of assets through more risky assets than those with moderate strategy. Banks with risk-free development strategies work efficiently with minimal risk. Banks with a losing strategy work inefficiently, or even at a loss. At the same time, depending on level of risks in their operations and availability of funds, there are reserves available to improve their financial situation.

Source: Developed by the authors.

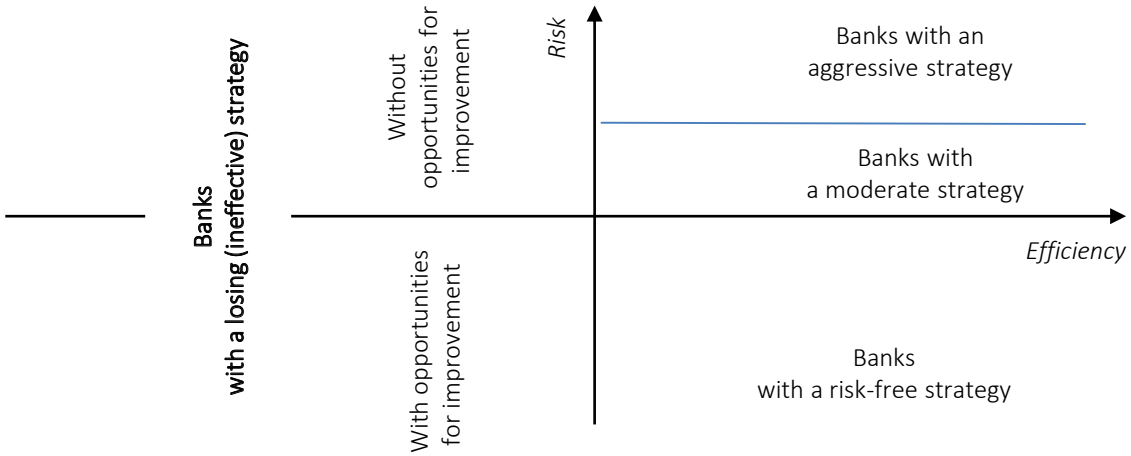

Figure 1. The matrix of a bank's development strategy

Figure 2 shows banks of Ukraine that are placed according to the efficiency and risk indicators.

The chart shows that a vast majority of Ukrainian banks are conducting their activities in a fairly balanced way considering efficiency and risk. Moreover, more than a half have chosen moderate development strategy, that is, they conduct a well-balanced policy as to realization of credit and investment policy, attraction of funds for deposits and have an optimal structure of capital-resource base.

Therefore, in the long run, they can provide stable functioning and demonstrate stress resistance to external and internal threats. There is still part of banks that have an aggressive development strategy. They show rather high performance indicators but characterized by significant level of risk activity. It should be noted that one bank has a risk-free strategy and there are no banks with losing strategy. Such results characterize the banking system of Ukraine as effective and stable.

While studying a bank's work, in addition to using the coefficient methodology of the study, it is important to evaluate absolute performance of the institution, in particular, using factor analysis (Gavurova, 2017). The main absolute indicator for evaluating performance of the bank is a volume of profit. Risks of work can be estimated considering changes in volume of reserves for all active operations of institutions.

Source: Developed by the authors.

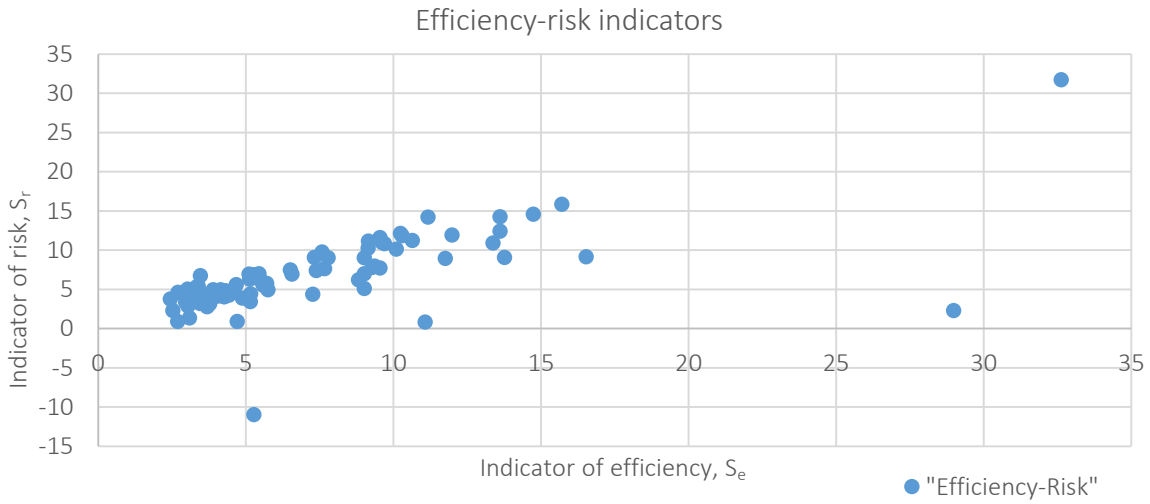

Figure 2. Banking system of Ukraine in the "Efficiency-Risk" parameters

http://dx.doi.org/10.21511/bbs.14(3).2019.11

Table 6. Factor profit analysis of Raiffeisen Bank Aval

Source: Calculated by the authors on the basis of financial reporting of Raiffeisen Bank Aval (National Bank of Ukraine, 2017).

	Reference and calculation indicators	January 1, 2017	January 1, 2018
1	Total income of the bank	7,902,799	8,968,612
2	Total assets of the bank	55,999,735	72,108,061
PBT	Profit before income tax	4,189,463	1,601,295
Z_1	Bank's equity	10,072,078	10,904,638
Z_2	The efficiency of using assets of the bank (the ratio of total income and aggregate assets)	0.141122087	0.154047475
Z_3	The multiplier effect of equity capital (the ratio of total assets of the bank to equity)	5.559898861	6.612605001
Z_4	The return on revenue (the ratio of gross profit to the total income of the bank)	0.530012395	0.144156082
$\Delta PBT(Z_1) = 10,904,638 \cdot 0.1411 \cdot 5.5599 \cdot 0.53 - 4,189,463 = 345,347.7$			
$\Delta PBT(Z_2) = 10,904,638 \cdot 0.154 \cdot 5.5599 \cdot 0.53 - 10,904,638 \cdot 0.1411 \cdot 5.5599 \cdot 0.53 = 415,343.8$			
$\Delta PBT(Z_3) = 10,904,638 \cdot 0.154 \cdot 6.6126 \cdot 0.53 - 10,904,638 \cdot 0.154 \cdot 5.5599 \cdot 0.53 = 937,257.7$			
$\Delta PBT(Z_4) = 1,601,295 - 10,904,638 \cdot 0.154 \cdot 6.6126 \cdot 0.53 = -4,286,117$			
$\Delta PBT = 345,347.7 + 415,343.8 + 937,257.7 - 4,286,117 = -2,588,168$			

Note: Calculated by the authors using the method of chain substitutions (Seredynska et al., 2010).

For factor analysis of gross profit and reserves a method of chain substitutions (Liamets & Tevyashev, 2004; Seredynska et al., 2010) is used.

The factors influencing the volume of gross profits of a bank are as follows:

- amount of equity capital of the bank (Z_1);
- a coefficient of total return on assets of the bank (Z_2);
- multiplicative effect of equity capital (Z_3);
- profitability ratio of the bank (Z_4) (Table 6).

As can be seen from results of the factor analysis, despite an increase in bank's equity, an increase in the total return on total assets and expansion of activities, the volume of gross profit of the bank decreased significantly by UAH 2,588,168 thousand due to a decrease in the profitability ratio by 3.7 times.

To assess risks of a bank, the article analyzes reserves observing active banking operations. Factors influencing the amount of reserves for ac-

Table 7. Factor analysis of reserves for active operations of Raiffeisen Bank Aval

Source: Calculated by the authors on the basis of financial reporting of Raiffeisen Bank Aval (National Bank of Ukraine, 2017).

	Reference and calculation indicators	January 1, 2017	January 1, 2018
1	Total liabilities	45,927,657	61,203,424
2	Total assets of the bank	55,999,735	72,108,061
BR	Bank reserves for active operations	25,965,223	7,138,819
X_1	Bank's equity	10,072,078	10,904,638
X_2	Coverage ratio of bank assets (the ratio of reserves in relation to the amount of assets of a bank)	0.463666895	0.099001686
X_3	The ratio of liabilities in the equity of a bank (ratio of liabilities to equity)	4.559899066	5.612605001
X_4	The coefficient of financial leverage of a bank (the ratio of total assets to total liabilities of a bank)	1.2193031	1.178170386
$\Delta BR(X_1) = 10,904,638 \cdot 0.4637 \cdot 4.5599 \cdot 1.2193 - 25,965,223 = 2,146,290.7$			
$\Delta BR(X_2) = 10,904,638 \cdot 0.099 \cdot 4.5599 \cdot 1.2193 - 10,904,638 \cdot 0.4637 \cdot 4.5599 \cdot 1.2193 = -22,109,173$			
$\Delta BR(X_3) = 10,904,638 \cdot 0.099 \cdot 5.6126 \cdot 1.2193 - 10,904,638 \cdot 0.099 \cdot 4.5599 \cdot 1.2193 = 1,385,710.8$			
$\Delta BR(X_4) = 7,138,819 - 10,904,638 \cdot 0.099 \cdot 5.6126 \cdot 1.21932 = -249,233.1$			
$\Delta BR = 2,146,290.7 - 22,109,173 + 1,385,710.8 - 249,233.1 = -18,826,404$			

Note: Calculated by the authors using the method of chain substitutions (Seredynska et al., 2010).

tive operations of a bank are defined as: a bank's equity (X_1), the bank assets coverage ratio (X_2), the ratio of liabilities in equity (X_3), and the coefficient of a bank's financial leverage (X_4).

Calculations for factor analysis of a change in the volume of reserves for active banking operations by the chain substitution method, which is presented above, are shown in Table 7.

During the year, the bank's reserves decreased from UAH 25,965,223 to UAH 7,138,819. This indicates an increase in the quality of the bank's assets portfolio and a decrease in the risk profile of active operations by reducing the asset coverage ratio and reducing the bank's financial leverage.

5. DISCUSSION

Results of the methodology implementation illustrated on Ukrainian banks confirmed its scientific validity and practical applicability and made it possible to study the efficiency of Ukrainian banks. The integral indicators of Ukrainian banks testify mainly to high polarization in efficiency of their activities and simultaneously demonstrate the balanced activity of most banks in the "efficiency-risk" terms.

The final scores of integral assessment with regard to efficiency and risk groups indicate the development strategy chosen by a bank in relation to the defined criteria and determine its position on the matrix of strategies for bank development. The placement of a bank on a matrix gives an opportunity to estimate the balance of banking activity efficiency level with the level of risk.

The Ukrainian banking system effectiveness and the activity of banks in particular are often assessed on the basis of their profitability and absolute amounts of capital, assets and income. At the same time, research is conducted in the context of groups of banks (Rushchyshyn & Kostak, 2018). In contradiction to this approach, the developed methodology takes into account the relative indicators of different aspects of the banks' activity and allows assessing the effectiveness of a single bank and the banking system as a whole, regardless of existing groups.

During the research of the evaluation of the Ukrainian banking system effectiveness methodology, the authors focus on methodological tools and do not show it with specific examples (Dzholos & Savchenko, 2017).

The risk-based banks' effectiveness assessment results mostly in the rating of banks within the banking system of the state, while the integral assessment can be used to compare banks in different countries.

The study of the impact level of risk on the bank's development strategy (Chmutova & Kharytonova, 2017) focuses on risk indicators and does not take into account efficiency. It is expedient to use the results of factor analysis to increase efficiency and minimize risks for the bank management (Sergienko, 2017). It allows controlling absolute rates of profit and reserves for active bank operations. Factor analysis with a method of chain substitutions has shown that for Raiffeisen Bank Aval, main factors of gross profit growth are increase in coefficients of the bank's total returns and the multiplier effect of equity, while a significant decrease in the profitability ratio of the bank is a factor of a significant reduction in gross profit. While reduction of the bank's assets coverage ratio and its financial leverage are factors that lead to decrease in the amount of total reserves for active operations of the bank.

CONCLUSION

The developed methodology of integral evaluation of bank performance makes it possible to assess the efficiency of a bank taking into account risks of its operations. It is based on multi-dimensional analysis of a bank's work, which can be carried out drawing on available public data. The integral indicator is a tool for comprehensive evaluation of banking activities and it can be used to analyze absolute efficiency and stability of banks in different banking systems.

http://dx.doi.org/10.21511/bbs.14(3).2019.11

The value of such an assessment for a bank management at the micro level is to determine the strategy of a banking institution development in the context of "efficiency-risk" parameters and to develop a set of measures to balance these two indicators. In terms of macroeconomic analysis, such an integral assessment gives an opportunity to assess the banking system on stability and overall efficiency.

Indicators of a risk-oriented integral assessment of the performance of state-owned banks enable us to assess the overall efficiency of banks, identify directions and intensify a search for reserves to increase the efficiency of banking activities and reduce risk.

The following directions for improving efficiency and stability of the Ukrainian banks should be outlined: reducing the cost of activities, finding new sources of income through expansion of the areas of interaction between banks and economic entities; optimizing the structure of income, expenses and assets, increasing the resource base.

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APPENDIX A

Table A1. Calculated indicators of Ukrainian banks. S_e group

Source: Calculated by the authors on the basis of banks' financial reporting (National Bank of Ukraine, 2017).

BANK	K_{se1}	K_{se2}	K_{se3}	K_{se4}	K_{se5}	K_{se6}	K_{se7}	K_{se8}	K_{se9}	K_{se10}	K_{se11}	K_{de12}	K_{se13}	S_e
PJSC KB "PRYVATBANK"	0.0180003	0.0447508	–0.939466	0.720146	1.135531	0.6772642	0.078311	–0.09279	–1.184877	–0.542308	0.457692	0.086283	10.1165	9.161553
JSC "OSHCHADBANK"	0.02353347	0.0115194	–0.429658	0.439881	2.170291	0.8083115	0.038831	–0.05792	–1.491658	–0.598661	0.401339	0.142515	7.41775	6.991942
JSC "UKREKSIMBANK"	0.02087202	0.0007673	–0.567021	0.132706	3.738593	0.7566696	0.020464	–0.04728	–2.31021	–0.697904	0.302096	0.069531	11.8297	10.91104
JSC "UKRGAZBANK"	0.0335864	0.007841	–0.566718	0.209697	2.01697	0.9077802	0.048946	–0.04608	–0.941424	–0.484914	0.515086	0.118889	12.3075	12.41711
JSC "RAIFFEIZEN BANK AVAL"	0.08015114	0.0364501	0.0364577	0.428549	0.785098	0.6572725	0.124377	0.02221	0.1785444	0.217351	1.217351	0.191388	6.61261	9.087999
PJSC "SBERBANK"	0.0829379	0.0073864	0.1264711	0.11458	1.263593	0.9010614	0.095415	0.01525	0.1598553	0.190271	1.190271	0.198473	8.0902	10.8075
PJSC "UKRSOTSBANK"	0.01588337	0.0272566	–0.463006	0.519939	0.887593	0.6815729	0.077424	–0.08162	–1.054216	–0.513196	0.486804	0.146715	5.6721	5.109707
PJSC "ALFA–BANK"	0.05623754	0.0277804	–0.050718	0.281268	0.915569	0.7923296	0.120985	–0.00249	–0.020568	–0.020153	0.979847	0.21504	12.4503	14.25542
PJSC "PUMB"	0.06469462	0.0208291	–0.126608	0.278476	1.015039	0.8870515	0.109216	–0.00968	–0.088596	–0.081386	0.918615	0.202393	9.5485	11.21612
JSC "UKRSYBBANK"	0.08996702	–0.001474	0.1577575	0.074521	0.970274	0.8317031	0.106322	0.02608	0.2452564	0.324953	1.324953	0.317063	8.35981	11.13994
PJSC "PROMINVESTBANK"	0.05010185	0.0133551	–0.105064	0.154652	1.096565	0.806552	0.095948	–0.03103	–0.323456	–0.244403	0.755597	0.134601	3.26811	4.364108
JSC "OTP BANK"	0.06532216	0.030924	0.0692549	0.341926	0.944052	0.8808187	0.107822	0.01502	0.1392715	0.161807	1.161807	0.221461	8.45723	10.98043
PJSC "KREDI AGRIKOL BANK"	0.07296171	0.0108663	0.0858177	0.185592	1.093808	0.9099349	0.093733	0.0169	0.1802831	0.219933	1.219933	0.246031	9.48101	12.14874
JSB "PIVDENNYI"	0.03194727	0.0198573	–0.320728	0.412804	1.183306	0.81283	0.067156	–0.0277	–0.412494	–0.292032	0.707968	0.155804	11.0694	11.91454
PJSC "VTB BANK"	–0.00293783	0.0109943	–0.358384	0.125787	0.545351	0.5269461	0.103038	–0.04021	–0.390207	–0.280683	0.719318	0.15746	8.91368	9.077683
PJSC "SITIBANK"	0.06018764	0.0040257	0.1962832	0.068656	1.202109	0.8758389	0.080112	0.03133	0.3910804	0.642253	1.642253	0.135543	10.4267	14.20209
JSC "PROKREDYT BANK"	0.05190201	0.0123478	–0.132267	0.220952	1.484725	0.9290867	0.067393	–0.00876	–0.130015	–0.115056	0.884944	0.101582	8.41336	10.2471
PJSC "KREDOBANK"	0.07558556	0.0271602	0.0385744	0.306715	0.973659	0.8724945	0.109356	0.01052	0.096163	0.106394	1.106394	0.213978	9.51627	11.86518
JSC "TASKOMBANK"	0.06184064	0.0159901	–0.469587	0.239934	1.302301	0.9196021	0.09904	–0.02913	–0.294141	–0.227287	0.772713	0.123596	14.8167	15.85739
PJSC "BANK KREDYT DNIPRO"	0.01499828	0.0118783	–0.706407	0.366979	1.4835	0.7303739	0.051848	–0.07078	–1.365102	–0.577185	0.422815	0.191375	9.98209	8.961543
PJSC "INH BANK UKRAINE"	0.08212581	–0.004566	0.0318653	0.086871	1.239784	0.9863257	0.089318	0.01643	0.1839383	0.225397	1.225397	0.156008	2.65679	5.425306
PJSC "MEGABANK" KHARKIV	0.01755206	0.0228751	–0.603933	0.60184	2.099502	0.7741857	0.042051	–0.07075	–1.682497	–0.627213	0.372787	0.113212	8.52929	7.722643
PJSC "MIB"	0.01688696	0.0102455	–0.710187	0.314139	1.560416	0.7387625	0.038108	–0.02071	–0.543474	–0.352111	0.647889	0.117279	31.3967	31.70169
PJSC "BANK VOSTOK"	0.05884176	0.021461	–0.55047	0.369806	1.132983	0.8494624	0.091139	–0.03726	–0.408823	–0.290188	0.709812	0.187343	13.9668	14.56887
PJSC "UNIVERSAL BANK"	0.0562569	0.0118462	0.0952699	0.147539	0.837349	0.7779863	0.107061	0.0142	0.1326436	0.152929	1.152929	0.180459	6.70873	9.023402
PJSC "A-BANK"	0.15817545	0.0817581	0.2823695	0.324896	0.931393	0.9229846	0.273502	0.05401	0.1974631	0.246049	1.246049	0.208731	6.55263	9.755988
PJSC KB "PRAVEKS–BANK"	0.03410258	0.0233667	–0.329476	0.473259	0.664021	0.7866961	0.084041	–0.06552	–0.779602	–0.438077	0.561923	0.226018	5.05083	4.940509
JSKB "INDUSTRIALBANK"	0.05458895	0.0090381	–0.053649	0.184648	1.212904	0.8366519	0.073466	–0.01534	–0.208824	–0.17275	0.82725	0.200013	3.3788	4.81184

http://dx.doi.org/10.21511/bbs.14(3).2019.11

Table A1 (cont). Calculated indicators of Ukrainian banks. S_e group

BANK	K_{se1}	K_{se2}	K_{se3}	K_{se4}	K_{se5}	K_{se6}	K_{se7}	K_{se8}	K_{se9}	K_{se10}	K_{se11}	K_{de12}	K_{se13}	S_e
PJSC "MARFIN BANK"	0.0340216	0.0287544	–0.184885	0.422569	0.779974	0.8015385	0.086071	–0.01883	–0.218817	–0.179532	0.820468	0.204945	8.97872	10.13666
BANK INVESTYTSII TA ZAOSHCHADZEN	0.03892378	0.0189658	–0.245107	0.309183	1.43711	0.9254196	0.066998	–0.03016	–0.450094	–0.310389	0.689611	0.137985	7.99921	9.023593
PJSC "IDEIA BANK"	0.22103794	0.0353801	0.28011	0.163788	1.272895	0.884214	0.266564	0.04152	0.1557423	0.184473	1.184473	0.142939	8.45494	11.60756
JSC "PIREUS BANK MKB"	0.05649631	0.0254902	–0.122418	0.343423	0.919428	0.8868442	0.09188	–0.01951	–0.212391	–0.175184	0.824816	0.26481	5.65034	6.947303
PJSC "VIES BANK"	0.06093126	0.0284595	–0.050572	0.28899	0.971475	0.8349407	0.104697	–0.01153	–0.110155	–0.099225	0.900775	0.313578	2.59803	4.146604
JSC "BM BANK"	–0.0227836	0.0166804	–0.926495	0.386617	1.106763	0.7162038	0.048921	–0.15751	–3.219688	–0.763016	0.236984	0.282456	4.60786	0.824533
JSB "KLIRYNHOVYI DIM"	0.01321487	0.0217993	–0.417207	0.493511	1.420188	0.6481346	0.051026	–0.06022	–1.180146	–0.541315	0.458685	0.163174	6.6988	6.220274
PJSC "KB "GLOBUS"	0.02026125	0.0500815	–0.674153	0.494387	0.936829	0.6217183	0.108099	–0.08272	–0.765222	–0.433499	0.566501	0.149761	8.14986	7.804965
JSC "MISTO BANK"	0.07252368	0.0053668	–0.110973	0.046882	0.855976	0.6264797	0.148249	–0.02175	–0.146728	–0.127953	0.872047	0.08123	6.37511	7.632235
PJSC JSKB "ARKADA"	0.01121368	0.2376664	–0.172519	0.942894	0.205078	0.3299065	0.25211	–0.0634	–0.251462	–0.200935	0.799065	0.649511	2.63065	3.189441
PJSC "POLTAVA–BANK"	0.04812294	0.0392939	–0.052924	0.415441	1.012917	0.7466948	0.098065	–0.00777	–0.079261	–0.07344	0.92656	0.231268	3.25388	4.95341
PJSC "DEUTSCHE BANK DBU"	0.05011646	0.0099074	–0.072955	0.176637	1.227645	0.9776433	0.064277	–0.00801	–0.124653	–0.110837	0.889163	0.270488	5.8087	7.469841
PJSC "KREDYT EUROPA BANK"	0.0254496	–0.001195	–0.039448	0.167968	0.913865	0.9619176	0.049062	–0.01087	–0.221655	–0.181438	0.818562	0.237167	3.62749	4.921399
PJSC JSKB "LVIV"	0.02659059	0.0256135	–0.561127	0.539788	1.456752	0.7871104	0.05703	–0.06439	–1.129017	–0.5303	0.4697	0.15725	8.34909	7.956077
PJSC "SEB KORPORATYVNYI BANK"	0.04981907	0.0057512	–0.052341	0.101163	1.333781	0.8551342	0.059909	–0.00925	–0.154482	–0.133811	0.866189	0.18396	4.00594	5.59926
"PERSHYI INVESTYTSIINYI BANK"	0.05290048	0.024032	–0.277796	0.448817	1.207914	0.8978148	0.084236	–0.04004	–0.47539	–0.322213	0.677787	0.152762	6.51655	7.398244
PJSC "KREDYTVEST BANK"	0.05742419	0.0154291	–0.060389	0.230316	1.220915	0.9478831	0.078026	–0.00787	–0.100886	–0.091641	0.908359	0.249548	4.53424	6.299038
PJSC "KOMINVESTBANK"	0.03376502	0.0565649	–0.122948	0.563708	0.689594	0.5946912	0.108409	–0.02476	–0.228356	–0.185904	0.814096	0.276165	4.73327	5.773901
PJSC "BTA BANK"	–0.10421441	0.0044268	–1.141595	0.178354	1.776505	0.7487514	0.053799	–0.62487	–11.61489	–0.920729	0.079271	0.076982	1.8271	–10.9438
PJSC "BANK AVANHARD"	0.04888865	0.007873	–0.022037	0.109594	1.210151	0.9782312	0.077445	0.01119	0.1444471	0.168835	1.168835	0.212367	4.35529	6.855087
PJSC "MOTOR–BANK"	0.03680989	0.0130345	–0.159091	0.380087	1.060902	0.9065495	0.055727	–0.03006	–0.539401	–0.350397	0.649603	0.22852	4.83487	5.53886
PJSC "BANK "HRANT"	0.09815729	0.0232515	0.0375921	0.206429	1.021987	0.8515326	0.129316	0.02779	0.2149087	0.273737	1.273737	0.279514	2.31761	5.027852
PJSC "JSB "RADABANK"	0.09598668	0.0266979	0.0459102	0.269516	1.015992	0.8894973	0.130136	0.01281	0.0984346	0.109182	1.109182	0.254176	4.60529	6.981706
PJSC "KRYSTALBANK"	0.07718206	0.0240045	0.1044112	0.184281	0.648629	0.7975368	0.146223	0.03161	0.2161738	0.275793	1.275793	0.406553	4.48722	6.942005
PJSC "BANK 3/4"	0.05755216	0.0070078	0.0639744	0.0946	0.558265	0.8108451	0.131086	0.03823	0.2916028	0.411637	1.411637	0.477206	2.05502	4.626444
PJSC "ASVIO BANK"	0.11051175	0.0135256	–0.013553	0.128147	1.259028	0.7912607	0.127405	0.00674	0.052877	0.055829	1.055829	0.27649	2.54995	4.680951
JSC "UKRBUDINVESTBANK"	0.03895027	0.0410067	–0.048266	0.374675	0.605062	0.8383471	0.113431	–0.00999	–0.088032	–0.080909	0.919091	0.171964	4.64193	6.218758
PJSC "YUNEKS BANK"	0.07995044	0.0177545	–0.125765	0.219495	1.074351	0.7824674	0.114687	–0.03862	–0.336733	–0.251907	0.748093	0.331756	3.17159	4.099462
PJSC "BANK SICH"	0.02811179	0.0569869	–0.340303	0.444787	0.789734	0.7634236	0.138194	–0.08102	–0.586295	–0.3696	0.6304	0.250642	4.16432	4.407944
PJSC "AIBOKS BANK"	0.04281893	0.1169414	–0.338893	1.279802	0.474426	0.6259354	0.16559	–0.09588	–0.579012	–0.366693	0.633307	0.138614	3.52377	4.064948

Table A1 (cont). Calculated indicators of Ukrainian banks. S_e group

BANK	K_{se1}	K_{se2}	K_{se3}	K_{se4}	K_{se5}	K_{se6}	K_{se7}	K_{se8}	K_{se9}	K_{se10}	K_{se11}	K_{de12}	K_{se13}	S_e
PJSC "EUROPROMBANK"	0.12408587	0.0063706	0.0281807	0.059212	1.478666	0.9391872	0.143516	0.01372	0.0955758	0.105676	1.105676	0.092712	2.07627	4.725337
PJSC "BANK ALIANS"	0.06346895	0.0387092	0.2294362	0.217145	0.356511	0.8988971	0.219099	0.10393	0.4743474	0.902397	1.902397	0.336569	2.68167	6.742561
PJSC "BANK "UKR. KAPITAL"	0.05984643	0.0270394	–0.096248	0.276759	0.990057	0.7098866	0.111137	–0.02037	–0.18325	–0.15487	0.84513	0.251772	3.17404	4.456944
JSC "METABANK"	0.0564053	0.0478326	–0.018339	0.371919	0.747577	0.8638277	0.134533	0.0018	0.013406	0.013588	1.013588	0.286238	3.03823	4.95484
PJSC "BANK "YUNISON"	0.13154805	0.0385042	0.1202904	0.240629	0.734568	0.6156226	0.179089	0.0467	0.2607898	0.352795	1.352795	0.351285	2.57962	5.279994
PJSC "JSKB "KONKORD"	0.08893904	0.0389558	–0.095385	0.325011	0.859394	0.8112637	0.137988	–0.02999	–0.217326	–0.178527	0.821473	0.295611	3.14484	4.386104
JSC "KIB"	0.05556715	0.0484293	–0.149555	0.445818	0.823112	0.8823442	0.127485	–0.04534	–0.355665	–0.262355	0.737645	0.361717	3.22813	4.140995
PRJSC "KB "AKORDBANK"	0.04662434	0.0979295	–0.193862	0.593643	0.456413	0.6889307	0.182293	–0.04917	–0.269725	–0.212428	0.787572	0.406204	3.45563	4.267194
PJSC "OKSI BANK"	0.03839211	0.0108496	–0.156842	0.271458	1.678892	0.6974985	0.052265	–0.05564	–1.064664	–0.51566	0.48434	0.179152	2.80676	2.804961
POLIKOMBANK	0.03884108	0.0337031	–0.090224	0.365915	0.938319	0.7023228	0.096031	–0.0336	–0.349933	–0.259223	0.740777	0.215426	2.67803	3.626209
PJSC "AP BANK"	0.07783516	0.0332362	–0.007766	0.297466	0.825478	0.9253961	0.114883	–0.00388	–0.033768	–0.032665	0.967335	0.39311	2.00182	3.751623
JSC "ALTBANK"	0.06369766	0.0318819	0.0113628	0.33724	0.716298	0.7085925	0.104542	–0.00259	–0.024757	–0.024159	0.975841	0.331722	2.44178	4.069141
PJSC "RVS BANK"	0.01926192	0.0585134	–0.088572	0.303645	0.11804	0.2049228	0.202932	–0.03816	–0.188046	–0.158282	0.841718	0.194683	2.32105	2.888884
PJSC "KB "ZEMELMYI KAPITAL"	0.05921499	0.011534	–0.088136	0.199127	1.264779	0.8620238	0.07471	–0.03357	–0.449299	–0.310011	0.689989	0.287005	2.525	3.416101
PJSC "VERNUM BANK"	0.11863127	0.0422076	0.003425	0.285973	1.000289	0.8877062	0.161675	0.00133	0.0082395	0.008308	1.008308	0.25042	2.38928	4.489589
PJSC "SKAI BANK"	0.03286025	0.0195172	–0.16544	0.20071	0.632596	0.3543553	0.102981	–0.08623	–0.837302	–0.455724	0.544276	0.255732	1.91402	1.371585
PJSC "BANK FAMILNYI"	0.04085892	0.0270495	–0.064242	0.848208	0.627339	0.7944014	0.080471	–0.02804	–0.348418	–0.25839	0.74161	0.16128	2.29129	3.455329
PJSC "JSKB "TRAST–KAPITAL"	0.07506941	0.0119311	0.0088489	0.169789	0.969017	0.4071427	0.100158	0.0076	0.0759004	0.082134	1.082134	0.194115	1.30332	3.137197
PJSC "DIVI BANK"	0.1113323	0.0234069	–0.087398	0.087127	0.353192	0.8170558	0.355336	–0.06182	–0.173964	–0.148185	0.851815	0.610992	1.42642	2.302499
PJSC KB "TSENTR"	0.12179053	0.0725769	–0.445888	2.126648	0.722195	0.805291	0.196563	–0.31485	–1.601773	–0.615647	0.384353	0.101231	1.40212	0.909304
PJSC "BANK "PORTAL"	0.14001833	0.0086571	0.0348529	0.06186	0.967935	0.9527871	0.14748	0.03453	0.2341065	0.305665	1.305665	0.334385	1.12711	3.879154
PJSC "ROZRAKHUNKOVYI TSENTR"	0.10182771	0.0025338	0.0301635	0.020472	0.704276	0.6283709	0.144713	0.03108	0.2148015	0.273563	1.273563	0.49569	1.24264	3.370024
UKR.BANK REKONSTRUKTSII TA ROZVYTKU	0.01376934	0.0008472	–0.045704	0.023032	1.098778	0.7135309	0.042915	–0.04002	–0.932507	–0.482537	0.517463	0.336114	1.14206	0.912855
PJSC "ALPARI BANK"	0.1065879	0.0007597	–0.014999	0.023692	0.985519	0.9764263	0.108155	–0.01647	–0.15232	–0.132186	0.867814	0.575875	1.01805	2.292745

Note: Compiled and calculated by the authors according to the National Bank of Ukraine's list of banks.

http://dx.doi.org/10.21511/bbs.14(3).2019.11

Table A2. Calculated indicators of Ukrainian banks. S_r group

Source: Calculated by the authors on the basis of banks' financial reporting (National Bank of Ukraine, 2017).

BANK	K_{sr1}	K_{sr2}	K_{sr3}	K_{sr4}	K_{sr5}	K_{sr6}	K_{sr7}	S_r	Integral indicator
PJSC KB "PRYVATBANK"	–6.069255337	0	–0.89806668	9.116541795	0.805984797	1.109691	0.797577	16.52556275	–7.364009726
JSC "OSHCHADBANK"	–0.719809929	–0.003211997	–0.263142	6.417754152	0.669038819	1.155818	0.720754	9.010675843	–2.018733937
JSC "UKREKSIMBANK"	–0.715506619	–0.082862281	–0.31478073	10.82970742	0.531861284	1.092339	0.727182	13.36668184	–2.455642364
JSC "UKRGAZBANK"	–0.273258187	–0.003229499	–0.15635361	11.30750754	0.899625114	1.088437	0.659789	13.6099124	–1.192800548
JSC "RAIFFEIZEN BANK AVAL"	–0.185403358	0	–0.09900169	5.612605001	0.748529651	1.17817	0.179186	7.3226639	1.765335085
PJSC "SBERBANK"	–0.604646924	0	–0.48380311	7.09019562	0.858665725	1.14104	0.312094	9.690739773	1.116760047
PJSC "UKRSOTSBANK"	–1.87951825	0	–0.99329904	4.672097081	0.747977968	1.214037	0.768872	9.006685383	–3.896978719
PJSC "ALFA-BANK"	–0.299391174	0	–0.17119665	11.45033288	0.848538896	1.087334	0.492303	13.60750603	0.647918335
PJSC "PUMB"	–0.305895443	0	–0.17406757	8.548500552	0.811830917	1.11698	0.41642	10.63462578	0.581495289
JSC "UKRSYBBANK"	–0.285641409	0	–0.13904134	7.359811446	0.769586972	1.135873	0.127904	9.146535676	1.993400173
PJSC "PROMINVESTBANK"	–2.498133388	0	–1.54539387	2.268106035	0.465688676	1.440896	0.523807	7.266091799	–2.901984216
JSC "OTP BANK"	–0.348829878	–0.003318736	–0.20468017	7.457228446	0.84723743	1.134098	0.35826	9.609001236	1.371427763
PJSC "KREDI AGRIKOL BANK"	–0.122198535	0	–0.07687992	8.481014875	0.807776844	1.11791	0.288357	10.23254336	1.916195637
JSB "PIVDENNYI"	–0.103272876	0	–0.06468677	10.06943035	0.773183401	1.09931	0.597974	11.98289103	–0.068346803
PJSC "VTB BANK"	–3.2367739	0	–1.20026077	7.913684185	0.866864834	1.126363	1.052282	13.76078359	–4.683100289
PJSC "SITIBANK"	–0.016063067	0	–0.00472346	9.426662814	0.888932158	1.106082	0.375018	11.16667058	3.035423994
JSC "PROKREDYT BANK"	–0.041053547	0	–0.03269532	7.413359974	0.737906853	1.134892	0.481288	9.143164459	1.103939065
PJSC "KREDOBANK"	–0.104966206	–0.007087716	–0.06031639	8.516268458	0.854631903	1.117422	0.290114	10.29155365	1.573622046
JSC "TASKOMBANK"	–0.074097017	0	–0.05934651	13.81668681	0.847446893	1.072376	0.520542	15.70564766	0.151744295
PJSC "BANK KREDYT DNIPRO"	–0.607407387	0	–0.2771353	8.982090942	0.878054154	1.111333	0.805007	11.75225772	–2.790714666
PJSC "INH BANK UKRAINE"	–0.083559328	0	–0.05967378	1.656793732	0.603201879	1.603575	0.258356	3.377893681	2.047412135
PJSC "MEGABANK". KHARKIV	–0.083636624	0	–0.0605522	7.529293162	0.726303256	1.132815	0.801192	9.546177725	–1.823534789
PJSC "MIB"	–0.241858798	0	–0.05503001	30.39671513	0.932394256	1.032898	0.716016	32.61899494	–0.917307759
PJSC "BANK VOSTOK"	–0.04064988	0	–0.02748982	12.96676766	0.847267872	1.07712	0.430154	14.73318835	–0.164313362
PJSC "UNIVERSAL BANK"	–0.269715791	0	–0.17258497	5.708726694	0.830176041	1.17517	0.372462	7.780706523	1.242695851
PJSC "A-BANK"	–0.169680589	0	–0.21313813	5.552634964	0.816594035	1.180095	0.379065	7.583973864	2.172013778
PJSC KB "PRAVEKS–BANK"	–0.026681671	0	–0.00528709	4.050826106	0.755411238	1.246863	0.388894	5.746638146	–0.806129175
JSKB "INDUSTRIALBANK"	–0.137628312	–0.062862908	–0.09410761	2.378799211	0.683178887	1.42038	0.387376	4.307176555	0.504663681
PJSC "MARFIN BANK"	–0.306848476	0	–0.10833026	7.978720482	0.842931031	1.125333	0.493221	10.09270085	0.043960489
BANK INVESTYTSII TA ZAOSHCHADZEN	–0.087396442	0	–0.07066506	6.999213803	0.859181397	1.142873	0.59574	9.012848861	0.010744115
PJSC "IDEIA BANK"	–0.285052037	0	–0.21257905	7.454939691	0.827497764	1.134139	0.348561	9.537296217	2.070267147
JSC "PIREUS BANK MKB"	–0.1938154	0	–0.11359742	4.65034387	0.799384288	1.215038	0.331221	6.564621751	0.382681143

Table A2 (cont.). Calculated indicators of Ukrainian banks. S_r group

BANK	K_{sr1}	K_{sr2}	K_{sr3}	K_{sr4}	K_{sr5}	K_{sr6}	K_{sr7}	S_r	Integral indicator
PJSC "VIES BANK"	–0.627505357	0	–0.25201004	1.59803337	0.458072359	1.625769	0.400937	3.892332335	0.254271394
JSC "BM BANK"	–4.52766118	0	–1.64943229	3.607864494	0.713648401	1.277172	1.420793	11.07087204	–10.24633953
JSB "KLIRYNHOVYI DIM"	–1.005036079	0	–0.34915555	5.698800307	0.81181134	1.175476	0.817642	8.814513658	–2.59423972
PJSC "KB "GLOBUS"	–0.120042571	0	–0.06693659	7.149861866	0.807105746	1.139863	0.799928	9.283813787	–1.478848414
JSC "MISTO BANK"	–0.431878599	0	–0.22897305	5.375108846	0.823138732	1.186043	0.428485	7.665514939	–0.033279622
PJSC JSKB "ARKADA"	–0.050775604	0	–0.01491997	1.630648963	0.374362741	1.613253	0.78311	3.45197229	–0.26253113
PJSC "POLTAVA–BANK"	–0.078567191	–0.027366133	–0.0417807	2.253882476	0.656146749	1.443679	0.515533	4.139749287	0.813660853
PJSC "DEUTSCHE BANK DBU"	–0.000113706	0	–0.00014538	4.808697009	0.815842118	1.207957	0.364891	6.502416012	0.967424548
PJSC "KREDYT EUROPA BANK"	–0.196291637	0	–0.0878814	2.6274898	0.717550494	1.380591	0.432385	4.59472518	0.326673468
PJSC JSKB "LVIV"	–0.132019837	0	–0.07413971	7.349092798	0.758174542	1.136071	0.679936	9.358409684	–1.402332835
PJSC "SEB KORPORATYVNYI BANK"	0	0	0	3.005938366	0.716555235	1.332675	0.376529	4.671228055	0.928032202
"PERSHYI INVESTYTSIINYI BANK"	–0.101936789	0	–0.04355763	5.516549071	0.801926529	1.181273	0.480091	7.389190278	0.009053684
PJSC "KREDYTVEST BANK"	–0.005249651	0	–0.0036261	3.534243006	0.64454515	1.282946	0.397206	5.125729182	1.173308325
PJSC "KOMINVESTBANK"	–0.112628901	0	–0.06508528	3.733274982	0.777272582	1.267861	0.548343	5.705292479	0.068608284
PJSC "BTA BANK"	–1.47701669	0	–0.38163083	0.827098968	0.277413223	2.209045	2.090397	5.266226008	–16.21005221
PJSC "BANK AVANHARD"	–0.112678202	–0.00909569	–0.07274737	3.355293984	0.755605692	1.298036	0.478358	5.282764284	1.572323159
PJSC "MOTOR–BANK"	–0.037120049	0	–0.01835905	3.834871303	0.787483942	1.260765	0.377378	5.581970193	–0.043110328
PJSC "BANK "HRANT"	–0.051679796	0	–0.0401591	1.317607057	0.551679225	1.758952	0.257278	3.020639824	2.00721205
PJSC "JSB "RADABANK"	–0.178284017	0	–0.09614526	3.605292845	0.762171112	1.27737	0.274021	5.441523304	1.540182269
PJSC "KRYSTALBANK"	–0.083792676	0	–0.02776265	3.487219069	0.745979588	1.286761	0.186225	5.106855573	1.835149075
PJSC "BANK 3/4"	–0.013730451	0	–0.00819309	1.055018994	0.493046389	1.94785	0.213565	2.700655137	1.925788695
PJSC "ASVIO BANK"	–0.125369397	0	–0.07246617	1.549950364	0.58986186	1.645182	0.311054	3.362186698	1.318764512
JSC "UKRBUDINVESTBANK"	–0.089260589	0	–0.0403707	3.641925206	0.774183635	1.27458	0.432483	5.485077322	0.733680472
PJSC "YUNEKS BANK"	–0.35814012	0	–0.15671734	2.171592098	0.656284966	1.460492	0.351124	4.246788446	–0.147326096
PJSC "BANK SICH"	–0.016376658	0	–0.01237198	3.164323726	0.75342362	1.316023	0.742417	5.157226191	–0.749282547
PJSC "AIBOKS BANK"	–0.079140437	0	–0.0469809	2.52376652	0.599544011	1.396233	0.454954	4.268978631	–0.204030886
PJSC "EUROPROMBANK"	–0.357450129	0	–0.31087262	1.076270259	0.499996564	1.929135	0.415275	3.431250802	1.294086146
PJSC "BANK ALIANS"	–0.048269047	–0.182195209	–0.06784048	1.681666372	0.592687711	1.594648	0.187453	3.452956321	3.289604595
PJSC "BANK "UKR.KAPITAL"	–0.087227237	0	–0.05143128	2.17403962	0.650772387	1.459973	0.456101	4.01372593	0.44321802
JSC "METABANK"	–0.099299365	0	–0.0481905	2.038231664	0.652905311	1.490621	0.439166	3.88848738	1.066352634
PJSC "BANK "YUNISON"	–0.54177079	0	–0.37079077	1.579622702	0.138562439	1.633063	4.09E–05	3.31186599	1.968127699
PJSC "JSKB "KONKORD"	–0.088484032	0	–0.04830458	2.144844023	0.643972343	1.466234	0.250005	3.824104881	0.561998924
JSC "KIB"	–0.044664634	0	–0.01910831	2.228130989	0.671587404	1.448807	0.47046	4.0295734	0.111421177

http://dx.doi.org/10.21511/bbs.14(3).2019.11

Table A2 (cont.). Calculated indicators of Ukrainian banks. S_r group

BANK	K_{sr1}	K_{sr2}	K_{sr3}	K_{sr4}	K_{sr5}	K_{sr6}	K_{sr7}	S_r	Integral indicator
PRJSC "KB "AKORDBANK"	–0.208705608	0	–0.09276544	2.45562725	0.68541565	1.407228	0.439618	4.423664746	–0.156471092
PJSC "OKSI BANK"	–0.033502508	0	–0.01993564	1.806761191	0.635271781	1.553477	0.562467	3.685683832	–0.880722336
POLIKOMBANK	–0.099237459	0	–0.07416548	1.678025322	0.588387418	1.595939	0.568949	3.639687104	–0.013477907
PJSC "AP BANK"	–0.022525674	0	–0.00715876	1.001816524	0.280816609	1.998187	0.179242	2.4402113	1.311411494
JSC "ALTBANK"	0	0	–0.00021033	1.441782097	0.576443261	1.693586	0.149371	2.977257006	1.091883628
PJSC "RVS BANK"	–0.190613162	0	–0.02179143	1.321047072	0.525909222	1.756975	0.195882	3.037107042	–0.148223243
PJSC "KB "ZEMELMYI KAPITAL"	–0.002526069	0	–0.00174445	1.52499818	0.54352801	1.655738	0.37333	3.18003224	0.236068349
PJSC "VERNUM BANK"	–0.12113698	0	–0.11628454	1.389281274	0.497642239	1.719797	0.26645	3.153796276	1.335792876
PJSC "SKAI BANK"	–0.38020047	0	–0.07103784	0.914024823	0.402639216	2.094062	0.495584	3.091571516	–1.719986083
PJSC "BANK FAMILNYI"	–3.18814794	0	–0.14829636	1.291288347	0.291772309	1.77442	0.190636	5.152655402	–1.697326146
PJSC "JSKB "TRAST–KAPITAL"	–0.782800236	–0.182267808	–0.23120319	0.30331833	0.2004284	4.296866	0.226528	3.777079986	–0.639882502
PJSC "DIVI BANK"	–0.050858424	0	–0.02876768	0.426420556	0.276961179	3.345103	0.112904	2.527522828	–0.225023632
PJSC KB "TSENTR"	–0.123157105	0	–0.07120108	0.402123963	0.271750196	3.486795	0.142061	2.687386235	–1.77808271
PJSC "BANK "PORTAL"	–0.09631562	0	–0.12838677	0.12710856	0.102777832	8.867291	0.019141	4.878511287	–0.999357217
PJSC "ROZRAKHUNKOVYI TSENTR"	0	0	–0.00044092	0.242638114	0.15541096	5.121364	0.000885	2.959835879	0.410187734
UKR.BANK REKONSTRUKTSII TA ROZVYTKU	0	0	–0.00030795	0.142062114	0.012068002	8.039174	0.707995	4.705021641	–3.792166753
PJSC "ALPARI BANK"	0	0	0	0.018054687	0.012210843	56.38728	1	28.97390504	–26.68115978

Note: Compiled and calculated by the authors according to the National Bank of Ukraine's list of banks.