**Banks Rating in the Context of Their Financial Activity Using Modified Taxonometical Method**

**Abstract.** In the paper the rating of banks is conducted by indicators of reliability with the using of modified taxonometical method. The rating is built on the basis of bank reliability methodology, which takes into account the global analysis of management, outflow of deposits and current condition of the bank on assignment of long-term credits, and also analysis of assets and profitability of bank and value of currency constituent of its activity.

**Keywords:** bank, analysis, reliability of bank, rating approach, criteria of reliability, taxonometical method.

**Formulas:** 5; **fig.:** 1, **tabl.:** 3, **bibl.:** 12.

**JEL Classification:** G 01, G 21, G 28, G 33

**Introduction.** Management of the bank, bank customers and, last but not least for bank’s financial development, investors must have a clear "picture" on the issue - whether a particular bank is reliable or not - compared with other banks. An important question is - where to invest money, because nobody deposits money in unreliable bank. Bank’s financial development aims as a minimum stable its development and, as a maximum, effective functioning. The result of the crisis affecting the banking system of Ukraine is distrust of banks, depositors and investors carefully assess the situation, and therefore the transition from unreliable condition to a group of reliable banks, raising reliability level are important tasks for the banking business owners and management of banks.

Experts, depositors, shareholders, investors, etc. should be able to be acquainted with clear and detailed information on the actual condition of a single bank and the prospects for its further development. It is possible to realize, with the appropriate mechanism of banks research activities based on public statements and conducting banks financial reliability rating [Dosyak 2009, Lerner 2010].

Methods of rating banks create evaluation system, which makes clear investigated banks comparing mechanism according to the set of specific financial targets. The results of these methods are objective information base for decision-making.

**Literature review and the problem statement.** When choosing a determination method of banks rating in a number of other approaches taxonometical method (Euclidean distances method) is used. [Bubenko, Vladimirova 2009; Senchenko 2011; Turylo 2011]. Ratings, which are based on this method provide a comprehensive assessment of banks, allowing to determine the best of them according to a number of indicators, a set of which, in turn, may vary depending on the specific task.
There are a number of methods to analyze and assess the reliability of banks, which in most cases use a rating approach. One of the last works devoted to a detailed review of modern methods of rating banks of Ukraine are papers of Horditsa T.M. [Horditsa 2011] Turylo A.M. and Vcherashnya I.S. [Turylo 2011] in which the authors also cite list and description of the main approaches of the reliability of banks determination. In conclusion the authors of these works [Turylo 2011] prefer the rating system CAMELS [Analysis of the commercial bank: teach. guide 2001; On the procedure for the determination of ratings according to CAMELS rating system] and still [Turylo 2011, Horditsa 2011] concluded that each of the analyzed method has certain advantages and disadvantages, but the lack of a single unified method of banks reliability analysis is one of the factors that lead to manifestations of information asymmetry criterion.

The problems of banks reliability rating, banking management issues and audits, analytical ensuring of commercial banks effective functioning, commercial banks financial analysis, methods of commercial banks financial stability and reliability determination are also considered by such well-known economists as Belyh L., Vitlinskyy V., Kochetkov A., Kromonov V., Lavrushin O., Lerner Y., Mazaraki A., Moroz A., Rajevski K., Shirinska E. Shmatov O. Sinki J.F. and other.

The aim of the study is to conduct bank rating on parameters that characterize the reliability of banks using the modified taxonometical method to calculate the ranking of banks.

**Research results.** In classical taxonometical method [Bubenko, Vladimirova 2009; Senchenko 2011; Prosvetov 2005] the matrix $P$ is used:

$$
P = \begin{pmatrix}
    p_{11} & \ldots & p_{1i} & \ldots & p_{1n} \\
    \vdots & \vdots & \vdots & \ddots & \vdots \\
    p_{si} & \ldots & p_{si} & \ldots & p_{sn} \\
    \vdots & \vdots & \vdots & \ddots & \vdots \\
    p_{bi} & \ldots & p_{bi} & \ldots & p_{bn}
\end{pmatrix}, \quad (1)
$$

For matrix $P$ financial performances of banks (1) $i$-th column vector elements is a uniform list of values of $i$-rate (the number of indices $n$) for each of the banks $b$ and $s$-th row vector elements - a list of diverse values for $s$-th bank ($i = 1,n; s = 1,b$).

To compare numerical values with each other, it is necessary to bring them to dimensionless form. It is proposed to implement the indicators by normalization.

For numerical values, with which each indicator will be compared, it is convenient to take vector-column norm (each criterion norm) of the investigated banks:

$$
p'_{s,i} = \frac{p_{s,i}}{\sqrt{\sum_{s=1}^{b} p_{s,i}^2}}, \quad (2)
$$

where $p_{s,i}$ - the numerical value of $i$-indicator ($i = 1,n$) on the $s$-th bank ($s = 1,b$);
n – number of indicators considered;
b – the number of banks investigated.

Reproduced approach differs from the approach which uses valuation due to counting of standard deviation [Bubenko, Vladimirova 2009; Senchenko 2011, Prosvetov 2005].

Another important step is a process of "benchmark" bank formation [4, 9]. To form the "benchmark" bank, with which all others will compare, the optimum values of normalized i-th indicators for all banks are determined. Respectively, the maximum or minimum values depending on the direction of the impact on effective sign are selected [Senchenko 2011; Prosvetov 2005]. The selected optimal values form a matrix-line:

\[
\mathbf{P}_{et} = \left[ \begin{array}{ccc}
\max_{s} \{ p'_{s,1} \} & \cdots & \max_{s} \{ p'_{s,n} \} \\
\min_{s} \{ p'_{s,1} \} & \cdots & \min_{s} \{ p'_{s,n} \}
\end{array} \right],
\]

(3)

where \( \max_{s} \{ p'_{s,i} \} \) – determination of the i-th indicator maximum or minimum normalized value depending on the direction of the impact on effective sign (s = 1,b; i = 1,n).

Another change which is proposed to implement, is not to correct optimal values of the i-th normalized indicator on the value of standard deviation [Senchenko 2011], and for calculations take only values (3), understanding their content as optimal ("benchmark") values of the i-th normalized indicator that do not require any adjustment. Rating position of the bank is based on the relation that represents the distance \( D_s \) between the s-th bank and "benchmark" bank:

\[
D_s = \sqrt{\sum_{s=1}^{b} (p'_{s,i} - \text{pet}_i)^2}.
\]

(4)

Banks ratings are determined by (4) – the less is \( D_s \) distance value, the higher is the rating of the bank. However, for easy analysis of banks ratings as well as for more adequate detail of the data in graphical form it is proposed to use the relation that describes the total rating number \( R_s \) for each of the bank:

\[
R_s = 1 - \frac{D_s}{\sqrt{\sum_{s=1}^{b} D_s^2}}.
\]

(5)

In this case, the higher is the value of total rating number \( R_s \), the higher is the rating of the bank.

The bank reliability is offered to evaluate and analyze, using the following criteria, which are proposed to merge into several groups [Samorodov 2011]:

The first criteria group includes:
1) $K_1$ - the outflow of individuals $K_{1,1}$ and legal entities $K_{1,2}$ deposits from the bank;

2) $K_2$ - does the bank lends long-term loans;

Let’s look at the analysis of these criteria more detail. In consideration of the $K_1$ criterion the calculations ratio of deposits to total deposits amount should be taken. This will allow more adequately evaluate the situation when removed deposits of 10 million UAH may comprise for one bank 1% of total deposits, and for another it may be a loss of 90% of deposits. In this case, the conclusion is obvious - for the second bank it is a disaster. It is proposed for analysis to take the average value of the outflow of deposits throughout the banking system (in a particular group, to which the bank is attributed) and in the considered bank. At this stage, all banks in which the share of withdrawn deposits is less than the share of seized deposits on all banks are offered to extract from among reliable. Moreover, the analysis of individual and legal entities deposits can be divided. But the criterion $K_3$ consideration is important because the confidence of households and business to a particular bank, and even more so in times of crisis, is a very valid reason to believe that the bank is reliable (but with taking into account the entire complex criteria).

The next criteria-limit $K_2$ enables to estimate how much money has the bank to lend either legal entities or individuals. Does the bank lends long-term loans to purchase real estate and/or cars etc. This is a figure of the bank sufficient liquidity, i.e. in this case the bank has free cash resources.

The second group of criteria includes criteria that characterize the financial performance of the following banking activities:

3) $K_3$ - capital adequacy;

4) $K_4$ - the amount of provisions in the loans (assets);

5) $K_5$ - profitability or unprofitability of the banking structure;

6) $K_6$ - monetary component of banking.

In analysis of the $K_3$ indicator the ratio of the value of bank assets to total assets of the bank is analyzed. Those banks that do not meet capital adequacy proposed for removal from reliable numbers.

The volume of reserves for the loans (assets) include: reserves for funds impairment in other banks; reserves for loans impairment; reserves for securities impairment in the bank’s portfolio; reserves for impairment of securities which are held to maturity; reserves for other financial assets; reserves for other assets [Horditsa 2011].

Therefore, on the stage of criterion $K_4$ analysis several parameters that must be evaluated are calculated:

- the ratio of reserves as % of total assets of the bank;
- return on assets is the ratio of profit (loss) to assets.

However, these figures should be calculated as the entire banking system (in a particular group, to which the bank is attributed), and for the particular bank. Then comparative analysis will help to remove unreliable banks from the given list considering $K_4$ criterion - the amount of reserves in the loans (assets).

But when analyzing the banks on the criterion of the value of reserves in the loans (assets) could be a situation where banks, which were formed the largest reserves are unprofitable banks and a ratio of net income (loss) to the assets of these banks is much higher than the figure for the banking system as a whole. The same can be seen while analyzing banks, which have $R_3$ value that is close to this value for the banking system as a whole. Clearly said that banks which were formed the minimum reserves are reliable - also is not correct. In
this sense, the evaluation of the value of banks reserves at reliability analysis allows to exclude unreliable banks. It is proposed to use indicators of the entire banking system as a “benchmark” indicator (in a particular group, to which the bank attributed).

Let’s analyze $K_5$ criterion - profitability or unprofitability of the banking structure. What conclusions can be drawn from the analysis of bank profitability in a system? The positive fact is that if even in crisis the bank takes profits, it indicates that the management of the bank is correct; the shareholders that support bank are serious and so on. However, this method can be used. The bank’s losses must be compared with the size of bank assets. If the loss is 5% of the value of assets, it is a bad sign. On the other hand, if the bank is profitable - it does not mean that it is reliable (some banks with the interim administration are profitable, but the problem of trust them money or not is the problem of the depositor). Thus, such a comparison helps not to identify reliable banks, but rather to weed out unreliable.

As for the monetary component of banking activity ($K_6$ criterion), the higher the % of foreign exchange in bank loans, the greater is its exposed risk during the devaluation of the hryvnia [Turylo 2011]. On the other hand, the more foreign currency deposits ( liabilities) are in the bank, the more risk it is exposed if the loans are lent in a local currency. Therefore, it can be concluded the following:

- if the funds involved and lend in foreign currency - risk of exchange rate fluctuations assumed by the client, borrower;
- if the bank attracts funds in foreign currency and lend credits in the national currency - the exchange rate risks are assumed by the bank (since it requires hryvnia from customers, but must repay debts in foreign currency);
- if the funds involved in the national currency, and loans lent in foreign currency – the bank additionally earns on exchange with the devaluation of the national currency (i.e. it receives loans in foreign currency, and repay debts in hryvnia, which by that time has already depreciated).

When analyzing the banks and the banking system it is additionally necessary to consider the following criteria:
- $K_6$ - the ratio of loans lent to legal entities $K_{7,1}$ and individuals $K_{7,2}$ to the volume of total assets of the bank;
- $K_9$ - the ratio of attracted funds from the individuals and legal entities.

Methodology for determining reliability rating of banks is proposed to use in rating of 9 conventional banks. These financial statements of conventional banks were taken from public sources [The structure of assets, liabilities, equity, financial results of the banks of Ukraine]. In Table 1 the data on the amount of investigated banks’ capital and assets is presented.

<table>
<thead>
<tr>
<th>№</th>
<th>Bank Name</th>
<th>Bank Capital, thousands of UAH</th>
<th>Bank Assets, thousands of UAH</th>
<th>Net Profit (Losses), thousands of UAH</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Bank №1</td>
<td>140 178</td>
<td>1 262 161</td>
<td>-21 579</td>
</tr>
<tr>
<td>2</td>
<td>Bank №2</td>
<td>113 234</td>
<td>591 209</td>
<td>5 453</td>
</tr>
<tr>
<td>3</td>
<td>Bank №3</td>
<td>105 846</td>
<td>1 270 479</td>
<td>485</td>
</tr>
<tr>
<td>4</td>
<td>Bank №4</td>
<td>216 050</td>
<td>1 310 625</td>
<td>321</td>
</tr>
</tbody>
</table>
Table 2 – Summary data of criteria $K_1$ – $K_9$ values

<table>
<thead>
<tr>
<th>Criteria</th>
<th>$K_{11}$</th>
<th>$K_{12}$</th>
<th>$K_2$</th>
<th>$K_3$</th>
<th>$K_4$</th>
<th>$K_5$</th>
<th>$K_6$</th>
<th>$K_7$</th>
<th>$K_8$</th>
<th>$K_9$</th>
</tr>
</thead>
<tbody>
<tr>
<td>$N_1$</td>
<td>7.02</td>
<td>-6.43</td>
<td>1</td>
<td>0.9255</td>
<td>-4.545</td>
<td>-1.709</td>
<td>-0.052</td>
<td>0.9827</td>
<td>0.743</td>
<td>0.7249</td>
</tr>
<tr>
<td>$N_2$</td>
<td>2.1</td>
<td>6.09</td>
<td>1</td>
<td>1.5961</td>
<td>-1.418</td>
<td>0.922</td>
<td>0.0705</td>
<td>0.9773</td>
<td>0.8504</td>
<td>0.8837</td>
</tr>
<tr>
<td>$N_3$</td>
<td>-3.5</td>
<td>15.48</td>
<td>1</td>
<td>0.6943</td>
<td>-9.356</td>
<td>-1.464</td>
<td>0.038</td>
<td>0.8874</td>
<td>0.2681</td>
<td>0.7443</td>
</tr>
<tr>
<td>$N_4$</td>
<td>4.81</td>
<td>5</td>
<td>1</td>
<td>1.3737</td>
<td>-1.464</td>
<td>-45.44</td>
<td>0.024</td>
<td>0.7455</td>
<td>0.8676</td>
<td>0.6756</td>
</tr>
<tr>
<td>$N_5$</td>
<td>-14.59</td>
<td>-0.27</td>
<td>1</td>
<td>1.2958</td>
<td>-45.44</td>
<td>-4.581</td>
<td>0.024</td>
<td>0.7455</td>
<td>0.6886</td>
<td>0.1927</td>
</tr>
<tr>
<td>$N_6$</td>
<td>2.18</td>
<td>1.26</td>
<td>1</td>
<td>1.5002</td>
<td>-4.581</td>
<td>-0.408</td>
<td>0.024</td>
<td>0.8092</td>
<td>0.8077</td>
<td>0.9027</td>
</tr>
<tr>
<td>$N_7$</td>
<td>2.29</td>
<td>-3.58</td>
<td>1</td>
<td>1.5002</td>
<td>-3.793</td>
<td>-1.38</td>
<td>0.024</td>
<td>0.8644</td>
<td>0.8429</td>
<td>0.4854</td>
</tr>
<tr>
<td>$N_8$</td>
<td>1.41</td>
<td>4.86</td>
<td>1</td>
<td>1.5877</td>
<td>-21.79</td>
<td>0.180</td>
<td>0.024</td>
<td>0.9995</td>
<td>0.7921</td>
<td>0.7921</td>
</tr>
<tr>
<td>$N_9$</td>
<td>-1.04</td>
<td>-1.38</td>
<td>1</td>
<td>0.8047</td>
<td>21.79</td>
<td>0.299</td>
<td>0.024</td>
<td>0.817</td>
<td>0.9354</td>
<td>0.9354</td>
</tr>
</tbody>
</table>

Source: Data, which calculated according to author’s methodology [Samorodov 2011]

Based on the data, presented in summary table 2 for criteria values, total rating numbers are calculated (5) (which describes the bank rating) and ranking chart of studied banks is built. Table 3 shows the values of total rating number and places of the studied banks in the rating. Figure 1 shows a chart of the banks rating.

Table 3 – Banks in the rating on the basis of 01.07.20XX

<table>
<thead>
<tr>
<th>№</th>
<th>Bank Name</th>
<th>The value of the total rating number $R_s$, units</th>
<th>Rating Place</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Bank №1</td>
<td>0.58888</td>
<td>8</td>
</tr>
<tr>
<td>2</td>
<td>Bank №2</td>
<td>0.79091</td>
<td>1</td>
</tr>
<tr>
<td>3</td>
<td>Bank №3</td>
<td>0.74409</td>
<td>4</td>
</tr>
<tr>
<td>4</td>
<td>Bank №4</td>
<td>0.78488</td>
<td>2</td>
</tr>
<tr>
<td>5</td>
<td>Bank №5</td>
<td>0.46817</td>
<td>9</td>
</tr>
<tr>
<td>6</td>
<td>Bank №6</td>
<td>0.71615</td>
<td>5</td>
</tr>
<tr>
<td>7</td>
<td>Bank №7</td>
<td>0.64951</td>
<td>6</td>
</tr>
<tr>
<td>8</td>
<td>Bank №8</td>
<td>0.76688</td>
<td>3</td>
</tr>
<tr>
<td>9</td>
<td>Bank №9</td>
<td>0.63273</td>
<td>7</td>
</tr>
</tbody>
</table>

Source: calculated by author on the basis of equations (1)-(5)
Making credit relations requires the bank to assess the reliability analysis and not just its own, but also the reliability of its partners (mainly borrowers, which may include other banks). Special attention is paid to the analysis of the banks-borrowers activity because their credit relations in modern crisis exacerbated and interbank credit is dangerous and risky. Therefore, some banks create at analytical services for the analysis of the balance sheets and statements of other banks.

For a visual example, let’s analyze the results, which were obtained for the conventional bank "Bank 2". The analysis of the bank "Bank 2" reliability showed that in the rating of banks reliability, the bank is on the first place with the value of the total rating number $R_s = 0.79091$.

![Figure 1 – Banks rating diagram](image)

Source: built by author on the basis of equation (5)

Comparing banks on the first and second places, it should be noted that the bank’s "Bank 2" capital lower almost in 2 times and the bank’s assets lower in 2,2 times, but net income higher almost in 17 times (Table 1).

Very important is the fact that in comparison with the bank "Bank 9", the bank, which attributed to the first group according to NBU classification (Table 1 [12]), the bank "Bank 2" is ahead of the first 6 positions in the ranking of reliability, which cannot fail to state a high level of bank management in conducting banking activities.

**Conclusions.** Obtained results make it possible to evaluate the place of “Bank 2” among their competitors - conventional banks of the group. In this case the first place in the rating should be used as weighty enough information during the PR campaign that carried out by the bank.

Analyzing the performance of the financial activities, which form reliability criteria of the bank and used in banks rating according to the methodology, management and/or analytical department of the bank can estimate their values and apply preventive actions to support the current position in the banks ranking in future period (as minimum) or improve their current positions in the ranking,
despite the fact that the performance of the banks-competitors may be better than as 01.07.20XX.

References
On the procedure for the determination of ratings according to CAMELS rating system. (n.d.). Approved by the NBU of 08.05.2002 № 171.