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CLUSTER ANALYSIS OF REPUTATION RISK LEVEL OF UKRAINIAN BANKS

The article is devoted to the problems of estimating the level of reputation risk of modern Ukrainian banks. The methodical principles of implementation of cluster analysis during reputation risk level diagnostics were substantiated: algorithm of analysis performance was offered; seven stages were distinguished; their logical sequence was defined. The connection was formalized and the necessity of using the following quantitative indicators of banks business reputation assessment was proved: level of the term clients' funds in liabilities; ratio of the loans classified by the first category of quality with the total loan portfolio; coefficient of the capital participation in the formation of assets and their protection against risks. Based on the results of the banks cluster analysis according to the level of reputational risk, 3 clusters were built; each of them obtained characteristics and recommendations for minimizing possible losses from the risk of business reputation loss.

Keywords: bank, risk, business reputation, capital, loan, cluster, analysis, financial resources.

Problem statement. The current conditions for the development of the banking system of Ukraine are caused by the structural disproportions in the economy and its financial sector, which result in a constant volume increase regarding the problem loans and their reserves, problems with borrowing resources and their timely return, withdrawal a significant number of banks from the banks market. The above mentioned intensifies the instability in the banking services market, deepens distrust to domestic banks, and in general leads to the loss of their positive business reputation, that is, to the occurrence of reputational risk.

The effective solution of these problems depends on the creation of appropriate conditions for the development of both the economy and the banking sector. Therefore, there arises a need to perform an assessment of the reputational risk level of the Ukrainian banks, which results will allow to determine the conditions and objectives of maintaining a positive image and business reputation of both a certain separate bank and the banking system as a whole.

Analysis of recent studies and publications. The conducted analysis of the scientists' research indicates that the term "reputational risk" was first used in 1988, but due to the development of information and communication technologies since the early twenty-first century it has been increasingly used by researchers and practitioners. This is confirmed by the results of J. Farrell's analysis, who emphasizes that from 2003 to 2011, the number of printed and electronic publications using the concepts of "reputational risk", "corporate reputation" grew annually by an average of 13%¹.

Problems of determining the nature and formation of reputation risk management methods are considered in the scientific works of the foreign researchers: A. Griffin, who justifies the need for strategic management of reputation risks²; A. Zaman, who defines the features of the reputational risks influence on the creation of additional cost³; R. Eccles, who provides the essential characteristics of business reputation⁴, and others.

¹ Farrell, J. (2015). Reputation Risk: Beyond Solution Provider Hype and Now a Core Enterprise Risk? *Intelligent management trends*. <<http://www.intelligentmanagementtrends.com/blog/reputation-risk-beyond-solution-provider-hype-and-now-a-core-enterprise-risk>> (2015, June, 25).

² Гриффин, Э. (2009). *Управление репутационными рисками: Стратегический подход*. Москва: Альпина Бизнес Букс, 237.

³ Заман, А (2008). *Репутационный риск: управление в целях создания стоимости*. Москва: Олимп-Бизнес, 416.

⁴ Eccles, R.G., Newquist, S.C., Schatz, R. (2007). Reputation and its risks. *Harvard Business Review*, 85 (2), 104-117.

Among the domestic researchers the following of them devoted their works to the problems of reputational risks management: Zh. Dovgan, T. Golovchenko, L. Kuznetsova, N. Maslova, K. Trostianska, etc. For example, N. Maslova states that, in case of the financial and credit institutions, the business reputation determines the clients' and partners' advantages, provides strength and efficiency of business relationships, financial indicators and market well-being of the bank¹. L. Kuznetsova emphasizes the threat to the business reputation of the banks in liberalizing the standards of regulating banking operations with derivatives².

However, despite a sufficient number of scientific works devoted to the development of reputational risks, the problem of their identification³ and the assessment for the development of effective management decisions in the banking activities are not clearly investigated; there is a fragmentary approach to the organizational and applied aspects of managing such risks and there are no guidance papers on assessments of the banks reputational risk.

The object of the article. The aim of the article is to quantify the level of the reputational risks of the Ukrainian banks on the basis of the cluster analysis.

In order to achieve this target, the following tasks were solved: algorithm for conducting the cluster analysis was developed; three clusters of Ukrainian banks were distinguished by the level of reputational risk; analysis of the results of clustering Ukrainian banks was conducted; recommendations were made regarding the minimization of the risks of the business reputation loss.

Presentation of basic material of the research. The business reputation of the bank characterizes its position in the financial market, which is determined on the basis of modern methods of assessing the reputational risk in order to identify its place (rank) in a particular group of banks or in the banking system; the cluster analysis is one of such methods. Determining the groups of Ukrainian banks upon the level of risk of their business reputation is an important and relevant analysis category. The analysis results can be used in forming the bases of strategic management of banks reputational risks in order to increase the society's trust in them. The cluster analysis is a grouping of objects, but its main difference from the usual grouping is that each cluster contains the similar objects that differ markedly from the objects of the other clusters⁴. Consequently the cluster analysis is a multidimensional statistical procedure that collects data containing information about the selection of objects and then arranges objects in relatively uniform groups.

The main purpose of the cluster analysis is to split a large number of researched objects and features into uniform groups or clusters in the appropriate sense. This means that the task on grouping data and identifying the corresponding structure is solved.

In our research, the clustering of Ukrainian banks was performed on the basis of the method of the cluster "K-means" analysis with the aim to identify the uniform groups upon the feature of the "business reputational risk" in the banking market. The use of the cluster analysis does not require any prior knowledge of the analyzed indicators, so the task of the cluster analysis is usually solved in the initial stages of the research, when there is not enough information. Its solution helps to understand better the nature of the objects analyzed⁵.

The main type of tasks solved by the k-means algorithm is the presence of assumptions (hypotheses) regarding the number of clusters; in such case they must be different as far

¹ Маслова, Н. (2010). Бренд банку: сутність, елементи, вплив на клієнтів. *Вісник КНТЕУ*, 5, 24–32.

² Кузнєцова, Л.В. (2015). Інноваційні фінансові інструменти захисту банків від ризиків на кредитному ринку. *Науковий вісник Херсонського державного університету. Серія Економічні науки*, 15 (2), 142–145.

³ Basel Committee on Banking Supervision (2009). *Consultative Document. Proposed Enhancements to the Basel II Framework* < <http://www.bis.org/publ/bcbs150.pdf> > (2009, April, 17).

⁴ Григорук, П.М. (2006). *Багатомірне економіко-статистичне моделювання. Навчальний посібник для студентів ВНЗ*. Львів: Новий Світ-2000, 146.

⁵ Буреєва, Н.Н., Захарова, Е.Н., Радченко, С.А. (2007). Многомерный статистический анализ с использованием ППП STATISTICA. *Учебно-методические материалы по программе повышения квалификации*, 112.

as possible. The choice of the "k" number can be based on the results of previous theoretical studies or intuition.

In order to determine the target function of the classification, it is necessary to enter a characteristic indicating the degree of coherence of this classification with the introduced topology. The banks X_i and X_j will be assigned to one cluster, if the distance between these banks is quite small, and to the different clusters – if it is large enough. For each pair of banks, the “distance” between them, that is the level of their similarity, is to be measured.

In order to solve the tasks of cluster analysis of the risk of the banks business reputation loss, it is necessary to determine the sequence of the research, which is shown in the Fig. 1

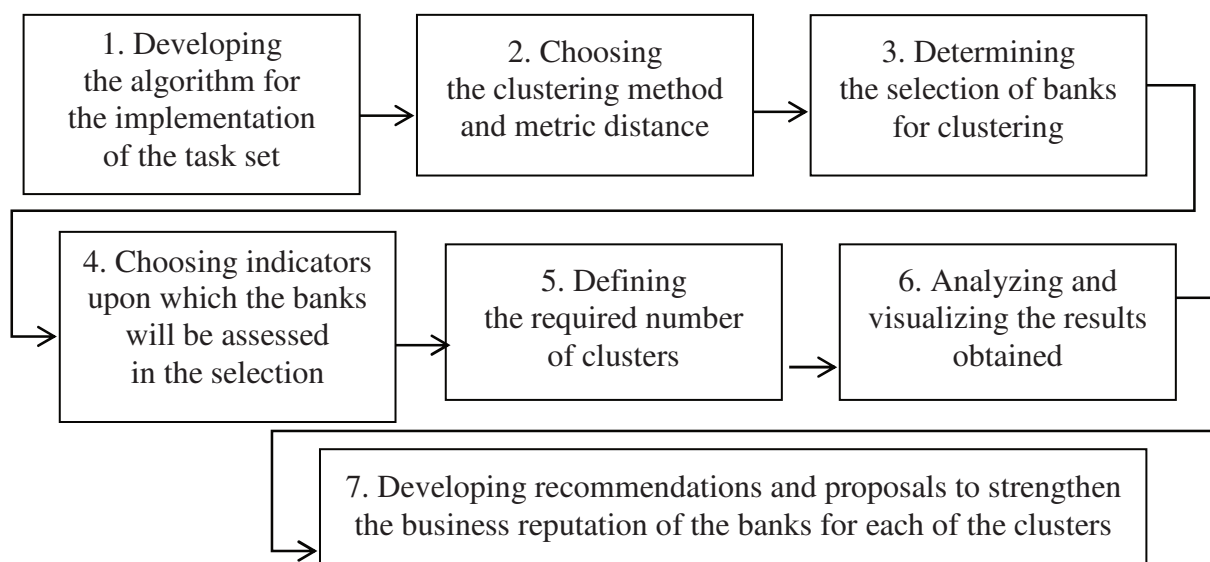


Fig. 1. Algorithm for carrying out the cluster analysis of the level of the banks reputational risk

Source: constructed by the author on the basis of data¹

The first stage of performing the cluster analysis of the level of the bank reputational risk is the development of the algorithm for the implementation of the task set. The peculiarity of this stage is the study of the possibilities of the cluster analysis for the consistent solution of this subdivision task. Determination of the features and methods of the cluster analysis allowed proceeding to the second stage of the research: choosing the clustering method and metric distance.

The second stage of the cluster analysis is the choice of the clustering method and metric distance. At this stage, the method of clusterization, most rational for the research of the banks competitiveness, was determined, namely the method of k-means, which belonged to the category of non-hierarchical methods. In our research the objects were the domestic banks. There were determined two signs of the characteristics: internal and external uniformity. The research was carried out by the program STATISICA 10.0 using the "cluster analysis" function. This method allows fulfilling the task of identifying the number of clusters of the banks on the basis of economic interpretation of the competition processes of the domestic banks in the market.

In the process of the cluster analysis, the distribution of the researched set of banks for the uniform groups is performed upon a certain number of indicators. An important practical

¹ Горелова, Г.В., Захарова, Е.Н., Радченко, С.А. (2006). *Исследование слабоструктурированных проблем социально-экономических систем: когнитивный подход*. Ростов-на-Дону: Издательство Ростовского университета, 334.

value of this analysis method is that it is possible, on its basis, to perform grouping not only upon one or several parameters, but also upon a certain number of absolute and relative indicators.

The third stage of the performed analysis is the determination of the number of banks, which indicators shall be used in analyzing the business reputation of Ukrainian banks. The selection included 93 banks, which, according to the NBU data, conducted their activity as of the date of 01.01.2018¹.

The fourth stage of clusterization is the formation of the information base of the source data, which are necessary for determining the business reputation of domestic banks in the market of banking services. The research used statistical information on the results of activity of the domestic banks, which was provided by the National Bank of Ukraine.

In order to construct clusters, we shall define the main indicators of activity that characterize the business reputation of Ukrainian banking institutions, as well as its risk: X_1 is a level of term clients' funds in liabilities, %; X_2 is a ratio of loans, classified by the first category of quality, to the total loan portfolio, %; X_3 is a coefficient of capital participation in the formation of assets, %.

The first indicator characterizes the growth of stability of the resource base of the bank, that is, characterizes the trust of the population and other investors; the second indicator characterizes the quality of the loan portfolio, that is, the level of the credit risk and the availability of conditions for timely fulfillment by the bank of its financial obligations; the third indicator characterizes the security of the assets (including low-quality ones) by own capital, that is, it determines the capital adequacy in activating the activity and covering various risks of the bank, including the reputational one.

At the fifth stage of the cluster analysis, based on the results of the domestic banks, we performed the multidimensional cluster analysis of 82 operating banks as of 01.01.2017 upon the given indicators.

The graph of the unification scheme splits all the banks into several groups, so we can make an assumption on the number of clusters. In this case, we assumed that there were 3 clusters present.

Consequently, we ranked the banks represented for the analysis by the latent sign "Business Reputation", that is, the placement of values in a certain order in terms of importance, significance, and made assumptions about the presence of 3 clusters.

In order to clarify the classification in the second stage, an iterative procedure was used, namely the K-means method.

The k-means method is a clustering method which purpose is to divide n observations into k clusters, so that each observation belongs to a cluster with its closest average value.

As a result of classification by the k-means method the banks were unified into three clusters:

- 16 banks (Public Joint-Stock Company "BTA Bank", Public Joint-Stock Company "BANK ¾", Public Joint-Stock Company "VERNUM BANK", etc.) got into the 1st cluster;
- 32 banks (Joint-Stock Company "Raiffeisen Bank Aval", Joint-Stock Bank "UKRGAZBANK", Joint-Stock Company "UkrSibbank", Public Joint-Stock Company "CITIBANK", etc.) got into the 2nd cluster;
- 45 other banks (Public Joint-Stock Company "Commercial Bank "PRIVATBANK", Joint-Stock Company "OSHCHADBANK", Joint-Stock Company "Ukreximbank", Public Joint-Stock Company "SBERBANK", etc.) got into the 3rd cluster.

At the next, the sixth, stage, we analyzed the obtained results of the cluster analysis of the business reputation of Ukrainian banks in the market that required further interpretation, research and study of the properties and characteristics of banks for the possibility of accurate description of the formed clusters.

¹ Основні показники діяльності банків України 2018 (Національний банк України). *Офіційний сайт Національного банку України*. <<https://bank.gov.ua/control/uk/publish/article?art>> (2018, апрель, 17).

Firstly, we conducted the research of the influence level of each of the proposed factors on the bank's involvement into a particular cluster; with this aim we calculated the average values of the bank indicators by clusters (Table 1)

Table 1

Average values of the banks' indicators by clusters

Clusters	Factors		
	<i>X₁ is a level of term clients' funds in liabilities, %</i>	<i>X₂ is a ratio of loans, classified by the first category of quality, to the total loan portfolio, %</i>	<i>X₃ is a coefficient of capital participation in the formation of assets, %</i>
1	37,37	45,76	72,48
2	33,40	65,69	22,52
3	45,77	22,65	19,43

By the results of the analysis, we concluded that the first factor (X_1 , the level of term clients' funds in liabilities) occurred to be the factor determining the assignment of banks to the 3rd cluster; the second factor (X_2 , the ratio of credit operations, classified according to the first category of quality, to their total amount) occurred to be the factor determining the assignment of banks to the 2nd cluster; the 1st cluster was constructed taking into account the influence of the factor X_3 (assets protection by own capital).

Now let's characterize the results of the clusterization. The first cluster is represented by 15 banks, most of which are the banks with the smallest amount of assets in the banking system. The following averaged indicators are typical for such banking institutions: the level of term clients' funds in liabilities is equal to 37.37%, the ratio of credit operations, classified according to the first category of quality, to their total amount is equal to 45.76%, and the coefficient of capital participation in the assets formation is equal to 72.48%. The latter indicator is the highest among all the clusters, therefore, these banks are sufficiently protected by their own capital, and their financial stability is sufficiently secured with capital that is able to protect the bank against the potential risky losses today and in the nearest future. That is, their activity in the market of banking services and their business reputation are protected by their own capital. The second cluster includes 26 banks, among them the largest assets belong to Joint-Stock Company "Raiffeisen Bank Aval", Joint-Stock Bank "UKRGAZBANK", Joint-Stock Company "UkrSibbank". The following averaged indicators are characteristic for these banks: the level of term clients' funds in liabilities is equal to 33.40%, the ratio of credit operations, classified according to the first category of quality, to their total amount is equal to 65.69%, and the coefficient of capital participation in the assets formation is equal to 22.52%. This group of banks has the smallest number of depositors to trust their long-term funds, as the first indicator in this bank is the lowest one. In view of this, the banks have a high-quality loan portfolio to form a positive business reputation (X_2 has a maximum value of almost 65% of loans classified under the 1st category of quality). The banks of this cluster need to increase their trust in themselves and strengthen their positive business reputation on the basis of managerial, marketing, organizational measures in order to increase the sustainability of attracted resources (term deposits), as well as to increase their capital, since the last indicator of the ratio of capital to the assets is rather low in comparison with the banks of the other clusters.

The third cluster includes 41 banks, among which the largest banks according to the assets amount are Public Joint-Stock Company "Commercial Bank "PRIVATBANK", Joint-Stock Company "OSHCHADBANK", Joint-Stock Company "Ukreximbank", Public Joint-Stock Company

"SBERBANK", etc. The following averaged indicators are typical for such banking institutions: the level of term clients' funds in liabilities is equal to 45.77%, the ratio of credit operations, classified according to the first category of quality, to their total amount is equal to 22.65%, and the coefficient of capital participation in the assets formation is equal to 19.43%. The analysis of the obtained results allows us to make a conclusion that the depositors trust the banks of this cluster more than others, but this is the result of a positive business reputation gained for a long period of their operation, while the indicators, characterizing the modern low-quality loan portfolio, as well as the least degree of protection by own capital against the possible losses caused by various types of bank risks, show an accumulation of reputational risk. Therefore, the banks of this cluster need to improve the quality of their loan portfolio, to negotiate with borrowers for repayment of bad debts, and to approach more closely the indicative assessment of potential borrowers.

Conclusion. The development of communication and information technologies promotes the need for constant adaptation of banks to the modern conditions of functioning of the economy by improving risk management processes. In recent years, the risk of the bank business reputation occurred to be undervalued, unregulated and least studied among the existing banking risks. The research performed confirms the hypothesis that the level of the bank's protection of borrowed financial resources with the capital determines and protects the business reputation of the bank in the market and creates conditions for minimizing the reputational risk. The quality management of this risk allows forming the society's positive beliefs and trust in the bank, which is a prerequisite for its competitiveness, financial stability and sustainable development in modern conditions.

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