Bank investment attractiveness and the methodology for its assessment at mergers and acquisitions

Yaremenko, Nataliia

Ukrainian Academy Of Banking Of The National Bank Of Ukraine

2014

Nataliia S. Yaremenko[1]

BANK INVESTMENT ATTRACTIVENESS AND THE METHODOLOGY FOR ITS ASSESSMENT AT MERGERS AND ACQUISITIONS

The article provides a rationale for carrying out the analysis of investment attractiveness of a bank at choosing a target bank for merger or acquisition. The author's own methodology is suggested for bank investment attractiveness assessment which enables a well-grounded bank choice for such a type of agreement considering its comparable investment attractiveness.

Keywords: *mergers and acquisitions; investment attractiveness; Harrington's desirability function; integral index.*

Наталія С. Яременко

ІНВЕСТИЦІЙНА ПРИВАБЛИВІСТЬ БАНКУ ТА МЕТОДИКА ЇЇ ОЦІНЮВАННЯ ПРИ ЗЛИТТІ ЧИ ПОГЛИНАННІ

У статті обґрунтовано доцільність проведення аналізу інвестиційної привабливості банку при виборі банку-цілі угоди злиття чи поглинання. Запропоновано власну методику оцінювання інвестиційної привабливості банку, яка дозволить зробити обґрунтований вибір банку-цілі угоди та врахувати порівняльну інвестиційну привабливість банку при оцінюванні його вартості.

Ключові слова: *злиття та поглинання; інвестиційна привабливість; функція бажаності Харрінгтона; інтегральний показник.*

Форм. 17. Табл. 3. Рис. 1. Літ. 14.

Наталия С. Яременко

ИНВЕСТИЦИОННАЯ ПРИВЛЕКАТЕЛЬНОСТЬ БАНКА И МЕТОДИКА ЕЕ ОЦЕНКИ ПРИ СЛИЯНИИ И ПОГЛОЩЕНИИ

В статье обоснована целесообразность проведения анализа инвестиционной привлекательности банка при выборе банка-цели сделки слияния или поглощения. Предложена собственная методика оценки инвестиционной привлекательности банка, которая позволит сделать обоснованный выбор банка-цели соглашения и учесть сравнительную инвестиционную привлекательность банка при оценке его стоимости.

Ключевые слова: *слияния и поглощения; инвестиционная привлекательность; функция желательности Харрингтона; интегральный показатель.*

Problem statement. The efficiency of integration processes is determined by such factors as the level of reasoning while selecting an object for merger or acquisition, the identification of opportunities for achieving a synergy effect from merger, the determination of proper price for such a contract and the quality of preparation of such an integration process. Each of these factors plays its own role in a particular moment of the integration life cycle, shaping the results and efficiency of M&A agreement.

Maximum efficiency in the process of merger and acquisition can be achieved under the conditions of selecting a proper object for M&A agreement and determining the right conditions under such an agreement. The process of integration must correspond to situational requirements, and each stage of integration must be planned in detail (Balyant, 2009).

Object selection for such an agreement is the first stage in the process of merger and acquisition, and an error at this stage already could ruin all further activities.

[1] Ukrainian Academy of Banking of the National Bank of Ukraine, Sumy, Ukraine.

Potential buyer first has to determine the features of a bank to purchase, then to create a list of potential bank candidates which satisfy these criteria.

Latest research and publications analysis. As it is stated by N.B. Rudyk, criteria in selecting an integration partner can be presented as a set of limitation on size, geographical location, financial parameters etc (Rudyk, 2000). At this, all information on all potential M&A partners should be summarized in a way to be further comparable.

S. Reed and A. Lajoux (2007) also indicate that the process of merger and acquisition should be targeted at those industries and companies which would provide an opportunity to use the strong features of an agreement initiator and at the same time strengthen the weak sides. Potential buyer should have a quantitative estimation of the alternatives in accordance with the strategic plan, and these alternatives must be ranged by desirability.

After analyzing the available studies on the issue we can state that the selection of a bank for M&A must be based on the analysis of its investment attractiveness, that is of its compliance with a particular investor's aims.

Unresolved issues. Most of the existing methodologies for investment attractiveness analysis have been developed for industrial enterprises, while in relation to banks this issue has yet been studied insufficiently.

The aim of this research is the development of a methodology for banks investment attractiveness estimation before M&A which would include a reasoned analysis and selection of a target bank for such an agreement.

Key research findings. The selection of bank-candidates for M&A based on the analysis of their investment attractiveness should be carried out in two stages:

- Analysis of limitations, exclusion of some banks and forming the short list of banks.
- Calcuting the integral index of banks' investment attractiveness from within the short list.

At the stage of forming the short list the buyer is excluding from the analysis those banks which are of no interest to him, even before carrying out a detailed research.

The second stage of selecting the target bank for M&A starts with the analysis of investment attractiveness from the viewpoint of a potential buyer.

Under bank investment attractiveness here we understand "the economic category, the essence of which depends primarily upon the financial condition of a particular credit institution, and also upon a range of internal and external factors" (Galiy, 2003).

Calculting the integral index first of all means the generalization of all the indicators related to a studied object (in our case this is bank investment attractiveness). At this, the integral indicator must meet the following requirements:

- be quantitative and preferably a single digit;
- be demonstrative as to the aim and the tasks of its construction;
- to include the maximum of its components and at the same time to squeeze the excessive information, contained in separate components of the integral indicator;
- to be invariable as to the measurement units of its components.

Analysis of bank's investment attractiveness aimed at selecting an object for M&A includes solving a range of tasks, logically structured in several stages (Figure 1).

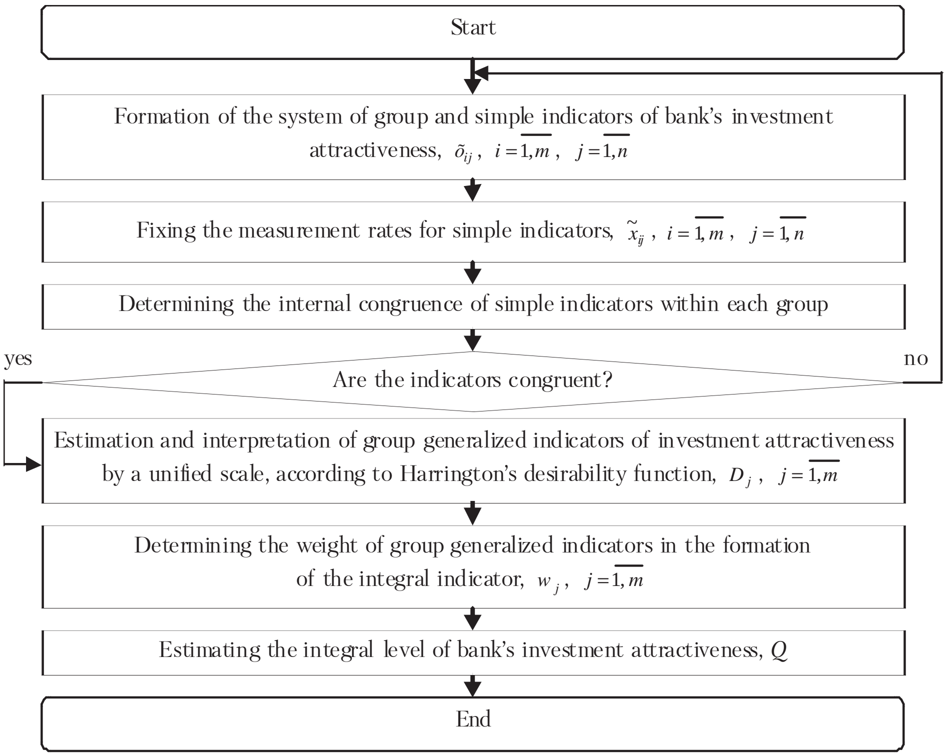

Figure 1. **Algorithm for calculating the integral indicator of bank's investment attractiveness,** *author's construction*

Bank's attractiveness for M&A is determined by a set of various factors, the list and the meaning of which can change depending on the aim's of a buyer. All factors of investment attractiveness can be considered within two large groups – the internal and external ones (Yaremenko, 2013a; Yaremenko, 2013b).

Formation of the indicators' system for the estimation of bank's investment attractiveness during M&A agreements should be carried out taking into account the following positions:

- Since Ukraine's banking system can be described as non-homogenous by banks' size, the system of indicators must be built on the basis of relative indicators to solve the problem with size.
- While estimating investment attractiveness, banks' reports can be used as information support data, taking only the open source data (since confidential information is seldom available to potential buyers).
- The optimal range of the selected indicators is from 6 to 25 (Pogostinskaya and Pogostinskiy, 1999). Their excessive quantity decrease the sensitivity of the integral indicator to changes, while their too low quantity causes errors in the results and in this case some influential factors might be mistakenly omitted.

The systematized set of the indicators that are to be taken into consideration while estimating the investment attractiveness of a bank for M&A is presented in Table 1.

Table 1. **Factors of external and internal influence on the investment attractiveness of a bank as an object for M&A, and their indicators,** *developed by the authors*

#	Groups of indicators	Indicators of investment attractiveness
Internal factors of bank's investment attractiveness		
1.	Capital suffieincy, D_1	Adequacy of regulative capital, x_1
		Ratio of regulative capital to total assets, x_2
		Ratio of regulative capital to liabilities, x_3
		Capital security, x_4
		Stock capitalization of earnings, x_5
		Capital multiplier, x_6
2.	Business activities, D_2	Ratio of borrowed and attracted funds, x_7
		Ratio of attracted deposits, x_8
		Ratio of individual deposits in liabilities, x_9
		Ratio of credit & investment portfolio in total assets, x_{10}
3.	Liquidity, D_3	General liquidity of bank's liabilities, x_{11}
		Liquidity balance between credits lended and deposits attracted, x_{12}
4.	Activities' efficiency, D_4	Return on assets, x_{13}
		Return on own capital, x_{14}
		Net interest margin, x_{15}
5.	Market coverage, D_5	Quantity of regions where bank is present, x_{16}
		General quantity of bank branches, x_{17}
External factors of bank's investment attractiveness		
6.	Investment attractiveness of state, D_6	Index of investment attractiveness by European Business Association, x_{18}
7.	Investment attractiveness of a region, D_7	Index of a region's investment attractiveness, x_{19}
		Indicators of banks presence density in a region, x_{20}

To compare the indicators we would need to unify the scales of measurement for all of them. After the unification of measurements the tolerance range should be from 0 to 1. This would increase the appropriateness of interpretation of these indicators and would enable the correct correlation. At this, 0 stands for the lowest (unsatisfactory) value of the indicator, and 1 stands for the highest (optimal) value. While performing the procedure of unification, it is worth keeping in mind that for information unidirectionality all the indicators should be divided into stimulators, destimulators and nominators. For stimulators, the optimal values are as high as possible; for destimulators – the lowest ones are optimal; and nominators are those indicators the values of which demonstrate the best quality of an object (Pogostinskiy and Pogostinskaya, 1999).

If an indicator is the stimulator, then its conversion for unification is performed by the formula:

$$\tilde{x}_{ij} = \frac{x_{ij} - x_{j\min}}{x_{j\max} - x_{j\min}}, \quad i = \overline{1,m},\ j = \overline{1,n}, \tag{1}$$

where n – the quantity of indicators; m – the quantity of the studied objects; x_{ij} – the value of j indicator for a particular studied object; $x_{j\min} = \min_i x_{ij}$; $x_{j\max} = \max_i x_{ij}$.

If an indicator is the destimulator, then its conversion for the unification is performed by the following formula:

$$\tilde{x}_{ij} = \frac{x_{j\max} - x_{ij}}{x_{j\max} - x_{j\min}}, \quad i = \overline{1,m},\ j = \overline{1,n}. \tag{2}$$

In the case when an indicator behaves likes a nominator, the transformation will look like:

if between $x_{j\min}$ and $x_{j\max}$ there exists an optimal point $x_{j\text{nom}}$:

$$\tilde{x}_{ij} = 1 - \frac{\left| x_{ij} - x_{j\,nom} \right|}{\max\left\{ \left(x_{j\max} - x_{j\,nom} \right) \left(x_{j\,nom} - x_{j\min} \right) \right\}}, \quad i = \overline{1,m},\ j = \overline{1,n}, \tag{3}$$

where $x_{j\text{nom}}$ is the boundary (nominating) point, where the best value is achieved by an indicator;

- if between $x_{j\min}$ and $x_{j\max}$ there is a certain interval $\left[x_{j\,nom}^{lower}; x_{j\,nom}^{upper} \right]$, where the best value is achieved by the indicator:

$$\tilde{x}_{ij} = \begin{cases} \dfrac{x_{ij} - x_{j\min}}{x_{j\,nom}^{lower} - x_{j\min}}, & x_{j\min} \le x_{ij} < x_{j\,nom}^{lower},\ x_{ij} = x_{j\max}, \\ 1, & x_{j\,nom}^{lower} \le x_{ij} < x_{j\,nom}^{upper}, \\ \dfrac{x_{j\max} - x_{ij}}{x_{j\max} - x_{j\,nom}^{upper}}, & x_{j\,nom}^{upper} \le x_{ij} < x_{j\max}, \\ 0, & x_{ij} = x_{j\min}. \end{cases} \tag{4}$$

To check for the homogeneity of the chosen single indicators within each group we need to analyze the correlation between them. For this we suggest using the Cronbach's alpha method which clearly shows the internal consistency between the features of the same object. The formula by which we can find the Cronbach's alpha is the following (Cronbach, 1951):

$$\alpha = \frac{n \times \overline{R}}{1 + (n-1) \times \overline{R}}, \tag{5}$$

where n – the quantity of components in the subindex; $\overline{R}$ – the average correlation of the values.

The Cronbach's alpha takes the values within the range between 0 and 1. High value of alpha means that the selected variables characterize the object properly; the acceptable level of alpha is usually α = 0.7 (Table 2).

Table 2. **The scale of values of the Cronbach's alpha** (Nunally, 1978)

Cronbach's alpha	The level of internal consistency
$\alpha \ge 0.9$	perfect
$0.8 \le \alpha < 0.9$	good
$0.7 \le \alpha < 0.8$	acceptable
$0.6 \le \alpha < 0.7$	partially acceptable
$0.5 \le \alpha < 0.6$	low
$\alpha < 0.5$	unacceptable

After calculating the alphas certain changes in the set of indicators is possible, as needed for forming the generalized indicators.

After determining the set of generalized indicators which describe the investment attractiveness of a bank and are consistent with each other, the next stage is to determine the generalized indicator of each determined group.

For constructing the groups' generalized indicators of bank's investment attractiveness we choose the generalized function of desirability by J. Harrington (1965):

$$D_j = \sqrt[n]{\prod_{i=1}^{n} d_i}, \ j = \overline{1,m}, \tag{6}$$

where D_j – the generalized desirability for a group of indicators; m – quantity of factors' groups; d_i – partial desirability; n – quantity of indicators to evaluate the condition of a research subject;

$$d_i = \exp(-\exp(-\tilde{x}_i)), \tag{7}$$

where $\tilde{x}_i$ is the indicator in its unmeasurable shape.

The generalized function of Harrington can be treated as quantitative and universal indicator of the object under study, and if to add to that such its features as adequacy, efficiency and statistical sensitivity, it becomes obvious that it can be used as an optimization criteria (Adler, 1976).

Table 3. **Verbal-numerical scale of J. Harrington (1965)**

Verbal evaluation	Value brackets in the desirability function
Very good	1.00–0.80
Good	0.80–0.63
Satisfactory	0.63–0.37
Bad	0.37–0.20
Very bad	0.20–0.00

To calculate the integral indicator of bank's investment attractiveness we use the generalized desirability function of Harrington. However, in this case there might be a problem with objectivity of the value obtained related to the calculations method. The formula (6) as suggested by J. Harrington, contain a significant drawback: in it all partial desirabilities are treated as equal, however, this is not always the case with generalized indicators.

This drawback in using the Harrington's function in calculating the integral indicator as the geometric mean for particular desirabilities of the group indicators is of vital importance since it impacts the veracity of the output information further used in managerial decision-making. Therefore, while forming the group indicators it is necessary to take into account the level of importance (value) for each factor for an investor.

In order to take into account the value (importance) of each indicator (group of indicators) while integrating them into the cumulative indicator of bank's investment attractiveness we suggest to correct the formula (6) by adding the weight ratio into it. After this the formula for calculating the integral indicator will look like this:

$$Q = Q(D;w) = \sqrt[\sum_{j=1}^{m} w_j]{\prod_{j=1}^{m} D_j^{w_j}}, \tag{8}$$

where w_j – the weight ration of an indicator.

To calculate the integral indicator of bank's investment attractiveness we use the corrected function of Harrington (8), in which $D = (D_1, ..., D_m)$ is the vector of generalized group indicators of investment attractiveness. And here we face the serious problem of determining the exact numerical values of the weight ratios $w_1, \ldots, w_m$, $w_j \geq 0$, $w_1 + \ldots + w_m = 1$.

A researcher usually obtains some volume of information I on weight ratios which determine the generalized group indicators of bank's activities, therefore, it is expedient to use the results of modelling the uncertainty of choice on a particular vector from the set $W(I)$ of all possible vectors of weight ratios by means of randomization of this choice $\tilde{w}(I) = (\tilde{w}_1(I), \ldots, \tilde{w}_m(I))$ (Khovanov, 1996).

Having the randomized values of the weight ratios we can obtain the estimates $\bar{w}_j(I) = M\tilde{w}_j(I)$, $j = 1, \ldots, m$ of this weight ratios, thus obtaining the numerical image $\bar{w}(I) = (\bar{w}_1(I), \ldots, \bar{w}_m(I))$ of the non-numerical, inaccurate and not full information I. The accuracy of the obtained numerical estimates for the weight ratios can be measured by means of standard deviation $\bar{s}_j(I) = \sqrt{D\tilde{w}_j(I)}$, $j = 1, \ldots, m$ of random values $\tilde{w}_1, \ldots, \tilde{w}_m$ (Vishnyakov, 2001).

Let us consider the case when a researcher does not have information on the comparable weight of the group indicators for bank's activities $(I = \varnothing)$. Let us assume that a random vector of weight ratios $\tilde{w}_1, \ldots, \tilde{w}_m$ is distributed on a discrete set $w(n)$ of all such vectors, the components of which are measured with the step $h = 1 / n$:

$$w_j \in w(n) = \left\{0, \frac{1}{n}, \frac{2}{n}, \ldots, \frac{1}{n}, \ldots, \frac{n-2}{n}, \frac{n-1}{n}, 1\right\}. \qquad (9)$$

Then the set of all possible weight ratios will be:

$$W(m,n) = \left\{w^{(t)} = \left(w_1^{(t)}, \ldots, w_m^{(t)}\right) w_j^{(t)} \in w(n), w_1^{(t)} + \ldots + w_m^{(t)} = 1, t \in T(m,n)\right\}, \qquad (10)$$

where $T(m,n) = \{1, \ldots, N(m,n)\}$ is the set of all possible values of the index t, containing $N(m,n)$ elements:

$$N(m,n) = \binom{n+m-1}{n} = \binom{n+m-1}{m-1} = \frac{(n+m-1)!}{n!(m-1)!}. \qquad (11)$$

The described sitation is the case when there is no information of the comparable value of certain groups of indicators of bank's activity. However, under real conditions within any real research there is always some additional information I about the weight ratios $w_1, \ldots, w_m$. As a rule, it is not of numerical character, and can be presented in the form of equalities and inequalities, so it is ordinal (serial) information. Besides this ordinal information, a researcher may also have available some fuzzy information on certain weight ratios within the ranges, that is some interval information. Also, there might be some partial information on the weight ratios $w_1, \ldots, w_m$, and this information cannot be treated either as ordinal, or interval.

$$W(m,n,I) = \left\{w^{(t)} = \left(w_1^{(t)}, \ldots, w_m^{(t)}\right): w^{(t)} \in W(m,n), t \in T(m,n,I)\right\}, \qquad (12)$$

where $T(m,n,I) = \{1, \ldots, N(m,n,I)\}$, that is the set $T(m,n,I)$ consists of the numbered possible values of t.

The set of all possible values of the weight ratios with consideration of all existing information $W(m,n,I)$ is the subset of all possible weight ratios $W(m,n)$. If $I = \varnothing$, then $W(m,n,I) = W(m,n)$, opposite to that – $W(m,n,I) \subset W(m,n)$ and $N(m,n,I) < N(m,n)$ (Vishnyakov, 2001).

As a result of randomization while selecting the vector of the weight ratios within the set $W(m,n,I)$ we get the randomized vector of weight ratios $\tilde{w}(I)=(\tilde{w}_1(I),\ldots,\tilde{w}_m(I))$ which is a discrete value, equally distributed on the given set.

Then the distribution mean is $\bar{w}_j(I)=M\tilde{w}_j(I)$ and the standard deviation is $\bar{s}_j(I)=\sqrt{D\tilde{w}_j(I)}$ (where $D\tilde{w}_j(I)$ is the dispersion of the random value $\tilde{w}_j(I)$ of the j-the randomized value ratio):

$$\bar{w}_j(I)=M\tilde{w}_j(I)=\frac{1}{N(m,n,I)}\sum_{t=1}^{N(m,n,I)} w_j^{(t)}; \quad (13)$$

$$\bar{s}_j(I)=\sqrt{D\tilde{w}_j(I)}=\sqrt{\frac{1}{N(m,n,I)}\sum_{t=1}^{N(m,n,I)}\left(w_j^{(t)}-\bar{w}_j(I)\right)^2}. \quad (14)$$

Placing into the Harrington function $Q_+(D;w)$ a vector of weight ratios $w^{(j)}=\left(w_1^{(t)},\ldots,w_m^{(t)}\right)$ from the set of the allowed vectors of the weight ratios $W(m,n,I)$, we get for the estimated object the following values of the integral indicator:

$$Q^{(t)}=Q_+^{(t)}(D;I)=Q_+\left(D;w^{(t)};I\right)=\sqrt[\sum_{j=1}^{m} w_j^{(t)}]{\prod_{j=1}^{m} D_j^{w_j^{(t)}}}. \quad (15)$$

As an integral indicator of bank's investment attractiveness we take the mathematical mean:

$$\bar{Q}_+(I)=M\tilde{Q}_+(I)=MQ_+\left(D;\tilde{w}(I)\right)=\frac{1}{N(m,n,I)}\sum_{t=1}^{N(m,n,I)} Q_+^{(t)}(D) \quad (16)$$

of the randomized integral indicator $\tilde{Q}_+(I)=Q_+\left(D;\tilde{w}(I)\right)$. As an accuracy measure for this indicator we use the standard deviation $S(I)=\sqrt{D\tilde{Q}_+(I)}$, calculated by the formula

$$S(I)=\sqrt{D\tilde{Q}_+(I)}=\sqrt{\frac{1}{N(m,n,I)}\sum_{t=1}^{N(m,n,I)}\left(Q_+^{(t)}(D)-\bar{Q}_+(I)\right)^2}. \quad (17)$$

Application of the randomization method for the selection of weight ratios enables taking into account all additional, non-numerical, partial or uncertain information on the comparable weight of the generalized group indicators.

Conclusions and prospects for further research. In this study we suggest to ground the choice of a bank for M&A on the estimation of its investment attractiveness, that is on how a particular bank matches the goals of a particular investor. A method of bank's investment attractiveness estimation for merger or acquisition is offered, it would enable the well-grounded choice of a bank, presenting its comparative investment attractiveness for its further value estimation.

Further research in this direction may include testing this method on real data for bank's investment attractiveness estimation for M&A agreements.

Адлер Ю.П., Маркова Е.В. Планирование эксперимента при поиске оптимальных решений. – М.: Наука, 1976. – 279 с.

Балянт Г.Р. Ефективність злиття і поглинань банків // Вісник Хмельницького національного університету.– 2009.– №2, Т. 1. – С. 7–9.

Вишняков И.В. Система методов оценки коммерческих банков на базе обязательных нормативов Центрального банка РФ // Экономическая наука современной России.– 2001.– №2. – С. 57–73.

Галий Е.А. Анализ надежности и инвестиционной привлекательности коммерческого банка: Автореф. дис... канд. экон. наук: спец. 08.00.05 «Экономика и управление народным хозяйством (управление инновациями и инвестиционной деятельностью)». — СПб., 2003. — 20 с.

Григорук П.М., Ткаченко І.С. Методи побудови інтегрального показника // Бізнес Інформ.— 2012.— №4. — С. 34—38.

Погостинская Н.Н., Погостинский Ю.А. Системный анализ финансовой отчетности. — СПб.: Издательство Маслова В.А., 1999. — 96 с.

Рид С.Ф., Лажу А.Р. Искусство слияний и поглощений / Пер. с англ. — 3-е изд. — М.: Альпина Бизнес Букс, 2007. — 957 с.

Рудык Н.Б. Рынок корпоративного контроля: перспективы развития в РФ // Финансист.— 2000.— №11. — С. 15—17.

Хованов Н.В. Анализ и синтез показателей при информационном дефиците. — СПб.: Санкт-Петербургский университет, 1996. — 196 с.

Яременко Н.С. Ідентифікація зовнішніх факторів інвестиційної привабливості банку з метою прийняття рішення про злиття чи поглинання // Проблеми і перспективи розвитку банківської системи України: Збірник тез доповідей XVI Всеукраїнської науково-практичної конференції (24—25 жовтня 2013 р.): В 2 т. — Суми: УАБС НБУ, 2013. — Т. 2. — С. 149—151.

Cronbach, L.J. (1951). Coefficient alpha and internal structure of tests. Psychometrika, 16(3): 297—334.

Harrington, J. (1965). The desirability function. Industrial Quality Control, 21: 494—498.

Nunnally, J.C. (1978) Psychometric theory. New York: McGraw Hill. 701 p.

Yaremenko, N.S. (2013b). Formation of the System of Internal Factors of Investment Attractiveness of the Bank as an Object of M&A. Economics & Management: Proceedings of the 3rd International Conference of Young Scientists EM-2013. Lviv Polytechnic Publishing House. Pp. 66—69.

Стаття надійшла до редакції 29.04.2014.