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MULTICRITERIA EVALUATION OF LITHUANIAN BANKS FROM THE PERSPECTIVE OF THEIR RELIABILITY FOR CLIENTS

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Abstract. In recent years, efforts have been made to rank banks according to their reliability. However, the methods used for this purpose are not accurate. The analysis shows that reliability of banks is a complex phenomenon which can only be described by a set of criteria. The task is complicated by the fact that the criteria used have various dimensions as well as being oppositely directed. To solve the above problems, multicriteria evaluation methods, allowing the values of all the criteria of different dimensions and changeability to be integrated into a single generalized quantity, may be used.

Keywords: bank reliability, multicriteria evaluation methods.

1. Introduction

About half a year ago, Lithuanian banks were ranked according to their reliability (Kučinskaitė, Putelytė 2007). The first attempt to do it was made three years ago (Putelytė 2004). These investigations differed in the number of the evaluation criteria used. In the first case, three main criteria (the most favourable terms of crediting the purchase of the property and availability of relevant information on the bank's website or over the telephone) were used. The second investigation was more exhaustive because it involved much more criteria significant for the clients.

The present investigation aimed at ranking Lithuanian banks is based on some particular methods. All the criteria are scored a particular number of points, depending on their significance. Less important criteria are given 5 points, while more important get 10 points. The total rank is obtained by integrating the points obtained from a particular bank (see Table 1).

In making the present investigation, valuable and comprehensive information about the performance of Lithuanian banks has been collected, allowing the authors to solve the problem of banks' ranking by applying advanced mathematical methods (Hwang, Yoon 1981; Figueira *et al*. 2005; Ustinovichius *et al.* 2007). The object of investigation – establishing of the banks' ranks, is a complex process which can be analysed only by investigating and evaluating the criteria describing their various facets. The problem is complicated by the fact that these criteria may have various dimensions and their values may change in opposite directions, implying that, in one case, a better situation may be indicated by the increase of some of the criteria values, while, in the other case, it is shown by the decrease of the criteria values. This makes the integration of these values into a single generalizing quantity much more difficult.

To solve the above problems, multicriteria evaluation methods, allowing us not only to reduce these multidimensional criteria to a common denominator but also to determine their significances with respect to the object considered, may be successfully used.

The present paper aims to perform multicriteria evaluation of reliability of Lithuanian banks and to compare

Table 1. The results obtained in ranking Lithuanian banks (Kučinskaitė, Putelytė 2007)

No.	Name of the bank	The number of departments for servicing private bank clients	Time spent by journalists awaiting their turn to be attended to (min.)	The number of ATMs	Private clients (thous.)	Clients of Internet banking (thous.)	The number of debit and credit cards given to clients (thous.)	One year fixed deposit (Lt) interest rate (%)	Mean margin of profitability (%)	The cost of preparing property loan package (Lt)	The cost of changing contract terms (Lt)	Possibility to postpone loan repayment in case of financial problems (years)	Commission charges on payment (e.g. of taxes) in cash (Lt)	Web page (are the data provided clear, and informative?)	Rating of longterm debts (determined by international agencies)	Net profit (losses) (2007, II quarter, thous. Lt)	Total points
1.	DnB NORD	78	16	150	500	220	302	5	0.7	350–450	350–450	2	4	excellent	A	51 361	70
2.	Snoras	245	8	327	241	833	706	5.5	0.8	100–300	200	2	2	very good	BB–	32 526	69
3.	SEB Vilniaus bankas	71	37	274	1059	704	1213	4.7	0.85	from 300	300	3	3	very good	A	220 366	68
4.	Hansa-bankas	128	20	370	1015	833	1278	4.15	0.8	from 200	from 125	2	3	poor	Aa2	144 026	65
5.	Ūkio Bankas	52	4	28	89	44*	66	6	0*	from 200	200	2 months	2	average	BB	50 017	60
6.	Sampo	17	9	57	65	60	73	4.65	0.7	300	200	1	4	excellent	A1/P–1	15 607	58
7.	Šiaulių bankas	50	2	11	104	20.8	42	5.55	1.55*	100	150	1	2.5	average	Ba2	20 541	57
8.	Parex	28	15	61	40	21.7	28	5.51	0.8	from 200	200	3	2	good	BB+	–1 241	56
9.	Nordea	12	0	45	66.3	63	67	5.6	0.9	from 300	250	0.25*	not established	satisfactory	AA–	9 846	42
10.	Medicinos bankas	45	0	0	15.4	0*	0	6.5	3.14*	from 200	200	1	4	average	B+*	3 028	41

* additional data obtained by the authors

the results obtained with the data provided in the earlier performed ranking (Kučinskaitė, Putelytė 2007). This is relevant because the literature on the problem of evaluating banks' performance deals only with some specific aspects of this process (Jasienė, Čapskas 2008). It should be noted that the analysis was made in November 2007, and it is evident that the values of some criteria have changed since that time. Therefore, now, the ranks of the banks may be also slightly different. However, the goal of the paper is to offer methodology for evaluating banks' reliability which could be used for making calculations based on scientifically grounded methods, when required.

2. The criteria describing the reliability of Lithuanian banks

In the present research, multicriteria evaluation of Lithuanian banks is based on the data provided in the previous investigation (see Table 1). Some data, however, were missing. For example, no information was given about the number of e-banking clients (in "Ūkio bankas" and "Medicinos bankas") and the mean margin of property loan interest (in "Ūkio bankas", "Šiaulių bankas", "Medicinos bankas") and about a possibility to postpone loan repayment in case of financial problems (in "Nordea" bank), as well as the rating of long-term debts determined by international agencies (in "Medicinos bankas"). These additional data were obtained by the authors who either called to the respective banks or spoke to bank employees to get the information. As shown in Table 1, the criteria have various dimensions, e.g. units, minutes, litas, percent, etc. Some of the criteria are maximizing, while others are minimizing. It implies that, in the first case, the situation is better, when the criteria values are increasing, while, in the second case, the situation is better, when the criteria values are decreasing (e.g. for the time of awaiting one's turn to be attended to). Moreover, some criteria have no numerical expression (e.g. rating of long-term debts, quality of the bank's website, etc.). Therefore, all the criteria were revised and their values were transformed to make them suitable for further calculation.

3. Description of the criteria

Criterion 1 is the number of departments for servicing individual clients. This is a maximizing criterion, implying that the more departments there are, the better the situation is. The availability of departments for servicing individual clients is very important for people living far from the regional centres because they can get bank services without going to these centres.

Criterion 2 is the time of awaiting one's turn to be attended to. The shorter the time, the better. Therefore, this criterion is minimizing, implying that the smaller the value of this criterion, the better the quality of servicing and the situation in the bank in this respect.

In many cases of multicriteria evaluation, the minimum criterion value cannot be equal to zero.

The values may be converted to positive values by the formula (Ginevičius, Podvezko 2007a):

$$r'_{ij} = r_{ij} + 1, \qquad (1)$$

where: r_{ij} is the value of i-th criterion; r'_{ij} is rearranged i-th criterion value for j-th object.

In using some multicriteria evaluation methods, minimizing criteria should be transformed to maximizing ones. This may be made by the formula (Hwang, Yoon 1981; Ginevičius 2008; Ginevičius, Podvezko 2007a):

$$\tilde{r}_{ij} = \frac{\min\limits_{j} r_{ij}}{r_{ij}}, \qquad (2)$$

where: $\tilde{r}_{ij}$ is maximized i-th criterion value; $\min\limits_{j} r_{ij}$ is the smallest i-th criterion value ($\min\limits_{j} r_{ij} > 0$).

Criterion 3 is the number of ATMs (Automated Teller Machines) of the bank. Some banks have no ATMs. For this reason, they make agreements with other banks, and their clients can use ATMs of these banks to get cash. However, since they are not their clients, this operation is more expensive for them. Taking into account the fact that the banks not possessing ATMs still have the opportunity to encash their money, these banks were not excluded from calculations based on this criterion.

Criterion 4 is the number of individual clients. This criterion is maximizing and does not need to be transformed.

Criterion 5 is the number of bank clients in the Internet. This is also a maximizing criterion.

Criterion 6 is the number of credit and debit cards distributed by a bank to its clients. The criterion is better, when more cards are given to the clients, therefore, it should not be transformed either. However, some banks have not issued any credit and debit cards. In this case, zero criterion value was given to them.

Criterion 7 is the interest rate for one-year deposit. This criterion is of special importance in the time of growing inflation, when the offered interest rate should be such as to protect the client's money from depreciation. This criterion is also maximizing.

Criterion 8 is the mean margin of property loan interest. When the economic and financial state is worsening, banks, usually, do not try to attract more clients for getting property loans because it is more difficult to foresee how many of the clients could become insolvent. Though the situation is unfavourable, the clients are still interested in getting loans at the lowest interest rate. Therefore, this criterion is minimizing. Its value should be maximized, i.e. transformed by the formula (2). Zero values of the criterion remain unchanged.

Criterion 9 defines the cost of preparing property loan package. The smaller the cost, the better, therefore, this criterion is minimizing. Banks have different approaches to determining this cost. Some of them give the true cost, while others define only the lower limit. This may be considered a drawback and a sort of trick. Taking into account this situation, the data presented in the journal "Veidas" were rearranged as follows: the true cost remained unchanged, while in the case, when the lower and upper limits were given, the upper limit was taken. In this case, when only the lower limit was indicated, the upper limit, the highest for all banks, was taken for calculations. The data were transformed by using the formula (2).

Criterion 10 is the cost of changing the contract terms. The situation in this case is similar to that of the criterion 9, therefore, the same operations were made with the values of this criterion.

Criterion 11 shows the possibility to postpone repayment of the loan if the client was faced with financial problems. The longer the time of repayment, the better the situation. Therefore, this criterion is maximizing.

Criterion 12 denotes the charges on payments (e.g. taxes, etc.) in cash. The smaller the charges, the better the situation. Therefore, this criterion is minimizing. Quantitative evaluation of this criterion is complicated because some banks refuse to accept tax payments in cash. Considering this as a drawback, zero value was given to this criterion of the above banks. Other values were converted to maximizing by the formula (2). Zero values of the criterion remained unchanged.

Criterion 13 describes the quality of the bank's website. In the survey presented in the journal 'Veidas' only qualitative description of this criterion is provided, e.g. excellent, good, satisfactory, etc. In quantitative evaluation of the banks and their ranking, these estimates should be converted into the numerical ones. This was made in the following way (see Table 2):

Table 2. Quantitative evaluation of the quality of banks' websites

Qualitative evaluation of bank's website	Excellent	Very good	Good	Average	Satisfactory	Unsatisfactory
Quantitative evaluation of bank's website	6	5	4	3	2	1

The higher the quality of the site, the higher the estimate. Therefore, this criterion is maximizing.

Criterion 14 presents the rating of long-term debts determined by international agencies, such as "Moody's", "Fitch Ratings", "Standard&Poor". In general, it shows bank's capability to respond to liabilities when the number of insolvent clients has grown. Long-term debts are indicated by the levels denoted by the respective symbols (Table 3).

The higher the estimate, the larger its numerical value, therefore, this criterion is also maximizing.

The results obtained in ranking Lithuanian banks are presented in Table 1. To use these data as a set of criteria describing bank reliability, they should be expressed quantitatively. To achieve this, the lowest rank should be assigned the smallest number of points, while the highest value should be given the largest point number.

Criterion 15 is net bank profit (loss) in the second quarter of 2007. To find a quantitative expression for this criterion was rather complicated because some banks were unprofitable. To keep these banks in the analysis (ranking), negative criteria values were made positive according to the formula (Ginevičius, Podvezko 2007a):

$$r_{ij}^{*} = \left| \min_{j} r_{ij} \right| + r_{ij} + 1, \qquad (3)$$

where: r^{*}_{ij} is rearranged net profit (losses) of i-th criterion for j-th object; $\min\limits_{j} r_{ij}$ is the smallest value of i-th criterion.

The higher the profit, the better the situation, therefore, this criterion is maximizing.

Rearranged values of all the criteria are given in Table 4.

Table 3. Evaluation of banks based on long-term debts according to international agencies' rating

Evaluation symbols used by international agencies			Symbol's meaning	The suggested scoring (points)
Moody's	S&P	Fitch Ratings		
Aaa	AAA	AAA	The highest level of safety	24
Aa1	AA+	AA+	High level of safety	23
Aa2	AA	AA		22
Aa3	AA–	AA–		21
A1	A+	A+	Higher investment rating	20
A2	A	A		19
A3	A–	A–		18
Baa1	BBB+	BBB+	Lower investment rating	17
Baa2	BBB	BBB		16
Baa3	BBB–	BBB–		15
Ba1	BB+	BB+	Non-investment (speculation) rating	14
Ba2	BB	BB		13
Ba3	BB–	BB–		12
B1	B+	B+	High speculation rating	11
B2	B	B		10
B3	B–	B–		9
Caa1	CCC+	CCC	Poor state	8
Caa2	CCC	–		7
Caa3	CCC–	–		6
Ca	CC	CC	Particularly high speculation rating	5
C	C	C	Potential failure to meet liabilities	4
–	–	DDD	Failure to meet liabilities	3
–	–	DD		2
–	D	D		1

Table 4. Rearranged data on the commercial banks of Lithuania for 2007

Criterion No.	Type of criterion	Banks									
		1	2	3	4	5	6	7	8	9	10
1	+*	78	245	71	128	52	17	50	20	12	45
2	–**	17	9	38	21	5	10	3	16	1	1
3	+	150	327	274	370	28	57	11	61	45	0
4	+	500	241	1059	1015	89	65	104	40	66.3	15.4
5	+	220	833	704	833	44	60	20.8	21.7	63	4
6	+	302	706	1213	1278	66	73	42	28	67	0
7	+	5.0	5.5	4.7	4.15	6.0	4.65	5.55	5.51	5.6	6.5
8	+	1	0.875	0.8235	0.875	0	1	0.4516	0.875	0.778	0.113
9	–	450	300	450	450	450	300	100	450	450	450
10	–	450	200	300	450	200	200	150	200	250	200
11	+	2	2	3	2	0.17	1	1	3	0.25	1
12	+	0.5	1	0.6667	0.6667	1	0.5	0.8	1	0	0.5
13	+	6	5	5	1	3	6	3	4	2	3
14	+	19	12	19	22	13	20	13	14	21	9
15	+	52603	33768	221608	145268	51258	16849	21783	1	11088	4270

* maximizing criterion
** minimizing criterion

4. Multicriteria methods used for determining the reliability of banks

Multicriteria methods are based on two matrices: a matrix of the criteria describing the banks considered, statistical data or expert estimates $\mathbf{R} = \|r_{ij}\|$, and weight (significance) vector of the criteria $\Omega = \|\omega_i\|$ ($i = 1, \ldots, m$; $j = 1, \ldots, n$), where m is the number of criteria and n is the number of the objects (banks) compared. Multicriteria evaluation methods are used for ranking the banks according to their reliability.

The data on the commercial banks of Lithuania for 2007 (matrix **R**) are given in Table 4. The type of criteria (maximizing '+' or minimizing '–') is indicated in column 2.

In the present investigation, four multicriteria evaluation methods, such as *SR* (sum of ranks), *SAW* (Simple Additive Weighting), *TOPSIS* (Technique for Order Preference by Similarity to an Ideal Solution) and *COPRAS* (Complex Proportional Assessment) were used.

The criterion V_j of the *SR* method was calculated by the formula (Ginevičius, Podvezko 2004, 2006, 2008a):

$$V_j = \sum_{i=1}^{m} m_{ij}, \tag{4}$$

where: m_{ij} is i-th criterion rank for j-th object. The best value of the criterion V_j is the smallest value.

The main concept of quantitative multicriteria methods is clearly demonstrated by the method *SAW* (Hwang, Yoon 1981; Ginevičius, Podvezko 2008b; Ginevičius *et al.* 2006, 2008; Shevchenko *et al*. 2008). The criterion S_j of this method is the sum of the weighted criteria values:

$$S_j = \sum_{i=1}^{m} \omega_i \tilde{r}_{ij}, \tag{5}$$

where: ω_i is the weight of i-th criterion; $\tilde{r}_{ij}$ is normalized i-th criterion value for j-th object.

SAW is based on 'classical' normalization (Ginevičius, Podvezko 2007b):

$$\tilde{r}_{ij} = \frac{r_{ij}}{\sum_{j=1}^{n} r_{ij}} \tag{6}$$

$$(i = 1, \ldots, m;\ j = 1, \ldots, n;\ \sum_{j=1}^{n} \tilde{r}_{ij} = 1).$$

The data on the commercial banks of Lithuania for 2007 normalized by the method SAW are given in Table 5.

The best value of the criterion S_j is the largest value.

The method *TOPSIS* is based on vector normalization (Hwang, Yoon 1981; Opricovic, Tzeng 2004; Zavadskas *et al.* 2006):

$$\tilde{r}_{ij} = \frac{r_{ij}}{\sqrt{\sum_{j=1}^{n} r_{ij}^2}} \tag{7}$$

$$(i = 1, \ldots, m;\ j = 1, \ldots, n),$$

where $\tilde{r}_{ij}$ is normalized value of i-th criterion for j-th object.

Table 5. The data on the commercial banks of Lithuania for 2007 normalized by the method SAW

Criterion	Banks									
	1	2	3	4	5	6	7	8	9	10
1	0.1086	0.3412	0.0989	0.1783	0.0724	0.0237	0.0696	0.0279	0.0167	0.0627
2	0.0200	0.0378	0.0090	0.0162	0.0580	0.0340	0.1134	0.0213	0.3402	0.3402
3	0.1134	0.2472	0.2071	0.2797	0.0212	0.0431	0.0083	0.0461	0.0340	0.0000
4	0.1565	0.0754	0.3315	0.3177	0.0279	0.0203	0.0326	0.0125	0.0208	0.0048
5	0.0785	0.2971	0.2511	0.2971	0.0157	0.0214	0.0074	0.0077	0.0225	0.0014
6	0.0800	0.1870	0.3213	0.3385	0.0175	0.0193	0.0111	0.0074	0.0177	0.0000
7	0.0941	0.1035	0.0884	0.0781	0.1129	0.0875	0.1044	0.1036	0.1053	0.1223
8	0.1473	0.1288	0.1213	0.1288	0.0000	0.1473	0.0665	0.1288	0.1146	0.0166
9	0.0690	0.1034	0.0690	0.0690	0.0690	0.1034	0.3103	0.0690	0.0690	0.0690
10	0.0512	0.1151	0.0767	0.0512	0.1151	0.1151	0.1535	0.1151	0.0921	0.1151
11	0.1297	0.1297	0.1946	0.1297	0.0110	0.0649	0.0648	0.1946	0.0162	0.0649
12	0.0754	0.1508	0.1005	0.1005	0.1508	0.0754	0.1206	0.1508	0.0000	0.0754
13	0.1579	0.1316	0.1316	0.0263	0.0789	0.1579	0.0789	0.1053	0.0526	0.0789
14	0.1173	0.0741	0.1173	0.1358	0.0802	0.1235	0.0802	0.0864	0.1296	0.0556
15	0.0942	0.0605	0.3968	0.2601	0.0918	0.0302	0.0390	0.0000	0.0199	0.0076

The best variant (solution) V^* and the worst variant V^- are calculated by the formulas:

$$V^* = \{V_1^*, V_2^*, ..., V_m^*\} = \{(\max_j \omega_i \tilde{r}_{ij} / i \in I_1), (\min_j \omega_i \tilde{r}_{ij} / i \in I_2)\}, \quad (8)$$

$$V^- = \{V_1^-, V_2^-, ..., V_m^-\} = \{(\min_j \omega_i \tilde{r}_{ij} / i \in I_1), (\max_j \omega_i \tilde{r}_{ij} / i \in I_2)\}, \quad (9)$$

where: I_1 is a set of indices of maximized criteria, I_2 is a set of indices of minimized criteria.

The distance D_j^* of every considered variant to the ideal (best) solutions and its distance D_j^- to the worst solutions are calculated by the formulas:

$$D_j^* = \sqrt{\sum_{i=1}^{m} (\omega_i \tilde{r}_{ij} - V_i^*)^2}, \quad (10)$$

$$D_j^- = \sqrt{\sum_{i=1}^{m} (\omega_i \tilde{r}_{ij} - V_i^-)^2}. \quad (11)$$

The criterion C_j^* of the method *TOPSIS* is calculated by the formula:

$$C_j^* = \frac{D_j^-}{D_j^* + D_j^-} \ (j = 1, ..., n) \quad (12)$$

$$(0 \le C_j^* \le 1).$$

The largest value of the criterion C_j^* corresponds to the best variant.

The criterion Z_j of the method *COPRAS* is calculated by the formula (Kaklauskas *et al*. 2006, 2007; Zavadskas, Kaklauskas 2007; Zavadskas *et al.* 2007; Zavadskas, Antucheviciene 2007; Viteikiene, Zavadskas 2007):

$$Z_j = S_{+j} + \frac{S_{-\min} \sum_{j=1}^{n} S_{-j}}{S_{-j} \sum_{j=1}^{n} \frac{S_{-\min}}{S_{-j}}}, \quad (13)$$

where: $S_{+j} = \sum_{i=1}^{m} \omega_i \tilde{r}_{+ij}$ is the sum of the weighted values of maximizing criteria $\tilde{r}_{+ij}$, $S_{-j} = \sum_{i=1}^{m} \omega_i \tilde{r}_{-ij}$ is same for minimizing criteria (their minimum value $S_{-min} = \min_j S_{-j}$).

Calculating the values of the criterion Z_j, a method of normalization of the initial data based on the use of formula (6) was applied.

Below, basic components of multicriteria methods are discussed in detail.

5. Determining the criteria weights and the agreement of expert estimates

One of two components of multicriteria evaluation methods is represented by the values of the criteria weights (significances) ω_i.

The effect of particular criteria describing the investigated object on the result obtained differs to some extent, therefore, when using quantitative multicriteria evaluation methods, the criteria weights (significances) should be determined. The so-called subjective multicriteria evaluation is often used, when experts determine the criteria weights. However, objective estimates are also obtained (Ustinovičius, Zavadskas 2004; Ginevičius 2006; Zavadskas *et al.* 2006).

The expert evaluation method yields a matrix $C = ||c_{ik}||$ ($i = 1, ..., m$; $k = 1, ..., r$), where m is the number of the criteria considered, r is the number of experts. Experts can assess the criteria in various ways. Any scale of measurement may be used, e.g. units, percentage, fraction of unity, various scoring systems based on points, simple (0–1) pairwise comparison of criteria (Zavadskas, Kaklauskas 2007), as well as the scale of Saaty's analytical hierarchical process (AHP) (Saaty 1980, 2005; Ginevičius *et al*. 2008; Su *et al*. 2006), etc.

When the method of direct determination of the criteria weights is used, the sum of the weights elicited from each expert should be equal to unity (or 100 %). In this case, the weight of the i-th criterion ω_i is the mean value of all experts' estimates $\overline{c_i}$:

$$\omega_i = \overline{c_i} = \frac{\sum_{k=1}^{r} c_{ik}}{r}. \quad (14)$$

In the case of percentage, the obtained value is divided by 100.

In the present investigation, experts used a direct method of criteria evaluation, i.e. the sum of the estimates of any expert was equal to 100. The estimates of 15 criteria elicited from 9 experts are given in Table 6. In the last columns of the table, the sums of the estimates of each criterion elicited from all experts, as well as the criteria weights and ranks are provided.

We can see that expert estimates and approaches to criteria evaluation differ. It is hardly possible to determine if expert estimates are in agreement based on the data presented in Table 6. To use the calculated criteria weights ω_1 in multicriteria evaluation of banks, the level of agreement of experts' estimates should be determined. For this purpose, the concordance coefficient W (Kendall 1970; Podvezko 2007; Viteikienė 2006) is applied.

Table 6. Direct evaluation of the criteria weights (significances) by experts

Criteria	Experts									Total	Weight	Rank
	1	2	3	4	5	6	7	8	9			
1	10	10	7	3	9	5	5	12	5	66	0.0733	7
2	4	9	5	3	7	10	5	15	5	63	0.0700	8
3	7	8	5	10	6	5	5	7	5	58	0.0644	9
4	7	3	3	6	5	1	10	7	15	57	0.0633	10
5	7	3	10	12	10	10	10	5	10	77	0.0856	2-3
6	7	3	3	3	3	2	10	4	7	42	0.0467	13
7	2	10	10	10	6	10	8	13	5	74	0.0822	4-5
8	5	10	10	6	12	15	8	8	5	79	0.0878	1
9	2	7	5	6	4	7	1	3	2	37	0.0411	14
10	3	7	5	6	2	8	1	2	2	36	0.0400	15
11	1	8	5	6	8	9	1	2	7	47	0.0522	11
12	4	8	7	3	3	6	1	12	2	46	0.0511	12
13	8	7	5	12	14	5	13	6	7	77	0.0856	2-3
14	15	4	10	10	7	3	11	1	13	74	0.0822	4-5
15	18	3	10	4	4	4	11	3	10	67	0.0744	6
Total	100	100	100	100	100	100	100	100	100	100	1.00	–

The calculation of the concordance coefficient is based on ranking of the criteria. Ranking is a procedure, when the most important criterion is assigned the rank equal to one. The second most important criterion is given the rank 2, etc., while the criterion which is the last according to its importance is given the rank m, where m is the number of the criteria (objects). The equivalent criteria are assigned the same rank, i.e. an arithmetical mean of the respective ranks.

In fact, the level of the agreement of experts' estimates, i.e. the concordance coefficient, is determined by the criterion χ^2, rather than by the value W. A random value

$$\chi^2 = Wr(m - 1) \qquad (15)$$

is distributed according to χ^2 distribution with the degree of freedom $\nu = m - 1$, where m is the number of the objects compared and r is the number of experts (Kendall 1970). Based on the selected significance

Table 7. Ranking of experts' criteria

Criteria	Experts									Sum
	1	2	3	4	5	6	7	8	9	
1	3	2	6.5	13.5	4	10	10	3.5	10	62.5
2	10.5	4	10	13.5	6.5	3	10	1	10	68.5
3	6.5	6	10	4	8.5	10	10	6.5	10	71.5
4	6.5	13.5	14.5	8	10	15	5	6.5	1	80
5	6.5	13.5	3	1.5	3	3	5	9	3.5	48
6	6.5	13.5	14.5	13.5	13.5	14	5	10	6	96.5
7	13.5	2	3	4	8.5	3	7.5	2	10	53.5
8	9	2	3	8	2	1	7.5	5	10	47.5
9	13.5	9	10	8	11.5	7	13.5	11.5	14	98
10	12	9	10	8	15	6	13.5	13.5	14	101
11	15	6	10	8	5	5	13.5	13.5	6	82
12	10.5	6	6.5	13.5	13.5	8	13.5	3.5	14	89
13	4	9	10	1.5	1	10	1	8	6	50.5
14	2	11	3	4	6.5	13	2.5	15	2	59
15	1	13.5	3	11	11.5	12	2.5	11.5	3.5	69.5
Total	120	120	120	120	120	120	120	120	120	1080

level α (in practice, α is usually equal to 0.05 or 0.01), the critical value χ^2_{kr} is found in the table of χ^2 distribution with the degree of freedom $\nu = m - 1$. If the value of χ^2 calculated from the formula (15) is larger than χ^2_{kr}, then, it is assumed that experts' estimates are in agreement (Kendall 1970; Zavadskas, Kaklauskas 2007; Podvezko 2007; Turskis *et al*. 2006).

The data obtained by direct evaluation of the criteria weights by experts (Table 6) can be easily rearranged into the ranking table. The results of ranking are given in Table 7.

Concordance coefficient is $W = 0.213$, and the value of χ^2 calculated by formula (15), $\chi^2 = 26.82$, is larger than the critical value $\chi^2_{kr} = 23.685$, taken from the table of χ^2 distribution with the degree of freedom $\nu = 15 - 1 = 14$ and the significance level $\alpha = 0.05$. Therefore, the experts' estimates are in agreement. In Table 7, different criteria have the same ranks assigned by the experts. Such ranks are referred to as tied ranks. If tied ranks are taken into account (Kendall 1970; Podvezko 2006, 2007), the values of W and χ^2 will even be larger, accordingly increasing the agreement level of experts' estimates.

The calculated criteria weights ω_i, revised in the manner described above, may be used in multicriteria evaluation of banks.

6. Multicriteria evaluation of Lithuanian banks

The ranks assigned to Lithuanian banks based on particular criteria which were determined by formula (4) are presented in Table 8.

The data obtained in multicriteria evaluation of Lithuanian banks by using formulas (4)–(13) are given in Table 9.

Based on the data presented in Table 9, a few conclusions can be drawn. One can see that evaluation (ranking) results obtained by using multicriteria methods differ considerably from those reported in other investigations (Kučinskaitė, Putelytė 2007). The calculations made in the present work show that all banks ranked according to their reliability on the date indicated can be divided into three groupings. The first group includes SEB "Vilniaus bankas", "Hansabankas" and "Snoras". The second group includes the bank "DnB NORD" and the third group embraces all other banks of Lithuania.

Table 8. The ranks assigned to Lithuanian commercial banks according to their reliability in 2007

Criteria	Banks									
	1	2	3	4	5	6	7	8	9	10
	3	1	4	2	5	9	6	8	10	7
	8	5	10	9	4	6	3	7	1.5	1.5
	4	2	3	1	8	6	9	5	7	10
	3	4	1	2	6	8	5	9	7	10
	4	1.5	3	1.5	7	6	9	8	5	10
	4	3	2	1	7	5	8	9	6	10
	7	6	8	10	2	9	4	5	3	1
	1.5	4	6	4	10	1.5	8	4	7	9
	7	2.5	7	7	7	2.5	1	7	7	7
	9.5	4	8	9.5	4	4	1	4	7	4
	4	4	1.5	4	10	7	7	1.5	9	7
	8	2	5.5	5,5	2	8	4	2	10	8
	1.5	3.5	3.5	10	7	1.5	7	5	9	7
	4.5	9	4.5	1	7.5	3	7.5	6	2	10
	3	5	1	2	4	7	6	10	8	9
Sum of ranks	72	56.5	68	69.5	90.5	83.5	85.5	90.5	98.5	110.5
Rank	4	1	2	3	7-8	5	6	7-8	9	10

Table 9. The results obtained in comparing the reliability of Lithuanian commercial banks by multicriteria methods

Method		Banks									
		1	2	3	4	5	6	7	8	9	10
SR	Value	72	56.5	68	69.5	90.5	83.5	85.5	90.5	98.5	110.5
	Rank	4	1	2	3	7–8	5	6	7-8	9	10
SAW	Value	0.1034	0.1475	0.1682	0.1609	0.0605	0.0730	0.0759	0.0695	0.0740	0.0699
	Rank	4	3	1	2	10	7	5	9	6	8
TOPSIS	Value	0.451	0.619	0.610	0.641	0.333	0.377	0.348	0.345	0.344	0.317
	Rank	4	2	3	1	9	5	6	7	8	10
COPRAS	Value	0.1052	0.1512	0.1673	0.1622	0.0646	0.0763	0.0833	0.0708	0.0626	0.0563
	Rank	4	3	1	2	8	6	5	7	9	10
Sum of ranks		16	9	7	8	34.5	23	22	30,5	32	38
Total rank		4	3	1	2	9	6	5	7	8	10
Rank given by other methods		1	2	3	4	10	5	6	7	8	9

7. Conclusions

One of the most important factors influencing the economic development of any state is effective performance and reliability of the banks. The reliability of banks is a complex phenomenon, described by a set of criteria, which have various dimensions and may be oppositely directed. The problems of this kind may be solved by using multicriteria evaluation methods allowing the integration of different criteria into a single generalizing quantity.

To perform quantitative multicriteria evaluation, the values of all the criteria should be rearranged in such a way that they could be used in calculations. In some cases, zero criteria values should be converted to non-zero values, while, in other cases, negative values should be made positive or their quantitative expression should be changed to qualitative, etc.

For multicriteria evaluation the values of the criteria as well as the criteria weights should be known. The criteria weights are determined by experts. Therefore, the agreement of experts' estimates should be checked.

Multicriteria evaluation of Lithuanian banks performed in the present investigation shows that the results obtained differ considerably from the data reported by other researchers using simpler and less accurate methods.

The research made allows the authors to divide all Lithuanian banks into three groups according to their reliability at the period considered. The first group includes SEB "Vilniaus bankas", "Hansabankas" and "Snoras", while the second group includes the bank "DnB NORD", and the third group embraces all other banks of Lithuania.

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