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**Factors influencing a bank's competitive ability:
the case of Lithuania and Latvia**

JEL Classification: G21

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Abstract

Research background: A commercial bank's competitive ability is of great importance as it plays a vital role in ensuring a bank's success; hence, it is necessary to identify the factors that contribute to the development of competitive advantage of commercial banks and to shift competitive ability to a higher level. The competitiveness of banks is assessed from customers' perspective, highlighting the main factors that influence them in choosing a particular bank.

Purpose of the article: The paper aims to assess the determinants influencing bank's competitive ability from customers' perspective by indicating the level of their influence. The following objectives are set: to distinguish the determinants influencing commercial bank's

competitive ability, to prepare a methodology for the assessment of factors, to evaluate the importance of the factors using expert evaluation method based on fuzzy analytic hierarchy process.

Methods: A questionnaire was prepared for the experts in order to collect the data; fuzzy analytic hierarchy process was implemented for processing the data.

Findings & Value added: The research was conducted in Latvia and Lithuania at the beginning of 2017. The results showed that the most important factor for bank's competitive ability in both — Lithuania and Latvia — is customers' trust. Reliability of the bank (both in Latvia and Lithuania) and the privileges of loyal customers (only in Latvia) have gained experts' attention as well. The proposed model of bank's competitive ability allows to evaluate the level of bank's competitiveness effectively, which would help the bank to plan its activities successfully and attract new customers in order to take the leading position in the market.

Introduction

Scientists analysing financial sector, and commercial banks in particular, assert that a bank's competitive ability is one of the substantial elements influencing commercial banks' successful activities (Alhassan & Ohene-Asare, 2016, pp. 268–288; Baumann *et al.*, 2017, pp. 62–74; Menicucci & Paolucci, 2016, pp. 86–115; Qian, 2016, pp. 320–324). Competition is necessary for commercial banks to succeed in the market. In fact, the increase of competition enhances the necessity of transparency in the banking industry in order to attract new customers and investors (Smollan, 2013, pp. 725–747). What is more, “higher level of competition ought to lead to better market discipline” (Smollan, 2013, pp. 725–747), which might make clients trust their banks more. Moreover, competition in the banking sector is an element which diminishes financial mediation's costs and improves the quality of services (Fernández-Olmos, 2011, pp. 374–390). Actually, it may help with attracting new customers and, furthermore, with customer retention. Besides, the power of bank competition could be defined as the degree of correspondence of the clients' needs (Dearmon & Grier, 2009, pp. 210–220). In reality, the existence of competition affects customers' intention to use a particular bank's services (Jasiene & Staroselskaja, 2010, pp. 29–41). What is more, competition is related to organization's ability to quickly respond to market's changes and to retain its (organization's) position in the market (Adu-Asare Idun & Aboagye, 2014, pp. 30–51) and stay in the market (Kliestikova *et al.*, 2017, pp. 221–237). In other words, competition is necessary for ensuring successful operations, as well as attracting more customers and retaining them. Therefore, it is important to develop banks' competitive ability. Consequently, it is significant to determine the factors affecting the development of competitiveness.

According to Laksamana *et al.* (2013, pp. 229–249), the level of competition in the financial sector might have an impact on the productivity of financial services. According to Fernández-Olmos (2011, pp. 374–390) competition in banking sector reduces financial mediation's costs. In fact, most scholars examining competition in the financial industry agree that it has a great impact on the quality of life (Jin *et al.*, 2014, pp. 1040–1051; Sekhon *et al.*, 2013, pp. 76–86; Simpasa, 2013, pp. 787–808). Thus, it is necessary to identify the factors affecting banks' competitive ability. The paper aims to assess the determinants influencing a bank's competitive ability and to indicate the level of their influence. The following objectives are set: to distinguish the determinants influencing commercial bank's competitive ability, to assess the factors, and to test the importance of the factors using expert evaluation method. The following methods are used in the study: literature review is performed using synthesis content, comparative, interpretative analysis; questionnaire and fuzzy analytic hierarchy process are used for the data collection and processing.

The research is conducted in relatively small markets — Latvia and Lithuania. Though the population of Latvia during the research period, i.e. April 2017, 1.9427 million (Central Statistical Bureau of Latvia, 2017) and 2,830 million in Lithuania in April 2017 (Statistics Lithuania, 2017). Moreover, the number of operating banks was 16 at the beginning of 2017 (Financial and Capital Market Commission, 2018) and 6 at the beginning of 2018 (Bank of Lithuania, 2018), respectively. This means that competition in the Latvian banking sector is particularly high and the identification of factors driving customers' decisions is especially important.

The paper is organised as follows. The concept of competitiveness in general is presented in the theoretical part, and the overview of recent pieces of research related to the investigations of competitiveness in banking as a specific (intermediator) sector. The analysis shows that nobody examines the influence on banks competitiveness from the customers' perspective, i.e. the factors driving customers' choice. The next part explains data collection and methodology for data processing. Finally, the last two present and discuss empirical results and concludes.

The concept of competitiveness

According to Titko and Lace (2012, pp. 304–310), a bank's competitive ability is the level of the bank's compliance with customer needs. Competitiveness could be defined as an organization's ability to perform strategically important activities in a more affordable or better way than others

(Ferreira *et al.*, 2011, pp. 313–337). Competitiveness is a company's possession of competitive advantage. In fact, the fundamental goal of businesses is to develop a strategy by which they can outperform their competitors. Competitiveness is being analysed at different levels of abstraction where company level, sector level, and country level can be distinguished (Čiarnienė & Stankevičiūtė, 2015, pp. 734–739). Beyond doubt, the path to the competitiveness of economies, which helps companies withstand international competition, goes through innovation. This enables companies to adapt quickly to the pace of the technological change, in order to increase competitiveness (Ciocanel & Pavelescu, 2015, pp. 728–737). Slightly different approaches could be found to competitive advantage in scientific literature. According to Pilinkienė *et al.* (2013, pp. 77–85), theoretical approaches to competitive advantage may be segmented into industry-focused approach, resource-based view approach and approach to competitive advantage. Chen (2015, pp. 107–116) states that the level of competition (low, modest, high) moderates the relationship between service quality and customer loyalty, positioning that competition is a market condition, whereas competitiveness is about the ability to create competitive advantage. What is more, Baumann *et al.* (2017, pp. 62–74) argue that competitiveness perceived by customers is likely to contribute to the explanation of customer loyalty, beyond traditional isolated service/satisfaction quality measures. Mulatu (2016, pp. 50–62) concludes that extensive discussion in literature has not contributed to a consensus in the meaning and definition of the “competitiveness” concept, stating that various protagonists on the competitiveness debate appear as if they had agreed to disagree on this ‘elusive’ concept and have thus ceased to question each other’s views. There are no specific reasons mentioned for the disagreement, consequently the twin questions of ‘coherence’, and ‘usefulness’ of the concept of competitiveness remain controversial. Voinescu and Moisoiu (2015, pp. 512–521) argue that from a theoretical perspective, any rapid assessment would reveal an obvious lack of consensus regarding the exact meaning of competitiveness.

Analysing the peculiarities of banks’ competitiveness it is necessary to emphasise the essence of banking services. Banks make the flow of funds smooth between “saving surplus units” as “input” and “saving deficit units” as “output” (Altunbas *et al.*, 1999, pp. 215–221; Resti, 1997, pp. 221–250). According to the traditional theory of financial intermediation, they are based on transaction costs and asymmetric information (Allen & Santomero, 1998, pp. 1461–1485). Investigations of banks competitiveness usually relate to assessment of such external factors as: concentration (Kumar & Patel, 2014, pp. 3169–3183; Lapteacru, 2014, pp. 41–60), con-

centration and market regulation (Mirzaei & Moore, 2014, pp. 38–71), regulatory environment (Zhang *et al.*, 2015, pp. 55–69), financial reforms (Poshakwale & Qian, 2011, 99–120) and such internal factors as: employee perceptions of the determinants of competitiveness in terms of resources, skills, and capabilities (Ferreira, *et al.*, 2011, pp. 313–337), efficiency of management (Lin *et al.*, 2007, 821–827), cross-selling and switching costs (Zhao *et al.*, 2013, 5452–5462).

This paper concentrates on the analysis of client-driven factors that can influence the competitive ability of banks. Three factors contribute to the development of the competitive advantage of banks from the client perspective and they are as follows (Cooke-Davies, 2002, pp. 185–190; Ika *et al.*, 2012, pp. 105–116):

- cost: competition in the banking sector leads to the development of attractive customer pricing policy in order to have a high appeal;
- security: the banking products involve a high level of money supply; hence customers want security;
- consulting and communication: providing post-purchase support for purchased products.

Taking into consideration various points of view, the concept of competitiveness is focused on the competitiveness of commercial banks and their competitive ability. In terms of this, the authors of the article believe that in order to determine the competitive ability commercial banks competitive advantage must be examined. Competitive advantage can include innovation, technology change, flexibility, trust and asset protection, generated a return on capital, satisfaction, service speed, automatic transactions or service delivery systems and other factors.

For identification of the factors, influencing customers' choice a qualitative research was conducted in Lithuania and Latvia in 2015 (Skvarciany, 2015, pp. 82–87). The respondents of the mentioned research had to determine 3–5 factors they considered affecting commercial bank's competitive ability. After summarising the research results, the following most important factors of banks' competitiveness were identified (see Figure 1).

These various aspects should be put in perspective with the current market situation to determine factors influencing bank's competitive ability the most.

Research methodology

In order to rank the distinguished factors, a questionnaire was prepared for the experts. The expert evaluation method is utilized in order to use the knowledge of professionals operating in the banking sector. All the experts were contacted personally and were offered to make a pairwise comparison of eight factors, influencing the bank's competitiveness. After reaching the experts and gaining the consent to take part in the study, the questionnaire was sent to the expert by e-mail. It took one month to contact the experts and to obtain their answers. The research was conducted in April 2017.

For the purpose of getting reliable research results, the following requirements were set for the experts: 1) to have work or research experience in the banking sector; 2) to have at least a Master's degree in one of the following study areas: finance, economics, management or business administration. The number of respondents in the expert evaluation was picked out according to Libby and Blashfield (1978, pp. 121–129) recommendations, according to which the reliability of the results obtained by the group of eight experts exceeds 90 percent threshold. According to Rudzkiene (Rudzkiene, 2009, pp. 163–260), the largest accuracy could be obtained when the number of experts varies between five and nine. Hence, the reliability of the current study is attained. Experts had to rate the factors of competitiveness in order to determine the level of the importance of each factor.

Fuzzy analytic hierarchy process (FAHP) method was used to define the weight of each factor. The essence of FAHP method is that experts compare all the factors to each other. In fact, FAHP is based on AHP method developed by Wind and Saaty (1980, pp. 641–658). According to van Laarhoven and Pedrycz (1983, pp. 229–241) the most popular scale that is used for pairwise comparison is based on fuzzy number. FAHP method was used in order to reduce uncertainty while calculating factors' weights (Ishizaka & Nguyen, 2013, pp. 3775–3782; Javanbarg *et al.*, 2012, pp. 960–966). In fact, scientists claim that Fuzzy AHP is the appropriate method for assessment of the factors having impact on competitiveness (Jiang *et al.*, 2017: pp. 5225–5232).

Triangle fuzzy numbers based on numerical assessment are provided for experts' evaluations in the current study. Triangle fuzzy number \tilde{A} is represented by (l, m, u) , and the membership function is defined by the equation (Beşikçi *et al.*, 2016, pp. 392–402; Nagpal *et al.*, 2016, 408–417; Stupňanová, 2015, pp. 64–75; Zhou & Lu, 2012, pp. 230–240) (see (1)).

$$\mu_{\tilde{A}}(x) = \begin{cases} \frac{x-l}{m-l}, & x \in [l; m]; \\ \frac{u-x}{u-m}, & x \in [m; u]; \\ 0, & \text{otherwise,} \end{cases} \quad (1)$$

with $-\infty < m \leq l \leq u < +\infty$;

where: $\mu_{\tilde{A}}(x)$ – triangle-shaped membership function,
 m – the best estimate (the most probable value),
 l – the lowest estimate,
 u – the highest estimate.

The assessment of experts' opinion is carried out using a triangular fuzzy-number scale, which is designed according to triangle-shaped membership function (see Table 1).

In order to compare all the factors to each other and to design pairwise comparison matrices, every expert had to make $n(n - 1)/2$ comparisons in order to design pairwise comparison matrix that is defined by the equation (2) (Cobo *et al.*, 2014, pp. 257–276).

$$\tilde{A} = \tilde{a}_{ij} = (l_{ij}, m_{ij}, u_{ij}), \quad (2)$$

where: $m_{ij} = \frac{\sum_{t=1}^T a_{ij}^t}{T}$,
 $l_{ij} = \min_t a_{ij}^t$,
 $u_{ij} = \max_t a_{ij}^t$,
 T – number of experts,
 $t = 1, 2, \dots, T$,
 $\tilde{a}_{ji} = \frac{1}{\tilde{a}_{ij}}, \forall i, j = 1, 2, \dots, n$.

Since experts complete the pairwise comparison matrices, the aggregated experts' assessment is calculated using a formula based on the geometric mean (see (3)).

$$\tilde{a}_{ij}^A = (\tilde{a}_{i1} \otimes \tilde{a}_{i2} \otimes \dots \otimes \tilde{a}_{in})^{1/n}, \quad (3)$$

where: \tilde{a}_{ij}^A – assessment of aggregated element that belongs to i row and j column.

n – the number of pairwise comparison matrices composed by one expert.

Since aggregated experts' assessments are calculated the fuzzy weights of the criteria are computed (see (4)) (Ayhan, 2013, pp. 11–23).

$$\tilde{w}_i = \tilde{a}_{ij}^A \otimes (\tilde{a}_{i1}^A \oplus \tilde{a}_{i2}^A \oplus \dots \oplus \tilde{a}_{in}^A)^{-1}, \quad (4)$$

where: $\tilde{w}_i = (Lw_i, Mw_i, Uw_i)$ – fuzzy weight of i alternative,
 Mw_i – the best fuzzy estimate (the most probable value),
 Lw_i – the lowest fuzzy estimate,
 Uw_i – the highest fuzzy estimate.

Chang's extent analysis is used (Chang, 1996, 649-655) in order to prioritize the elements of the structure. Firstly, the value of the fuzzy synthetic extent \tilde{S}_i with respect to i^{th} object is defined by formula (5).

$$\tilde{S}_i = \sum_{j=1}^n \tilde{a}_{ij} \otimes \left\{ \sum_{i=1}^n \sum_{j=1}^n \tilde{a}_{ij} \right\}^{-1}, i, j = 1, \dots, n. \quad (5)$$

Secondly, the degree of possibilities is calculated (see (6)).

$$V(\tilde{S}_{i+1} \geq \tilde{S}_i) = \begin{cases} 1, & \text{if } M_{i+1} \geq M_i, \\ \frac{L_i - U_{i+1}}{(M_{i+1} - U_{i+1}) - (M_i - L_i)}, & \text{if } L_i \leq U_{i+1}, i = 1, \dots, n, \\ 0, & \text{otherwise.} \end{cases} \quad (6)$$

Thirdly, the minimum value of the degree of possibility is computed (see (7)).

$$V(\tilde{S}_{i+1} \geq \tilde{S}_i | i = 1, \dots, n) = \min_{i \in \{1, \dots, n\}} V(\tilde{S}_{i+1} \geq \tilde{S}_i), i = 1, \dots, n. \quad (7)$$

Fourthly, the weight of alternative w_i is calculated (see (8)).

$$w_i = \frac{V(\tilde{S}_{i+1} \geq \tilde{S}_i | i=1, \dots, n; i+1 \neq i)}{\sum_{g=1}^n V(\tilde{S}_g \geq \tilde{S}_i | i=1, \dots, n; i+1 \neq g)}, i = 1, \dots, n. \quad (8)$$

In order to conduct the survey, eight experts from Latvia and six experts from Lithuania were selected. All the experts held Master/PhD degrees in economics/management/finance and had working experience in these fields over two years. Information about experts is presented in Table 2.

Since the weights of each factor are calculated, the most important factor could be identified.

Empirical findings

As it was mentioned above, according to the research conducted in Lithuania and Latvia in 2015 (Skvarciany, 2015) the factors influencing commercial banks' competitive ability were distinguished (see Fig. 1). In 2017 these factors were presented for experts' evaluation in order to determine the how much weight each of them carries.

Experts had to rate the factors of competitiveness in order to determine the degree to which they have an impact. The results of the survey are presented in Table 3.

Examining the weights of different factors, as illustrated in Table 3, it is evident that Lithuania's and Latvia's experts ranked trust in the first position (the weights are 0.697 and 0.728 respectively). Firstly, it could be explained by the fact that both countries suffered heavily from the financial crisis and during certain period even after the crisis the stability of banking sector remained threatened. For instance, *Parex bank* in Latvia was nationalised, restructured and renamed, which in turn led people to the perception that trust in bank management and its activities is the most important. The bankruptcy of *Snoras* and *Ūkio bankas* in Lithuania and *Krajbanka* in Latvia additionally verified it. This makes trust and the resulting perception regarding customer assets protection the most important factor for bank's competitive ability in Lithuania and Latvia. The second reason is post-soviet heritage, going through a change from socialism to capitalism in the 90's. As a consequence, many financial institutions went bankrupt, and people became a victim of fraud and theft. This has increased the fear level among people as to where to put their savings, taking into account that recollection of previous fallouts are still fresh. Thirdly, it is important that customer trusts its bank in good times, but more importantly to trust it in bad times. If your business is successful, then banks will try to finance it, but when your business finances are not so good and you need a loan for investments, that is the time for needing more support. If in time of need a bank refuses to lend to a customer, the customer's trust in bilateral understanding and respect could be lost. This is the case when banks have capital, but handed out financial stimulus is in limited amounts and it becomes more crucial not only for short-term savings, but especially for long-term deposits and/or pension funds. Customers make their decisions on where to open savings account based on their trust in the institution, rather than following most advertisements even if interest rate is lower. The authors of the current study suggest protecting existing customer base or attracting new customers to commercial banks in Lithuania and Latvia. Additional effort and resources should be allocated to address issues of trust with existing

and potential clients. Banking culture, owners' reputation and the nature of financial services should encourage trust and willingness to stay with current financial services provider. Another important matter is trust in online technology which is used by bank to avoid incidents or money frauds.

Reliability of a bank was ranked as the second most important factor, with 0.272 weight in Lithuania, and 0.273 in Latvia. The countries have regained independence relatively recently, so there are no established traditions in the banking sector yet. Main banks which people trust and hold their assets in are Scandinavian owned banks with long operating history. This is important, as it determines the reliability of the bank.

Moreover, Latvian experts ranked privileges to loyal customers in the third position (the weight is 0.029). As trust and reliability in commercial banks are the most important factors for banks competitive ability, privileges to loyal customers are a decisive factor for a certain group of people. If banks reward you for using their services then it is appealing to a certain amount of people. Such examples may be the reward system for payments, invitations to various events, travel insurance and other benefits. According to the Lithuanian experts, the weight of this factor is equal to zero.

However, the weights of accessibility of banking services, fees, and customers' satisfaction with online and offline services, and advertising are equal to zero in analysed countries. Satisfaction in online and offline services are not weighty for customers as they still see trust as a priority and they will not choose a bank based on better services. This factor may become more important among banks with the same trust level. Service quality can definitely help to reduce the number of complaints and ultimately increase trust. As advertising may be important to create a perception, it still has no effect on direct customer attraction, therefore Lithuanian and Latvian banks have abandoned this strategy. General information about the bank and its services is ineffective, as other factors presented in this paper are more significant for commercial banks' competitive ability. Therefore, banks tend to sponsor different cultural and sporting events more to increase their reputation. The bank fee level has an insignificant bearing on the competitive ability in comparison to other factors, and banks need not be the main argument to influence the decision of customers. There is a space to manipulate with bank fees and give more privileges to loyal customers, which might increase the number of customers or persuade them to use banks services more often. Accessibility to bank services is not perceived as an important issue due to very good banking networks in Lithuania and Latvia. Nevertheless, it is not the case in different countries. As internet banking is becoming more important, accessibility of the services also loses its importance, as many payments are made online.

Conclusions

As competitiveness is a significantly important element of a bank's successful activities, it is necessary to identify the factors influencing it. This is especially significant in the Latvian banking market, as the competition is very high. The object of this study is to identify factors that have the greatest impact on commercial banks' competitive ability. In order to distinguish the main factors, the results from previous research, which was conducted in Lithuania and Latvia, were used. The following factors were presented for experts evaluation: accessibility of bank services, fees, customers' satisfaction with bank's offline services, customers' satisfaction with bank's online services, reliability of a bank, advertising, privileges to loyal customers, trust in the bank. In order to rank the factors, an expert evaluation method was used. Experts had to compare the factors with each other and after the comparison procedure, the weights were assigned to each factor using fuzzy analytic hierarchy process. Customers' trust appeared to be the most important factor both in Lithuania and Latvia. This is to say, the higher the level of trust is, the higher the level of bank's competitiveness is. Reliability of the bank was ranked in the second position, and it could be explained by the fact that both countries have regained independence relatively recently, so there are no established traditions in the banking sector yet. In addition, there has been a negative experience during the financial crisis and closure of financial institutions, when people lost their savings. This has led to the reliability of a bank as an important factor. Moreover, Latvian experts ranked privileges to loyal customers at the third position. In fact, clients like being treated well and enjoy the benefits that are granted to them, such as discounts, loyalty points, insurance, reduction in bank fees, etc.

The results of this research could be used as analysis for a better understanding of the banking sector. The authors of the current study recommend using the results of this article for promoting the purposes of a bank or attracting new customers. For banks to become more competitive, they should solve the problem of trust and reliability. In fact, trust and reliability for banks should be identified as strategic assets and be part of their risk management portfolio.

However, what may be true in one market is not necessarily true for another. The level of operation, company level, sector level, country or international one can also be considered and investigated in the future.

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Annex

Table 1. Fuzzy AHP Scale

Intensity of importance of one criterion over another	Fuzzy number, \tilde{a}_{ij}	Triangular fuzzy numbers
Equal importance	$\tilde{1}$	(1, 1, 1)
Moderate importance	$\tilde{3}$	(2, 3, 4)
Strong importance	$\tilde{5}$	(4, 5, 6)
Very strong importance	$\tilde{7}$	(6, 7, 8)
Extreme importance	$\tilde{9}$	(8, 9, 10)
Intermediate values	\tilde{x} ($x = 2, 4, 6, 8$)	($x - 1, x, x + 1$)

Source: Cobo *et al.* (2014, pp. 257–276).

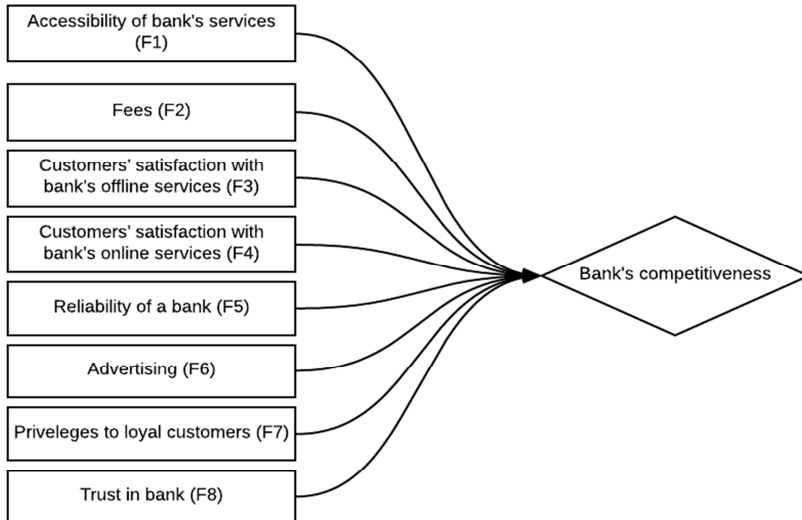
Table 2. Qualitative information about experts

Expert No.	Information about expert (Lithuania)	Expert No.	Information about expert (Latvia)
E _{LT1}	PhD in economics; working experience – 12 years	E _{LV1}	PhD in economics; working experience – 11 years
E _{LT2}	PhD in economics; working experience – 22 years	E _{LV2}	PhD in economics; working experience – 4 years
E _{LT3}	PhD in economics; working experience – 6 years	E _{LV3}	PhD in management; working experience – 12 years
E _{LT4}	Master in finance; working experience – 3 years	E _{LV4}	PhD in economics; working experience – 8 years
E _{LT5}	PhD in economics; working experience – 25 years	E _{LV5}	PhD in management; working experience – 7 years
E _{LT6}	PhD in management; working experience – 5 years	E _{LV6}	PhD in economics; working experience – 7 years
		E _{LV7}	PhD in economics; working experience – 19 years
		E _{LV8}	PhD in management; working experience – 5 years
		E _{LV9}	PhD in economics; working experience – 12 years

Table 3. Weights of factors of commercial banks' competitiveness

Factor	Lithuania		Latvia	
	Fuzzy weight	Prioritized eigenvalue	Fuzzy weight	Prioritized eigenvalue
Accessibility of bank services	(0.045; 0.061; 0.085)	0.000	(0.045; 0.062; 0.088)	0.000
Fees	(0.071; 0.102; 0.150)	0.000	(0.012; 0.015; 0.019)	0.000
Customers' satisfaction with bank's offline services	(0.086; 0.119; 0.165)	0.000	(0.071; 0.103; 0.149)	0.000
Customers' satisfaction with bank's online services	(0.036; 0.050; 0.069)	0.000	(0.054; 0.079; 0.114)	0.000
Reliability of a bank	(0.167; 0.233; 0.322)	0.272	(0.171; 0.235; 0.324)	0.273
Advertising	(0.055; 0.078; 0.122)	0.000	(0.070; 0.101; 0.146)	0.000
Privileges to loyal customers	(0.061; 0.091; 0.134)	0.000	(0.105; 0.145; 0.201)	0.029
Trust in bank	(0.190; 0.265; 0.368)	0.728	(0.188; 0.259; 0.356)	0.697

Figure 1. Factors influencing bank's competitiveness



Source: designed by authors based on Skvarciany (2015).

Appendix

Table A1. Expert E_{LT1} individual comparison matrix (with fuzzy numbers)

	F1	F2	F3	F4	F5	F6	F7	F8
F1	1.000	0.333	0.200	7.000	0.143	0.143	0.500	0.143
F2	3.000	1.000	0.333	7.000	3.000	0.250	4.000	1.000
F3	5.000	3.000	1.000	8.000	5.000	0.333	4.000	4.000
F4	0.143	0.143	0.125	1.000	0.250	0.167	0.200	0.250
F5	7.000	0.333	0.200	4.000	1.000	0.200	5.000	0.200
F6	7.000	4.000	3.000	6.000	5.000	1.000	6.000	6.000
F7	2.000	0.250	0.250	5.000	0.200	0.167	1.000	0.200
F8	7.000	1.000	0.250	4.000	5.000	0.167	5.000	1.000

Table A2. Expert E_{LT2} individual comparison matrix (with fuzzy numbers)

	F1	F2	F3	F4	F5	F6	F7	F8
F1	1.000	0.111	5.000	7.000	0.111	7.000	8.000	0.111
F2	9.000	1.000	9.000	9.000	0.111	9.000	9.000	0.111
F3	0.200	0.111	1.000	5.000	0.111	4.000	5.000	0.111
F4	0.143	0.111	0.200	1.000	0.143	3.000	5.000	1.000
F5	9.000	9.000	9.000	7.000	1.000	9.000	9.000	0.111
F6	0.143	0.111	0.250	0.333	0.111	1.000	0.500	0.111
F7	0.125	0.111	0.200	0.200	0.111	2.000	1.000	0.111
F8	9.000	9.000	9.000	1.000	9.000	9.000	9.000	1.000

Table A3. Expert E_{LT3} individual comparison matrix (with fuzzy numbers)

	F1	F2	F3	F4	F5	F6	F7	F8
F1	1.000	5.000	0.200	5.000	0.333	0.200	0.333	2.000
F2	0.200	1.000	0.333	3.000	0.200	0.333	0.200	0.200
F3	5.000	3.000	1.000	7.000	5.000	5.000	5.000	0.333
F4	0.200	0.333	0.143	1.000	0.111	0.333	0.200	0.111
F5	3.000	5.000	0.200	9.000	1.000	5.000	5.000	1.000
F6	5.000	3.000	0.200	3.000	0.200	1.000	0.333	0.200
F7	3.000	5.000	0.200	5.000	0.200	3.000	1.000	0.200
F8	0.500	5.000	3.000	9.000	1.000	5.000	5.000	1.000

Table A4. Expert E_{LT4} individual comparison matrix (with fuzzy numbers)

	F1	F2	F3	F4	F5	F6	F7	F8
F1	1.000	0.200	9.000	7.000	7.000	3.000	1.000	7.000
F2	5.000	1.000	9.000	9.000	1.000	1.000	0.111	0.333
F3	0.111	0.111	1.000	1.000	0.143	0.250	0.143	0.111
F4	0.143	0.111	1.000	1.000	0.111	0.200	0.143	0.111
F5	0.143	1.000	7.000	9.000	1.000	0.200	7.000	0.143
F6	0.333	1.000	4.000	5.000	5.000	1.000	0.200	4.000
F7	1.000	9.000	7.000	7.000	0.143	5.000	1.000	0.143
F8	0.143	3.000	9.000	9.000	7.000	0.250	7.000	1.000

Table A5. Expert E_{LT5} individual comparison matrix (with fuzzy numbers)

	F1	F2	F3	F4	F5	F6	F7	F8
F1	1.000	0.200	0.143	0.143	0.111	3.000	0.111	0.111
F2	5.000	1.000	0.333	0.333	0.143	1.000	0.333	0.143
F3	7.000	3.000	1.000	1.000	0.167	7.000	7.000	0.200
F4	7.000	3.000	1.000	1.000	0.200	7.000	5.000	0.143
F5	9.000	7.000	6.000	5.000	1.000	7.000	7.000	1.000
F6	0.333	1.000	0.143	0.143	0.143	1.000	0.143	0.143
F7	9.000	3.000	0.143	0.200	0.143	7.000	1.000	0.200
F8	9.000	7.000	5.000	7.000	1.000	7.000	5.000	1.000

Table A6. Expert E_{LT6} individual comparison matrix (with fuzzy numbers)

	F1	F2	F3	F4	F5	F6	F7	F8
F1	1.000	0.333	0.143	0.143	0.200	0.143	0.333	0.143
F2	3.000	1.000	0.333	0.333	0.333	0.200	3.000	0.143
F3	7.000	3.000	1.000	1.000	1.000	3.000	3.000	0.200
F4	7.000	3.000	1.000	1.000	1.000	0.200	3.000	0.200
F5	5.000	3.000	1.000	1.000	1.000	3.000	5.000	1.000
F6	7.000	5.000	0.333	5.000	0.333	1.000	0.143	0.143
F7	3.000	0.333	0.333	0.333	0.200	7.000	1.000	0.143
F8	7.000	7.000	5.000	5.000	1.000	7.000	7.000	1.000

Table A7. Expert E_{LV1} individual comparison matrix (with fuzzy numbers)

	F1	F2	F3	F4	F5	F6	F7	F8
F1	1.000	6.000	1.000	0.500	0.125	0.250	0.125	0.111
F2	0.167	1.000	0.143	0.143	0.125	0.143	0.111	0.125
F3	1.000	7.000	1.000	0.500	0.125	6.000	0.500	0.167
F4	2.000	7.000	2.000	1.000	0.143	0.250	2.000	0.143
F5	8.000	8.000	8.000	7.000	1.000	6.000	7.000	0.500
F6	4.000	7.000	0.167	4.000	0.167	1.000	2.000	0.143
F7	8.000	9.000	2.000	0.500	0.143	0.500	1.000	0.125
F8	9.000	8.000	6.000	7.000	2.000	7.000	8.000	1.000

Table A8. Expert E_{LV2} individual comparison matrix (with fuzzy numbers)

	F1	F2	F3	F4	F5	F6	F7	F8
F1	1.000	5.000	0.333	1.000	0.167	0.250	0.143	0.167
F2	0.200	1.000	0.333	0.333	0.143	0.333	0.167	1.000
F3	3.000	3.000	1.000	1.000	0.200	3.000	1.000	0.250
F4	1.000	3.000	1.000	1.000	0.250	2.000	0.125	2.000
F5	6.000	7.000	5.000	4.000	1.000	0.333	0.333	0.333
F6	4.000	3.000	0.333	0.500	3.000	1.000	0.500	0.200
F7	7.000	6.000	1.000	8.000	3.000	2.000	1.000	0.167
F8	6.000	1.000	4.000	0.500	3.000	5.000	6.000	1.000

Table A9. Expert E_{LV3} individual comparison matrix (with fuzzy numbers)

	F1	F2	F3	F4	F5	F6	F7	F8
F1	1.000	7.000	3.000	1.000	0.167	0.250	0.167	0.167
F2	0.143	1.000	0.250	0.143	0.111	0.143	0.111	0.143
F3	0.333	4.000	1.000	6.000	0.167	4.000	2.000	0.333
F4	1.000	7.000	0.167	1.000	0.333	3.000	0.143	3.000
F5	6.000	9.000	6.000	3.000	1.000	1.000	1.000	1.000
F6	4.000	7.000	0.250	0.333	1.000	1.000	1.000	0.200
F7	6.000	9.000	0.500	7.000	1.000	1.000	1.000	0.125
F8	6.000	7.000	3.000	0.333	1.000	5.000	8.000	1.000

Table A10. Expert E_{LV4} individual comparison matrix (with fuzzy numbers)

	F1	F2	F3	F4	F5	F6	F7	F8
F1	1.000	6.000	2.000	0.500	0.143	0.200	0.143	0.143
F2	0.167	1.000	0.200	0.143	0.111	0.200	0.111	0.111
F3	0.500	5.000	1.000	5.000	0.143	1.000	5.000	0.200
F4	2.000	7.000	0.200	1.000	0.143	5.000	1.000	5.000
F5	7.000	9.000	7.000	7.000	1.000	7.000	7.000	1.000
F6	5.000	5.000	1.000	0.200	0.143	1.000	0.200	0.143
F7	7.000	9.000	0.200	1.000	0.143	5.000	1.000	0.200
F8	7.000	9.000	5.000	0.200	1.000	7.000	5.000	1.000

Table A11. Expert E_{LV5} individual comparison matrix (with fuzzy numbers)

	F1	F2	F3	F4	F5	F6	F7	F8
F1	1.000	6.000	0.250	1.000	0.200	0.167	0.125	0.143
F2	0.167	1.000	0.250	0.250	0.125	0.200	0.167	0.125
F3	4.000	4.000	1.000	2.000	0.143	4.000	1.000	0.200
F4	1.000	4.000	0.500	1.000	0.250	3.000	0.167	3.000
F5	5.000	8.000	7.000	4.000	1.000	2.000	0.250	1.000
F6	6.000	5.000	0.250	0.333	0.500	1.000	1.000	0.200
F7	8.000	6.000	1.000	6.000	4.000	1.000	1.000	0.143
F8	7.000	8.000	5.000	0.333	1.000	5.000	7.000	1.000

Table A12. Expert E_{LV6} individual comparison matrix (with fuzzy numbers)

	F1	F2	F3	F4	F5	F6	F7	F8
F1	1.000	5.000	0.200	0.500	0.167	0.143	0.111	0.125
F2	0.200	1.000	0.200	0.200	0.111	0.167	0.143	0.111
F3	5.000	5.000	1.000	1.000	0.125	3.000	0.500	0.167
F4	2.000	5.000	1.000	1.000	0.167	2.000	0.143	2.000
F5	6.000	9.000	8.000	6.000	1.000	1.000	1.000	0.500
F6	7.000	6.000	0.333	0.500	1.000	1.000	0.500	0.167
F7	9.000	7.000	2.000	7.000	1.000	2.000	1.000	0.125
F8	8.000	9.000	6.000	0.500	2.000	6.000	8.000	1.000

Table A13. Expert E_{LV7} individual comparison matrix (with fuzzy numbers)

	F1	F2	F3	F4	F5	F6	F7	F8
F1	1.000	5.000	0.200	0.500	0.125	0.200	0.125	0.111
F2	0.200	1.000	0.111	0.111	0.111	0.111	0.111	0.111
F3	5.000	9.000	1.000	1.000	0.111	3.000	0.250	0.125
F4	2.000	9.000	1.000	1.000	0.111	0.167	2.000	0.111
F5	8.000	9.000	9.000	9.000	1.000	3.000	0.500	0.200
F6	5.000	9.000	0.333	6.000	0.333	1.000	1.000	0.111
F7	8.000	9.000	4.000	0.500	2.000	1.000	1.000	0.125
F8	9.000	9.000	8.000	9.000	5.000	9.000	8.000	1.000

Table A14. Expert E_{LV8} individual comparison matrix (with fuzzy numbers)

	F1	F2	F3	F4	F5	F6	F7	F8
F1	1.000	6.000	1.000	1.000	0.125	0.200	0.143	0.111
F2	0.167	1.000	0.125	0.143	0.111	0.167	0.125	0.143
F3	1.000	8.000	1.000	1.000	0.143	7.000	1.000	0.143
F4	1.000	7.000	1.000	1.000	0.125	0.333	3.000	0.125
F5	8.000	9.000	7.000	8.000	1.000	7.000	8.000	1.000
F6	5.000	6.000	0.143	3.000	0.143	1.000	1.000	0.125
F7	7.000	8.000	1.000	0.333	0.125	1.000	1.000	0.143
F8	9.000	7.000	7.000	8.000	1.000	8.000	7.000	1.000

Table A15. Expert E_{LV9} individual comparison matrix (with fuzzy numbers)

	F1	F2	F3	F4	F5	F6	F7	F8
F1	1.000	7.000	0.333	2.000	0.167	0.333	0.167	0.143
F2	0.143	1.000	0.125	0.143	0.111	0.125	0.143	0.111
F3	3.000	8.000	1.000	3.000	0.125	5.000	0.500	0.167
F4	0.500	7.000	0.333	1.000	0.143	0.250	4.000	0.143
F5	6.000	9.000	8.000	7.000	1.000	5.000	2.000	0.333
F6	3.000	8.000	0.200	4.000	0.200	1.000	3.000	0.143
F7	6.000	7.000	2.000	0.250	0.500	0.333	1.000	0.167
F8	7.000	9.000	6.000	7.000	3.000	7.000	6.000	1.000