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Competition, concentration, efficiency, and their relationship in the Lithuanian banking sector

The paper examines the impact of increasing concentration and new technologies on the degree of competition and efficiency of the Lithuanian commercial banks. A quantitative assessment of changes in the market structure and efficiency of the Lithuanian banking sector was carried out. The study also estimates competitive behavior in this sector.

Keywords: Competition; Concentration; Efficiency; Panzar-Rosse model; Mergers and Acquisitions; Market Structure; Banks.

Straipsnyje nagrinėjama koncentracijos įtaka Lietuvos bankų sektoriaus konkurencijai ir efektyvumui. Atliekami šio sektoriaus konkurencijos bei koncentracijos lygių tyrimai; vertinamas šio sektoriaus efektyvumas, taip pat analizuojami konkurencingumo, koncentracijos ir efektyvumo tarpusavio ryšiai Lietuvos bankų sektoriuje.

Raktiniai žodžiai: konkurencija, koncentracija, efektyvumas, Panzar-Rose modelis, susijungimai ir įsigijimai, rinkos struktūra, bankai.

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Introduction

In the current era, market structure and competition in the European financial system are major economic policy issues. The degree of competition in the financial sector may influence the efficiency of the production of the financial services. Relationships between competition, banking system performance, efficiency, and stability have been extensively analyzed in theoretical literature as well as in empirical research. In general, in a competitive environment, only the most efficient and innovative firms survive. However, for the financial sector there might be instances in which competition may have a negative impact on stability, as the least efficient firms may have an incentive to increase their risk exposure in order to reach the industry profitability level. If these firms are large enough, the financial stability of the firms may be threatened.

Banking competition is a crucial issue for the new members of the EU. The most important change in the business environ-

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ment of the Lithuanian banking sector, after joining the EU, is the possibility of new banks entering using a "single banking license". Banks that are licensed in any EU country have the right to open new branches and conduct operations in any other Member State without submitting to licensing procedures. That way the Lithuanian banks are subjected to stiffer competitive pressure: domestic banks have higher levels of general expense than banks in the EU countries. New branches of foreign banks may enjoy a competitive edge over the domestic banks due to lower costs (resulting from the use of their parent bank's IT systems, for example). The most important change for clients using banking services should be to lower transaction costs and to have better access to lending in the Single Banking Market. However, accession to the EU also creates additional challenges for Lithuanian banking industry. The solutions and likely ways to survive in a competitive environment for domestic financial institutions in the EU, are the improvement of their efficiency and competitiveness by mergers and acquisitions (which will contribute to a reduction of operating costs), further development of products for households and small and medium sized businesses, outsourcing, and engagement in the servicing of niche markets. Those processes are supported by new technologies as well as by the Internet.

A number of analysts, who have investigated the trade-off between competition and concentration, have found that there is no evidence that the banking sector concentration relates negatively to competition (Claessens, Laeven, 2003; Gelos, Roldos, 2002; Hempell, 2001; Haaf, 2000; Jansen, Haan, 2003; Northcott, 2004; Pawłowska, 2003, 2005; Yildirim, 2007).

This paper examines the impact of the increasing concentration and new technologies, linked with the mergers and acquisitions (M&A) process, on the degree of competition and efficiency of Lithuanian commercial banks in the period of 2000-2006. In order to carry out a quantitative assessment of the changes in the degree of competition, market structure and efficiency of the Lithuanian banking sector, this study has been structured into two investigations:

Firstly, it estimates the competitive behavior in the Lithuanian banking system, by applying the non-structural J. C. Panzar and J. N. Rosse (1987) approach, based on panel data for Lithuanian commercial banks for the period of 2000-2006. The above methodology enables to identify the nature of the market structure, i.e. monopoly or perfectly collusive oligopoly, monopolistic competition and perfect competition, by applying the elasticity of total interest revenues function with respect to changes in the banks' input prices, called the H-statistic.

Secondly, based also on the above mentioned panel data, this study estimates the concentration and efficiency changes in the Lithuanian banking sector. This investigation tries to assess the relationship between competition, concentration and efficiency in the Lithuanian banking sector.

Based on the micro-data of the banks' balance sheets and profit and loss accounts for the years 2000-2006, monopolistic competition has been found (as confirmed by the fact that the values of the H statistic lay clearly between zero and one).

The aim of the research: to examine the impact of concentration on the degree of competition and efficiency of the

Lithuanian commercial banks during the analyzed period 2000-2006.

Research object: Lithuanian banking sector during period 2000-2006.

Research methods: systematic analysis of scientific literature, logic analysis and synthesis, empirical research by applying the Panzar-Rosse model, correlation analysis.

Measures of competition in the banking industry: literature review

The literature on the measurement of competition in the banking industry can be divided into two major streams: structural and non-structural approaches. The structural approach to the measurement of competition embraces the Structure-Conduct-Performance paradigm (SCP) and the efficiency hypothesis, as well as a number of formal approaches with roots in Industrial Organisation theory. The two former models investigate, respectively, whether a highly concentrated market causes collusive behaviour among the larger banks resulting in superior market performance, and whether it is the efficiency of larger banks that enhances their performance. Non-structural models for the measurement of competition, namely the Iwata model (Iwata, 1974), the Bresnahan model, and the Panzar-Rosse model (Panzar, Rosse, 1987), were developed in reaction to the theoretical and empirical deficiencies of the structural models. These New Empirical Industrial Organisation approaches test competition and the use of market power, and stress the analysis of banks' competitive conduct in the absence of structural measures. These nonstructural approaches ignore the impact of concentration.

Structural measures of competition. Structural measures of competition may, in turn, be divided into two major schools of thought: the formal and non-formal approaches. The study of the relationship between market performance and market structure has its roots in the non-formal framework of the SCP paradigm. Since its origins, this framework has evolved largely independently of ongoing refinements in formal models of imperfectly competitive markets (Martin, 1993). The empirical application of the SCP paradigm in its original form and the recognition that the market structure should be treated as an endogenous variable, led to a reformulation of the empirical tests and to attempts to build a formal theoretical framework for the structural equations. Oligopoly theory has replaced structure-conduct-performance as the organizing framework for industrial economics. In some cases, this work recast structure-conduct-performance arguments in a more formal mould (Martin, 1993). Yet, large discrepancies between the formal and non-formal approaches remain.

The first part of this section discusses two non-formal approaches to the market structure-market performance relationship, the SCP framework and the efficiency hypothesis. These approaches are called non-formal as measures for the market structure are not derived theoretically, but chosen at will. The second part presents two formal derivations of the competition-concentration relationship, one based on the Herfindahl-Hirschman index and one on the k bank concentration ratio. These measures of the market structure follow formally from theoretical derivations. Both the formal and the nonformal approaches link competition to concentration, as in every approach a

concentration ratio takes up a central position.

Non-formal structural approaches to competition. The SCP and the efficiency hypothesis are the two most common non-formal structural approaches to measure the impact of concentration on competition. In its original form, the SCP explains market performance as the result of an exogenously given market structure, which depends upon basic demand and supply side conditions (Reid, 1987; Scherer, Ross, 1990) and which influences the conduct of banks in the industry. A higher level of concentration in the market is assumed to foster collusion among the active banks and to reduce the degree of competition in that particular market. The application of the SCP to the banking literature has been criticised by various authors, for instance by R. A. Gilbert (1984), G. C. Reid (1987), J. Vesala (1995) and J. Bos (2002). Their criticism is directed at the form of the model rather than at the specification of the variables used. Much of the criticism is related to the one-way causality – from market structure to market performance – inherent in the original model as it is still being applied in many banking studies, and to the failure by recent studies to incorporate new developments in the theory of industrial organisations. The extensive literature applying the structure-performance paradigm to the banking industry has been summarised by, for instance, R. A. Gilbert (1984) and P. Molyneux et al. (1996). In this context, it should be noted that most of the studies applying the SCP framework to the banking industry do not take explicit account of the conduct of banks. This being the case, the remaining of the analysis will focus on the structure-performance (S-P) relationship.

The efficiency hypothesis, developed by H. Demsetz (1973) and S. Peltzman (1977), challenges the line of reasoning of the traditional S-P paradigm and offers a competing explanation of the relation between market structure and performance. The hypothesis claims that if a bank achieves a higher degree of efficiency than other banks in the market (i.e. its cost structure is comparatively more effective), its profit maximising behaviour will allow it to gain market share by reducing prices (Molyneux, Forbes, 1995). Market structure is therefore shaped endogenously by banks' performance, so that concentration is a result of the superior efficiency of the leading banks (Vesala, 1995).

Empirically, one may distinguish the S-P paradigm from the efficiency hypothesis by looking at the endogenous variable measuring the performance of a particular bank, which is usually estimated as a function of exogenous market structure and control variables, as in:

$$\prod_{i,t} = \alpha_0 + \alpha_1 CR_{j,t} + \alpha_2 MS_{i,t} + \sum_k \alpha_{k+2} X^k_{i,j,t} \quad (1)$$

$\prod_{i,t}$ is a performance measure for bank i, $CR_{j,t}$ is a measure of concentration in region j (the region to which bank i belongs) and $MS_{i,t}$ is the market share of bank i; t refers to period t. CR and MS each proxies an aspect of the market structure. X^k is a vector of control variables included to account for both bank-specific and region-specific characteristics (Molyneux, Forbes, 1995). The traditional structure-performance relationship would apply to the data if $\alpha_1 > 0$ and $\alpha_2 = 0$, and the efficiency hypothesis holds if $\alpha_1 = 0$ and $\alpha_2 > 0$.

The control variables usually included in the empirical analysis proxy market demand conditions (e.g. per capita income

or wage, levels of population density, immigration into specific markets), cost differences across banks, size-induced differences between banks, such as scale economies (e.g. measure of individual bank size), different risk categories (Molyneux et al., 1996) and ownership differences (Lloyd-Williams et al., 1994).

The results of the rather limited number of studies investigating the structure-performance relationship for European banking markets are no less ambiguous than those obtained from the US banking industry (Gilbert, 1984; Weiss, 1989; Molyneux et al., 1996; and Bos, 2002). The scarcity of those studies is mainly the result of the lack of sub-market banking data for the European banking markets, which makes it extremely difficult to define a meaningful (relevant) market area and a reasonable measure of concentration in universal banking and nation-wide banking markets.

Formal structural approaches to competition. The growing body of literature subjecting the choice of profitability measures to formal analysis has been summarised by S. Martin (1993). Most of these formal studies generalise the Lerner index of monopoly power. They do not stress any measure of profitability as correct or the best, but provide guidance in selecting tests of market power and profitability.

The overall organising framework, which will now be introduced, has its roots in Industrial Organisations theory. It provides the basis for the discussion of formal structural and non-structural models in competition theory. The derivations are based on the profit maximisation problem foroligopolistic markets presented, for instance, by K. G. Cowling (1976) and K. G. Cowling and M. Waterson (1976). There are *n* unequally sized banks in the industry producing a homogeneous product. Bank size differences are incorporated by the shape of the individual banks' cost functions. The profit function for an individual bank takes the form:

$$\prod_i = px_i - c_i(x_i) - F_i \qquad (2)$$

where Π_i i is profit, x_i is the volume of output, p is the output price, c_i are the variable costs and F_i are fixed costs of bank i.

This section discussed formal and non-formal approaches to the relationships between market structure and market performance. The non-formal structure-performance paradigm and efficiency hypothesis, although lacking formal back-up in micro-economic theory, have frequently been applied to the banking industry and provide policy makers by measures of market structure and performance as well as their interrelationship.

Non-structural measures of competition. This section discusses three non-structural measures of competition, namely the Iwata model, the Bresnahan model and the Panzar and Rosse approach. The derivations of the first two measures are based on the results obtained for the oligopoly profit-maximisation problem. The Panzar and Rosse method is based on the comparative static properties of the reduced-form revenue approach.

The Iwata Model. The Iwata model allows the estimation of conjectural variation values for individual banks supplying a homogeneous product in an oligopolistic market (Iwata, 1974). Although, to the best of our knowledge, this measure has been applied to the banking industry only once, it is included in the present overview for completeness' sake. Defining the price elasticity of demand as $\eta_D = - (dp/dX)(x/p)$, equation can be written as p – (

$1/\eta_D$)(p/x)($1+\lambda_i$) $x_i - c'(x_i) = 0$, which, by re-arranging yields:

$$\lambda_i = \eta_D((c'(x_i) - p)/p)(X/x_i) - 1 \quad (3)$$

The numerical value of this conjectural variation will be obtained indirectly. Under the assumptions that p and x_i/X are strict functions of exogenous variables, and that η_D , the elasticity of demand, is constant, the method involves the estimation of a market demand function and cost functions of individual banks to obtain a numerical value of the conjectural variation for each bank. The application of this model to the European banking industry is difficult, especially given the lack of micro-data for the structure of cost and production for homogeneous products of a large number of players in the European banking markets.

The Bresnahan model. T. F. Bresnahan (1982) and L. Lau (1982) present a short-run model for the empirical determination of the market power of an average bank. Based on time-series of industry data, the conjectural variation parameter $\lambda = ($ $1 + d\sum_{i \neq j}$ x_j / dx_i)/n, with $0 \leq \lambda \leq 1$, is determined by simultaneous estimations of the market demand and supply curves. Banks maximise their profits by equating marginal cost and perceived marginal revenue. The perceived marginal revenue coincides with the demand price in competitive equilibrium and with the industry's marginal revenue in the collusive extreme (Shaffer, 1993). Under the bank equality assumption of the Bresnahan model, equation can be rearranged to yield p + f'(X) Xλ = c'(x_i).

Empirical applications of the Bresnahan model are rather scarce. It has been estimated by S. Shaffer (1989 and 1993) for, respectively, the US loan markets and for the Canadian banking industry. M. Suominen (1994) applied the model in its original one-product version to the Finnish loan market for the period 1960-84 during which the interest rates applied by banks were tightly regulated. Interest rates on loans were deregulated in August 1986, but interest rates on deposits remained effectively restricted until 1990. An adapted two-product version is applied to the Finnish loan market for the period after deregulation (September 1986-December 1989). M. Suominen finds coefficient estimates for λ which are close to zero and not significantly different from zero at the 5 per cent level for the period with regulated interest rates in both markets, and values of λ indicating use of market power after the deregulation of the loan market. J. Swank (1995) estimated Bresnahan's model to obtain the degree of competition in the Dutch loan and deposit markets over the period 1957-90, and found that both markets were significantly more oligopolistic than in Cournot equilibrium.

The Panzar and Rosse approach. The method developed by J. C. Panzar and J. N. Rosse (1987) determines the competitive behaviour of banks on the basis of the comparative static properties of reduced-form revenue equations based on cross-section data. J. C. Panzar and J. N. Rosse (P-R) show that if their method is to yield plausible results, banks need to have operated in a long-term equilibrium (*i.e.* the number of banks needs to be endogenous to the model) while the performance of banks needs to be influenced by the actions of other market participants. Furthermore, the model assumes a price elasticity of demand, *e*, greater than unity, and a homogeneous cost structure. To obtain the equilibrium output and the equilibrium number of banks, profits are maximised

Table 1

Discriminatory power of H

Values of H	Competitive environment
$H \leq 0$	Monopoly equilibrium: each bank operates independently as under monopoly profit maximisation conditions (H is a decreasing function of the perceived demand elasticity) or perfect cartel.
$0 < H < 1$	Monopolistic competition free entry equilibrium (H is an increasing function of the perceived demand elasticity).
$H = 1$	Perfect competition. Free entry equilibrium with full efficient capacity utilisation.

Source: J. A. Bikker and K. Haaf (2001).

at the bank as well as the industry level. That means, first, that bank i maximises it profits where marginal revenue equals marginal cost:

$$R_i'(x_i, n, z_i) - C_i'(x_i, w_i, t_i) = 0 \quad (4)$$

x_i being the output of bank i, n the number of banks, w_i a vector of m factor input prices of bank i, z_i a vector of exogenous variables that shift the bank's revenue function, and t_i a vector of exogenous variables that shift the bank's cost

function. Secondly, it means that, in equilibrium, the zero profit constraint holds at the market level:

$$R_i^*(x^*, n^*, z) - C_i^*(x^*, w, t) = 0 \quad (5)$$

Variables marked with * represent equilibrium values. Market power is measured by the extent to which a change in factor input prices (∂w_k) is reflected in the equilibrium revenues (∂R_i^*) earned by bank i. Panzar and Rosse define a measure of competition, the „H statistic" as the

Table 2

P-R model results in other studies

Authors	Period	Countries considered	Results
Shaffer (1982)	1979	New York	Monopolistic competition
Nathan and Neave (1989)	1982-1984	Canada	1982: perfect competition; 1983-1984: monopolistic competition
Lloyd-Williams *et al.* (1991)	1986-1988	Japan	Monopoly
Molyneux *et al.* (1994)	1986-1989	France, Germany, Italy, Spain and UK	Monopoly: Italy; monopolistic competition: France, Germany, Spain, UK
Vesala (1995)	1985-1992	Finland	Monopolistic competition for all but two years – monopoly
Molyneux *et al.* (1996)	1986-1988	Japan	Monopoly
Coccorese (1998)	1988-1996	Italy	Monopolistic competition
Rime (1999)	1987-1994	Switzerland	Monopolistic competition
Bikker and Groeneveld (2000)	1989-1996	15 EU countries	Monopolistic competition
De Bandt and Davis (2000)	1992-1996	France, Germany and Italy	Large banks: monopolistic competition in all countries; small banks: monopolistic competition in Italy, monopoly in France, Germany
Bikker and Haaf (2000)	1988-1998	23 OECD countries	Monopolistic competition

Source: J. A. Bikker and K. Haaf (2000).

sum of the elasticities of the reduced form revenues with respect to factor prices:

$$H = \sum_{k=1}^{m} \frac{\partial R_i^* w_{k_i}}{\partial w_{k_i} R_i^*} \qquad (6)$$

The estimated value of the H statistic ranges between $-\infty < H \leq 1$. H is smaller than zero if the underlying market is monopoly, it ranges between zero and unity for monopolistic competition, and an H of unity indicates perfect competition. Table 1 summarises the discriminatory power of H.

S. Shaffer (1983) demonstrated formal linkages between the Panzar-Rosse H statistic, the conjectural variation elasticity and the Lerner index. Only a limited number of studies tests the P-R method for the banking industry. Table 2 summarises the results of those investigations.

S. Shaffer (1982), in his pioneering study on New York banks, observed monopolistic competition. For Canadian banks, A. Nathan and E. H. Neave (1989) found perfect competition for 1982 and monopolistic competition for 1983-1984. D. M. Lloyd-Williams et al. (1991) and P. Molyneux et al. (1996) revealed perfect collusion for Japan. P. Molyneux et al. (1994) tested the P-R statistic on a sample of French, German, Italian, Spanish and British banks for the period 1986-89 in order to assess the competitive conditions in major EC banking markets. They obtain values for H which are not significantly different from zero and from unity for France, Germany (except for 1987), Spain and the UK, thus pointing to monopolistic competition. The H-statistic for Italy during 1987-89 is negative and significantly different from zero; hence it was not possible to reject the hypotheses of monopoly. P. Coccorese (1998), however,

who also intends to evaluate the degree of competition in the Italian banking sector, obtains significantly non-negative values for H. H was also significantly different from unity, except in 1992 and 1994.

J. Vesala (1995) applies the model to the Finnish banking industry (1985-92) to test for competition and market power in the Finnish banking sector. His estimates of H were always positive, but significantly different from zero and from unity only in 1989 and 1990. For Switzerland, B. Rime (1999) observed monopolistic competition. J. A. Bikker and H. J. Groeneveld (2000) determine the competitive structure of the whole EU banking industry. The estimated values for the H-statistic lie between two thirds and one in most countries. The hypothesis $H = 0$ is rejected for all countries, whereas $H =1$ cannot be rejected for Belgium and Greece at the 95 % confidence level. O. De Brandt and P. Davis (2000) investigate banking markets in France, Germany and Italy within groups of large and small banks. Aiming to assess the effects of EMU on market conditions, they obtain estimates of H, which are significantly different from zero and from unity for large banks in all three countries. The H statistics estimated for the sample with small banks indicate monopolistic competition in Italy, and monopoly power in France and Germany. J. A. Bikker and K. Haaf (2000) consider banks in 23 OECD countries and investigate small, medium-sized and large banks separately. This P-R analysis finds monopolistic competition virtually everywhere, although perfect competition can not be rejected for some market segments.

The structure-performance relationship, a simplified version of the traditional SCP paradigm, and the efficiency hypothesis integrate measures of concentration

and competition. Formal derivations of this class of relationships provide evidence of the theoretical appropriateness of both the *HHI* and the CR_k as measures of concentration in structural models. Various types of empirical applications of the structure-performance relationship, seeking to find support for either the SCP model or the efficiency hypothesis, were discussed.

Three non-structural measures of competition were presented. Their derivations are based on oligopoly theory of the Industrial Organisations approach (Bresnahan and Iwata model), or on the comparative static properties of reduced form revenue equations (Panzar and Rosse approach). Whereas both the Bresnahan and the Panzar and Rosse methods were applied to the European banking industry, the application of the Iwata model posed difficulties, given the lack of required micro-data on the structure of cost and production of a large number of players in the European banking markets. Since studies applying the Bresnahan method to European markets are scarce, no trends may be observed in their results. Monopolistic competition is the prevailing outcome in the studies applying the Panzar and Rosse method to European countries.

Measures of concentration in the banking industry: literature review

The importance of concentration ratios arises from their ability to capture structural features of a market. Concentration ratios are therefore often used in structural models explaining competitive performance in the banking industry as the result of market structure. Concentration ratios are also able to reflect changes in

concentration as a result of the entry of a bank into the market or its exit from it, or caused by a merge. This feature is used in the US, for instance, in the enforcement process of anti-trust laws in banking (Bikker, Haaf, 2000).

The concept of industrial concentration has been extensively treated and lively debated in the economic literature. Despite the many different approaches to its measurement, general agreement prevails about the constituting elements of concentration measures, *i.e.* the number of banks (fewness) and the distribution of bank sizes (inequality) in a given market. However, the classification of concentration measures in the literature is not systematic. This section presents concentration indices (*CI*) exhibiting the general form:

$$CI = \sum_{i=1}^{n} s_i \bullet w_i \; , \qquad (7)$$

where s_i is the market share of bank i, w_i is the weight attached to the market share and n is the number of banks in the market in question. The most frequently used concentration indices are presented in the Table 3.

Concentration measures can be classified according to their weighting schemes and structure. Researchers (Marfels, 1971; Dickson, 1981) discuss the weighting schemes of a number of concentration ratios. The weighting scheme of an index determines its sensitivity towards changes at the tail-end of the bank size distribution. C. Marfels differentiates between four groups of weights:

◆ weights of unity are attached to the shares of an arbitrarily determined number of banks ranked in descending order ($w_i = 1, \forall_i \leq k$), and zero weights are attached to the remaining banks in the

Banking sector concentration ratios

Ratio	Ratio range	Ratio form
The k bank concentration ratio	$0 < CR_k = 1$	$CR_k = \sum_{i=1}^{k} s_i$
The Herfindahl-Hirschman Index	$1/n = HHI = 1$	$HHI = C_H = \sum_{i=1}^{n} s_i^2$
The Hall-Tideman Index	$0 < HTI = 1$	$HTI = 1/(2\sum_{i=1}^{n} i * s_i - 1)$
The Rosenbluth Index	$0 < RI = 1$	$RI = 1/(2C)$
The comprehensive industrial concentration index	$0 < CCI = 1$	$CCI = s_1 + \sum_{i=2}^{n} s_i^2 * (1 + (1 - s_i))$
The Hannah and Kay Index	$1/s_1 = HKI = n$	$HKI = (\sum_{i=1}^{n} s_i^{\alpha})^{1/(1-\alpha)}$, $\alpha > 0$ ir $\alpha \neq 1$,
The U index	$1/n = U = 8$	$U = (\sum_{i=1}^{n} s_i * (s_i * n^{(\alpha-1)/\alpha}))^{\alpha}$
The Hause Indices	$0 < H_m = 1$	$H_m(\alpha, \{s_i\}) = \sum_{i=1}^{n} s_i^{2-(s_i*(HHI - s_i^2))^{\alpha}}$
Entropy Measure	$0 = E = \log n$	$E = -\sum_{i=1}^{n} s_i * \log_2 s_i$

Source: J. A. Bikker (2000).

industry ($w_i = 0$, $\forall_i > k$). An example is the k bank concentration ratio, probably the most frequently used concentration ratio;

◆ banks' market shares are used as their own weights ($w_i = s_i$, $\forall_i$), so that greater weights are attached to larger banks. These indices take account of all banks in the industry. An example is the Herfindahl-Hirschman index, well-known from both theory and practice;

◆ the rankings of the individual banks are used as weights ($w_i = i$, $\forall_i$), where banks can be ranked in ascending or descending order. All banks are included in computing this index. Examples are the Rosenbluth index and the Hall-Tideman index;

◆ each market share is weighted by the negative of its logarithm ($w_i = -\log s_i$, $\forall_i$). A smaller absolute weight is thus attached to larger market shares. An example is the Entropy index.

V. A. Dickson's (1981) approach to weighting schemes is somewhat more theoretical. By defining conjectural variation elasticity, he presents the derivation of various weighting schemes embedded in microeconomic theory. V. A. Dickson found only six of the 15 indices under investigation consistent with theoretical market models: the CR_k, the HHI, the CCI, the H_m, the HKI and the U. Some of the indices presented in this section are more complex and hence consistent with more than one of the weighting schemes; an example is the CCI.

The structure of concentration indices can be discrete or cumulative. Discrete

measures of concentration correspond to the height of the concentration curve at an arbitrary point. The *k* bank concentration ratio, for instance, belongs to this class of discrete measures. Practical advantages of discrete measures are simplicity and limitation of required data. In the literature, both supporters and critics of discrete concentration measures are numerous. Both parties, however, stress the impact of concentration on the market behaviour of banks. Supporters of discrete measures maintain the view that the behaviour of a market dominated by a small number of banks is very unlikely to be influenced by the total number of enterprises in the market: the calculation of concentration indices on the basis of the entire bank size distribution would be unnecessarily large-scale, while only marginally changing the final results. Critics adhere to the view that every bank in the market influences market behaviour and stress a severe disadvantage of discrete indexes: they ignore the structural changes in those parts of the industry which are not encompassed by the index of concentration. The competitive behaviour of the smaller market players might force the larger players to act competitively as well.

Cumulative or summary measures of concentration, on the other hand, explain the entire size distribution of banks, implying that structural changes in all parts of the distribution influence the value of the concentration index. Of the measures presented in this section, the *HHI*, the *CCI*, the *RI* and the *HTI* as well as the *E* display this feature. Marfels (1971b) showed that it is possible to find corresponding measures of inequality for every summary measure of concentration, but that discrete measures of concentration do not exhibit this duality. Hence, he argues that

the behaviour of discrete measures resulting from changes in the number of banks in the industry or in bank size disparity cannot be clearly identified.

In this section will be discussed only most frequently used concentration ratios: the *k* bank Concentration Ratio and the Herfindahl-Hirschman Index.

Simplicity and limited data requirements make the *k* bank concentration ratio one of the most frequently used measures of concentration in the empirical literature. Summing only over the market shares of the *k* largest banks in the market, it takes the form (Table 3). There is no rule for the determination of the value of *k*, so that the number of banks included in the concentration index is a rather arbitrary decision. The concentration ratio may be considered as one point on the concentration curve, and it is a one-dimensional measure ranging between zero and unity.

The Herfindahl-Hirschman Index *(HHI)* is the most widely treated summary measure of concentration in the theoretical literature and often serves as a benchmark for the evaluation of other concentration indices. In the United States, the *HHI* plays a significant role in the enforcement process of antitrust laws in banking. An application for the merger of two banks will be approved without further investigation if the basic guidelines for the evaluation of the concentration in deposit markets are satisfied. Often called the full-information index because it captures features of the entire distribution of bank sizes, it takes the form (Table 3).

As mentioned above, the Herfindahl-Hirschman index stresses the importance of larger banks by assigning them a greater weight than smaller banks, and it incorporates each bank individually, so that arbitrary cut-offs and insensitivity to

the share distribution are avoided. Herfindahl-Hirschman indices in the range below 1000 show a very low concentration, in the range 1000 – 1800 show a moderate concentration, in the range above 1800 show a very high concentration of the banking system, whereas the index value equal to 10000 shows a full concentration (monopoly).

Concentration ratios are often used as input for public policy rules and measures regarding the banking market structure. Policy makers can select suitable concentration indices dependin g on the features of their banking market (e.g. the type or level of concentration), their perceptions regarding the relative impact larger and smaller banks have on competition in a certain market, and their perceptions regarding the relative impact of size distribution and number of banks (for instance, reflecting the impact of a new entry). These features and perceptions mainly determine which index is most appropriate. Concentration ratios are also used to measure the impact of concentration on competition.

With the exception of the *k* bank concentration ratio and the Herfindahl-Hirschman index, the measures of concentration presented in the Table 3 have been applied only sparingly in the empirical banking literature. The former two indices are also often used as proxies for the market structure in structural approaches to measure competition, i.e. the Structure-Conduct-Performance paradigm and the efficiency hypothesis. The Herfindahl-Hirschman index, furthermore, is a statutory measure to evaluate the impact which a proposed merger in the US banking industry is to have on the market structure in the region concerned. Applied in practice, the various concen-

tration measures may show strongly diverging values for the same market, owing to the use of varying weighting schemes, which reflect mainly different assessment regarding the relative impact of larger and smaller banks on competition in a certain market. Policy makers and researchers should choose concentration indices depending on the features of their banking market and their perceptions regarding the relative impact larger and smaller banks have on competition and regarding the relative impact of size distribution and number of banks.

Competition, concentration, efficiency, and their relationship in the Lithuanian banking sector: research methodology and empirical results

Research methodology. This study estimates competitive behavior in the Lithuanian banking sector by investigating the degree of competition. The nature of the estimation of the H-statistic, means that we are especially interested in understanding how interest revenues react to variations in the cost figures. We assume that banks use three inputs (i.e. funds, labor, and capital), which is consistent with the intermediation approach.

In order to estimate the H-statistic for the Lithuanian banking sector the following reduced form revenue equation has been estimated:

$$\ln(IR) = c + a_1 \ln w_1 + a_2 \ln w_p +$$
$$+ a_3 \ln w_k + doth \qquad (8)$$

where:
Dependent variable:
IR – interest revenue function which was defined in the

following way: interest revenue/total assets,

Three factor prices:

w_l – unit price of labor which was defined in the following way: personnel expenses/total assets,

w_p – unit price of funds which was defined in the following way: interest expenses/ total assets,

w_k – unit price of capital which was defined in the following way : other expenses/fixed assets,

Other bank specific variables:

oth – the size of nonperforming loans (NPL),

and c – constant.

In this study, which uses panel data for Lithuanian commercial banks and applies the equation (8) among the different panel regression techniques, fixed effects estimations have been used. The sum of the factors prices function (denoted with the coefficients a_1, a_2 and a_3) of the reduced-form of revenues (see equation (8)) constitutes the value of the H-statistic for the Lithuanian banking sector.

The Panzar and Rosse approach also has some limitations: general limitations are the assumptions made as well as the resulting biases when applying this technique to real world (bank) data (see Hempell, 2000). Despite these limitations, the model's special advantages make it a valuable tool in assessing market conditions. The P-R methodology analyses directly the competitive conduct of banks based on the comparative static properties of reduced form of revenue function, without employing any structural measures (see Koutsomanoli-Fillipaki and Staikouras, 2004).

The research of concentration in Lithuanian banking sector is based on two most frequently used concentration measures: the Herfindahl-Hirschman index and the k bank concentration ratios, for k = 1, 3 and 5, based on market shares in terms of total assets, loans and deposits of banks.

The research of efficiency in Lithua-

nian banking sector is based on two most frequently used efficiency indicators: ROA (profit before tax over average assets) and ROE (profit before tax over tier 1 equity).

There are investigated relationships between concentration, competition and efficiency in Lithuanian banking sector at the macro-level by using correlation analysis in this article. This paper tests 3 connections implied by the SCP paradigm and the efficiency hypothesis. The structure-conduct-performance (SCP) paradigm postulates a connection between market structure, behaviour and profitability. According to L. G. Goldberg and A. Rai (1996), this paradigm provides an explanation for the positive connection between concentration and profitability often found in the American banking sector. The reasoning is as follows: in markets with a high degree of concentration, firms have more market power which allows them to set prices above marginal costs and achieve higher profits. Another explanation for the connection between concentration and profitability is the efficiency hypothesis. The efficiency hypothesis states that more efficient enterprises will be capable of expanding their market share and will have higher profitability.

The SCP paradigm and the efficiency hypothesis imply 3 hypotheses:

H1: A higher degree of concentration leads to less competitive behaviour.

H2: A higher degree of concentration leads to greater efficiency.

H3: Less competitive behaviour will lead to greater efficiency.

The data. The panel data for this analysis comprises all Lithuanian commercial banks covered by the National Bank of Lithuanian's balance sheet as well as profit and loss accounts statistics. These statistics consist of annual data from all

Table 4

Estimation results of the yearly H-statistics in Lithuanian banking sector (2000-2006)

	2000	2001	2002	2003	2004	2005	2006
H-statistics	0,42	0,48	0,56	0,59	0,63	0,65	0,68

Source: own analysis

banks reporting to the National Bank of Lithuania and cover the period from 2000 to 2006.

Empirical Results. For the Lithuanian banking sector the H-statistic has been estimated for each year of the analyzed period 2000-2006. The empirical results with respect to the yearly H-statistic in the period 2000-2006, listed in Table 4, have shown monopolistic competition as a characteristic of the analyzed banks' behaviour for each analyzed year.

The research results of Lithuanian banking sector concentration are presented in Table 5. In the period 2000-2006, competition processes resulted in a decrease in the concentration of the Lithuanian banking sector as measured by concentration indices: Herfindahl-Hirschman (HHI) and CR_1, CR_3, CR_5. The development of these indicators also clearly demonstrates a decreasing concentration level in the Lithuanian banking sector. At the end of 2006, the market share of the five largest banks accounted for 84 % of assets, more than 86 % of loans and more than 88 % of deposits (see Table 5). Herfindahl-Hirschman indices in the range above 1800 show a very high concentration of the Lithuanian banking sector (see Table 5).

A deterioration of profitability ratios ROA and ROE in year 2000-2001 was the consequence of a significant slow-down in economic growth in Lithuania in 1999-2000, followed by lower creditworthiness

Table 5

Lithuanian banking sector's concentration indicators in 2000-2006

Concentration indices	2000	2001	2002	2003	2004	2005	2006
Herfindahl-Hirschman Indices (HHI)							
For loans	2805	2428	2211	2165	1987	1968	2026
For assets	2810	2478	2264	2100	1884	1815	1871
For deposits	3123	2811	2664	2489	2324	2103	2084
1 largest bank (CR_1)							
For loans	46,61%	42,38%	39,20%	38,44%	33,73%	28,71%	32,72%
For assets	43,27%	39,81%	37,71%	36,33%	32,66%	28,90%	31,13%
For deposits	42,35%	40,12%	39,14%	35,67%	35,19%	30,24%	28,71%
3 largest banks (CR_3)							
For loans	79,94%	74,78%	72,20%	71,94%	70,61%	69,93%	71,31%
For assets	83,21%	77,94%	73,82%	71,09%	67,61%	65,32%	66,37%
For deposits	88,09%	83,86%	81,10%	78,63%	75,28%	72,58%	72,99%
5 largest banks (CR_5)							
For loans	90,30%	86,19%	83,30%	82,09%	83,85%	84,93%	86,01%
For assets	90,94%	87,89%	84,36%	81,60%	79,45%	81,79%	83,96%
For deposits	95,80%	93,72%	92,13%	90,38%	87,84%	87,67%	88,26%

Source: own analysis

Table 6

Lithuanian banking sector's efficiency indicators in 2000-2006 (%)

Efficiency ratios	2000	2001	2002	2003	2004	2005	2006
Profit before tax over average assets (ROA) (%)	0,40	-0,16	0,85	1,06	1,03	0,79	1,13
Profit before tax over tier 1 equity (ROE) (%)	4,03	-1,67	8,48	11,10	11,93	11,04	16,11

Source: own analysis

of businesses (see Table 6).

However, during the period 2000-2006, the Lithuanian banking sector was undergoing intense transformation and development. The modernization of distribution channels and the implementation of new technologies have increased the availability of services and the effectiveness of banks' operation.

We have investigated relationships between concentration, competition, and efficiency in the Lithuanian banking sec-

tor at the macro-level by using correlation analysis. The results of this research are presented in Table 7.

A higher degree of concentration means that the same number of producers has control over a larger share of the means of production. This could lead to anti-competitive behaviour. In most cases we find a significant relation between concentration and competition. Column 2 of Table 7 shows that we find a significant negative connection between competition

Table 7

Correlation analysis of competition, concentration and efficiency in the Lithuanian banking sector (2000-2006)

	H-statistics	ROA	ROE
H-statistics	1,0000	0,7737	0,8705
Herfindahl-Hirschman Indices (HHI)			
For loans	-0,9598	-0,6707	-0,7376
For assets	-0,9829	-0,7077	-0,7981
For deposits	-0,9831	-0,6709	-0,8043
1 largest bank (CR$_1$)			
For loans	-0,9422	-0,6124	-0,7410
For assets	-0,9554	-0,6280	-0,7642
For deposits	-0,9332	-0,6408	-0,8077
3 largest banks (CR$_3$)			
For loans	-0,9205	-0,6181	-0,6673
For assets	-0,9874	-0,7130	-0,8120
For deposits	-0,9847	-0,6899	-0,8129
5 largest banks (CR$_5$)			
For loans	-0,6041	-0,5286	-0,4274
For assets	-0,8502	-0,7283	-0,7095
For deposits	-0,9719	-0,7171	-0,8123
Profit before tax over average assets (ROA) (%)	0,7737	1,0000	0,9622
Profit before tax over tier 1 equity (ROE) (%)	0,8705	0,9622	1,0000

Source: own analysis

and concentration. So we find support for hypothesis H1.

The results also show negative connection between concentration and efficiency ratios ROA and ROE in Lithuanian banking sector. Our results provide no support for the second hypothesis.

The final building block of the SCP paradigm is the relationship between market conduct and efficiency. Table 7 presents a significant positive connection between competition and efficiency ratios ROA and ROE in Lithuanian banking sector. So our results provide no support for hypothesis H3.

Conclusions

1. The literature on the measurement of competition in the banking industry can be divided into two major streams: structural and non-structural approaches. The structural approach to the measurement of competition embraces the Structure-Conduct-Performance paradigm (SCP) and the efficiency hypothesis, as well as a number of formal approaches with roots in Industrial Organisation theory. The structure-performance relationship, a simplified version of the traditional SCP paradigm, and the efficiency hypothesis integrate measures of concentration and competition. Formal derivations of this class of relationships provide evidence of the theoretical appropriateness of both the HHI and the CR_k as measures of concentration in structural models.

2. Non-structural models for the measurement of competition, namely the Iwata model (Iwata, 1974), the Bresnahan model, and the Panzar-Rosse model (Panzar, Rosse, 1987), were developed in reaction to the theoretical and empiri-

cal deficiencies of the structural models. Whereas both the Bresnahan and the Panzar and Rosse methods were applied to the European banking industry, the application of the Iwata model posed difficulties, given the lack of required micro-data on the structure of cost and production of a large number of players in the European banking markets. Since studies applying the Bresnahan method to European markets are scarce, no trends may be observed in their results. Monopolistic competition is the prevailing outcome in the studies applying the Panzar and Rosse method to European countries.

3. The importance of concentration ratios arises from their ability to capture structural features of a market. Concentration ratios are therefore often used in structural models explaining competitive performance in the banking industry as the result of market structure. Concentration ratios are also able to reflect changes in concentration as a result of the entry of a bank into the market or its exit from it, or caused by a merge. The choice of the concentration index is mainly dependent on the policy makers' perception of the relative influence on competition attached to large and small banks. The Herfindahl-Hirschman index and the k bank concentration ratio appear most frequently, both in theory and practice. The simple structure of these indices and the limited data requirement of the CR_k contribute to this success.

4. The study estimates competitive behavior in the Lithuanian banking system by applying the method developed by J. C. Panzar and J. N. Rosse (1987). The research of concentration in Lithuanian banking sector is based on two most frequently used concentration measures: the Herfindahl-Hirschman index and the k

bank concentration ratios, for k = 1, 3 and 5, based on market shares in terms of total assets, loans and deposits of banks. The research of efficiency in Lithuanian banking sector is based on two most frequently used efficiency indicators: ROA and ROE. The panel data for this analysis comprises all Lithuanian commercial banks covered by the National Bank of Lithuanian's balance sheet as well as profit and loss accounts statistics. These statistics consist of annual data from all banks reporting to the National Bank of Lithuania and cover the period from 2000 to 2006.

5. For the Lithuanian banking sector the H-statistic has been estimated for each year of the analyzed period 2000-2006. The empirical results with respect to the yearly H-statistic in the period 2000-2006 have shown monopolistic competition as a characteristic of the analyzed banks' behaviour for each analyzed year.

6. In the period 2000-2006 competition processes resulted in a decrease in the concentration of the Lithuanian banking sector as measured by concentration indices: Herfindahl-Hirschman (HHI) and CR_1, CR_3, CR_5. The development of these indicators also clearly demonstrates a decreasing concentration level in the Lithuanian banking sector. At the end of 2006, the market share of the five largest banks accounted for 84 % of assets, more than 86 % of loans and more than 88 % of deposits. Herfindahl-Hirschman indices in the range above 1800 show a very high concentration of the Lithuanian banking sector.

7. A deterioration of profitability ratios ROA and ROE in year 2000-2001 was the consequence of a significant slow-down in economic growth in Lithuania in 1999-2000, followed by lower creditworthiness of businesses. However, during the period 2000-2006, the Lithuanian banking sector was undergoing intense transformation and development. The modernization of distribution channels and the implementation of new technologies have increased the availability of services and the effectiveness of banks' operation.

8. We have investigated relationships between concentration, competition and efficiency in the Lithuanian banking sector at the macro-level by using correlation analysis. This paper tests the 3 hypotheses implied by the SCP paradigm and the efficiency hypothesis: (H1): a higher degree of concentration leads to less competitive behaviour; (H2): a higher degree of concentration leads to greater efficiency; (H3): less competitive behaviour will lead to greater efficiency.

9. A higher degree of concentration means that the same number of producers has control over a larger share of the means of production. This could lead to anti-competitive behaviour. In most cases we find a significant relation between concentration and competition. The research results show that we find a significant negative connection between competition and concentration. So we find support for hypothesis H1. The results also show negative connection between concentration and efficiency ratios ROA and ROE in Lithuanian banking sector. Our results provide no support for the second hypothesis. The final building block of the SCP paradigm is the relationship between market conduct and efficiency. The research results present a significant positive connection between competition and efficiency ratios ROA and ROE in Lithuanian banking sector. So our results provide no support for hypothesis H3.

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KONKURENCIJA, KONCENTRACIJA, EFEKTYVUMAS IR JŲ TARPUSAVIO RYŠIAI LIETUVOS BANKŲ SEKTORIUJE

S a n t r a u k a

Šiuo metu Europos finansų sistemos rinkos struktūra ir konkurencija yra aktualus ekonominės politikos klausimas. Finansų sektoriaus konkurencija gali ženkliai įtakoti finansinių paslaugų teikimo efektyvumą. Bankų sektoriaus konkurencija, efektyvumas ir stabilumas bei jų tarpusavio ryšiai yra plačiai nagrinėjami tiek teoriniame, tiek ir praktiniame lygmenyje. Be to, konkurencinėje aplinkoje gali išlikti tik inovatyvios ir efektyviai veikiančios verslo struktūros. Itin didelė konkurencija finansų sektoriuje gali turėti neigiamą įtaką šio sektoriaus stabilumui, kadangi mažiau efektyvios verslo struktūros gali pradėti vykdyti labiau rizikingą veiklą, siekdamos didesnio pelningumo lygio.

Šiame straipsnyje nagrinėjama koncentracijos įtaka Lietuvos bankų sektoriaus konkurencijai ir efektyvumui. Siekiant šio tikslo, buvo atliekami tokie tyrimai: pirmiausiai buvo atliekamas Lietuvos bankų sektoriaus konkurencijos lygio tyrimas, naudojant Panzar-Rose modelį, o toliau buvo tiriamas Lietuvos bankų sektoriaus koncentracijos lygis bei atliekamas šio sektoriaus efektyvumo įvertinimas. Naudojant koreliacinę analizę, buvo atliekamas konkurencingumo, koncentracijos ir efektyvumo tarpusavio ryšių Lietuvos bankų sektoriuje tyrimas.

Bankų sektoriaus konkurencijos įvertinimo metodus galima būtų suskirstyti į dvi pagrindines grupes: struktūriniai ir nestruktūriniai konkurencijos įvertinimo metodai. Dažniausiai naudojami struktūriniai konkurencijos įvertinimo metodai yra SCP paragdima ir efektyvumo hipotezė. Nestruktūriniai konkurencijos įvertinimo metodai yra šie: Iwata modelis, Bresnahan modelis ir Panzar-Rose metodas. Iwata modelis yra retai naudojamas praktikoje dėl šio modelio pritaikymui reikalingų duomenų trūkumo. Tačiau tiek Bresnahan modelis, tiek ir Panzar-Rosse metodas yra dažnai naudojami empirinuose tyrimuose, siekiant įvertinti bankų sektoriaus konkurencingumą.

Bankų sektoriaus koncentracijos lygiui įvertinti gali būti naudojami daugybė koncentracijos indeksų, tačiau dažniausiai praktikoje yra naudojami šie koncentracijos rodikliai: „k" bankų koncentracijos indeksas ir Herfindahl-Hirschman indeksas. Pagrindinė šių koncentracijos indeksų populiarumo priežastis – nesudėtingas pritaikomumas empiriniuose tyrimuose bei lengvai prieinami pradiniai duomenys.

Atliekant konkurencijos, koncentracijos, efektyvumo ir jų tarpusavio ryšių Lietuvos bankų sektoriuje tyrimą, buvo naudojama tokia tyrimo meto-

dologija: Lietuvos bankų sektoriaus konkurencijos lygiui tirti buvo naudojamas Panzar-Rose metodas, bankų sektoriaus koncentracijos lygio įvertinimui buvo naudojami „k" bankų koncentracijos ir Herfindahl-Hirschman indeksai. Vertinant „k" banko koncentracijos rodiklį, buvo nagrinėjama vieno didžiausio, trijų ir penkių didžiausių bankų rinkos dalis. Šiame Lietuvos bankų sektoriaus koncentracijos tyrime buvo nagrinėjami šie bankų sektoriaus rodikliai : turtas, paskolos ir indėliai. Bankų sektoriaus efektyvumo įvertinimui buvo naudojami šie rodikliai: ROA ir ROE.

Siekiant ištirti konkurencijos, koncentracijos ir efektyvumo tarpusavio ryšius Lietuvos bankų sektoriuje, buvo naudojama koreliacinė analizė bei naudojamasi pagrindiniais SCP paradigmos ir efektyvumo hipotezės teiginiais. SCP paradigma teigia, kad labiau koncentruotoje rinkoje rinkos dalyviai turi didesnę rinkos galią, kas leidžia nustatyti paslaugų/produktų kainas didesnes nei ribiniai kaštai ir tokiu būdu uždirbti didesnį pelną. Efektyvumo hipotezė teigia, kad labiau efektyvios įmonės turi daugiau galimybių padidinti jų užimamą rinkos dalį, kas sąlygoja didesnį pelningumo lygį. Remiantis SCP paradigma ir efektyvumo hipoteze buvo suformuluotos 3 hipotezės:

1 hipotezė (H1) – didėjanti koncentracija įtakoja mažesnę rinkos konkurenciją.

2 hipotezė (H2) – didėjanti koncentracija įtakoja didesnį rinkos dalyvių efektyvumą.

3 hipotezė (H3) – mažesnė rinkos konkurencija įtakoja didesnį rinkos dalyvių efektyvumą.

Lietuvos bankų sektoriaus konkurencijos, koncentracijos, efektyvumo ir jų tarpusavio ryšių tyrimo rezultatai:

1. Naudojant Panzar-Rose metodą nustatyta, kad Lietuvos bankų sektoriui būdinga monopolinė konkurencija.

2. Lietuvos bankų sektorius pasižymi aukštu koncentracijos lygiu, nors pastaraisiais metais ir pastebimas bankų sektoriaus koncentracijos lygio mažėjimas, kurį būtų galima vertinti kaip vidutinį koncentracijos lygį.

3. Lietuvos bankų sektoriaus efektyvumo rodikliai ROA ir ROE mažėjo per 2000-2001 metų laikotarpį, tačiau per 2002-2004 metus žymiai pagerėjo (2-3 kartus, lyginant su 2000 metų lygiu).

4. Lietuvos bankų sektoriaus konkurencijos, koncentracijos ir efektyvumo tarpusavio ryšių tyrimas, naudojant koreliacinę analizę ir testuojant 3 anksčiau minėtas hipotezes, patvirtino, kad pirma hipotezė (H1) yra teisinga Lietuvos bankų sektoriaus atveju, t.y. didėjanti koncentracija neigiamai veikia rinkos konkurencijos lygį. Atlikti tyrimai parodė stiprų neigiamą ryšį tarp koncentracijos ir efektyvumo, todėl galima teigti, kad antra hipotezė (H2) nepatvirtinta Lietuvos bankų sektoriaus atveju. Testuojant trečią hipotezę (H3) Lietuvos bankų sektoriaus atveju, buvo pastebėtas stiprus teigiamas ryšys tarp rinkos konkurencijos ir efektyvumo, kas leidžia daryti išvadą, kad trečia hipotezė (H3) yra nepatvirtinta Lietuvos bankų sektoriaus atveju.