Competition and Efficiency in the Banking Sector of EU New Member States

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ABSTRACT

Bank performance and, in particular, bank efficiency is a frequently debated question in the academic environment due to the extremely important role of banks in the national economy. A wide range of studies are devoted to the exploration of bank efficiency drivers. The goal of the current research is to investigate the relationship between competition and efficiency in the banking sector of new member states of the European Union.

Non-parametric frontier technique - Data Envelopment Analysis (DEA) - was used as a tool for measuring bank relative efficiency. Input-oriented DEA model under Variable Returns to Scale assumption was applied. For measuring competition in the banking sector such measures, as Herfindahl-Hirschman Index (HHI) and the share of assets held by the top 5 banks (CR5), were used as proxies.

Study was based on the sample data of 97 banks operating in seven New Member States of EU, covering the period of 2006-2012. Analysis revealed the fact that statistically significant correlation exists between average efficiency and both concentration index and HHI, indicating strong negative relationship between competition and efficiency in the banking sector of NMS.

Keywords: Bank efficiency, Competition, Concentration, DEA, European banks.

1. INTRODUCTION

The overwhelming goal of any bank is shareholder value maximization. One of the main components contributing to the shareholder value is profitability that, in turn, is affected by efficiency. Companies with a greater efficiency are able to lower costs and, consequently, to offer lower prices, gain market share and earn more profit [1]. Thus, the questions of efficiency measuring and enhancing in the banking industry are extremely important both for bank shareholders and managers. Besides, considering the role of banks in the national economy, efficiency-related issues are essential at the government level.

Topicality of the research subject is confirmed also by the results of the authors' conducted research, using such databases, as Scopus, ProQuest and Science Direct. Making a search with the keywords "bank efficiency" more than 50000 articles published since 2012 were found.

A wide range of studies are aimed to detect the factors affecting bank efficiency or to determine the causality between bank efficiency and its drivers. The most frequently investigated issues are regarded to the relationship between bank size and efficiency [2][3][4][5], ownership structure as a factor contributing to the efficiency scores [6][7][8][9][10][11] and the relationship between efficiency and banking structural financial indicators [12][13][14][15][16][17][18][19][20].

The goal of the present research is to investigate the relationship between banking market competition and efficiency. The authors' stated hypothesis is, as follows:

H1: There is a significant relationship between efficiency and competition in the banking sector of the analyzed countries.

Testing of the hypothesis was based on the sample data of banking sector of seven new member states (NMS) of the European Union (EU): Latvia (LV), Lithuania (LT), Estonia (EE), Bulgaria (BG), Malta (MT), Slovakia (SK) and Slovenia (SI). Data set covers the period of 2006-2012.

Data Envelopment Analysis (DEA) was employed in the present study to measure efficiency of individual banks in each particular country. Input-oriented DEA model was constructed based on the intermediation approach. Generalized efficiency scores for banking sectors were estimated with the *median* function.

Competition in the banking sector was measured, using Herfindahl-Hirschman Index (HHI) and the share of assets held by the top 5 banks (CR5).

The present paper contributes to the academic literature scope, extending the information on bank performance in the NMS of the EU, including the Baltic States.

2. BANK EFFICIENCY AND COMPETITION

Bank performance, the main contributing factor to the bank value, can be expressed "in terms of competition, concentration, efficiency, productivity and profitability." [15]. The wide range of closely related concepts causes the necessity to explore the interrelationship between the results of studies on bank performance measuring with application of different methods and ratios.

Hypotheses stated and tested in bank performance-related studies primarily are based on three main theoretical statements: 1) Quiet life hypothesis [20][41][43]; 2) Structure-Conduct-Performance hypothesis [27][42][31]; 3) Efficient Structure Hypothesis [41][42].

1) *Quiet life* hypothesis (QLH) developed by Hicks in 1935 posits that market power will reduce the pressure towards efficiency [21]. Banks with large market share tend to be less efficient, because focus their efforts mostly on risk reduction [22].

2) *Structure-Conduct-Performance* (SCP) hypothesis developed by Bain in 1956 [23] states that higher concentration in the banking market leads to lower competition and hence to higher bank profitability.

3) *Efficient Structure Hypothesis* (ESH) developed by Demsetz in 1973 [24] assumes that more efficient banks increase their market share by pushing less efficient competitors from the market, thus increasing their market shares.

Some examples of the recent studies in regards to the exploration of the link between efficiency and competition in the banking industry are presented in the Table 1.

Table 1.
Studies on relationship between competition and efficiency in the banking industry

Source	Research period	Region/ number of analyzed banks
Castellanos, Garza-García 2013 [25]	2002-2012	Mexico/ n.a.
Fungáčová *et al.* 2012 [26]	2002-2011	China/ 76
Andries, Capraru 2012 [12]	2001-2009	EU27/ 923
Ferreira 2012 [27]	1996-2008	EU27/2124
Tabak *et al.* 2011 [28]	2001-2008	Latin America/ 495
Guillen *et al.* 2014 [29]	1990-2007	Latin America/ 200
Fang *et al.* 2011 [9]	1998-2008	SEE countries/ 171
Abbasoglu *et al.* 2007 [30]	2001-2005	Turkey/ 47
Chortareas *et al.* 2010 [31]	1997-2005	Latin America/ 2500
Bikker, Bos 2008 [15]	1996-2006	30 OECD countries/ 2124
Casu, Girardone 2006 [32]	1997-2003	EU15/ n.a.
Weill 2003 [33]	1994-1999	Eu12/ 1746

The results of studies are controversial that can be explained with specifics of the analyzed region and difference in methods applied in data analysis. There is a range of studies providing support to direct positive relationship between efficiency and competition, i. e., higher competition results in higher efficiency of the banking sector [12][34][25]. Other researchers assert that there is no evidence of correlation between competition and efficiency [32][26][42].

Linking competition in the banking market with concentration level, both positive [28] and negative [41] impact of concentration on efficiency level was proved. Besides, research findings revealed the fact that "degree of concentration is not necessarily related to the degree of competition" [32]. Some researchers do not use concentration indices as proxies for measuring competition.

Thus, one of the crucially important questions for the study on exploring causal link between bank efficiency and competition in the banking sector is the choice of methods and underlying measures applied in the empirical analysis.

The most popular methods for measuring bank efficiency are stochastic frontier approach (SFA) [34][9][12][35][33][8] and Data Envelopment Analysis (DEA) [36][37][38][39][40].

As for measuring competition in the banking sector, commonly used methods and measures are, as follows:

1) Concentration ratios [30][29][41][27];

2) Herfindhal-Hirschman Index [31][28][41][42][27];

3) Lerner index of competition [9][12][20][43];

4) H-statistic developed by Panzar and Rosse [44][32][33][45];

5) Boone indicator [46][25].

The selection of the research methods and underlying measures is based on experts' subjective viewpoint and preferences. However, it should be emphasized that the analysis results differ sufficiently depending on the methods applied. Thus, the choice of model specification and ratios should be substantiated with regards to peculiarities of the analyzed business environment.

3. DATA AND METHODS

Research sample consists of 97 banks (as for 2012) operating in seven European countries. Data was extracted from BankScope database, covering the period of 2006-2012. Such countries, as Poland, Romania and Czech Republic, were excluded from the list, because their banking sector is substantially larger that banking sector in the analyzed countries. For instance, in 2012 the banking sector of Poland was represented by 640 domestic and foreign financial institutions, according to the data of the European Central Bank [47].

To measure competition within the banking sector, the authors used: 1) concentration ratio CR5 - the share of assets held by the top 5 banks, and 2) Herfindhal-Hirschman Index (HHI) – the sum of squared market shares of each bank representing the sector.

Statistics on CR5 in the banking sector of the analyzed countries is presented in the Figure 1 [48].
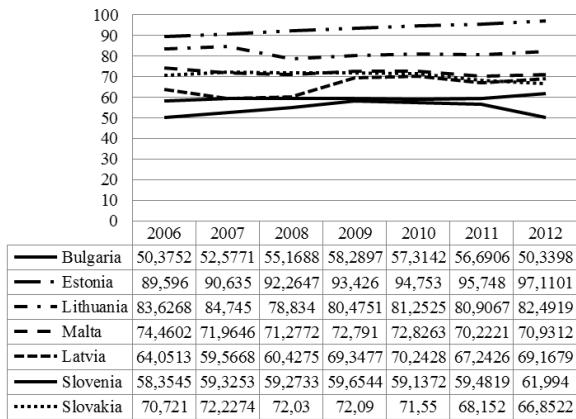
	2006	2007	2008	2009	2010	2011	2012
Bulgaria	50,3752	52,5771	55,1688	58,2897	57,3142	56,6906	50,3398
Estonia	89,596	90,635	92,2647	93,426	94,753	95,748	97,1101
Lithuania	83,6268	84,745	78,834	80,4751	81,2525	80,9067	82,4919
Malta	74,4602	71,9646	71,2772	72,791	72,8263	70,2221	70,9312
Latvia	64,0513	59,5668	60,4275	69,3477	70,2428	67,2426	69,1679
Slovenia	58,3545	59,3253	59,2733	59,6544	59,1372	59,4819	61,994
Slovakia	70,721	72,2274	72,03	72,09	71,55	68,152	66,8522

Figure 1. CR5 in the banking sector of NMS, 2006-2012

Based on the sample statistics, it can be concluded that process of bank capital consolidation led to relatively high concentration within the sector. Concentration ratios in all the countries exceed 50% in all the analyzed period. The most concentrated is Estonian market and the less concentrated is Bulgarian market.

Statistics on HHI in the banking sector of the analyzed countries is presented in the Figure 2 [48].
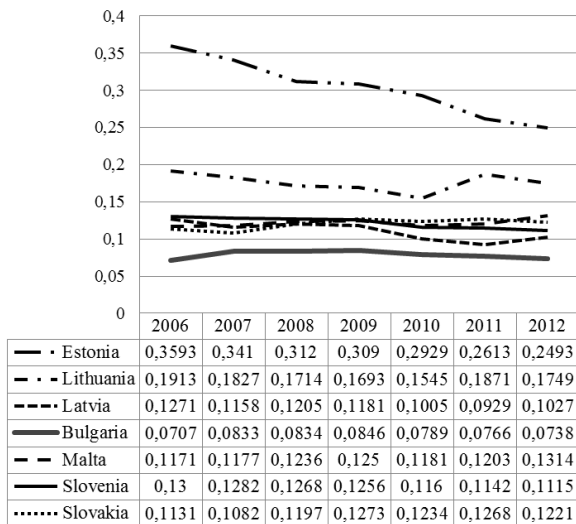
	2006	2007	2008	2009	2010	2011	2012
Estonia	0,3593	0,341	0,312	0,309	0,2929	0,2613	0,2493
Lithuania	0,1913	0,1827	0,1714	0,1693	0,1545	0,1871	0,1749
Latvia	0,1271	0,1158	0,1205	0,1181	0,1005	0,0929	0,1027
Bulgaria	0,0707	0,0833	0,0834	0,0846	0,0789	0,0766	0,0738
Malta	0,1171	0,1177	0,1236	0,125	0,1181	0,1203	0,1314
Slovenia	0,13	0,1282	0,1268	0,1256	0,116	0,1142	0,1115
Slovakia	0,1131	0,1082	0,1197	0,1273	0,1234	0,1268	0,1221

Figure 2. HHI in the banking sector of NMS, 2006-2012

As for HHI values, in most analyzed countries it does not exceed 2000 points (0,2). The maximum value is equal to 10000 points. The lower the index the closer is the market to monopoly. Estonia demonstrates the highest values of the index, but the decreasing trend indicates the growth of competition in the Estonian banking sector.

For measuring bank efficiency, non-parametric method – Data Envelopment Analysis (DEA) – was used. It was introduced in 1978 by Charnes *et al.* [49] and based on the concept of productive efficiency. The idea is to identify the most efficient companies and to construct the efficient production frontier. Measuring the distance from this frontier, it is possible to evaluate relative inefficiency of other companies within the reference set. Efficiency score is estimated as the ratio of weighted outputs to weighted inputs. To find the weights, optimization task is solved for each company in order to maximize its efficiency score (see formulas 1 and 2).

$$\max h_0 = \frac{\sum_{r=1}^{s} u_r y_{r0}}{\sum_{i=1}^{m} v_i x_{i0}} \tag{1}$$

subject to:

$$\frac{\sum_{r=1}^{s} u_r y_{rj}}{\sum_{i=1}^{m} v_i x_{ij}} \leq 1; \tag{2}$$

Efficiency is estimated relatively to other reference set members. The maximal efficiency score is equal to 1, and the lower values indicate relative inefficiency of analyzed banks.

Initially, the model was applied under constant returns to scale (CRS) assumption followed by the model developed by Banker *et al.* in 1984 [50] that employed variable returns to scale (VRS) assumption. In the present paper input-oriented DEA model under VRS assumption was applied. The input-orientated models are the most frequently used for measuring bank efficiency with DEA [4][39][51]. It is based on the assumption that bank managers have higher control over inputs rather than outputs [52]. DEA model was constructed, based on intermediation approach that emphasizes bank intermediary function. Two variables were employed: bank deposits as inputs and loans as outputs.

4. RESULTS

To evaluate banking sector's efficiency, DEA efficiency scores of individual banks were estimated. The average results for each particular country are presented in the Figure 3.
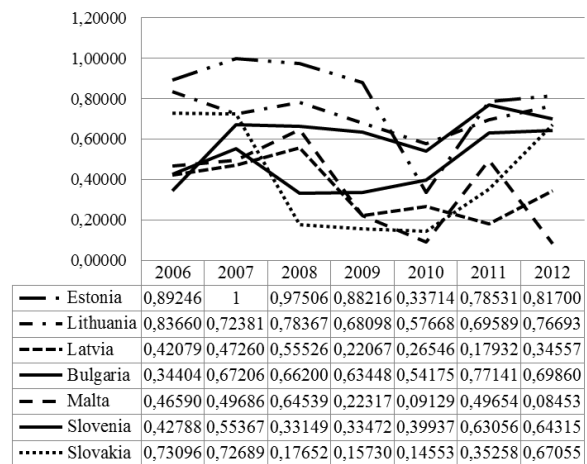
	2006	2007	2008	2009	2010	2011	2012
Estonia	0,89246	1	0,97506	0,88216	0,33714	0,78531	0,81700
Lithuania	0,83660	0,72381	0,78367	0,68098	0,57668	0,69589	0,76693
Latvia	0,42079	0,47260	0,55526	0,22067	0,26546	0,17932	0,34557
Bulgaria	0,34404	0,67206	0,66200	0,63448	0,54175	0,77141	0,69860
Malta	0,46590	0,49686	0,64539	0,22317	0,09129	0,49654	0,08453
Slovenia	0,42788	0,55367	0,33149	0,33472	0,39937	0,63056	0,64315
Slovakia	0,73096	0,72689	0,17652	0,15730	0,14553	0,35258	0,67055

Figure 3. Efficiency scores of the banking sector of NMS, 2006-2012 [estimated by the authors]

The highest efficiency scores demonstrate Estonia and Lithuania. The similar results were yielded in the previously conducted researches [34]. The period of 2008-2010 is characterized by significant efficiency drop within the sample that was caused by the global financial downturn.

The estimated efficiency scores were used in the correlation analysis that was performed by means of SPSS software. Relationship between DEA scores of each particular country, CR5 and HHI was tested (see Table 2).

Table 2.
Results of the analysis: DEA efficiency vs. CR5 and HHI

	DEA vs. CR5		DEA vs. HHI	
	Pearson correlation	Sig	Pearson correlation	Sig.
EE	0,427	0,339	0,361	0,427
LT	0,527	0,224	0,722	0,067
LV	0,665	0,111	0,655	0,110
BG	0,277	0,547	0,452	0,309
MT	-0,377	0,405	-0,411	0,360
SI	-0,319	0,485	-0,593	0,160
SK	-0,839*	0,018	-0,717	0,069
*. Correlation is significant at the 0.05 level (2-tailed).				

Data provided in the Table 2 indicates the fact that there is no statistically significant correlation either between DEA score and CR5 (except Slovakia) or between DEA score and HHI. It should be emphasized that the values of the correlation coefficients are rather high in some cases (see Latvia and Lithuania), but not statistically significant. However, conducting the same analysis by means of Excel software, the results would point to the significant relationship (considering criterion of 0,5 for Pearson correlation coefficient). It means, in turn, that researchers should perform such kind of analysis with extreme caution, thinking not only on models and ratios, but also on software technical features.

Besides, the correlation coefficients are positive and negative in different cases. In this regard the question arises about the theoretical basis for this relationship.

Based on Quiet Life hypothesis, market power has a negative impact on efficiency due to the slack management. Thus, in highly concentrated market (as in the sample) with several top banks controlling the banking sector efficiency should be lower than in less concentrated market. Consequently, there should be negative correlation between CR5 and DEA scores.

In turn, Structure-Conduct-Performance hypothesis assumes positive relationship between market concentration and overall profitability (efficiency). Banks with a large market share "will face less competition to obtain more output results with less input costs" [27]. Thus, there should be positive correlation between CR5 and DEA scores.

Based on Efficient Structure Hypothesis, efficient companies determine market structure, increasing their market shares and, hence, increasing market concentration. Thus, there should be positive correlation between DEA scores and CR5.

As for HHI relationship with the efficiency scores, the same conclusions can be made from the theory. The higher is HHI (closer to 1 or 10000 points) the closer is the market to

monopoly, the more assets are concentrated in several largest banks.

The authors hold the view that positive relationship between efficiency and concentration is logically to be assumed. Banks with large market share compete against each other and do not spend their resources for competitive struggle with all other market players. Thus, the economy of resources positively influences efficiency.

To finalize the study, correlation analysis was performed using the whole data set (all three variables were included). The results are presented in the Table 3.

Table 3.
Bivariate correlation between DEA scores, CR5 and HHI

		DEA	CR5	HHI
DEA	Pearson Correlation	1	0,406**	0,514**
	Sig. (2-tailed)		0,004	0,000
CR5	Pearson Correlation	0,406**	1	0,904**
	Sig. (2-tailed)	0,004		0,000
HHI	Pearson Correlation	0,514**	0,904**	1
	Sig. (2-tailed)	0,000	0,000	
**. Correlation is significant at the 0.01 level (2-tailed).				

The results based on the whole sample data indicate the significant correlation (**) between DEA scores and both CR5 and HHI (at 99% confidence level). Correlation coefficients are positive in both cases that is aligned with the theory and logical premises. Increase of HHI or CR5 points to the decrease of competition in the market.

The research findings do not allow making an unambiguous conclusion. Results of the analysis of statistics on individual countries (see Table 2) are in the conflict with the results received from the analysis of the whole sample data (see Table 3). The significant contradiction can be explained with a difference in a volume of data set. As for 2012, whole sample included 97 banks, but data of only 8 Estonian and 8 Lithuanian banks was analyzed.

5. CONCLUSIONS

The present paper demonstrates the results of testing the authors' stated hypothesis on the relationship between efficiency and competition in the banking sector of NMS of the EU. Efficiency was measured by means of Data Envelopment Analysis – non-parametric method based on the efficient frontier approach. For measuring competition in the banking sector the authors used concentration ratio (market share of 5 top banks) and Herfindahl-Hirschman Index..

Highest average efficiency was demonstrated by Estonian and Lithuanian banking sector that is aligned with the results of previously conducted studies. Besides, Estonia and Lithuania have the most concentrated banking market. The largest banks in the Baltic States are Scandinavian owned banks Swedbank, SEB bank and DNB bank. Based on BankScope data, in 2012 Swedbank market share in Latvia, Lithuania and Estonia was 16%, 22% and 47% (!), respectively.

Correlation analysis based on data provided by BankScope in regards to individual countries did not revealed any statistically significant correlation between the analyzed measures. However, quite small number of banks in some countries

discredits the reliability of the received results. In turn, the analysis of the whole sample data provides the strong support to the stated hypothesis. Correlation coefficients between DEA scores and competition measures are significant. With the increase of HHI the situation in the market tends to monopoly, degree of competition decreases and, consequently, efficiency grows up. Similar conclusions can be made in regards to relationship between CR5 and DEA efficiency. In highly concentrated banking sector strong market players press out small banks and efficiency increases. Thus, the present study provided evidence on strong positive relationship between concentration and efficiency and, hence, a strong negative relationship between competition and efficiency in the banking sector of NMS.

However, it should be emphasized that the results could differ widely depending on methodological approach. In the present study simplified DEA model with only two variables was applied. Some researchers investigated the relationship between competition and cost and profit efficiency separately and received quite different results. The topic for further investigation could be testing the research hypothesis with application of different specification of DEA model. Besides, considering increased debate on the relationship between competition and concentration, it would be interesting to use other measures of competition in the analysis.

6. ACKNOWLEDGEMENTS

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