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Are Larger Banks More Efficient in the Central Eastern European Countries?

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Abstract

Theoretical background: The relationship between the size of banks and their efficiency has become an important subject for academics and policy makers in the recent decades. However, the outcomes of these studies are relatively divergent concerning the direction of this dependence.

Purpose of the article: The goal of this study is to assess how the size of banks affects their efficiency in the CEE countries in the years 2005–2017. Additionally, the relationship between the market concentration and banks efficiency is checked.

Research methods: The research covers 108 banks operating in eleven CEE countries. The efficiency scores are achieved through the SFA method and regressed with the individual bank characteristics and macroeconomic and sectoral variables.

Main findings: The results show that growing bank's size and market share positively affect its efficiency. Additionally, higher concentration of the banking market has a similar effect. Higher inflation and GDP *per capita* decrease bank profit efficiency which can indicate that banks achieve the highest efficiency gains in less prosperous countries, however, in the low inflation environment. Additionally, banks' efficiency is boosted with the growing development of the banking sector and increasing lending to the economy. Fast-growing banks tend to be more efficient, probably due to the positive effect of the financial leverage on profits.

Introduction

The efficiency of the banking sector has become an important subject for academics and policy makers in the recent decades (Berger, Hasan, & Zhou, 2009; Duygun, Sena, & Shaban, 2013; Mesa, Sánchez, & Sobrino, 2014; Niţoi & Spulbar, 2015; Silva, Guerra, Tabak, & de Castro Miranda, 2016; Peng, Jeng, Wang, & Chen, 2017; Avramidis, Cabolis, & Serfes, 2018). Among them, studies analyze the relationship between the size of banks and their efficiency. However, the outcomes of these studies are relatively divergent. Some of them indicate that the size of banks positively impacts their performance (Berger, Demsetz, & Strahan, 1999; Haynes & Thompson, 1999; Bikker & Haaf, 2002; Amel, Barnes, Panetta, & Salleo, 2004), however, others notice an opposite direction of this dependence (Rhoades, 1999; Mamatzakis, Matousek, & Vu, 2016) or do not find any significant relationship (Avkiran, 1999; Casu & Girardore, 2006). Similar discrepancies are recognized in the assessment of the possible impact of the concentration of the banking structure. The difference in the obtained conclusions may come from the fact that these studies were conducted in various macroeconomic conditions and timeframes, as well as sets of examined banks operating in different geographical regions.

The goal of this study is to determine how the size of banks affects their efficiency in the Central Eastern European (CEE) countries in the years 2005–2017. Additionally, the relationship between the market concentration and banks efficiency is checked. The timeframe of the research was chosen in such a way as to cover periods of economic growth, as well as crises or slowdowns. During the analysed period, CEE banks' activity was exposed to the effects of the global financial crisis of 2007–2009 and the crisis of public finance in some euro area countries in 2011–2013. The research refers to 108 banks which operate in eleven CEE countries. In the study the hypothesis was made that banks can improve their efficiency by increasing the value of their assets.

The study fills the existing gap in literature on the relationship between the size of the bank and its efficiency in the banking sector in the CEE countries in the pre- and post-global financial crisis period. It shades a new perspective on the banking market concentration versus banks' efficiency relationship, as well. Additionally, it takes into consideration the impact of some macroeconomic variables on bank's efficiency as: GDP *per capita*, inflation rate, level of development of the banking sector, as well as the individual bank's capital ratio.

The rest of the paper consists of three sections and conclusions. The first one presents conclusions from the literature review, the second – data and methods used in the research, and the third discusses the results of the research. Finally, the entire study is summarized.

Banks' size and efficiency – literature review

The literature does not present a uniform answer to the question about the impact of the size of the bank on its performance. The conclusions of the studies presented in the literature explain this relationship using two theories: the market power (MP) theory and the efficient structure (ES) theory. The first one states that bank's performance significantly depends on the structure of the market (the structure-conduct-performance paradigm, SCP). In the more concentrated sector, larger banks can gain a monopolistic premium, which enables them to set more favorable for them prices and improve their efficiency and profitability. The ES theory states that due to the competitive advantage, more efficient enterprises are able to grow at the expense of less viable competitors and with the economy of scale become even larger and more efficient (Demsetz, 1973). In the banking sector, efficient banks can lower prices of their products, become more competitive and gain new customers.

The relationship between the size of enterprises and their performance was developed by Bain (1951). He stated that in the market with smaller number of enterprises, the market participants increase prices and achieve higher profits. Such conduct has been also noticed in the research conducted on banks over the last few decades. Gilbert (1984) states that in the 1960s, as a result of changes in the legal regulations concerning the effects of bank mergers, large U.S. banks were able to offer lower rates on deposits and higher rates on loans and thus raise their profits and efficiency.

Hay and Liu (1997) confirm the existence of the positive relationship between bank's market share and efficiency. Large banks due to the solid cost policy improve efficiency of their operations and raise profitability. In consequence, they become larger and increase market share. Similarly Boot and Schmeits (2005) state that larger banks may withstand harsh competition and increase further their size and market share. Especially during an economic downturn, smaller units could not afford to develop new products and expose themselves to the risk of losing customers. Larger banks are able to provide competitive products, operate with larger network of offices and maintain customer loyalty.

Results of the research conducted by Evanoff and Fortier (1988) on the U.S. banking sector in the 1970s and 1980s indicate that more efficient banks acquire less competitive entities, *inter alia*, based on their size and cost reduction ability. In the recent decade, using the ES theory, Homma, Tsutsui, and Uchida (2014) explain the behaviour of Japanese banks which operate in the period 1974–2005. They state that large banks operate more efficiently and gain larger market share due to acquiring less efficient and weaker performing competitors.

The research on the relationship between the bank's size and its performance in the CEE countries is rather limited. Among them Andries and Ursu (2016), based on the research on banks operating in seven CEE countries over the period of 2004–2008, find that banks' efficiency characterises in an upward trend and is positively affected by the level of banking sector concentration and the size of banks. Efthyvoulou and

Yildirim (2014), based on the performance of banks in seventeen CEE countries over the period 2002–2010, assess their market power and efficiency. They notice a significant inconsistency in these variables in the analysed countries and diversified responses of banks to the effects of the financial crisis, among others, due to the ownership structure. Most of other papers concentrate rather on assessing banks' efficiency (Anayiotos, Toroyan, & Vamvakidis, 2010; Poghosyan & Poghosyan, 2010; Tuskan & Stojanovic, 2016).

Data and research methods

The parametric method – stochastic frontier approach (SFA) – was used for estimating the profit efficiency scores for each bank in the sample. The nonparametric DEA method is an alternative way of measuring bank's efficiency. An important advantage of the DEA method is the ability to determine efficiency for a small number of entities. However, its disadvantage is that outliers or data errors are not filtered out and significantly distort efficiency scores of the analysed entities. The misspecification problem is eliminated in the statistical SFA method. Given the fact that the research sample consists of 108 banks, it is justified to use the SFA method. The one-step approach model of Battese and Coelli (1995) was applied. The profit function is the multi-product trans-log specification:

$$ln\frac{Prof_{it}}{W3_{it}} = b_0 + b_1\ln\left(\frac{W1_{it}}{W3_{it}}\right) + b_2\ln\left(\frac{W2_{it}}{W3_{it}}\right) + b_3\ln\left(Q1_{it}\right) + b_4\ln\left(Q2_{it}\right) + b_5\frac{1}{2}\left(\ln\left(Q1_{it}\right)\right)^2 +$$

$$b_6\frac{1}{2}\left(\ln\left(Q2_{it}\right)\right)^2 + b_7\ln\left(Q1_{it}\right)\ln\left(Q2_{it}\right) + b_8\frac{1}{2}\left(\ln\left(\frac{W1_{it}}{W3_{it}}\right)\right)^2 + b_9\frac{1}{2}\left(\ln\left(\frac{W2_{it}}{W3_{it}}\right)\right)^2 +$$

$$b_{10}\ln\left(\frac{W1_{it}}{W3_{it}}\right)\ln\left(\frac{W2_{it}}{W3_{it}}\right) + b_{11}\ln\left(\frac{W1_{it}}{W3_{it}}\right)\ln\left(Q1_{it}\right) + b_{12}\ln\left(\frac{W1_{it}}{W3_{it}}\right)\ln\left(Q2_{it}\right) +$$

$$b_{13}\ln\left(\frac{W2_{it}}{W3_{it}}\right)\ln\left(Q1_{it}\right) + b_{14}\ln\left(\frac{W2_{it}}{W3_{it}}\right)\ln\left(Q2_{it}\right) + b_{15}\frac{1}{2}T_t^2 + b_{16}\ln\left(\frac{W1_{it}}{W3_{it}}\right)T_t + b_{17}\ln\left(\frac{W2_{it}}{W3_{it}}\right)T_t +$$

$$b_{18}\ln\left(Q1_{it}\right)T_t + b_{19}\ln\left(Q2_{it}\right)T_t + b_{20}\ln\left(Eq\_TA_{it}\right) + b_{21}\ln\left(\frac{W1_{it}}{W3_{it}}\right)\ln\left(Eq\_TA_{it}\right) +$$

$$b_{22}\ln\left(\frac{W2_{it}}{W3_{it}}\right)\ln\left(Eq\_TA_{it}\right) + b_{23}\ln\left(Q1_{it}\right)\ln\left(Eq\_TA_{it}\right) + b_{24}\ln\left(Q2_{it}\right)\ln\left(Eq\_TA_{it}\right) +$$

$$b_{25}\ln\left(Eq\_TA_{it}\right)T_t + v_{it} + u_{it} \tag{1}$$

where: the dependent variable *Prof* is measured with a bank Operating Income. The bank is treated as a financial intermediary generating loans and other earning assets from deposits and other financial liabilities with the use of labor and fixed assets. In the model, two outputs are considered: Loans (Q1) and Other Financial Assets (estimated as Financial Assets – Net Total Loans) (Q2). The inputs comprise: (1) Fixed Assets (X1), (2) Labor (X2), and (3) Total Financial Liabilities (X3) (Andries & Ursu, 2016; Barth, Lin, & Ma, 2013; Halkos, Tzeremes, & Nickolaos, 2013).

The prices of inputs are calculated according to the following formulas:

– Cost of Physical Capital (W1) – the sum of Equipment and Depreciation divided by Fixed Assets,

– Cost of Labor (W2) – Compensation and Benefits Expense over Total Assets,

– Cost of Funds (W3) – Interest Expense over Total Financial Liabilities.

Following the study of Berger and Mester (1997) and Andries and Ursu (2016), the ratio of Equity to Total Assets (Eq_TA) is included as an input to control for differences across banks' risk preferences. To introduce linear homogeneity restrictions, the dependent variable and all three input prices are normalized by the Cost of Funds – W3. Finally, the time dummy (T) is employed to allow for technological and other time-specific changes (Lensink, Meesters, & Naaborg, 2008; Lozano-Vivas & Pasiouras, 2010; Andries & Ursu, 2016). Based on estimation of equation (1), the values of inefficiency effects u_{it} are obtained and next efficiency scores η_{it} are calculated using the formula $\exp\{-u_{it}\}$.

In order to investigate the relationship between bank profit efficiency across CEE countries and bank's size, efficiency scores η_{it} are regressed on the bank's size and potential explanatory variables describing macroeconomic situation, each country banking sector, and bank-specific situation according to the following specification:

$$\eta_{it} = \delta_0 + \delta_1 \text{bank\_size}_{it} + \delta_2 \text{gdp\_cap}_{jt-1} + \delta_3 \text{infl}_{jt-1} + \delta_4 \text{loan\_gdp}_{jt} + \delta_5 \text{CR}_{jt} +$$

$$\delta_6 TCR + \varepsilon_{it} \tag{2}$$

The positive coefficient would mean that the determinant increases bank profit efficiency. In the equation (2), GDP *per capita* (gdp_cap) and Inflation (infl) measure income level and change in annual average consumer price level. Ratio of Banking Loans to GDP (loan_gdp) represents the level of development of financial intermediation in a particular country. Market concentration (CR) is measured with two indicators: the Market Share of the 5 Largest Banks in a country (CR5) and the Herfindahl–Hirschman Index (HHI). The size of the bank is represented by a natural logarithm of bank total assets (bank_size) and an individual bank Market Share (M_Sh) estimated as a ratio of a bank's total assets to total bank assets in a country. In order to control for characteristics of a bank, the Total Capital Ratio (TCR) is employed.

Data on individual banks are obtained from the SNL database. Data on the rate of inflation, GDP per capita and loans to GDP come from Eurostat, while data on the market concentration come from the ECB Statistical Data Warehouse. All data are of annual frequency and cover the period between 2005 and 2017. The research concerns eleven CEE countries: Bulgaria (9 banks), the Czech Republic (11), Estonia (6), Croatia (16), Hungary (9), Lithuania (7), Latvia (7), Poland (21), Romania (9), Slovenia (5), and Slovakia (8).

Results and discussion

In the first stage of the analysis, banks' profit inefficiency scores u_{it} and next efficiency scores η_{it} are calculated with the use of the trans-log equation (1). Table 1 presents the values of average efficiency scores for the individual countries and for individual years.

Table 1. Average profit efficiency scores

Country	PE*	Year	PE**
Bulgaria	85.4%	2005	87.7%
Czech Republic	85.2%	2006	86.2%
Estonia	83.3%	2007	83.8%
Croatia	83.8%	2008	81.6%
Hungary	83.1%	2009	82.5%
Lithuania	83.2%	2010	82.9%
Latvia	86.1%	2011	86.1%
Poland	82.9%	2012	83.3%
Romania	84.9%	2013	79.8%
Slovenia	76.8%	2014	84.1%
Slovakia	87.9%	2015	83.8%
		2016	84.1%
		2017	83.6%

Note: PE – profit efficiency score, * average for the entire period, ** average over all countries.

Source: Author's own study based on the SNL data.

The results indicate that efficiency of banks in the CEE countries is rather high, however, slightly diverse. The distribution of the efficiency scores is rather concentrated around the average of 84% (the value of kurtosis 2.75). The two extreme values of efficiency refer to Slovenia, with the least efficient banking sector of 76.8%, and Slovakia, with the most efficient banking sector of 87.9%. Analyzing CEE banks' performance over the entire period it can be noticed that they operate with a variable efficiency. Efficiency scores for individual years indicate that banks' efficiency drops in the periods of macroeconomic slowdown caused by the financial crisis of 2007–2009 and by the crisis of public finances in the euro area of 2012–2013. After these periods, banks significantly restored their efficiency.

In the second stage of the research, the impact of bank's size and market share on the efficiency scores η_{it} was checked. The controlling by macroeconomic, sectoral and bank individual variables were applied. The results confirm the assumption of the significant impact of the bank's size on its efficiency (Table 2). Additionally, the results confirm the increase in the market concentration, measured both with CR5 and HHI, positively affects individual bank's efficiency (Model 5 and 6). As the coefficients in Models 1 and 2 indicate, bank's efficiency improves with the increase of the market share and total assets. The result proved the research hypothesis which

states that banks can raise their efficiency by increasing their assets and the market share. For a robustness check efficiency was regressed with variables representing bank's capital capacity (Models 3 and 4).

Table 2. Relationship between profit efficiency scores and macroeconomic and individual bank variables

Variable	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
l.GDPpc	-0.040 (0.034)	-0.031 (0.033)	-0.042* (0.023)	-0.039* (0.021)	-0.113*** (0.036)	-0.103*** (0.035)
l.Inflation	-0.006* (0.003)	-0.006 (0.000)	-0.006** (0.003)	-0.006** (0.003)	-0.007** (0.003)	-0.007** (0.003)
Loan_GDP	0.001* (0.000)	0.001* (0.000)	0.001** (0.000)	0.001** (0.000)	0.001*** (0.000)	0.001*** (0.000)
CR5	–	–	–	–	0.004*** (0.001)	–
HHI	–	–	–	–	–	0.941*** (0.243)
M_Sh	0.211*** (0.091)	–	0.419*** (0.142)	–	–	–
Bank_size	–	0.058** (0.027)	–	0.352** (0.171)	0.058*** (0.012)	0.057** (0.027)
TCR	–	–	-0.005** (0.002)	-0.005** (0.002)	-0.005*** (0.002)	-0.005*** (0.002)
Constant	0.146 (0.296)	0.141 (0.294)	0.112 (0.211)	0.357 (0.211)	-0.125 (0.305)	-0.235 (0.303)
N	714	714	714	714	714	714
R2	0.046	0.043	0.062	0.057	0.119	0.112
F-stat	3.83	3.61	5.43	4.87	5.36	4.92

Note: l.GDPpc, l.Inflation – GDP *per capita*, inflation rate lagged one year; standard errors in brackets, ***, **, * represent 1%, 5% and 10% significance level, respectively.

Source: Author's own study based on the SNL data.

The outcome of these regressions is consistent with the ES theory, which states that more efficient banks grow by increasing their market share at the expense of the less competitive institutions.[1] Referring to the macroeconomic variables, the results of the research imply that higher inflation and GDP *per capita* decrease bank profit efficiency which can indicate that banks achieve the highest efficiency gains in less prosperous countries, however, in the low inflation environment. Additionally, banks' efficiency is boosted with the growing development of the banking sector and increasing lending to the economy. Bank efficiency is impacted by bank's individual characteristics. Negative coefficient at TCR ratio shows that fast-growing banks with lower capital equipment tend to be more efficient, probably due to the positive effect of the financial leverage on profits.

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[1] The National Bank of Poland reported in 2018 that for some recent period in Poland large banks have become more efficient and earn majority of profits of the banking sector, see: Box 2.5 Concentration of earnings of domestic commercial banks (*Raport o stabilności systemu finansowego*, 2018, pp. 57–58).

Conclusions

This paper presents the study on the relatively rarely described problem of the impact of bank's size on its profit efficiency in CEE countries in the years 2005–2017. The results show that in the analysed period, banks were characterized by relatively high profit efficiency, although diversified across the countries. The average efficiency throughout the region significantly decreased during the financial crisis of 2007–2009, as well as during the economic slowdown following the public finance crisis in the euro area.

The analysis of the relationship between the level of efficiency and individual and macroeconomic factors show that banks with a higher asset value and having a larger market share achieve higher efficiency. Additionally, higher concentration of the banking market has a similar positive effect on the banks' efficiency.

Referring to the macroeconomic variables, the results imply that higher inflation and GDP *per capita* decrease bank profit efficiency. Such relationship indicates that banks achieve the highest efficiency gains in less developed countries, however, in the low inflation environment. Additionally, banks' efficiency is boosted with the growing development of the banking sector and increasing lending to the economy. Bank efficiency is impacted by banks' individual characteristics, as well. Negative coefficient at TCR ratio shows that fast-growing banks tend to be more efficient, probably due to the positive effect of the financial leverage on profits.

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