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Determinants of financial performance of banks in Central and Eastern Europe

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Abstract: The aim of this study is to investigate the bank-specific, industry-specific, and macroeconomic determinants of the financial performance of banks in Central and Eastern European Countries. For this purpose, first we determined the factors affecting performance, based on findings in the literature. We constructed a financial performance index (FPI) based on CAMEL ratios and then ran the computed index on the aforementioned determinants. In the analysis, we used unbalanced panel data covering the period 2009-2014, which were collected from the BankScope database, World Development Indicators, and the Financial Structure and Development Dataset. We conducted an empirical analysis using fixed-effect panel regression. Our results suggest that the asset quality and earnings of banks are negatively affected by size, and positively affected by business mix and inflation. Capital adequacy and liquidity were found to be negatively affected by size and positively affected by bank concentration and economic growth.

JEL Classifications: C23, C38, G21

Keywords: Bank performance, CEE, CAMEL, factor analysis, panel regression
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1. Introduction

Over the last three decades, studies of the banking sector in Central and Eastern European (CEE) transition economies have been gaining in importance, due to banking reforms that involved the liberalization, privatization, and recapitalization of the banking sector in the region (Andries & Capraru, 2013; Barisitz, 2008). In the transition economies of Central and Eastern Europe (CEE), financial sectors are dominated by banks rather than equity markets, even though financial systems were not functional when Communism collapsed and the banks were not able to provide intermediary services in these countries (Bonin, Hasan, & Wachtel, 2012; Haselmann, Wachtel, & Sobott, 2017). The transition of the CEE banking system started in the late 1980s and early 1990s with the emergence of a banking sector in the planned economies, which included the processes of bank privatization. In the late 1990s and early 2000s, foreign banks played a dominant role in the banking sector in the region, and capital transfer, mainly from European countries to the CEE banking sector, was accelerated. The financial crisis and global recession starting in 2008 tested the strength of the financial institutions and regulatory structures in the region (Bonin et al., 2012; Ilgun & Coskun, 2009). Even though the development of market-based banking systems is time-consuming, the transition of banking sectors in the region has was mostly been completed. The majority of CEE countries have market-oriented banks that utilize modern banking technologies and are generally independent of direct government influence (Haselmann et al., 2017).

This study focuses on the bank-specific, industry-specific, and macroeconomic determinants of the financial performance of banks in Central and Eastern Europe. We contribute to the literature by departing from mainstream measures of financial performance, such as return on asset, return on equity, and net interest margin. Using factor analysis, we construct a two-dimensional financial performance indicator that is based on individual measures of capital adequacy, asset quality, management efficiency, earnings, and liquidity—commonly known as CAMEL variables. Then we estimate the impact of the aforementioned determinants on the financial performance of banks, using panel regression techniques.

The remainder of the paper is organized as follows. Section 2 surveys the relevant literature on the performance determinants of banks in CEE countries. Section 3 explains the methodology used to construct our dependent variable and describes the data sample; the independent variables and the empirical model used are also outlined in this section. In Section 4, the empirical results are presented and discussed. Finally, Section 5 provides some concluding remarks.

2. Literature review

The transition of the CEE banking sector has been attracting the interest of many researchers. Thus, several studies have been conducted on the impact of institutional reforms, regulations, ownership structure, the EU's accession of the banking sector, and market development and its effect on the risks and performance of the banking system in the region. Since this study focuses on the financial performance of banks and the determinants affecting their performance, we will first summarize the studies on the performance of the banking sector in CEE countries and then explain the bank-specific, industry-specific, and macroeconomic determinants of their performance with examples from the literature. Since we utilize the CAMEL perspective to evaluate financial performance, we also summarize the variables used to develop the CAMEL ratings for the banking sector.

2.1. Studies on bank performance in the CEE countries

In the transition period of the post-Communist countries after 1991, previously government-owned companies had to be restructured and reorganized in order to be competitive. These companies were overemployed and were not able to compete internationally. Since the economy was centrally planned, these companies struggled to adapt to new industry developments. The banking sector was no exception. Banks in transitional economies had to adapt to a changing business environment. Following the liberalization of the financial markets, they were challenged to become more market-oriented and competitive. Additionally, while new banks entered the market, existing large banks had to be restructured. By enforcing changes and creating a market-oriented financial system, these countries were aware of the importance of the banking sector in economic development. As a result, researchers of banking sector performance in the transition economies became interested in capturing the effects of the banking reforms.

Studies of the performance of the banking sector in Central and Eastern Europe focus on different aspects of bank performance and different factors affecting it. The majority of related studies analyze the effects of bank-specific and macroeconomic factors on banks'

profitability. Most authors rely mainly on return on equity, return on assets, and net interest margin as determinants of bank profitability. Some studies also use the CAMEL rating system as bank-specific factors in evaluating the financial performance of the banks. Various studies also use stochastic frontier analysis (SFA) and data envelopment analysis (DEA) to estimate the efficiency and performance of CEE banks.

In one of the early studies on bank performance in the transition economies, Fries, Neven, & Seabright (2002) analyzed the performance of banks in 16 transition economies for the years 1994-99, based on their public financial accounts, using a novel econometric approach that models banks as multi-product firms.

Havrylchyk & Jurzyk (2011) focused on the type of investment and the impact of ownership structure on bank performance. They also analyzed bank performance in light of the impact of the mode of foreign bank entry in Central and Eastern Europe, the characteristics of the parent bank, and economic conditions in the home country. Agapova & McNulty (2016) used bank interest rate spreads as measures of financial intermediation and examined the relationship between spreads and bank efficiency in the transition economies of Central and Eastern Europe, and they tested the relationships between spread and macroeconomic factors.

Niţoi & Spulbar (2015) investigated the cost efficiency differences of commercial banks in Central and Eastern Europe, using a heteroscedastic SFA. They included variables that measured the level of economic development, macroeconomic stability, credit risk, solvency risk, bank performance, loan specialization, the liquidity level, and the efficiency of the financial intermediation process. They also conducted a cross-country analysis to identify differences in efficiency among countries. Andries (2011) examined determinants of the efficiency and productivity of the banking systems of CEE countries by SFA and DEA. In their study, a Malmquist productivity index was calculated to evaluate the growth in productivity of the banks. In a similar study, Psillaki & Mamatzakis (2017) investigated the effects of financial regulations and structural reforms on the cost efficiency of the CEE banking industry. They estimated the cost efficiency scores using SFA, and examined the importance of regulations and reforms on bank performance, using the EBRD transitional reform indicator and the Fraser Economic Freedom Index. Andries & Căpraru (2011) examined the relationships among financial liberalization, banking system structure, and bank performance, measured in terms of cost efficiency and the total productivity growth index in seventeen Central and Eastern Europe countries. They implemented the SFA method to analyze the efficiency of the banks. Nurboja & Košak (2017) analyzed the gap in cost efficiency in banks in emerging markets in Southeast Europe (SEE) with respect to EU membership, using b-convergence and s-convergence tests, and they concluded that banks from non-EU countries were lowering their cost efficiency gap compared to EU banks. They conducted SFA to determine the cost efficiency scores and used a fixed-effects model, as well as a system generalized method of moments (GMM) for estimation purposes. Djalilov & Piesse (2016) analyzed the determinants of bank profitability in Central and Eastern Europe and transition countries in the former USSR. According to their results, the determinants of profitability vary across transition economies. Moreover, the authors concluded that the banking sector in early transition economies is more competitive and that the banks are more likely to fail. Finally, they found that capitalization plays a significant role in bank profitability.

Andrieș & Căpraru (2014) investigated the effects of the European Union integration process on the efficiency of banks and the convergence of cost efficiency across banking systems in Central and Eastern European countries. They implemented SFA to model

bank efficiency and tested the robustness of the results using several methods such as DEA, the Theil index, and the mean logarithmic deviation. Koutsomanoli-Filippaki, Margaritis, & Staikouras (2012) used the directional technology distance function approach and estimated the profit efficiency of banks in 25 EU member countries. They used DEA to estimate the technical and allocative components of profit efficiency. They investigated differences in efficiency related to bank size across countries, between old and new EU members. Pančurová & Lyócsa (2013) estimated 11 Central and Eastern European banks' cost and revenue efficiency using DEA, and they analyzed the determinants of performance. They used various explanatory variables, such as size, financial capitalization, foreign ownership, profitability ratio, and loan risk ratio to examine the determinants of bank efficiency.

Tochkov & Nenovsky (2011) analyzed the technical, allocative, and cost efficiency of the Bulgarian banks using DEA. They also identified bank-specific factors, institutional reform factors, and European Union-related factors to determine the efficiency levels of the banks. They used financial indicators (the CAMEL rating system) as bank-specific factors, and institutional factors such as progress in banking reform, large-scale privatization, and enterprise restructuring in Bulgaria. Another factor was the impact of EU accession on bank efficiency. They also added the growth rate of real GDP per capita to control for macroeconomic changes.

Andrieş & Căpraru (2013) analyzed the impact of financial liberalization and reforms on banking performance in 17 CEE countries. They measured the impact of levels of liberalization and openness on cost efficiency, distinguishing member and non-member European Union countries in terms of cost efficiency and productivity growth levels. They concluded that financial liberalization improves the cost efficiency of banks in the region. In their analysis, banking system characteristics, and macroeconomic and bank-specific determinants were used as control variables to assess the relationship between bank performance and the degree of financial liberalization.

Fang, Hasan, & Marton (2014) investigated the impacts of diversification in loan and asset portfolios on bank performance in 15 Eastern European countries and examined the relationship between bank performance and institutional changes, such as bank liberalization, corporate governance restructuring, and legal reforms. They measured the performance of the banks in the transition economies using two performance variables: return on assets and profit efficiency. Menicucci & Paolucci (2016) investigated the relationship between bank-specific characteristics and profitability in the European banking sector. They used return on equity, return on assets, and net interest margin as profitability measures. For control variables, they used size, capital ratio, loan ratio, deposits, and loan loss provisions as bank-specific determinants of profitability.

In a similar article that analyses the main determinants of the profitability of banks in EU27, Petria, Căpraru, & Ihnatov (2015) used three categories of bank determinants: bank-specific, industry specific and macroeconomic factors. In this analysis, the return on average assets and the return on average equity were chosen as profitability measures. Krzysztof, Kowalewski, & Kozłowski (2011) analyzed both short-term and long-term performance persistence in the Central European banks. They also investigated the effects of country-specific and macroeconomic factors, capital quality, and bank size on the strength of performance persistence. They tested performance persistence by using non-parametric tests and stochastic kernel estimation. As profitability measures, they used ROA, and they calculated the quotient of operating income and assets. Curak, Poposki, &

Pepur (2012) investigated bank-specific, industry-specific and macroeconomic determinants of bank profitability. In the analysis they used bank size, solvency risk, liquidity risk, credit risk, fees income, and operating expenses as internal variables, and economic growth, banking system reform, and concentration as external variables. Return on assets was used as a dependent variable to measure bank profitability.

2.2. The CAMEL framework for financial performance of banks

Most studies that investigate the financial performance of banks use a one-dimensional measure such as return on assets, return on equity, or net interest margin. Zhao, Sinha, & Ge (2009) have shown that using indexes is better than using raw accounting variables, because the latter significantly reduce the cost of expected misclassification. Previous studies, such as Derviz & Podpiera (2008) and Rashid & Jabeen (2016), either used a CAMEL index provided by local authorities or constructed a financial performance index based on CAMEL variables. Our study departs from these studies by relying on factor analysis.

The dependent variable in our study is a composite vector of capital adequacy, asset quality, management capability, earnings strength, liquidity, and sensitivity to market risk—in brief, CAMELS. We follow an approach similar to that of Klomp & Haan (2012), who used factor analysis to model banking risk. All in all, we use 13 variables that can be divided into five distinct groups, as defined by Evans, Leone, Gill, & Hilbers (2000).

The first group consists of capital adequacy measures. The literature recommends the selection of the total capital ratio and the total equity ratio as primary indicators of capital adequacy. The second group measures asset quality. We follow Klomp & Haan (2012) and choose the following variables: (1) the ratio of loan loss provisions to gross loans, (2) the ratio of impaired loans to gross loans, and (3) the ratio of impaired loans to equity.

The third group is related to management capability. The cost-to-income ratio and the ratio of overheads to total assets are used as indicators of managerial quality. The higher these indicators are, the more likely a financial institutions will face managerial deficiencies (Dietrich & Wanzenried, 2014; Hassan & Bashir, 2005; Naceur & Goaied, 2005; Petria, Căpraru, & Ihnatov, 2015b).

The fourth component of the CAMELS rating system is earnings. These variables include return on assets and return on equity as measures for earnings and financial profitability. The choice of these two variables is in line with the majority of studies on bank performance and profitability.

The fifth group consists of variables indicating liquidity. We use the following ratios: liquid assets to total assets, fixed assets to total assets, total loans to deposits, and liquid assets to deposits and short-term funding. Our choice is in line with previous relevant studies (Curak et al., 2012; de Haas & van Lelyveld, 2006; Hassan & Bashir, 2005; Klomp & Haan, 2012; Kosmidou, 2008; Pasiouras & Kosmidou, 2007).

2.3. Determinants of bank financial performance

The determinants of the financial performance of banks are classified into three categories: bank-specific factors, industry-specific factors, and macroeconomic factors.

Bank-specific factors

The bank-specific variables that we selected as determinants of bank performance are the following: size, deposits, business mix and diversification, and operating efficiency.

Size: The size of a bank is measured by the natural logarithm of total assets, as in most studies of banking (Athanasoglou, Brissimis, & Delis, 2008; Demirgüç-Kunt & Huizinga, 1999; Dietrich & Wanzenried, 2014; Petria et al., 2015). Although size is considered an important determinant of bank performance, its effects remains ambiguous. Size is supposed to capture the effects of economies of scale through increased operational efficiency and, thus, is expected to have a positive effect on bank performance (Bourke, 1989; Klomp & Haan, 2012; Lee & Kim, 2013; Menicucci & Paolucci, 2016; Molyneux & Thornton, 1992). Other studies suggested that this relationship is non-linear (Athanasoglou et al., 2008; Lee & Kim, 2013) and added the square of variable size to the list of bank-specific determinants. Still other studies have found a negative impact of size on bank profitability, suggesting that smaller banks benefit from economies of scale, while larger ones don't (Pasiouras & Kosmidou, 2007; Sufian & Chong, 2008; Vennet, 2002).

Deposits: Bank deposits are measured by the ratio of total deposits to total assets, as suggested by a part of the empirical literature (Allen & Rai, 1996; Lee & Hsieh, 2013; Menicucci & Paolucci, 2016; Naceur & Goaied, 2005). The larger the ratio, the more likely a bank will produce profits by increasing its income-earning activities. Thus, we expect that the effect of deposits on bank performance will be positive. However, this effect depends on the ability of banks to generate sound income-earning assets. Dietrich & Wanzenried (2011, 2014) used the growth of bank deposits as a proxy for banking growth and argued that the effect on bank performance was ambiguous. New entrants might be attracted by high growth rates, and this would reduce the profit per market participant. Other researchers calculated the natural logarithm of total deposits to capture network embeddedness (Sufian, 2012; Sufian & Chong, 2008; Sufian & Habibullah, 2009; Sufian & Noor, 2012) and argued that banks with a larger number of branches might attract more deposits and, therefore, more profitable opportunities.

Business mix and diversification: According to Stiroh (2000), in the 1990s, many European banks widened and diversified their product offerings. Following Goddard, Molyneux, & Wilson (2004), Alexiou & Sofoklis (2009), and Petria et al. (2015), we use the ratio of other operating income to average total assets to capture the effects of off-balance sheet activity on bank performance. While Petria et al. (2015) found a positive and significant impact of diversification on the profitability of banks operating within the EU27, Căpraru & Ihnatov (2014) found no evidence of a significant impact in a sample of CEE banks.

Operating efficiency: We follow Rashid & Jabeen (2016) in including this variable as a bank-specific determinant of bank performance, and as a measure, we use the ratio of operating expenses to interest income. Rashid & Jabeen (2016) found no significant impact of operating efficiency on bank performance, despite the expectation that the effect would be negative.

Industry-specific factor

We measure the market structure in the banking sector by using the concentration ratio, which measures the proportion of an industry's total assets controlled by its three largest firms (Dietrich & Wanzenried, 2014). According to the structure-conduct-performance hypothesis, banks in highly concentrated markets tend to collude by increasing the odds of

higher interest rates being charged on loans and lower interest rates being paid on deposits (Gilbert, 1984). This would suggest a positive impact of the market structure on bank performance. On the other hand, if the industry concentration results from tougher inter-bank competition, the impact of the market structure might turn negative (Berger, 1995). We thus conclude that the effect of market structure is unknown.

Macroeconomic factors

In our study, we control for the effects of macroeconomic fluctuations, commonly known as business cycle effects. Bank performance can be affected by recessions and expansions in many ways. During a period of slow economic activity, bank lending is more likely to decline, and the quality of loans might deteriorate, raising the risk of default. We use GDP per capita growth as a proxy for cyclical output. We expect that the impact on bank performance would be positive, although previous empirical studies of CEE banks found no significant effect (Căpraru & Ihnatov, 2014; Djalilov & Piesse, 2016). Căpraru & Ihnatov (2014) found an initial significant positive effect that was later offset by the inclusion of a financial crisis dummy variable.

The second macroeconomic variable that we selected is the inflation rate, as measured by the percentage change in the deflator. Some previous empirical studies have shown a positive impact of inflation on bank performance (Bourke, 1989; Căpraru & Ihnatov, 2014; Demirgüç-Kunt & Huizinga, 1999; Dietrich & Wanzenried, 2014; Molyneux & Thornton, 1992); others have found no significant effect (Djalilov & Piesse, 2016; Klomp & Haan, 2012; Petria et al., 2015). Therefore, we assume that the effect of inflation is undetermined.

3. Research

3.1. Methodology

In this section, first, the dataset that is used to estimate the determinants of bank performance in CEE countries is briefly described, and the method that is used to develop bank performance indicators is explained in detail. Then, the bank-specific, industry-specific and macroeconomic variables used are described, along with their expected effects on bank performance. Finally, the empirical model is explained. Since our sample is a cross-section of individual banks and a time series, our empirical approach is based on panel data regression analysis. The reason for choosing the fixed-effects model instead of the random-effects model is clarified, and the estimation model is described.

3.2. Data and sample

The unbalanced panel used in the study consists of 128 banks from nine Central and Eastern European (CEE) countries, six of which are current European Union members. The countries included in the study are Belarus, the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Moldova, Poland, and Ukraine. Data for bank-specific variables were taken from Bankscope over the period 2009-2014. Industry-specific data were taken from Beck, Demirgüç-Kunt, & Levine (2000, 2009) and Cihak, Demirgüç-Kunt, Feyen, & Levine (2012). We used the World Development Indicators (World Bank) to generate our macroeconomic determinants.

3.3. Dependent variable: Factor analysis

We apply factor analysis, using the 13 selected CAMEL indicators, to 128 banks in the nine countries of study. The Camel indicators are displayed in Table 1. All data were taken from BankScope.

TABLE 1. CAMEL INDICATORS

CAPITAL ADEQUACY	Total equity/total assets
	Total capital ratio
ASSET QUALITY	Loan loss provision/total loans
	Impaired loans/total loans
	Impaired loans/total equity
MANAGERIAL QUALITY	Overheads/total assets
	Cost-income ratio
EARNINGS AND PROFITABILITY	Return on equity
	Return on assets
LIQUIDITY	Fixed assets/total assets
	Liquid assets/deposits and short-term funding
	Liquid assets/total assets
	Gross loans/total deposits

Source: Authors.

TABLE 2. FACTOR ANALYSIS RESULTS

	Factor 1. Asset quality and Earnings	Factor 2. Capital adequacy and Liquidity	Variance explained/ uniqueness
	CAPITAL ADEQUACY		
Total equity/total assets	-0.158	**0.731**	0.440
Total capital ratio	-0.167	**0.725**	0.446
	ASSET QUALITY		
Loan loss provision/total loans	**0.676**	0.056	0.539
Impaired loans/total loans	**0.630**	0.163	0.576
Impaired loans/total equity	**0.771**	-0.155	0.381
	MANAGERIAL QUALITY		
Overheads/total assets	0.313	0.276	0.826
Cost-income ratio	0.388	0.092	0.841
	EARNINGS AND PROFITABILITY		
Return on equity	**-0.781**	0.013	0.390
Return on assets	**-0.856**	0.052	0.264
	LIQUIDITY		
Fixed assets/total assets	0.189	**0.430**	0.778
Liquid assets/Dep & ST funding	0.030	**0.657**	0.568
Liquid assets/total assets	0.089	**0.510**	0.732
Gross loans/total deposits	-0.121	-0.014	0.985
Kaiser-Meyer-Olkin test	0.659		
Likelihood ratio test *p*-value	0.000		

Source: Authors' calculations.

The results of the factor analysis are showcased in Table 2. The next step is to decide on the number of factors to represent financial performance. There are common criteria that

should be met in order to select the "right" number of factors. The most common ones are the so-called Kaiser criterion and the Cattell scree test.

The first criterion states that all factors with eigenvalues above one should be kept. The second criterion is a graphical method in which the eigenvalues are plotted against the factors. With this test, it is recommended that the factors that lie before the graph's elbow be retained.

In keeping with the results obtained through the factor analysis, we represent the financial performance of banks as a two-dimensional indicator. Table 2 displays the factor loadings on the first two factors, as well as the uniqueness of each. The two-factor model is highly significant, as suggested by the likelihood ratio test. The Kaiser-Meyer-Olkin test for sample adequacy is also greater than 0.6.

For the first factor, the financial performance of banks is measured by asset quality and earnings. The variables for these CAMEL components score high. The rule of thumb is to retain variables whose scores are greater than 0.4, as shown in Table 2. For the second factor, the capital adequacy and liquidity variables score high, and thus we obtain our second indicator of the financial performance of banks.

3.4. Bank-specific variables

The bank-specific variables that we selected as determinants of bank performance are the following: size, deposits, business mix and diversification, and operating efficiency. As suggested by the literature, size is measured by the natural logarithm of total assets; the expected effect on financial performance of banks is ambiguous. Deposits are expected to have a positive effect on financial performance. We choose the ratio of deposits to total assets as a proxy for this variable. In order to test the impact of business mix and diversification on financial performance, we use the ratio of other operating income to total assets. The expected effect is positive. The last bank-specific variable that we opt to include is operating efficiency, as measured by the ratio of total operating expenses to net interest income. The sign of the coefficient is expected to be negative, since the ratio is expected to capture inefficiency. We note that some of the bank-specific variables that are commonly included as control variables in the literature were used to build the financial performance indicators, and therefore we refrained from including them in our study.

3.5. Industry-specific variable

At the industry level, we measure the degree of market concentration by using the bank concentration ratio, as provided by the Financial Structure and Development Dataset of the World Bank. It is equal to the assets of the three largest banks as a share of the assets of all commercial banks. The expected effect of bank concentration is ambiguous.

3.6. Macroeconomic variables

The macroeconomic variables that we selected as determinants of bank performance are the real GDP per capita growth and the inflation rate as measured by the percentage change in the consumer price index (CPI). Economic growth is expected to have a

positive impact on bank performance, whereas the effect of inflation is ambiguous. The corresponding data is taken from the World Development Indicators (World Bank).

Table 3 defines and summarizes our independent variables.

TABLE 3. EXPLANATORY VARIABLES

DIMENSION	VARIABLE	EXPECTED IMPACT	SOURCE OF DATA
	BANK-SPECIFIC		
Size	Logarithm of total assets	+/-	BankScope
Deposits	Deposits/total assets	+	BankScope
Business mix	Other operating income/average total assets	+	BankScope
Operating efficiency	Total operating expenses/net interest income	-	BankScope
	INDUSTRY-SPECIFIC		
Bank Concentration	Assets of the three largest banks as a share of the assets of all commercial banks	+/-	World Bank-FSDD*
	MACROECONOMIC		
Economic growth	Annual real GDP per capita growth	+	World Bank- WDI**
Inflation rate	Annual percent change in CPI	+/-	World Bank- WDI

Source: Authors.
Note: * - Financial Structure and Development Dataset. ** - World Development Indicators

3.7. The empirical model

In this section, we present the model that we used to investigate the relationship between bank performance and the bank-specific, industry-specific, and macroeconomic factors in our sample. In keeping with the results of the factor analysis, bank performance will be modeled as a two-dimensional factor. Thus, we will estimate the following two equations:

$$BP_{it}^{1} = \beta_0 + \beta_1 BP_{it-1}^{1} + \beta_2 Size_{it} + \beta_3 Dep_{it} + \beta_4 Busmix_{it} + \beta_5 Opef_{it} + \beta_6 CR_{it} + \beta_7 Y_{it} + \beta_8 INF_{it} + \tau_t + \varepsilon_{it} \quad , \tag{1}$$

$$BP_{it}^{2} = \gamma_0 + \gamma_1 BP_{it-1}^{2} + \gamma_2 Size_{it} + \gamma_3 Dep_{it} + \gamma_4 Busmix_{it} + \gamma_5 Opef_{it} + \gamma_6 CR_{it} + \gamma_7 Y_{it} + \gamma_8 INF_{it} + \tau_t + \varepsilon_{it}, \tag{2}$$

Where, BP_{it}^{1} and BP_{it}^{2} are, respectively, the asset quality and earnings index and the capital adequacy and liquidity Index of bank i at time t. The bank-specific variables are size ($Size_{it}$), deposits (Dep_{it}), business mix and diversification ($Busmix_{it}$), and operating efficiency ($Opef_{it}$). We use one industry-specific variable, which is the concentration rate (CR_{it}). The macroeconomic determinants are economic growth (Y_{it})

and inflation (INF_{it}). We include lagged variables for bank performance to control for autoregressive tendencies. The parameter τ_t captures time fixed effects, whereas ε_{it} is the error term. We also performed a Hausman test that provided evidence for fixed-effects specification. The results of the Hausman test are provided in Table 4. Specifications 1 and 2 represent model (1) without and with a lagged dependent variable, respectively, while specifications 3 and 4 represent model (2), with similar considerations.

TABLE 4. HAUSMAN TEST RESULTS

	SPECIFICATION 1	SPECIFICATION 2	SPECIFICATION 3	SPECIFICATION 4
Chi-square	56.16	180.86	23.05	52.18
p-value	0.00	0.00	0.017	0.00

Source: Authors' calculations.

4. Results

The empirical results for Equation (1) are shown in Table 5, and the empirical results for Equation (2) are displayed in Table 6. For each specification, we first included only the bank-specific variables, then added the industry-specific variable, and finally the macroeconomic variables. The lagged dependent variable is omitted in the first three estimations in each table.

4.1. Asset quality and earnings

The empirical results show unequivocally that the size of a bank in a CEE country has a significant negative impact on bank performance, as measured by asset quality and earnings (Table 5). This suggests that smaller banks benefit from economies of scale, while the bigger banks do not. This result is in line with the findings of Pasiouras & Kosmidou (2007), Sufian & Chong (2008), and Vennet (2002). Deposits, as measured by the ratio of deposits to total assets, appear to have no significant effect on asset quality and earnings. This result is confirmed for all the specifications used. According to the results we obtained, asset quality and earnings are positively and significantly affected by business mix and the diversification of banks. This result is in line with the findings of Petria et al. (2015). Operating efficiency is found not to have a significant impact on asset quality and earnings.

As an industry-specific variable, we chose the concentration rate to test whether there is a positive or negative effect on asset quality and earnings. The estimation results show that the concentration ratio has no impact on bank performance when measured by asset quality and earnings. This result confirms the results obtained by Căpraru & Ihnatov (2014) for CEE banks.

We chose real GDP per capita growth and the CPI inflation rate as proxies for macroeconomic variables. Our results show that inflation has a positive and significant impact on asset quality and earnings. This may highlight the ability of CEE banks' management to predict inflation to a certain extent, implying that interest rates have been properly adjusted to achieve higher earnings.

TABLE 5. EMPIRICAL RESULTS 1

THE DEPENDENT VARIABLE IS "ASSET QUALITY AND EARNINGS"						
	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Size	-0.612***	-0.609***	-0.990***	-0.908***	-0.911***	-0.884***
	(0.187)	(0.188)	(0.249)	(0.320)	(0.328)	(0.309)
Deposits	-0.0776	-0.0740	-0.0204	-0.341	-0.344	-0.249
	(0.334)	(0.335)	(0.336)	(0.328)	(0.333)	(0.309)
Business mix	6.016***	5.836***	4.739**	6.435***	6.456***	5.284**
	(1.949)	(1.940)	(1.960)	(1.953)	(1.961)	(2.055)
Operating efficiency	-0.00243	-0.00245	-0.00606	-0.00827	-0.00831	-0.00485
	(0.00984)	(0.00984)	(0.00705)	(0.00612)	(0.00609)	(0.00637)
Bank concentration		-0.00970	-0.000399		0.00194	0.00607
		(0.00789)	(0.00941)		(0.0103)	(0.0102)
Economic growth			-2.518			-3.374*
			(1.959)			(2.007)
Inflation rate			0.00883***			0.0109***
			(0.00283)			(0.00335)
Lagged performance				-0.00357	-0.00326	-0.0516
				(0.0700)	(0.0702)	(0.0794)
Constant	8.882***	9.394***	14.52***	13.46***	13.41***	12.79***
	(2.773)	(2.718)	(3.548)	(4.826)	(4.772)	(4.465)
Observations	587	587	480	452	452	452
R-squared	0.203	0.208	0.303	0.298	0.298	0.329
Number of id	128	128	125	122	122	122
Individual FE	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES

Note: Robust standard errors in parentheses. *** - P<0.01, ** - P<0.05, * - P<0.

4.2. Capital adequacy and liquidity

Table 6 displays our estimation results when the "capital adequacy and liquidity" indicator is used. The size of banks has a significant negative and significant effect on bank performance for the first three specifications. However, once we include the lagged dependent variable in the list of explanatory factors, this effect is no longer significant. Our results also suggest that deposits and business mix have no significant impact on the capital adequacy and liquidity of banks operating in CEE countries. Operating efficiency has a positive and significant effect on capital adequacy. This result is only valid when the lagged performance measure is included in the absence of macroeconomic factors. The positive effect indicates that as banks become more inefficient, higher capital adequacy and higher liquidity are required.

Market concentration has a positive and significant impact on bank performance, as measured by capital adequacy and liquidity. This result confirms the structure-conduct-performance hypothesis and is in line with the works of Gilbert (1984).

TABLE 6. EMPIRICAL RESULTS 2

THE DEPENDENT VARIABLE IS "CAPITAL ADEQUACY AND LIQUIDITY"						
	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	Model 7	Model 8	Model 9	Model 10	Model 11	Model 12
Size	-0.593***	-0.597***	-0.293***	0.0545	0.0365	0.0155
	(0.118)	(0.116)	(0.110)	(0.123)	(0.120)	(0.112)
Deposits	-0.115	-0.120	-0.0753	0.0445	0.0353	0.0250
	(0.159)	(0.155)	(0.143)	(0.133)	(0.135)	(0.138)
Business mix	-1.144	-0.892	0.417	0.216	0.288	0.378
	(1.064)	(1.022)	(0.712)	(0.692)	(0.707)	(0.755)
Operating efficiency	-0.000665	-0.000637	-0.00135	0.00304**	0.00289**	0.000776
	(0.00320)	(0.00326)	(0.00147)	(0.00140)	(0.00139)	(0.00144)
Bank concentration		0.0136**	0.00135		0.00701**	0.00416
		(0.00616)	(0.00411)		(0.00347)	(0.00356)
Economic growth			3.568***			2.110**
			(1.033)			(0.858)
Inflation rate			-0.00263			-0.000692
			(0.00196)			(0.00185)
Lagged performance				0 .3774***	0 .3708***	0 .3496***
				(0.0459)	(0.0451)	(0.0454)
Constant	8.832***	8.114***	4.101**	-0.923	-1.036	-0.626
	(1.816)	(1.686)	(1.630)	(1.843)	(1.793)	(1.673)
Observations	587	587	480	452	452	452
R-squared	0.121	0.140	0.092	0.254	0.264	0.279
Number of id	128	128	125	122	122	122
Individual FE	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES

Note: Robust standard errors in parentheses. *** - P<0.01, ** - P<0.05, * - P<0.

As for the macroeconomic determinants, our empirical results show that economic growth has a positive and significant impact on bank performance, whether the lagged performance measure is omitted or not. This confirms our initial intuition that favorable business cycle effects have a positive impact on bank performance. Inflation, the measure of macroeconomic stability, is shown not to have a significant impact on capital adequacy and liquidity in all related models.

5. Conclusion

Over the past few years, bank performance in CEE countries has been widely investigated. However, most of the studies that deal with this problematic have focused on profitability and cost efficiency as measures of bank performance. We departed from this rich literature by building a CAMEL-based financial performance index using factor analysis. Then we estimated the impact of bank-specific, industry-specific, and macroeconomic factors on two performance dimensions, namely, "asset quality and earnings" and "capital adequacy and liquidity."

Our major findings clearly illustrate that bank size has a negative and significant impact on bank performance; that is, only small banks in CEE countries benefit from economies of scale. We also show that CEE banks with a more diversified income tend to have better asset quality and higher earnings. Our results also suggest that banks that incur higher

operating expenses increased their capital adequacy and liquidity. Moreover, the empirical findings suggest a positive and significant impact of bank concentration in CEE countries on capital adequacy and liquidity. Regarding the impact of macroeconomic variables, inflation is seen to have a positive impact on asset quality and earnings, whereas higher economic growth leads to higher capital adequacy and liquidity.

Overall, our empirical results show that bank performance in CEE countries not only relies on bank-specific determinants, but is also affected by industry-specific and macroeconomic variables. These results could provide insights to bank managers and regulators for improving the banking system and optimizing policy-making processes.

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