



Assessment of cost efficiency in the banking sector of selected countries in Southeastern Europe

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Abstract

This study examines the assessment of cost efficiency in the banking sector of selected countries in Southeastern Europe. In Southeastern Europe (SEE), where over 100 commercial banks operate, these institutions form the backbone of the financial sector, supporting between 80% and 90% of the financial system in five Balkan Peninsula nations. Kosovo stands out for having a lower participation rate (65%), with 80% to 90% of its banks under foreign government control. A study conducted from 2010 to 2021 employed Data Envelopment Analysis (DEA), a non-parametric technique, to scrutinize the cost-effectiveness and profitability of SEE's banking industry. DEA evaluated SEE's commercial banks in terms of cost efficiency, considering total costs as the dependent variable and inputs including deposits, workforce, and fixed assets. Interest expenses, personnel expenses, and capital-related expenses were compared concerning total deposits and assets, while securities and loans served as outputs. The findings unveiled commendable cost efficiency within SEE's banks. Subsequently, a panel regression analysis utilizing fixed and random effects was performed. Factors like Cost Efficiency, Asset Quality, Market Participation, Debt Ratio, Bank Size, Inflation, Ownership, and Gross Domestic Product were assessed against Return on Equity (ROE) and Return on Assets (ROA). The results underscored robust cost control measures within SEE's banks and highlighted significant factors—Cost Efficiency, Asset Quality, Market Participation, Debt Ratio, Bank Size, Inflation, and Ownership—exerting substantial influence on ROA and ROE. These insights offer valuable information for strategic decision-making, aiding stakeholders in developing targeted actions to enhance the financial sustainability and stability of Southeastern Europe's banking sector.

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1. Introduction

According to estimates, one of the most profitable sectors in the area is banking. Banks provide a variety of financial services that benefit both individuals and companies. Banks enable companies to launch and grow their operations, create more jobs, and provide their clients with better services. Commercial banks that are active in the market have discovered a niche where they may continue to make significant profits. Bank accounts, loans, domestic and international payments, bank cards, bank guarantees, letters of credit, and online banking are some of their services and products. The Economic Bulletin's analyses show that during the past

ten years, banks in Kosovo have made a total of around 630 million euros. Bank profits in Albania totaled 680 million euros between 2016 and 2020, but in Macedonia, they only reached 118 million euros in 2020. The significant disparity in interest rates between loans and deposits is a major factor in the huge profit margins of banks. Costs are indications of cost efficiency since they are one of the key factors affecting the income statement, which concentrates on management effectiveness in reduction. They are bank operating expenses that represent a portion of the banks' net profits and are inversely correlated with bank profits as a measure of the management's interpersonal skills during operations.

Although development in the Balkan nations is still behind, the economy of Southeastern Europe is expanding more rapidly. Strong trade ties with the less developed economies of the eurozone, chronically high debt levels, a slow pace of labor market adjustment, and a lack of structural changes in comparison to EU members are all indicators of the Balkan nations' lackluster economic growth. According to [Cigna and Guy \(2012\)](#), Southeast Europe's banking sector differs significantly from those of the US and Western Europe.

With a few exceptions, trade is extremely restricted in the region's non-stock market nations. As a result, in most WP nations, banks are the primary source of funding for businesses. Many local banks in Southeastern Europe run conventionally, taking deposits and making loans to businesses. The structural reform of the banking sector, according to [Bonin \(2004\)](#), was the initial phase in transition economies. The new banking sector was made up of new commercial banks, specialist banks, foreign banks, and local private banks.

The financial system, which is dominated by banks, is one of the most significant components of an economy. In WP, the banking system is responsible for 85% of all financial assets and is crucial to the area's financial stability. Commercial banks dominate the financial systems of BP nations, and banks with foreign capital are widely distributed in these systems as well. Most of these banks are from Greece, France, Italy, and Austria. The privatization of the banking industry has strengthened the financial system and capital markets of the WP nations, and the diversity of the financial system has made the case for increased financial stability.

During 2021, Serbia and Bosnia and Herzegovina will have the most banks. Serbia also takes the top spot for the biggest drop in the number of banks, from 33 in 2010 to 23 in 2021. With only 11, Kosovo and Montenegro have the fewest number of commercial banks.

Return on equity (ROE), also known as return on net assets, is a ratio of company's profitability to its equity. The ratio of return on equity (ROE) measures a company's profitability and its efficiency in generating profits. The more effective management is at turning equity into profit, the greater the ROE.

The return on equity of commercial banks in Southeastern Europe is trending upward. Similar to the return on assets indicator, this one also displays Montenegro, which had negative values until 2016 (excluding 2013 and 2014) and had a negative average of 2.40% from 2010 and 2021. The performance of commercial banks in North Macedonia is superior in this category, with a 12-year average of 9.85% and a peak value of 16.16% in 2017.

2. Literature Review

The health of the banking sector is crucial to the health of the country's economy since it serves as a cornerstone of the financial system in Southeastern European countries. One of the topics that many economists and scholars in these nations study and keep a close eye on is the financial performance of this industry. There has been plenty of study, as this is a well-known subject. There are two sections in the literature review. First, we will discuss the cost effectiveness of the banking industry in general and of the banking industry in BP in particular, and how efficiency is measured using the DEA model. Next, we will discuss how to assess the cost-effectiveness of the profitability of banks in general and of banks in BP in particular.

The DEA model, initially presented by academics in 1978, is a technique that has been shown to be effective in determining cost-efficiency outcomes. Based on Farrell's theories, [Charnes, Cooper, and Rhodes \(1978\)](#) paper "Measuring the Efficiency of Decision-Making Units" used linear programming to estimate production technology for the first time using an empirical constraint. The method was originally applied in Germany to calculate the marginal productivity of R&D and other industrial variables. Since then, a lot of books and journal articles have been produced about DEA or the application of DEA to other problem sets.

A relatively new technique called Data Envelopment Analysis (DEA) is used to assess how well a collection of homologous units called Decision Making Units (DMUs), which convert numerous inputs into multiple outputs, performs. The authors, [Jemric and Vujcic \(2002\)](#), employed Data Envelopment Analysis (DEA) to analyze the effectiveness of banks in the Croatian banking sector from 1995 to 2000. According to the research, foreign-owned banks are frequently more effective than domestically owned banks, and younger institutions are generally more efficient than older ones. For legacy and state-owned banks, non-performing portfolios from the previous system were a particular challenge; however, this issue has been remedied with the renovation of the former state institutions. Large state-owned banks' turnaround has boosted productivity while also significantly reducing interest rate spreads and boosting competition in the banking sector. Larger banks tend to be more effective locally, whereas smaller banks are more effective worldwide. [Belas, Kocisova, and Gavurova \(2019\)](#) used the DEA approach to identify the particular characteristics and macroeconomic variables that have an impact on the efficiency of the cost of the banking industry within the European Union

for the years 2008 to 2017. The link between cost effectiveness (as a dependent variable), as well as certain banking industry factors and macroeconomic variables (as independent variables), should also be determined.

Using the DEA approach and information from financial statements for the years 2006 to 2017, [Oredegebe \(2020\)](#) evaluates the cost-effectiveness of the Canadian banking sector and discovers that it is inefficient. The conversion of deposits into loans, strong capitalization, and managerial tolerance for rising administrative expenses are the key cost-effectiveness variables, according to the analysis of the factors. On the other hand, market strength and diversity decrease cost effectiveness. For cost effectiveness, the effect on profitability and credit risk is also insignificant. According to a study done with Vietnamese banks [Nguyen and Pham \(2020\)](#), more heterogeneity in the data results in lower average efficiency because factors like technical changes over time are also taken into account when assessing the relative efficiency of the three-pillar system of Vietnamese banks. The sensitivity of average sector efficiency levels is then examined by creating samples that are steadily more uniform across years and bank groups.

The study by [Grubišić, Kamenković, and Kaličanin \(2022\)](#) examined how the market power hypothesis, also known as the market power hypothesis, influences the benefit of the bank using banking data from the banking sectors of Serbia and Montenegro. They employed panel regression models to evaluate the market-power hypothesis. To investigate the market power hypothesis, a total of eight panel regression models were used for each nation. In order to evaluate the efficient structure hypothesis, the variable pertaining to efficiency was also included while assessing the internal drivers of profitability. Even though there was insufficient evidence to conclusively prove that market power has an impact on profitability in the Montenegrin banking industry, the fact that banks' earnings are, to some extent, a function of their efficiency supports the idea of coefficient structure. The coefficient of determination for the Serbian banking sector was much higher than for Montenegro when using the fixed effects model. Since the majority of the ratio's coefficients fell between 1% and 5% in the statistically significant range, it can be concluded that market power negatively affects the ability of Serbian banks to turn a profit.

A study by [Elahi and Poswal \(2017\)](#) with the major banks in England and Germany found that profitability, net interest margin, bank size, and income diversification all have a positive impact on cost efficiency. Credit risk and financial leverage, however, have a significant positive impact on banks in England but have an insignificant effect in Germany. After investigating the effects of cost effectiveness on the profitability of Islamic banks, [Hendrawan and Sulistyo \(2019\)](#) came to the conclusion that the profit and cost efficiency have little to no impact on the profitability of Islamic banks in Indonesia. According to [Fang, Lau, Lu, Tan, and Zhang \(2019\)](#), the profitability of Chinese banks is influenced by factors such as bank size, cost and profit efficiency, and particularly inflation. Additionally, when there is more risk involved and competition on the financial market, cost efficiency's positive impact on efficiency is unquestionably amplified.

According to the author's study, [Oredegebe \(2020\)](#) of the banking industry in Kanda, high capitalization and managerial income in administrative costs are efficient in the state of the costs of converting deposits into loans, while on the other side, other market power, diversification, and reduced cost efficiency.

The profitability of banks is influenced by a variety of internal and external factors, in addition to cost effectiveness.

The empirical study conducted by the authors [Rudhani, Ahmeti, and Rudhani \(2016\)](#) revealed a robust correlation among four key independent variables: capital size, liquidity risk, capital adequacy, and bank loans. Each factor underwent individual scrutiny along with profitability. Notably, as wealth and loan volume increased, profitability exhibited a positive correlation with both bank size and loan volume. Conversely, there existed an inverse correlation between bank profitability and credit risk, suggesting that higher capital adequacy might lead to reduced bank profitability.

The results of the study by the authors [Nuhui, Hoti, and Bektashi \(2017\)](#) highlight the substantial impact of individual bank characteristics on the profitability of commercial banks in Kosovo. This suggests that managerial factors at the bank level have a significant impact on profitability in this context. A bank's likelihood of being profitable appears to align with key factors such as significant liquid assets, a low capital adequacy ratio, minimal non-performing loans, and effective expenditure control. The study findings suggest that improving asset quality, implementing strict cost management procedures, and increasing liquidity are potential ways to increase the profitability of commercial banks in Kosovo. Moreover, the conclusions drawn emphasize that management efficiency and asset quality stand as the primary drivers significantly affecting the financial performance of commercial banks. Conversely, second-tier banks faced challenges primarily related to liquidity and capital adequacy ratios, indicating that heightened capital positions and increased liquid assets might inversely impact profitability. Furthermore, the study underscores how banks face limitations in leveraging investment risk due to its direct effect on capital demand, potentially impeding their ability to achieve specific levels of profitability.

In a study done with Albanian banks between 2002 and 2015, [Kola, Gjipali, and Sula \(2019\)](#) came to the same conclusion that a slight increase in risks for financial stability in the banking sector, as expressed in the model with an increase in problem loans, has a negative impact on the performance of the bank. Additionally, the author, [Morina \(2020\)](#), concluded that there is a strong inverse relationship between bank profit and non-performing loans in Kosovo's banking industry. As the quantity of troubled loans rises, so does the bank's

profitability. Kosovo's non-performing loans have declined over time, and the banking sector is now significantly more lucrative. This shows how these loans affect bank profitability. This element had a significant impact on ROA and ROE as well. Another key factor that greatly influenced ROA, but not ROE, was bank size. A better return on assets is also a result of banks' growing asset base. Another internal factor, the capital adequacy ratio, showed a somewhat negative effect on both indicators in the study investigation. Macroeconomic analysis revealed that, notwithstanding the modest benefits these advancements brought about, economic growth had a positive influence on ROA and ROE. Although only slightly, inflation had a negative impact on both variables.

According to studies by [Caliskana and Lecunab \(2020\)](#) involving Turkish banks over the years 1980–2017, macroeconomic variables including inflation, average annual interest rates, and currency rates have a major impact on how well the banking sector performs. Their findings show that, whereas past-year interest rates have a negative effect on both ROA and ROE, current-year interest rates are minimal. However, the negative effects are more pronounced in ROE. It is well known that equity reacts to changes in interest rates differently than assets. Assets, effectiveness, and liquidity are more crucial to profitability in the banking industry. The banking industry and the studied macroeconomic factors account for 85% of ROA and 70% of ROE.

[Durguti, Krasniqi, and Krasniqi \(2020\)](#) undertook a study using quarterly data spanning 2006 to 2019, aiming to assess the factors influencing the profitability of Kosovo's banking system. They employed two models—the dynamic Arellano-Bond model, which evaluates these factors over an extended period, and the traditional Ordinary Least Squares (OLS) regression model. The long-term analysis of the Generalized Method of Moments (GMM) Arellano-Bond model showed that the capital-to-assets ratio, problem loans, efficiency (EM), inflation rate, and real exchange rate all have a big effect on how much money a bank makes. Meanwhile, the OLS regression model highlighted the natural logarithm of assets, capital/assets ratio, non-performing loans, and Efficiency Management (EM) as significant factors. The study's outcomes suggest a general trend: internal variables, characterized as banking industry-specific factors, wield a more substantial influence on bank productivity compared to macroeconomic factors. This indicates that factors intrinsic to the banking sector have a greater impact on shaping bank profitability than broader economic indicators.

According to a study done with banks in Bosnia and Herzegovina by [Alihodžić \(2020\)](#), profit or loss growth rates, cost-income ratios, and growth rates of the gross domestic product had the most impacts on profitability indicators. There is no statistically significant correlation between CAR and ROE or ROA, according to the empirical findings of the study by [Alshiqi and Sahiti \(2021\)](#). NPL has a poor correlation with both ROE and ROA. This is in line with the earlier study. According to the study's results, capital investment and liquidity decline as the proportion of non-performing loans rises. These loans should be thoroughly assessed, and their administration should get additional attention. According to this study, credit risk is a significant indication of commercial banks in Southeastern European nations. By boosting these characteristics, commercial banks' profitability might rise. Based on research by [Grubišić et al. \(2022\)](#), which used banking data from the banking sectors of Serbia and Montenegro, market power or involvement in the banking system in Montenegro has little bearing on the sector's profitability. As opposed to Montenegro, the banking sector in Serbia had a substantially higher coefficient of determination than that of that country. It can be claimed that market power has a negative impact on the ability of Serbian banks to generate a profit because the majority of the ratio's coefficients were statistically significant between 1% and 5%.

3. The Purpose and Hypotheses of the Research

The purpose of this research is to investigate the cost efficiency as well as the profit analysis and the determinants that affect the profitability of commercial banks in BP. Through this research, we will understand the cost and profit efficiency in the banking sector of the Southeastern European countries through a non-parametric approach.

Bank profitability is best analyzed through the variables Return on Assets (ROA) and Return on Equity (ROE).

Bank-specific variables include cost efficiency, asset quality, market share, debt ratio, bank size, inflation, ownership, and gross domestic product.

In our paper, we construct three hypotheses:

H₁: Cost efficiency has a positive effect on the financial performance of commercial banks.

H₂: Bank-specific indicators have a positive impact on the financial performance of commercial banks.

H₃: Industry indicators have an impact on financial performance.

H_{3a}: Ownership and GDP have a positive effect on FP.

H_{3b}: Inflation has a negative impact on FP.

4. Research Methodology

The research methodology is a road map that, as such, presents a framework to provide answers to the research questions of the study, to enable the testing of the raised hypotheses, and to analyze the data that

informs us about the effect of the control components of the study. We entered into the achievement of the objectives in the organization.

The data will be analyzed through regression, where we will analyze the profit of the banks, while the cost efficiency will be analyzed through the DEA (data envelopment analysis) model.

DEA (data envelopment analysis) is a method that calculates efficiency levels within a group of organizations. In this model, we have to define inputs and outputs.

This study uses the two-stage linear programming technique. In the first stage, the cost efficiency of the banking sector will be assessed using DEA. To estimate cost efficiency, inputs, outputs, and input prices must first be calculated. Table 1 presents the variables that will be used to calculate the cost-efficiency of banks, variables that were also used by Adjei-Frimpong, Gan, and Hu (2014) and other authors:

Table 1. Variables used in the DEA model.

Variables	Description
Dependent variable total costs (KT)	The sum of interest and non-interest expenses
Inputs:	
Deposit (X1)	Customer deposits
Work (X2)	Staff expenses, such as salaries and benefits
Fixed assets (X3)	Tangible assets that the bank buys and uses for its products
Outputs:	
Loans (Y1)	Total consumer loans
Securities (Y2)	The bank invests in various securities (e.g., government securities, bonds, treasury bills and equity investments)
Price of inputs:	
Price of deposits (W1)	Interest expenses/Total deposits
Labor price (W2)	Personnel expenses/Total assets
Price of capital (W3)	Capital-related expenses (Operating expenses-personnel expenses)/ Total assets

The study identifies two input variables: customer deposits (X1), labor as personnel expenses of the bank's staff, such as salaries and benefits (X2), and fixed assets as tangible assets that the bank buys or invests and uses for its products (X3), two output variables: total customer loans (Y1) and securities (Y2), and also three input prices: the price of deposits (Z1) as interest expenses divided by total deposits, the price of labor (Z2) as personnel expenses divided by total assets, and the price of capital (Z3) as operating expenses minus personnel expenses divided by total fixed assets. DEA is a non-parametric way to estimate these variables. It is based on the idea that there is a convex production frontier between these data and the highest output-to-input ratios that was built using linear programming. Even in this study, we employed the DEA approach to assess cost effectiveness. How close a bank's cost is to the least cost (or the bank's best practice cost) of generating a particular level of output at a given input price and technological level determines how important cost effectiveness assessment is.

According to Farrell (1957), technical efficiency represents a company's capacity to maximize output from a given set of inputs. One of the simplest and most straightforward ways to gauge effectiveness is:

$$Efficiency = \frac{Outputs}{Inputs}$$

If a business simply uses one input to create one product, this is simple to do. However, businesses typically create a variety of outputs from a variety of inputs, so this approach might not be applicable.

As a result, Farrell (1957) created the relative efficiency metric that takes into account various, potentially conflicting inputs and outputs. This method seeks to establish a majority DMU border, measure the distance between the boundaries, and assess the effectiveness of the units. Relative effectiveness is quantified as:

$$Efficiency = \frac{Weighted\ sum\ of\ outputs}{Weighted\ sum\ of\ inputs}$$

In our paper, the regression will include bank-specific variables and macroeconomic variables as independent variables. Regression is a statistical measure that shows how the independent variables and the dependent variable are related to each other.

The general model will be:

$$FP = \beta_0 + \beta_1 Y_1 + \beta_2 Y_2 + \beta_3 Y_3 + \varepsilon$$

Where:

FP - The bank's financial performance.

Y₁ - Cost and profit efficiency measured through the DEA method.

Y₂ -Specific variables (Asset quality, market share, debt ratio, bank size).

Y₃ -Control variables (Macroeconomic)-Inflation, Bank ownership and GDP.

Table 2 presents the bank specific and control variable that will be used to calculate the determinants of financial performance of banking sector in SEE.

Table 2. Variables used in the regression.

Symbol	Variables description	The formula
ROA	Return to assets	Net profit/Total assets
ROE	Return on equity	Net profit/Capital
Specific variables of bank		
CE	Cost efficiency	The DEA model
AQ	Asset quality	Provisions for loan losses in relation to total loans
MS	Market participation	Bank assets/Total assets of the banking sector
LTA	Debt ratio	The ratio of loans against total assets as a measure of the bank's risk
SZ	Bank size	Natural logarithm of total assets
Control variables		
INF	Inflation	
OWND	Ownership	OWND is equal to 1 if the bank is local, the opposite of 0
GDP	Gross domestic product	

In the paper, given that we will express the financial performance through two specific indicators, this model will be detailed as follows:

$$ROE = \beta_0 + \beta_1CE + \beta_2AQ + \beta_3MS + \beta_4LTA + \beta_5SZ + \beta_6INF + \beta_7OWND + \beta_8GDP + \varepsilon$$

$$ROA = \beta_0 + \beta_1CE + \beta_2AQ + \beta_3MS + \beta_4LTA + \beta_5SZ + \beta_6INF + \beta_7OWND + \beta_8GDP + \varepsilon$$

Approximately the same regression equation was used by Ongore and Kusa (2013); Antoun, Coskun, and Georgievski (2018); Ali and Puah (2019); Le and Ngo (2020); Antoun et al. (2018); Istan and Fahlevi (2020); Ali, Pervez, Bansal, and Khan (2022) and Fang et al. (2019), etc. In addition to regression, we also used correlation, which shows how the variables are related to each other and whether this relationship is positive or negative.

The financial statements of commercial banks in the countries of Southeastern Europe (Kosovo, Albania, North Macedonia, Bosnia and Herzegovina, Serbia, and Montenegro) for the period 2010-2021 were used as a basis for extracting data for research.

Costs have always been a major factor in the entire operation of any organization, including commercial banks. Costs are a component of the company's operations since, without them, its job would be impossible (Ahmeti, 2013).

In order to achieve the greatest results for the company while minimizing expenses, management must try to influence the behavior of those who are in charge of carrying out duties, incurring expenditures, and earning money. This process is known as cost control. A continuous procedure that starts with the annual budget is cost control. As the financial year goes on, management evaluates existing operations, compares actual outcomes to budgeted results, and incorporates what it has learned into the new plan.

5. Results

The purpose of this study is to analyze the cost and profit efficiency of the banking sector in the countries of Southeastern Europe from 2010 to 2021 using a non-parametric approach. The obtained results are expected to show the existence of levels of profit efficiency far below those corresponding to cost efficiency. Below, we present the results calculated with the DEA model, correlation analysis, and regression analysis.

The purpose of the research is to evaluate the efficiency of the banking industry in BP from 2010 to 2021 by applying the DEA model to the data of commercial banks in BP. To assess banking efficiency, we use DEA analysis based on an input-oriented model. We calculated efficiency using constant and variable returns to scale. This is presented in Table 3. The average efficiency under constant return to scale in the studied period was 79.57%.

Table 3. Efficiency breakdown by state (2010-2021).

Country	Average cost efficiency
Albania	79.34%
Bosnia & Herzegovina	82.93%
Chuang	76.91%
North Macedonia	83.04%
Montenegro	82.37%
Serbia	76.30%
Average cost efficiency	79.57%

This result was approximately the same as the paper done by Milenković, Radovanov, Kalaš, and Horvat (2022), where they concluded that during 2015-2019, average cost efficiency was 85% for SEE countries. The country with the highest efficiency is North Macedonia with 83.04%, while Serbia has the lowest efficiency of 76.30%. Serbia also had the lowest efficiency in the paper conducted by Horvat et al. (2022) with the countries of SEE during 2015-2019.

This section of the study focuses on the findings made possible by using certain panel data analysis techniques to pinpoint the factors that affect the financial performance of the Southeastern European financial sector.

Table 4. Fixed effects model for ROA.

Variable	Coefficient	St. error	T-statistics	Prob.
(Constant)	-0.032	0.015	-2.154	0.032
CE	-0.007	0.009	-0.805	0.421
AQ	-0.008	0.003	-2.795	0.005
MS	0.054	0.018	2.981	0.003
LTA	0.025	0.009	2.764	0.006
SZ	0.002	0.001	2.141	0.033
INF	0.000	0.001	-0.395	0.003
OWND	-0.004	0.003	-1.090	0.276
GDP	0.000	0.001	0.607	0.044
Effects specification				
Cross-section fixed (Dummy variables)				
R-squared				0.667
Adjusted R-squared				0.514
F-statistic				23.65
Prob(F-statistic)				0.00

The outcomes of the fixed effects model are displayed in Table 4. It is clear that the variables Asset Quality, Market share, Loan-to-Asset, Size, Inflation and GDP are statistically significant because the probabilities linked to the coefficients are less than the significance level of 10%. The independent variables are responsible for 66.65% of the variances in the entire panel, according to the R-squared value. Because the F statistic has a value of 23.65% at a significant level of 1%, the model is suitable.

Probability must be less than 0.1 for a variable's impact to be considered significant. From our eight independent variables, six are significant, as the probability is below 10%. Table 5 demonstrates that the return on assets of the commercial banks in SEE is statistically significantly positively impacted by market share, loan-to-asset, size, inflation, and GDP. While cost efficiency, asset quality, and ownership have a negative impact on ROA.

The results consisted of the findings of Ongore and Kusa (2013); Antoun et al. (2018); Istan and Fahlevi (2020); Ali et al. (2022) and Fang et al. (2019) etc.

Given that Table 6's Chi-Sq value of 5.56 is significant at a 1% level of significance, the results of the fixed effects model are superior to those of the random effects model.

Table 5. The Hausman test for ROA.

Test summary	Chi-sq. statistic	Chi-sq. d.f.	Prob
Cross-section random	5.565	3	1

Table 6. Fixed effects model for ROE.

Variable	Coefficient	St. error	T-statistics	Prob.
(Constant)	0.012	0.108	0.115	0.908
CE	-0.055	0.063	-0.872	0.383
AQ	-0.030	0.019	-1.549	0.122
MS	0.325	0.129	2.516	0.012
LTA	0.136	0.065	2.097	0.036
SZ	-3.85	0.007	-0.006	0.996
INF	-0.003	0.005	-0.544	0.587
OWND	-0.028	0.023	-1.188	0.026
GDP	0.004	0.004	0.932	0.352
Effects specification				
Cross-section fixed (Dummy variables)				
R-squared				0.657
Adjusted R-squared				0.55
F-statistic				26.54
Prob(F-statistic)				0.00

Table 6 displays the outcomes derived from the fixed effects model. The coefficients' associated probabilities, falling below the 10% significance threshold, highlight the statistical significance of variables such as the firm's years in the Southeastern European financial sector, market share (MS), Loan-to-Asset (LTA) ratio, and ownership. The R-squared value, standing at 65.69%, suggests that these independent variables collectively explain a significant portion of the variances across the entire panel. Additionally, with an F statistic of 26.54% at a 1% significance level, the model appears suitable. In contrast, Table 7 reveals a Chi-Square value of 9.65, significant at the 1% level. This underlines that the fixed effects model outperforms the random effects model in this scenario.

Table 7. The Hausman test for ROE.

Test summary	Chi-sq. statistic	Chi-sq. d.f.	Prob
Cross-section random	9.655	4	0.03

Based on the regression model equation, market share (MS), Loan-to-Asset (LTA) and GDP have a positive impact on ROE, whereas Cost Efficiency (CE), Asset Quality (AQ), Size (SZ), Inflation (INF) and ownership have a negative impact. The results shown in Table 7 support these findings. Furthermore, all four independent variables significantly affect ROE as a dependent variable. The results consisted of findings of Ongore and Kusa (2013); Antoun et al. (2018); Ali and Puah (2019) and Le and Ngo (2020), etc.

6. Discussion

The study aims to assess the cost efficiency of the banking sector in the countries of the Southeastern Europe and its impact on financial performance. Since banks make a significant contribution to managing a nation's finances, financial performance is essential to the long-term viability of the banking industry. By using the DEA Model to calculate cost efficiency, we came to the conclusion that all the banks used in the model have cost efficiency higher than 70%, and the average of them is 79%.

The panel regression analysis of the collected data from the banking sector of SEE countries shows that of the eight independent variables that significantly affected the financial performance ROA, only six of them Asset Quality, Market share, Loan-to-Asset, Size, Inflation and GDP, while the ROE was significantly affected by only three of the eight independent variables: market share (MS), Loan-to-Asset (LTA), and ownership.

The results reveal that solvency and liquidity risk positively influence ROA and ROE, whereas credit risk and COVID-19 negatively affect the two dependent variables.

Table 8 presents a summary of the hypotheses. Therefore, three hypotheses were accepted after testing by panel regression analysis, two were partially accepted, and three were rejected.

Table 8. Final results after testing hypothesis.

Variable	ROA		ROE		Final results
	Hypothesis	Results	Hypothesis	Results	
Cost efficiency	+	-	+	-	Rejected
Asset quality	+	-	+	-	Rejected
Market share	+	+	+	+	Accepted
Loan-to-asset	+	+	+	+	Accepted
Size	+	+	+	-	Partially accepted
Ownership	+	-	+	-	Rejected
Inflation	-	+	-	-	Partially accepted
GDP	+	+	+	+	Accepted

7. Conclusion

This study examined the evaluation of cost effectiveness in the banking industry of nations in Southeastern Europe and its resultant influence on financial performance. Understanding how banks, key players in a country's financial system, may improve their long-term survival through efficient cost management is the relevance of this research. The results show that all banks included in the model demonstrate a noteworthy cost efficiency surpassing 70%, with an average efficiency rate of 79%, using the DEA Model to calculate cost efficiency. This shows that the banks under investigation have typically performed well in terms of cost control. Beyond cost effectiveness, the panel regression study revealed perceptive insights into the variables affecting financial success, particularly ROA and ROE. Notably, ROA was highly impacted by six out of eight independent factors, including Asset Quality, Market Share, Loan-to-Asset, Size, Inflation, and GDP. On the other hand, three important variables—Market Share, Loan to Asset, and Ownership—had a noticeable influence on ROE. Solvency and liquidity risk were found to have a favorable impact on both ROA and ROE, highlighting their contribution to improving financial performance. On the other hand, it was discovered that credit risk and the unanticipated difficulties brought on by the COVID-19 epidemic had a detrimental effect on these performance measures. Three hypotheses were accepted, two were partially accepted, and three were rejected as a result of the panel regression analysis's findings. This

complex comprehension of the interaction between cost effectiveness, numerous independent factors, and financial performance offers important insights into the current conversation in the banking industry and provides a basis for formulating strategic decisions and policies. In essence, this study serves as a foundation for future research and focused interventions aimed at boosting the sustainability and resilience of financial institutions in the area, as well as shedding light on the current situation of the banking industry in Southeastern Europe.

Our research has some limitations, just like any other study. The primary constraint is the period of the data; if we could extract the data every three months or every month, the effect computation would have been more accurate.

Considering the findings of this study, we recommend commercial banks pay attention to market share and ratio of loans to assets as these indicators affect financial performance positively, as well as cost efficiency and asset quality, which have a negative impact on financial performance. Any decline in these two will cause a decrease in ROA and ROE.

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