

The Determinants of Cost Efficiency: Evidence from the Kosovo Banking Sector

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ABSTRACT

In recent years, competition in the banking sector has increased, and even banks today have competition from non-banking institutions. Given that banks are the main intermediaries for the channeling of savings and investments, this situation presents pressure on the banking sector. Due to competition in the banking sector, banks are trying to find ways to increase their efficiency and take advantage of economies of scale and scope. The purpose of this study was to examine the cost efficiency of the banking sector in Kosovo. Data from eight commercial banks during the period 2014-2020 (quarterly financial statements) are analyzed to find out which specific variables of the banking sector affect cost efficiency. Our first stage of methodology was to find cost efficiency using the traditional model of Data Envelopment Analysis. In a second stage, we use the multiple regression model to find the impact of determinants in the cost-effectiveness. We included several variables such as the return on assets, capital adequacy, size of the bank, bank liquidity, loan loss provision coverage ratio, return on equity, and loans to asset ratio. Our results show that cost effectiveness was mainly explained by profitability (ROA), size of the bank, loan loss provision coverage ratio, and Return on Equity (ROE). Meanwhile, capital over total assets, total loans to total assets, and loans to deposits do not have any impact on cost efficiency.

ملخص

تستكشف هذه الدراسة تجريبيا العلاقة السببية في المدى القصير والطويل بين الشمول المالي المؤسسي وعدم المساواة في الدخل في 22 دولة عضو في الاتحاد الأوروبي، وهي مقسمة إلى فئتين فرعيتين: أعضاء الاتحاد الأوروبي القدامى والدول الأعضاء الجديدة في الاتحاد الأوروبي. واعتمد نموذج فيكتور لتصحيح الخطأ (PVECM) لرصد العلاقة السببية الديناميكية بين الشمول المالي وعدم المساواة في الدخل عند

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التحكم في تأثير التنمية الاقتصادية على عدم المساواة. والمستوى الحالي للشمول المالي في الدول الأعضاء القديمة في الاتحاد الأوروبي فقط من خلال توسيع نطاق خدمات أجهزة الصراف الآلي يؤدي إلى تقليص معدل عدم المساواة في الدخل على المدى الطويل، بينما يساهم من خلال توسيع نطاق فروع البنوك التجارية على المدى القصير. وعلى العكس من ذلك، خلصت الدراسة إلى أن الشمول المالي له تأثير ضعيف وخافت على عدم المساواة في الدخل في الدول الأعضاء الجديدة في الاتحاد الأوروبي على المدى الطويل، في حين أن توسع نطاق فروع البنوك التجارية فقط يؤدي إلى تقليل عدم المساواة في الدخل على المدى القصير. وتبرز النتائج أن الشمول المالي المقاس من خلال فروع البنوك التجارية يساهم في توزيع الدخل على نحو أكثر تساويًا في كلتا المنطقتين، لكن فقط على المدى القصير. والواقع أن ثمة حاجة قائمة لتعميق الشمول المالي المؤسسي من خلال زيادة توافر المنتجات المالية المتخصصة وخدمات الصراف الآلي وتنويعها لمعالجة العوائق التي تحول دون الشمول المالي، وخاصة في الدول الأعضاء الجديدة في الاتحاد الأوروبي.

ABSTRAITE

Ces dernières années, la concurrence dans le secteur bancaire s'est accrue, et même les banques sont aujourd'hui confrontées à la concurrence d'institutions non bancaires. Étant donné que les banques sont les principaux intermédiaires pour l'acheminement de l'épargne et des investissements, cette situation exerce une pression sur le secteur bancaire. En raison de la concurrence dans le secteur bancaire, les banques tentent de trouver des moyens d'accroître leur efficacité et de tirer parti des économies d'échelle et de gamme. L'objectif de cette étude était d'examiner la rentabilité du secteur bancaire au Kosovo. Les données de huit banques commerciales au cours de la période 2014-2020 (états financiers trimestriels) sont analysées pour découvrir quelles variables spécifiques du secteur bancaire affectent l'efficacité des coûts. Notre première étape méthodologique a consisté à trouver la rentabilité en utilisant le modèle traditionnel de l'Analyse de l'Enveloppement des Données. Dans un deuxième temps, nous utilisons le modèle de régression multiple pour déterminer l'impact des déterminants sur la rentabilité. Nous avons inclus plusieurs variables telles que le rendement des actifs, l'adéquation des fonds propres, la taille de la banque, la liquidité de la banque, le ratio de couverture des pertes sur prêts, le rendement des capitaux propres et le ratio prêts/actifs. Nos résultats montrent que l'efficacité des coûts est principalement expliquée par la rentabilité (ROA), la taille de la banque, le ratio de couverture des pertes sur prêts et le rendement des capitaux propres (ROE). Par ailleurs, le capital sur le total des actifs, le total des prêts sur le total des actifs et les prêts sur les dépôts n'ont pas d'impact sur l'efficacité des coûts.

Keywords: cost efficiency, profitability, liquidity, loan loss provision, bank size.

JEL Classification: D24, G24, G32, G33

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1. Introduction

Banks are considered among the main sources of external financing for businesses worldwide, both in industrialized and developing countries, taking a very important role in financing the business activities of these countries. After all, banks are essential for development in emerging economies. This group also includes Kosovo, where commercial banks are the main financial intermediaries.

The main purpose of this study is to analyze the efficiency and performance of Kosovo's banking system, which in turn could contribute to stimulating economic growth and ensure financial stability.

According to Ahmeti et al. (2014), in the banking system of Kosovo, commercial banks have undergone major changes since 2000 and these changes are a result of the entry of foreign banks, changes in the regulatory environment, and technological changes, but also increased competition. Since 2008, as a result of the financial crisis and changes in the banking system, the quality of bank loans and the overall financial performance of banks has weakened as a result of rising operating costs, although this has improved in recent years, which is also observed from the results that emerge from this study.

Since 2001, the number of commercial banks in Kosovo has grown steadily. In 2001, seven commercial banks operated in Kosovo, mainly with foreign capital. According to the Association of Banks in Kosovo, eleven commercial banks operate in Kosovo, constituting 67.8% of the total assets of the financial sector. The main activity of these banks is related to lending, of which, enterprises are given close to 64% of them mainly to the enterprises of the trade sector, then the industry sector (mining, production, energy, and construction), while the rest has been given to individuals respectively families. It is worth noting that the agricultural sector, which is supposed to employ most of the able-bodied population, has been given only 2.7% of total corporate loans. Regarding the liabilities of banks to customers, customer deposits have the largest stake with 81% of total liabilities. From year to year, the deposits of the banking sector have marked an annual increase of approximately 12%, reaching the value of over 4 billion euros, where the largest share is comprised of deposits of citizens (with over 67%) while the rest is made from firm deposits.

The banking sector during 2020 was characterized by an increase in activity, respectively an increase in lending, and other balance sheet items such as cash and balance with the CBK, as well as balance with commercial banks. Assets of the banking sector marked an annual increase of 12.4, reaching a value of 5.35 billion euros. Lending activity slowed down, mainly due to the pan-inflationary crisis and its effects on the economy. Kosovo's banking sector maintained its profitability position despite facing pandemic challenges. Revenues were characterized by an annual increase more favorable than expenditures, where in addition to interest expenses, all other categories of expenses increased (CBK - Financial Stability Report, 2020). The value of net profit decreased to 79.9 million euros from 86.2 million in the previous year. The main contributors to the increase in expenses, as well as the decrease in profit, were the expenses for loan loss provisions, which reflects the increase in credit risk affected by the Covid-19. The provisioning level, expressed as the ratio of expenses for provisions to net loans, almost tripled to 1.2 percent in 2020 from 0.4 percent of the sector average for the period 2017-2019, as a reaction of banks to the increase in credit risk and expectations for increased provision for loan provisions after the completion of the loan restructuring phase (CBK - Financial Stability Report, 2020).

2. Literature review

Cost efficiency is about saving money in order to improve a product. The measurement of cost efficiency by companies is performed by comparing the cost incurred and the revenue generated by the same process. Although the process of business activity does not end with measuring cost efficiency, it expresses a very important part of the business strategy.

Many studies in developed and developing countries have used different methods to assess the cost-effectiveness of banks, such as (Nicolae et al. 2015; Ding & Sickles, 2018) in US banks; (Altunbas et al., 2007; Mihai & Cristi, 2015; Molinos-Senante and Maziotis, 2021) in European banks, Nurboja and Kořak, 2017; Degl'Innocenti et al. 2017) in the southeast European countries; (Bođ'a & Zimková, 2015; Palečková, 2015; Zimková, 2015; Štefko et al. 2016) in Czech and Slovak banks; Elahi and Bilal (2017) in UK and Germany; (Kontesa et.al, 2017; Wang et al. 2019) in Chinese and Vietnamese banks; Makkar & Singh (2013); Kumar et al.

(2020) in banks of India and Pakistan; Rekik & Kalai, (2018) in Tunisian banks; Hassan & Jreisat (2016) in Egyptian banks, etc.

Just as studies differ in the findings, so they differ in variables obtained to assess cost-effectiveness determinants. In general, some studies include bank-specific variables such as profitability, bank ownership, bank size, bank risk, liquidity risk, solvency, capital ratio, years of operation, return on assets, provision for loan losses, non-performing loans, leverage ratios, capital adequacy, level of operating costs (Hassan and Jreisat, 2016; Stanek, 2015; Anwar, 2018; Sultana and Rahman, 2020); industry-specific variables, such as industry concentration, market structure, and competition, capitalization, (Belas et al. 2019; Ereta et al. 2020); and macroeconomic variables, such as GDP, economic growth and inflation, development of the banking sector (Ab-Rahim et al., 2012; Khan et al., 2014; Sultana and Rahman, 2020).

In theory and practice, in order to evaluate the cost-efficiency of commercial banks and beyond, two linear programming techniques have been used and are used such as stochastic frontier analysis (SFA), and data development analysis DEA. Justifying the use of one or the other method, we have analyzed various papers and have briefly presented the findings of these papers.

The first group of linear programming techniques includes studies that have utilized SFA (stochastic boundary analysis) (Gunes & Yildirim, 2016; Khalib et al. 2016; Othman et al. 2017; Sarmiento & Galan, 2017) as well as other authors, cited below.

Phan & Daly (2014) conducted an analysis using a set of Vietnamese commercial banks data covering the period 2006-2012 applying the Stochastic Frontier Approach (SFA). The study focuses on three types of risks, including credit risk, operational risk, and liquidity risk; and their impacts on cost efficiency. Research reveals that there are differences in cost-effectiveness regarding the type of risk. Basically, while credit and operational risk have positive effects on cost-effectiveness, liquidity risk has a negative effect. This study also found different risk implications for cost-effectiveness among groups of banks. Furthermore, the results of this paper confirmed a negative effect of the global financial crisis on cost-effectiveness.

Stanek (2015) identified specific determinants of the efficiency of Czech commercial banks during the period 2000–2012. I determine cost-

effectiveness by using the SFA method with time-variant efficiency to evaluate independent variables. The author's findings show that bank size negatively affects the bank's ability to generate revenue although it has no impact on cost efficiency. Cost-effectiveness increases with the ratio of deposits to assets and efficiency increases with the ratio of loans to assets.

Hadek et al. (2018) empirically analyzed the cost-effectiveness determinants of 37 Islamic banks during the period 2005-to 2014. Using the CFA method, the authors calculated the cost-effectiveness, which they also took as a dependent variable, while as independent variables, they took the return on assets (ROA), annual inflation rate, population density, and GDP per capita. They found that the first three independent variables have a positive impact on cost efficiency, while GDP has a negative impact on cost efficiency, with a positive correlation between credit risk and efficiency.

Determinants of cost-effectiveness, through specific factors and macroeconomic factors, were also analyzed by Doan et al. (2018); Anwar (2018); Ereta, et al. (2020); Sultana & Rahman (2020); Muttaqin et al. (2020), and Octrina and Mariam (2021). To evaluate cost-effectiveness, they used the CFA method, while to evaluate specific and macroeconomic factors, different types of regression estimates were used as pooled ordinary least square, fixed effect, or random effect panel regression.

Another important category in the cost-effectiveness literature is the studies that apply DEA ((Hassan & Jreisat, 2016; Amin et al. 2017; Elsa et al. 2018; Belas et al. 2019; Oredogbe, 2020; Nguyen & Pham 2020; Kumar et al. 2020).

Kocisova (2014) analyzed the determinants of cost efficiency and their impact, applying the DEA method to a sample of Slovak and Czech commercial banks during 2009-2013. The author divided the banks according to the volume of assets, into three large groups and concluded that large banks have higher cost efficiency than medium and small banks. Another analysis conducted by the researcher is that the banks of Northern Europe and Western Europe have higher cost efficiency than the banks of other European regions. Hassan and Jreisat (2016) compare the cost efficiency of the large, medium, and small banks and the cost efficiency of foreign and domestic banks using a balanced panel that covers 14 banks operating in Egypt from 1997 to 2013, and Amin et al., 2017, examined the effect of cost efficiency on the liquidity risk of Islamic banks and conventional

banks in 16 OIC countries from 1999 to 2013, by using DEA to compute cost efficiency and fixed-effect model to examine liquidity risk determinants.

Belas et al. (2019), in their study, examined the cost efficiency of the banking sector within the European Union for the period 2008-2017 and used the DEA method, to ascertain which specific variables and macroeconomic variables affect cost efficiency. Also, to find the ratio between cost-efficiency (as a dependent variable) as well as banking sector specific variables and macroeconomic variables (as independent variables).

Oredegbe (2020), in his paper, using the DEA method and data from the financial statements for the period 2006 to 2017, analyzes the cost-effectiveness of the banking industry in Canada and finds that the banking industry in Canada has cost inefficiencies due to technical and allocative inefficiencies, where technical inefficiencies play a dominant role. The analysis of cost-effectiveness determinants reveals that the conversion of deposits into loans, high capitalization, and managerial tolerance for increases in administrative costs promote cost-effectiveness. On the other hand, market power and diversification reduce cost-efficiency. Moreover, the impact of profitability and credit risk is negligible for cost efficiency.

The third group of studies includes studies that use other statistical and econometric methods. Almumani (2013) analyzes Jordanian banks for the period 2005-2011, and determines the controllable management factors that determine the profitability of the analyzed banks. For this purpose bank variables (profitability, cost efficiency, liquidity, credit composition, credit risk, capital adequacy, and bank size) are taken. The author finds that the cost-income ratio is the main endogenous factor under the control of management that determines the profitability of commercial banks in Jordan, while other variables did not show any statistical effect on profitability.

Researchers Elahi and Poswal (2017), taking as a sample 8 major banks of Great Britain and 8 leading banks of Germany for the period 2006-2015, aim to examine the factors influencing cost efficiency to compare the findings of both economies. The authors took cost-effectiveness as a dependent variable, while they chose net interest margin, credit risk, bank size, profitability, income diversification, and financial leverage as independent variables. Panel data were analyzed using smaller combined,

fixed, and random effects regression techniques, and the Hausman specification test and redundant fixed effects tests were used to identify the most appropriate model.

Alabi et al. (2019), in order to analyze the cost efficiency of money deposit banks, from the population of 22 banks, 13 of them were sampled for the research period 2010 - 2019. Data are provided from the financial statements of these banks. As control variables, the author took: bank size, inflation, and GDP, while as independent variables he used: personnel cost efficiency, Fueling, and maintenance cost-efficiency, and General Administrative Costs Efficiency. The dependent variable received Operating profit before tax. For data analysis, the author used fixed and random regression analysis methods. The results showed that cost efficiency has a significant impact on the financial performance of Nigerian deposit money banks.

3. Methodology and hypothesis

The purpose of this section is to present the methodology used in this study, to explain how the study was conducted and how the hypotheses were developed.

Two different frontier analysis methods are used to measure bank efficiency. The principal parametric method is the stochastic frontier approach (SFA), which uses econometric methods; while the principal non-parametric method is Data Envelopment Analysis (DEA), which uses mathematical programming. Some of the researchers, such as Rouissi & Bouzgarrou (2012); Phan and Daly (2014); Stanek (2015); Nițoi and Spulbar (2015), Hadhek et al. (2018); Anwar (2018); Ereta, et al. (2020); Sultana and Rahman (2020); Octrina and Mariam (2021), used SFA to analyze efficiency; and some of the researchers, such as (Adjeji-Frimpong et al. (2014); Hassan and Jreisat (2016); Amin et al. (2017); Belas et al. (2019); Oredgebe (2020), employed DEA method.

Data Envelopment Analysis (DEA), was originally used by Farrell (1957) and Charnes, Cooper, and Rhodes (1978) to measure input-output efficiency. DEA assumes the existence of a convex output frontier and is developed using linear programming methods that lie between these observations and the comparison between cost and output (Coelho & Watt, 2006; Antonelli & DeBonis, 2019).

This study uses a two-stage of linear programming technique - DEA. In the first stage, the cost efficiency of the banking sector was assessed using DEA. To assess cost efficiency, inputs, outputs, and input prices must first be calculated. Table 1 shows the variables which have been used to calculate the cost-efficiency of banks, variables that have also been used by other authors such as Adjeji-Frimpong et al. 2014, Amin et al., 2019 and other authors. The study identifies two input variables: customers deposits (X1), labor as personnel expenses of bank staff such as salaries wages, and benefits(X2) and fix assets as tangible assets that bank buys or invests and uses for its products (X3), two output variables: total customers' loans (Y1) and securities (Y2), also three input prices: price of deposits (Z1) as interest expenses divided by total deposits, price of labor (Z2) as personnel expenses divided by the total assets and price of capital (Z3) as operating expenses minus personnel expenses divided by total fixed assets. In order to evaluate these variables, the DEA as a non-parametric method is applied, assumes the existence of a convex output frontier constructed using linear programming methods that lies between these observations and the higher output-input ratios (Coelho & Watt, 2006). Even in the case of our study, to determine cost efficiency, we used the DEA method. The importance of cost-effectiveness assessment lies in how close a bank's cost is to the minimum cost (or best practice bank's cost) for producing a certain level of output with given input prices and technology.

Cost efficiency measures how close a bank's cost is to the minimal cost for the production of a certain level of output with a given level of input prices and technology. Denoting with N the banks that employ a vector of input quantities x_i for the i -th bank, given the input w_i , and the levels of output y_i , the cost efficiency model for bank i is expressed in linear programming as follows (Adjeji-Frimpong et al. 2014):

$$\begin{aligned}
 & \text{Minimize } \lambda, x_i^* w_i' & (1) \\
 \text{Subject to } & -y_i + Y\lambda \geq 0 \\
 & x_i^* - X\lambda \geq 0 \\
 & N1'\lambda = 1 \\
 & \lambda \geq 0 \quad i = 1, \dots, N
 \end{aligned}$$

where x_i^* is the frontier or cost-minimizing vector of input quantities for the i -th bank and λ is an $N \times 1$ vector of constants. To estimate cost efficiency the optimal values x_i^* are estimated by solving the linear programming as in equation 1, where X and Y are the matrices of

observed inputs and outputs for all the banks taken into analysis. The cost-efficiency of the i -th bank is calculated as the ratio of minimum cost to actual cost (Adjeji-Frimpong et al. 2014), as in the following formula:

$$CE = wi' xi * wi' xi \quad (2)$$

The measure of cost efficiency lies between zero and one. A cost-efficiency score of one denotes a fully cost-efficient bank, whereas inefficient cost banks show a value of less than one.

Table 1: Variables used in the Computation of Bank Efficiency

Variables	Description	Some previous research
Dependent variables: Total cost (TC)	Sum of interest expenses and non-interest expense	Niđoi & Spulbar, 2015
Inputs:		
Deposits (X ₁)	Customers deposits	Phan & Daly, 2014; Adjeji-Frimpong et al. 2014; Casu & Girardone, 2004
Labour (X ₂)	Personnel expenses of bank staff such as salaries wages and benefits	Phan & Daly, 2014; Adjeji-Frimpong et al. 2014; Casu & Girardone, 2004
Physical capital (X ₃)	Tangible, man-made objects that a company buys or invests in and uses to produce goods	Dong et al. (2014); Phan & Daly, 2014; Casu & Girardone, 2004
Outputs:		
Loans (Y ₁)	Total loans and advances (subtracted loan loss provisions from total loans)	Manlagnit, 2011; Dong et al. 2014, Xiaoqing Maggie and Heffernan, 2007; Niđoi & Spulbar, 2015; (Casu and Molyneux, 2003). Canhoto and Dermine (2003)
Securities (Y ₂)	Banks' investments in different types of securities (government securities, bonds, treasury bill, and equity investment)	Xiaoqing Maggie and Heffernan. 2007; Hendrawan, 2019; Adjeji-Frimpong et al. 2014; Casu and Molyneux, 2003. Canhoto and Dermine, 2003;
Input prices:		
Price of deposits (w ₁)	Total interest expenses divided by total deposits	Manlagnit, 2011; Niđoi & Spulbar 2015,
Price of labor (w ₂)	Personnel expenses divided by the total assets	Manlagnit, 2011; Phan & Daly, 2014; Adjeji-Frimpong et al. 2014; Niđoi & Spulbar 2015,
Price of capital (w ₃)	Depreciation / Fixed assets	Hendrawan, 2019;

The accounting data taken from the financial statements of banks are also compared with the data obtained from the CBK to create a more secure file to accurately determine the cost efficiency of these banks. The data collected will help to determine whether the bank has an adequate analysis or control over its operation to effectively achieve the stated goal. To achieve this, we used multiple linear regression. The target populations of this study are eight of the eleven commercial banks operating in Kosovo for the period 2014-2020. All these banks are working during the whole period taken for study. Based on the literature review and selected variables, we developed the following econometric model to investigate the impact of potential determinants on the cost-effectiveness of commercial banks in Kosovo.

$$CE = \beta_1 ROA + \beta_2 CAP + \beta_3 SZ + \beta_4 TLTD + \beta_5 LLPTL + \beta_6 ROE + \beta_7 LTA + \varepsilon \dots\dots (3)$$

Definitions of these variables are presented in Table 2.

Table 2. Definitions of variables

Symbols Interpretation	Variable description	Some previous research
Dependent variables		
CE Cost efficiency	Estimated using data envelopment analysis	Adjeji-Frimpong K., Gan Ch., Hu B. 2014; Belas et al. 2019; Oreddegbe et al. 2020
Independent variables		
ROA Return to assets	Net income / Total assets	Hassan & Jreisat 2016; Hadhek et al. 2018; Ereta, et al. 2020;
CAP Capitalization	The total value equity over total assets	Adjeji-Frimpong K., Gan Ch., Hu B. 2014; Amin et al. 2017; Belas et al. 2019
SZ Size of bank	Natural of the logarithm of total assets	Hadhek et al. 2018; Anwar 2018; Ereta et al. 2020; Alabi et al. 2020
TLTD Bank liquidity	The ratio of total loans to total deposits	Xiang, Shamsuddin, & Worthington, 2015; Gunes & Yildirim, 2016; Daude & Pascal, 2017; Amin, Ali, and Nor, 2018
LLPTL Loan loss provision coverage ratio	The ratio of loan loss provisions / Total loans	Xiang, Shamsuddin, & Worthington, 2015; Skala, 2015; Cummings & Durrani, 2016; Zheng et al. 2018;
ROE Return on equity	Net income to total equity	Hassan & Jreisat, 2016;; Batchimeg, 2017; Sultana & Rahman, 2020
LTA Loans to assets	Total loans to total assets	Staikouras et al. 2008; Amin et al. 2017; Belas et al. 2018;

Based on the model defined above, the following hypotheses are formulated:

H1: There is a significant relationship between return on assets (ROA) and cost efficiency,

H2: There is a significant relationship between capital adequacy (CAP) and efficiency,

H3: There is a significant relationship between bank size (SZ) and cost-efficiency,

H4: There is a significant relationship between bank liquidity (TLTD) and cost efficiency,

H5: There is a significant relationship between loan loss provision coverage (LLPTL) ratio and cost efficiency,

H6: There is a significant relationship between return on equity (ROE) and cost efficiency,

H7: There is a significant relationship between loans to assets (LTA) and cost efficiency.

4. Results and discussion

To test the impact of variables in CE, through the Gretl software we tested the equation (3). For the CE calculation we used the DEA software. and the results obtained from this evaluation are presented in the table below. The table provides the average efficiency scores. The table shows the number of banks (eight banks x 4 – quarterly), mean, minimum, and maximum scores.

Table 3. Average efficiency scores of Kosovo's Banking Sector (2014-2020 – quarterly)⁴

Year	Number of observations (8*4)	Cost efficiency		
		Mean	Min	Max
2014	32	0.830	0.496	1.000
2015	32	0.801	0.265	1.000
2016	32	0.784	0.232	1.000
2017	32	0.762	0.260	1.000
2018	32	0.785	0.464	1.000
2019	32	0.838	0.707	1.000
2020	32	0.863	0.420	1.000
Mean	32	0.809	0.406	1.000

The table presents the results of the annual and the overall efficiency of Kosovo's banking system between 2014 and 2020. The results evince that the overall average cost efficiency score for Kosovo's banking sector is 0.809.

The data are panel and cover banks from Kosovo for the period 2014 to 2020. Based on the analysis of the R-squared data it is 0.5856, which means that 58.56% of the variables included in our regression explain the changes in CE. The following are the results of the linear regression.

Table 4. Model 1: Pooled OLS, using 224 observations, Included 8 cross-sectional units; Time-series length = 7, Dependent variable: CE

	Coefficient	Std. Error	t-ratio	p-value	
const	0.909613	0.187606	4.849	<0.0001	***
ROA	-25.19940	4.932220	-5.109	<0.0001	***
CAP	0.049945	0.069837	0.7152	0.4754	
SIZE	-0.096185	0.029024	-3.314	0.0011	***
TLTD	0.171244	0.223149	0.7674	0.4438	
LLPTL	-0.009123	0.001517	-6.013	<0.0001	***
ROE	1.731750	0.384504	4.504	<0.0001	***
LTA	-0.348111	0.308289	-1.129	0.2603	

⁴ Instruction file = eg3-ins.txt; Data file = eg3-dta.txt; Cost efficiency DEA; Scale assumption: CRS

Mean dependent var	0.175211	S.D. dependent var	0.124699
Sum squared resid	1.256319	S.E. of regression	0.081747
R-squared	0.585678	Adjusted R-squared	0.570251
F(7, 188)	37.96471	P-value(F)	7.73e-33
Log-likelihood	216.7811	Akaike criterion	-417.5622
Schwarz criterion	-391.3372	Hannan-Quinn	-406.9451
rho	0.607858	Durbin-Watson	0.769920

In the first hypothesis where the return on assets to efficiency is tested, it shows that this indicator is significant, with a negative sign. We have the same result with Wang et al., (2007); Olson and Zoubin (2011); Tuškan and Stojanović, (2016);

In the third hypothesis, there is a significant relationship between bank size and cost-efficiency, but the coefficient has a negative sign. These results are in accordance with the literature of other authors (e.g., Hassan & Jreisat 2016; Ereta, et al. 2020; Stavárek, 2006; Chortareas et al., 2011; Chronopoulos et al., 2011). This result was expected, as due to their size, larger banks can attain lower unit costs. In the fifth hypothesis is a significant and negative relationship between loan loss provision coverage ratio and cost-efficiency. The same result is confirmed by Kwan (2006); Teshome et al. (2018), and Mamonov and Vernikov (2017). The sixth hypothesis is a significant and positive relationship between return on equity (ROE) and cost-efficiency. Also, these results are confirmed by Hassan & Jreisat (2016); Tan et al., (2017); Beccalli and Frantz, (2009).

While, other variables like the equity over total assets (the second hypothesis) loans to deposits (the fourth hypothesis), and loans to total assets (the seventh hypothesis) they do not have any effect on cost efficiency. Consequently fourth of our seven hypotheses have been validated.

5. Conclusions

Commercial banks that focus on traditional lending activity are more efficient by comparison, while banks that take on higher risks are more inefficient. Therefore, banks with less liquidity, lower solvency rates, and higher credit risk are more inefficient than more prudent credit institutions. Banks with higher performance and sound financial indicators are more efficient. In banking sectors where the level of cost efficiency is low, one way to improve efficiency could be to improve the level of capitalization. The regulatory authority can enforce strict rules on capital regulation and credit risk level, which together lead to an improvement in cost efficiency. To assess the ability of banks to increase efficiency, both regulators and practitioners increasingly rely on economic theory to measure the efficiency of banks and to compare institutes with each other.

The study was carried out with the main purpose to examine the cost efficiency of the banking sector in Kosovo over the period of 2014 to 2020. The non-parametric Data Envelopment Analysis (DEA) method is applied.

The purpose of this paper is to test which banking specifics have an impact on cost efficiency in the banking sector in Kosovo. In this case, we have confirmed four hypotheses, in which it is concluded that the Return on Assets (ROA), Size (SZ), and Loan Loss Provisions (LLPTL) have a negative and significant effect on cost efficiency, meanwhile Return on Equity (ROE) has a positive impact on cost efficiency.

The contribution of this study is that these results can be taken into account by the central bank, other banks, and other stakeholders. Another contribution is the inclusion of Kosovo banks for the first time in such a study.

There are some limitations to our work. One of them is the small number of banks operating in Kosovo, although we have included in the sample all those banks that have provided audited data. Another limitation is the

lifespan of the years that these banks have operated. Due to these limitations, it was not possible to include other explanatory variables, which resulted in a low R-square.

In the future, it would be good to increase the sample and the greater inclusion of variables, the increase in the number of years, as well as the inclusion of the Western Balkan countries.

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