FACTORS AFFECTING THE EFFICIENCY OF VIETNAM'S JOINT STOCK COMMERCIAL BANKS

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Abstract: ***Five years after the National Assembly's Resolution 42/2017/QH14 on the settlement of credit institutions' bad debts and the Prime Minister's Decision 1058/QD-TTG approving a plan for credit institution restructuring, this study assesses the effectiveness of Vietnam's Joint Stock Commercial Banks (JSCBs). Using the Data Envelopment Analysis (DEA) technique, a quantitative method, this study evaluates the efficiency of 18 selected JSCBs in Vietnam between 2018 and 2022. It employs the Tobit model and Ordinary Least Squares (OLS) model to investigate the factors that affect efficiency. The findings demonstrate that, with an average technical efficiency index of 44.09%, banks underutilize their input resources between 2018 and 2022. To increase business efficiency, JSCBs in Vietnam should manage human resources, increase capital mobilized from deposits, and enhance income from credit activities. Furthermore, empirical data indicates that JSCBs can function more efficiently if their total assets and equity are increased, and their existing loan portfolio is reduced.***

• Keywords: *bank efficiency, data envelopment analysis, ordinary least squares, tobit.*

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1. Introduction

In the context of globalization, foreign banks, non-bank financial intermediaries, fintech companies, and mobile service providers are powerful organizations with a wide impact and are capable of competing in active markets. Meanwhile, Joint Stock Commercial Banks (JSCBs) in Vietnam are facing many challenges, including low profits, a high percentage of bad debts, poor asset quality, liquidity concerns, and the potential risk of a collapsed system, all of which affect the social and economic life, as well as the manufacturing and business activities of citizens and companies. Resolution 42/2017/QH14 of the National Assembly on the settlement of bad debts of credit institutions and Decision 1058/QD-TTG of the Prime Minister, approving a scheme for restructuring the credit institution system associated with the settlement of bad debts for the period of 2016-2020 (extended until 31/12/2023), were issued by the Vietnam National Assembly in an effort to address bad debts quickly and thoroughly. The effect of these regulations during 2018-2022 showed that JSCBs in Vietnam had an average non-performing loan (NPL) ratio of less than 3%. However, JSCBs also experienced slow profit growth, decreased non-interest revenue, a lower net profit margin, and difficulties in service activities and stock investments. Because of the different studied periods and space, many previous evaluations and recommendations are not suitable in reality (Duong et al., 2020; Nguyen, 2017; Nguyen, 2008). Before, some authors only evaluated the initial period implementing these regulations above. Therefore, the purpose of this study is to assess the business efficiency of eighteen JSCBs over a longer time span (2018-2022) utilizing the Data Envelopment Analysis (DEA) method and Tobit Regression model. The study's findings would suggest factors that have increased the bank's efficiency.

2. Literature review

Efficiency is a crucial component of the banking sector, and many studies have looked into the efficiency of commercial banks. Efficiency can be measured using two different methods: the non-parametric linear programming approach and the parametric stochastic frontier production function approach. The non-parametric linear programming approach, or DEA, is used in this work. Scale efficiency (SE), or a bank's capacity to optimize its operations relative to its size, is a crucial aspect of efficiency. The effect of SE on the overall technical efficiency (TE) of JSCBs has been the subject of numerous studies. In Indonesian Islamic banks, SE and technical inefficiencies has a statistically significant correlation (Havidz & Setiawan, 2015).

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Technical inefficiency of Islamic Banks (IBs) is demonstrated to be caused by scale inefficiency in banks in MENA countries (Abdul Rahman & Rosman, 2013). The primary factor contributing to the technical inefficiency of IBs in Malaysia is determined to be scale (Yildirim, 2015).

Because the products that banks offer their customers are intangible, choosing the right variables to gauge their economies of scale, efficiency, and performance is a difficult task (Olgu, 2007). The three main methodologies used in the literature are the Production, Value-Added, and Intermediation approaches, although there is no agreement on how to choose input and output variables.

The "two-stage" approach is employed to account for environmental influences. Using any of the frontier methods or the fiscal rates mentioned in the previous sections, effectiveness scores obtained in "stage one" of this approach are regressed on designated environmental elements in "stage two". In recent years, numerous studies have utilized the estimated results from the Data Envelopment Analysis (DEA) as a dependent variable in both OLS and Tobit models.

The dependent variables in the OLS model consist of the TE (based on the DEA technique) that was applied previously (Yudistira, 2004). Using the DEA approach and Tobit regression, the effectiveness of commercial banking sectors is examined in many areas with varied results of influenced factors (Hu et al., 2008; Pasiouras, 2008; Raphael, 2013). A research conducted in Vietnam evaluates the performance of thirty-two commercial banks during the time of restructuring (2001 - 2005) (Nguyen, 2008). The input variables of this study include the net fixed asset, expenses for employees, total mobilized capital from customers. Meanwhile, output variables consist of interest and other equivalent amounts, other revenues and equivalent. To assess the effectiveness of company operations, the authors integrate the Tobit regression model, parametric analysis, and nonparametric analysis. The results also show that commercial banks in the studied period wasted 26.4% of input variables. Besides, the bank's assets, loan-to-deposit ratio, profit rate, bad loan rate, total expense, and total revenue impacted the business efficiency of commercial banks. Another study uses a Tobit regression model in conjunction with the DEA 2-stage technique to assess 21 commercial banks. (Nguyen, 2017). The TE index of 94% supports the research findings, which show that commercial banks employed reasonably efficient input resources between 2011 and 2015. The result from the Tobit Regression model indicates that increased business numbers in addition to the profit rate per total assets, bad loans per total credit balance, and total assets positively affect the TE of JSCBs.

3. Methodology

This research carried out a thorough investigation in two stages to evaluate the effectiveness of joint stock commercial banks. The first stage involved analyzing the effectiveness of the entire sample of banks collected using the DEA method. Efficiency scores were estimated with R. In the second phase, the impact of several factors on joint stock commercial banks' efficiency was investigated using the Tobit regression model, building upon the findings from the first stage. Tobit analysis was performed with STATA 14.

4. Data and variables

4.1. Data

The study used information from the yearly reports along with financial statements of 18 Vietnam JSCBs during the five years of 2018-2022, including BIDV, Vietinbank, Vietcombank, Techcombank, VPbank, MBbank, ACB, MSB, SHB, Eximbank, NamAbank, KienLongbank, NCB, PGbank, BacAbank, HDbank, OCB, and ABbank.

4.2. Variables

Phase 1:

After closely reviewing the aforementioned material, the author chose to employ the intermediation technique, which is frequently employed by writers. The DEA approach used two input elements, staff count (X1) and customer deposit (X2), and two output variables, interest income (Y1) and non-interest income (Y2). Other publications endorsed the selection of the input and output (Hassan et al., 2009; International Monetary Fund (IMF), 2023; Mester, 1993; Siems, 1992; Singh et al., 2008; Yue, 1992).

The author used output variables derived from the input variables above to run the DEA model, as described above, detecting the overall efficiency (or TE), pure TE (PE), and SE. The TE drawn from the DEA model was assumed to be CRS. The drawn PE was assumed to be VRS, where TE $\leq$ PE. TE/PE equals the SE. If TE = PE, then SE = 1, indicating

that the operational scale has no effect on efficiency.

Phase 2:

A large body of literature suggests that a variety of factors can affect a bank's efficiency. Based on this research, the bank's efficiency affected by the GDP growth rate, the bank's overall asset size, equity to entire assets, bad debt ratio, and inflation rate was examined. We estimate the subsequent model:

$$TE_{it} = \beta_0 + \beta_1 BZ + \beta_2 ETA + \beta_3 LTA + \beta_4 NPL + \beta_5 INF + \beta_6 GDP + U_{it}$$

$$SE_{it} = \beta_0 + \beta_1 BZ + \beta_2 ETA + \beta_3 LTA + \beta_4 NPL + \beta_5 INF + \beta_6 GDP + U_{it}$$

Where:

TE_{it}: Bank technical efficiency, which is the outcome of Phase 1 of the DEA model.

SE_{it}: Scale efficiency of the bank which is calculated from TE and PE.

BZ: Logarithm of the Bank's total assets.

ETA: Equity/Total assets

LTA: The loan to total asset ratio (total outstanding loans/Total assets)

NPL: Non-performing loan ratio (total bad debt/ Total outstanding debt)

INF: Inflation rate (growth rate last year)

GDP: GDP growth rate (growth rate of the gross domestic product)

β_0 is constant and U_{it} is the error component, according to the normal distribution.

Except for the value of INF and GDP collected from data from the World Bank, other variables' values are collected from Financial statements.

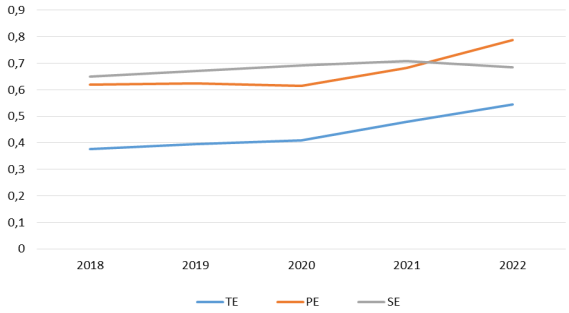
5. Empirical results

5.1. Phase 1: Bank Efficiency Measures

From 2018-2022, banks heavily rely on interest income, non-interest income tends to increase but still represents a relatively small proportion compared to interest income. To mitigate these risks, banks must explore alternative revenue sources and expand their offerings beyond traditional credit provision. By doing so, they can reduce their reliance on a single revenue stream and enhance their overall financial stability.

From 2018-2019, customer deposits experienced significant growth. However, the subsequent COVID-19 pandemic and the government's extended lockdown measures had a severe impact on customer deposits. The closure of businesses and companies, along with the stagnation of the tourism and export sectors, resulted in a decline in customer deposits. Many enterprises faced difficulties in mobilizing capital from customer deposits. Although there was a recovery in capital mobilization from customer deposits during 2021-2022, it remained lower than the pre-pandemic period. Because of the reduced deposit interest rates brought about by the State Bank of Vietnam's directive to lower lending rates to support economic recovery, customers do not prefer to put their money in banks.

Figure 1. Mean efficiency estimates of joint stock commercial banks



The average value of the TE points does not change with scale, but it varies according to the scale phase from 2018 to 2022, with the highest efficiency point being 1.000 (Figure 1).This means that among 18 sampled banks, there exists some banks with the highest efficiency and achieve minimum input and output optimization. Moreover, there are banks with low efficiency; the smallest efficiency point in the SE model is 0.192; whereas it is 0.161 (in the VRS model); and it is 0.149 (in the CRS model). These results indicate the differences in effectiveness between the investigated banks, with similar levels of output quantity, but some banks utilize minimum input optimization while others waste inputs.

The majority of Vietnam's JSCBs have been doing their business inefficiently between 2018 and 2020. Their lowest TE compared to PE and SE and their sharp rise to 54.56% in 2022 are indicators of this. This suggests that the ineffectiveness of Vietnam's JSCBs is more directly linked to their poor use of input resources than to the size of their business.

5.2. Phase 2: Influence factor of the efficiency

Correlation testing

The correlation between variables is detected using correlation testing, where the correlation coefficient runs from -1 to 1 referring to the

correlation's level between variables. The closer the value is to 1, the stronger the correlation, and if it equals 1, there is an absolute correlation relationship. The results show that the correlation coefficients between variables are all non-zero. Therefore, the variables in the research model are correlated.

Table 1: Correlation matrix

	TE	SE	BZ	ETA	LTA	NPL	GDP	INF
TE	1.000							
SE	0.735	1.000						
BZ	0.559	0.824	1.000					
ETA	0.449	0.264	-0.047	1.000				
LTA	-0.089	0.056	0.201	0.073	1.000			
NPL	-0.110	-0.266	-0.261	0.001	-0.113	1.000		
GDP	0.011	-0.056	-0.038	-0.003	0.011	0.105	1.000	
INF	-0.093	-0.055	-0.073	-0.054	-0.007	0.065	0.555	1.000

Source: Financial statements 2018 - 2022 and results from Stata 14 software

Multicollinearity test

The assessment of the variance inflation factor (VIF) 's aim is the investigation of the multicollinearity phenomenon. The max value of the VIF factor was 1.46 and the average value was 1.2, all of the VIF values in the test findings are less than 2, which suggests that multicollinearity was not present in this investigation**.**

Table 2: Description of the multicollinearity test

Variable	VIF	1/VIF
GDP	1.46	0.685375
INF	1.46	0.685859
BZ	1.12	0.894427
NPL	1.09	0.918599
LTA	1.05	0.948313
ETA	1.01	0.986302
Mean VIF	1.2	

Source: Financial statements 2018 - 2022 and results from Stata 14 software

OLS Regression Results

Table 3: OLS Regression Results for the dependent variable TE

Number of obs =	90	R^2 =	0.6042
F =	21.11	Adjusted R^2 =	0.5756
Prob > F =	0.0000	=	0.14567

TE	Coef.	Std. Err.	t	P>t	[95% Conf.	Interval]
BZ	0.1315027	0.0150655	8.73	0.000	0.1015381	0.1614673
ETA	0.0350756	0.0049396	7.1	0.000	0.025251	0.0449002
LTA	-0.0047614	0.0013432	-3.54	0.001	-0.0074329	-0.0020899
NPL	0.0028456	0.0085141	0.33	0.739	-0.0140887	0.0197799
INF	-0.0239585	0.031646	-0.76	0.451	-0.086901	0.038984
GDP	0.0066187	0.007684	0.86	0.392	-0.0086644	0.0219019
_cons	-1.178477	0.2205126	-5.34	0.000	-1.617068	-0.7398863

Source: Financial statements 2018 - 2022 and results from Stata 14 software

Table 4: OLS Regression Results for the dependent variable SE

Number of obs =	90	R^2 =	0.7952
F =	53.72	Adjusted R^2 =	0.7804
Prob > F =	0.0000	=	0.1249

SE	Coef.	Std. Err.	t	P>t	[95% Conf.	Interval]
BZ	0.2102253	0.012918	16.27	0.000	0.184532	0.2359187
ETA	0.0269117	0.0042355	6.35	0.000	0.0184875	0.0353359
LTA	-0.0032713	0.0011517	-2.84	0.006	-0.005562	-0.0009806
NPL	-0.0082447	0.0073005	-1.13	0.262	-0.0227651	0.0062757
INF	0.0233048	0.027135	0.86	0.393	-0.0306656	0.0772752
GDP	-0.0047392	0.0065887	-0.72	0.474	-0.0178439	0.0083654
_cons	-1.997705	0.1890797	-10.57	0.000	-2.373777	-1.621633

Source: Financial statements 2018 - 2022 results from Stata 14 software

Tobit Regression Results

Table 5: Tobit Regression Results for the dependent variable TE

Number of obs =	90	LR chi2=	79.87
Log likelihood =	35.066773	Prob > chi2 =	0.0000
		Pseudo R2 =	8.2063

TE	Coef.	Std. Err.	t	P>t	[95% Conf.	Interval]
BZ	0.133942	0.0152769	8.77	0.000	0.1035623	0.1643218
ETA	0.0367447	0.0050658	7.25	0.000	0.0266708	0.0468186
LTA	-0.0047275	0.0013585	-3.48	0.001	-0.0074291	-0.0020259
NPL	0.003895	0.0086303	0.45	0.653	-0.0132673	0.0210573
INF	-0.0255799	0.0320549	-0.8	0.427	-0.0893245	0.0381647
GDP	0.0072326	0.0077835	0.93	0.355	-0.0082458	0.0227109
_cons	-1.222549	0.2239425	-5.46	0.000	-1.667884	-0.7772152
/ sigma	0.1472951	0.0115148			0.1243967	0.1701935

Source: Financial statements 2018 - 2022 and results from Stata 14 software

Table 6: Tobit Regression Results for the dependent variable SE

Number of obs =	90	LR chi2 =	138.75
Log likelihood =	52.122741	Prob > chi2 =	0.0000
		Pseudo R2 =	4.0209

SE	Coef.	Std. Err.	t	P>t	[95% Conf.	Interval]
BZ	0.2142311	0.0129666	16.52	0.000	0.1884457	0.2400166
ETA	0.0296577	0.004382	6.77	0.000	0.0209436	0.0383717
LTA	-0.00323	0.0011476	-2.81	0.006	-0.0055122	-0.0009478
NPL	-0.0066939	0.007314	-0.92	0.363	-0.0212386	0.0078507
INF	0.0207135	0.0271346	0.76	0.447	-0.0332466	0.0746736
GDP	-0.0037293	0.0065929	-0.57	0.573	-0.0168399	0.0093814
_cons	-2.069375	0.1905703	-10.86	0.000	-2.448345	-1.690405
/ sigma	0.124394	0.0096067			0.10529	0.143498

Source: Financial statements 2018 - 2022 and results from Stata 14 software

The analytical results show that technical and scale efficiency is positively and statistically significantly impacted by a bank's entire assets (BZ) size below the 1% threshold. To be more precise, a one-unit increase in entire assets causes a rise of 0.1315 units (OLS) and 0.1339 units (Tobit) increased technical efficiency, as well as a rise in scale efficiency of 0.2102 units (OLS) and 0.2142 units (Tobit) (Table 3 - 6). As a result, banks with adequate capital also have higher levels of technological and scale efficiency.

The ETA also positively and statistically significantly affects technical and scale efficiency below the 1% threshold. TE increases by 0.0350 units (OLS) and 0.0367 units (Tobit) for every unit rise in the equity to entire assets ratio; scale efficiency increases by 0.0269 units (OLS) and 0.0296 units (Tobit) for every unit increase in equity to entire

assets. Because commercial banks' inherent capital is tiny compared to their asset size, it should neglect the effect of ETA on technical and scale efficiency. For banks with a safe capital ratio according to international standards, capital can be increased in the short term to enhance liquidity, asset quality, and ensure stable development, and gradually increase market share, contributing to improving operational effectiveness.

In both models, LTA has a significantly negative correlation with TE and SE at the 1% level. A one-unit increase in the loan-to-asset ratio causes a drop in TE of 0,00476 units (OLS) and 0,0472 units (Tobit), and a one-unit increase in the loan-to-asset ratio results in a reduction in scale efficiency of 0.00327 (OLS) and 0.00323 (Tobit) units. The findings indicate that increasing bank lending is not always a more effective strategy. The danger of credit rises in tandem with credit amount. Since long-term loans are particularly susceptible to market and economic volatility, they frequently entail high amounts of risk. In reality, commercial banks have been expanding their credit market, leading to a more lenient assessment of loan projects. However, their ability to manage and control credit quality is still limited, with limited analysis and evaluation of credit portfolio projects. This has resulted in higher risk in lending, reduced capital utilization efficiency, increased overdue debt ratio, and posed risks to the overall system. The research reveals no significant impact of NPL, INF, and GDP on technical and scale efficiency during the period of 2018-2022.

6. Conclusion and recommendations

This paper uses the DEA method to measure the efficiency of 18 JSCBs from 2018 to 2022. To investigate the determinants of efficiency, we then use the OLS and Tobit models. We find that the majority of Vietnam's JSCBs have clearly been operating inefficiently between 2018 and 2020, and their inefficiency is more directly linked to the poor use of input resources than to the size of their business. The size of a bank's total assets, the equity-to-assets ratio, and the loans-to-assets ratio are all associated with bank efficiency. However, the growth rate of GDP, the non-performing loan ratio, and the inflation rate are not significantly related to bank efficiency. The research shows that expanding the scale of assets, increasing capital ownership, and managing credit portfolios to mitigate risks can improve the efficiency of commercial banks.

Although there is a correlation, it has little effect on banks' overall technical efficiency. Therefore, banks with significant total assets must exercise caution when deciding to increase their capital and expand their operations. It is evident that excess capital infusion may lead to a decrease in overall efficiency. In addition, it is crucial for Vietnamese credit institutions to be cautious when increasing their capital ownership. Effective capital management policies are necessary to ensure the optimal utilization of resources. By implementing efficient capital management strategies, credit institutions can maximize the benefits of increased capital while minimizing potential drawbacks.

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