EJEM
Econ.J.Emerg.Mark.

Economic Journal of Emerging Markets
Available at https://journal.uii.ac.id/jep

Bank efficiency and shareholder value in Vietnam's Banking Sector

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Article Info

Article history:
Received 17 August 2024
Accepted 15 February 2025
Published 23 April 2025

JEL Classification Code:
D24, G21, G32.

Author's email:
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DOI:
10.20885/ejem.vol17.iss1.art3

Abstract

Purpose — This paper investigates the impact of bank efficiency on shareholder value in the context of Vietnamese commercial banks.

Methods — Bank technical efficiency is measured using the DEA input cost minimization method. We employ fixed effects model (FEM), random effects model (REM), and two-step difference generalized method of moments (GMM) to regress the research models.

Findings — The findings indicate that bank efficiency positively impacts shareholder value. Additionally, the study reveals that specific bank characteristics, such as return on equity, bank size, market risk, liquidity risk, and macroeconomic factors, such as GDP growth rate, inflation rate, and credit to the private sector, also affect shareholder value.

Implications — We recommend that bank managers implement policies to enhance technical efficiency, creating greater shareholder value.

Originality — This study is the first to explore the role of technical efficiency in predicting shareholder value, specifically within the context of Vietnamese banks.

Keyword — bank efficiency; shareholder value; Vietnam banking

Introduction

Like other countries worldwide, the banking sector in Vietnam plays a crucial role in developing the economy. Since Vietnam joined the WTO in 2007, the economy has experienced significant breakthroughs, with high economic growth rates leading to a substantial increase in capital demand. This growth has resulted in uncontrolled expansion within the banking system, and many poorly performing banks have begun to emerge, significantly impacting the national financial system. A series of bank restructuring solutions issued by the government during the 2013–2015 period helped bring the situation under control and resulted in a healthier financial system. Since 2016, the Vietnamese banking system has been more actively managed and controlled to ensure the smooth and efficient operation of capital flows within the economy.

From an academic perspective, as the banking system faced risks and was subsequently stabilized, many scholars began to question and focus on how effectively Vietnamese commercial banks were operating. This interest has attracted numerous studies measuring the technical efficiency of Vietnamese commercial banks (Kontesa et al., 2020; Lan et al., 2024; Le et al., 2022; Le et al., 2021; Thanh Ngo & Tripe, 2017; Nguyen & Simioni, 2015; Nguyen & Pham, 2020; Nguyen et al., 2016; Stewart et al., 2016; Vo & Nguyen, 2018; Dinh et al., 2019).

However, more importantly, the impact of technical efficiency on shareholder value has not yet been thoroughly explored. Therefore, this study does not focus on the detailed estimation of technical efficiency; instead, we analyze the impact of technical efficiency on the shareholder value of Vietnamese commercial banks. In other words, we ask whether banks with higher technical efficiency contribute to increased bank value.

P ISSN 2086-3128 | E ISSN 2502-180X

The concept of technical efficiency was first defined and clarified by Farrell (1957). Technical efficiency measures the extent to which a production unit utilizes available input resources to produce the maximum possible output. Technical efficiency is applied across all industries to evaluate the efficiency of a company, bank, or even a country. Coelli et al. (2005) further developed the theory of technical efficiency in the banking sector, suggesting that a bank is considered technically efficient when it minimizes input resources to produce a given output level. A production unit is considered technically efficient if it cannot reduce the input without reducing the corresponding output. Hughes and Mester (2012) expanded on technical efficiency, suggesting that efficiency should be considered from three perspectives: cost minimization, profit maximization, and managerial utility maximization. Managerial utility maximization refers to goals reflecting the priorities of managers, which may include cost, profit, market share, growth, and other strategic objectives.

Calculating technical efficiency is relatively complex and is often approached using nonparametric and parametric estimation methods. Data Envelopment Analysis (DEA) is a nonparametric method that uses linear programming to estimate the technical efficiency of decision-making units (DMUs). Stochastic Frontier Analysis (SFA) is a parametric method in which a frontier production function is estimated through regression techniques. This production function includes a random component to capture factors beyond the DMU's control and an inefficiency error component. In the banking sector, many studies apply the DEA or SFA method, and some even apply both methods simultaneously to calculate technical efficiency. The examples include studies on banks in OECD countries (Wanke et al., 2020), the US and Canada (Liu, 2019), India (Dar et al., 2021), and Vietnam (Nguyen and Pham (2020); Nguyen et al., 2016); Dong et al., 2014; Silva et al., 2017; Thoraneenitiyan & Avkiran, 2009). However, the DEA method is more commonly used in empirical studies to evaluate banking efficiency because it does not require assumptions about the form of the production function, is easy to apply to organizations using multiple inputs to generate multiple outputs, and is adaptable to various situations, especially in service industries (Liu et al., 2013).

Most previous empirical studies, whether at the national level or across economic regions, suggest that banks with higher technical efficiency tend to positively impact stock market prices, thereby enhancing shareholder value. For instance, Sufian and Majid (2009) were the first to investigate the relationship between China banks' efficiency and share price performance. Their study, covering the period from 1997 to 2006, used the DEA estimation method to estimate technical efficiency with two input factors: Total deposits and fixed assets, and two output factors: Total loans and investments. The fixed-effect estimation method was used to regress the research models. The results indicated that larger banks generally exhibited better technical efficiency than smaller banks, and technical efficiency positively correlated with stock returns. Pasiouras et al. (2008) investigated the relationship between the efficiency of Greek banks and their share price performance. Based on data collected from 2001 to 2005, the study found a positive and statistically significant relationship between technical efficiency and stock returns. Kale et al. (2020) examined the impact of changes in bank efficiency on the stock returns of banks listed in the Turkish market from 2002 to 2017. The study showed that improvements in bank efficiency were a significant factor in explaining positive changes in stock returns.

Alsharif (2021) evaluated the impact of bank efficiency on the profitability performance of stock prices for 12 listed commercial banks in Saudi Arabia from 2006 to 2018. The DEA method was used to calculate technical efficiency parameters through input cost minimization. The estimation model included three input factors: Personnel expenses, fixed assets, and deposits, and two output factors: Loans and other earning assets. The study found that banks with better technical efficiency experienced growth in stock prices. Sharma (2018) investigated the relationship between bank efficiency and stock performance in a developing country, India. The study included 22 listed banks from 2002 to 2012. The DEA method was used to estimate technical efficiency, considering both variable returns to scale (VRS) and constant returns to scale (CRS) efficiency with the same input and output factors. Four input factors included deposits, interest expenses, non-interest expenses, and personnel expenses, while three output factors included loans, interest

income, and non-interest income. The results indicated that efficient banks created more value for their investors. Hoang et al. (2020) investigated the influences of efficiency, concentration, and market power on the shareholder value of 73 Australian banks from 2000 to 2015. Tobin's Q ratio was used as a representative indicator of shareholder value, while bank efficiency was calculated using the SFA method with three input factors: Fund, physical capital, and labour, and two output factors from the main and off-balance sheet activities in banking. The study found that technical efficiency had a positive impact on shareholder value.

From a broader perspective, Fu et al. (2014) used the GMM estimation method to analyze the relationship between shareholder value and bank efficiency for a large sample of listed banks across 14 Asia-Pacific economies from 2003 to 2010. Technical efficiency, represented by profit and cost efficiency, was measured using the SFA method. The estimation model included three output factors: Total net loans, other earning assets, and non-interest income, and two input factors: Price of purchased funds, measured by the ratio of interest expenses to deposits and short-term funding, and price of physical capital, measured by the ratio of non-interest expenses to total fixed assets. The study indicated that cost and profit efficiency improvements positively correlated with stock price changes. Bank size, credit losses, and market risk also influenced stock prices. Fiordelisi and Molyneux (2010) investigated the factors affecting shareholder value for banks in the European region from 1998 to 2005. Bank efficiency was one of the explanatory variables considered in the regression models and was measured using the SFA method. The estimation model for bank efficiency was based on three input factors: Labour, physical capital, and financial capital, and three output factors: Deposits, total loans, and other earning assets. The study found that technical efficiency positively affected shareholder value.

However, the relationship between bank technical efficiency and shareholder value is unclear. Aftab et al. (2011) analyzed the impact of bank efficiency on share performance for banks listed on the Karachi Stock Exchange in Pakistan from 2003 to 2007. The DEA estimation method was used to estimate both VRS and CRS technical efficiency. The results showed that VRS technical efficiency had a demonstrable impact on stock prices, whereas CRS technical efficiency did not clearly impact stock prices. Siauwijaya (2020) studied the effect of bank efficiency, earnings per share, and price-earnings ratio on the stock returns of 33 banks in Indonesia from 2012 to 2016. The DEA method was also used to estimate bank efficiency. The findings indicated that bank efficiency did not significantly affect stock prices, while earnings per share and the price-earnings ratio positively influenced stock prices. Liadaki and Gaganis (2010) examined the impact of technical efficiency on the stock prices of 171 listed banks across 15 EU markets from 2002 to 2006. The SFA method was used to estimate profit efficiency and cost efficiency. The study found that changes in profit efficiency had a positive and significant effect on stock prices, while no relationship was found between changes in cost efficiency and stock returns. Thus, most previous studies, national or multinational, suggest that bank technical efficiency positively impacts shareholder value. Therefore, in the case of Vietnam, we also expect a positive relationship between bank efficiency and shareholder value.

Methods

The Model

Based on the studies by Fu et al. (2014), Fiordelisi and Molyneux (2010) and Hoang et al. (2020). The authors propose a model to analyze the impact of bank efficiency on shareholder value for banks in Vietnam as follows:

$$\textit{Shareholder value} = f\,(\textit{Bank efficiency; Bank characteristics; Macroeconomic factors})$$

where,

1) Shareholder value is measured by Tobin's Q. Similar to Fu et al. (2014) and Saif-Alyousfi 2020), Tobin's Q is calculated as the market value of equity plus the book value of debt, divided by the book value of assets.
2) Bank efficiency is represented by constant returns to scale technical efficiency (CRSTE)and variable returns to scale technical efficiency (VRSTE), estimated using the DEA method based

on input cost minimization. The estimation model includes three input factors: total assets, deposits, and personnel expenses, similar to the input factors used in previous studies (Alsharif, 2021; Abdulahi et al., 2023; Boubaker et al., 2023; Fukuyama et al., 2023; Gržeta et al., 2023; Henriques et al., 2018; Kamarudin et al., 2017; Kamarudin et al., 2015; Kamarudin et al., 2016; Řepková, 2014; Svitalkova, 2014). The three output factors include total loans, income, and profit before tax, similar to the output factors used in previous studies (Abdulahi et al., 2023; Boubaker et al., 2023; Kamarudin et al., 2016; Řepková, 2014; Wanke et al., 2016). We use the Vietnamese DEA add-in for Excel, developed by Ngo (2015), to estimate CRSTE and VRSTE.

3) Bank characteristics

- Return on Equity
  Return on equity (ROE) measures the bank's performance by comparing business profits with equity capital. A higher ROE generally reflects better operational performance, contributing to increased firm value and shareholder value. Most previous studies support the positive relationship between ROE and shareholder value (Arshad, 2021; Pennacchi & Santos, 2021; Widjaja & Ariefianto, 2022). Therefore, we expect a positive relationship between ROE and shareholder value in this study.
- Credit risk
  Credit risk is measured by the ratio of loan loss provisions to total loans. High loan loss provisions can reduce the bank's accounting profit and are expected to decrease shareholder value (Athanasoglou et al., 2008). However, Fiordelisi and Molyneux (2010) found that higher credit risk provisions have a positive relationship with shareholder value and serve as a tool for smoothing bank profits, which can build shareholder confidence in the bank's stability. On the other hand, Hoang et al. (2020) indicated that credit risk might reduce net interest margin and ROE but found no evidence of its impact on shareholder value. Similarly, other studies have found no evidence of credit risk affecting shareholder value (Fu et al., 2014; Widjaja & Ariefianto, 2022). Therefore, the relationship between credit risk and shareholder value is complex, and we have no clear expectations regarding their relationship.
- Market risk
  Market risk is typically measured by the ratio of total security investments to total assets (Fu et al., 2014). However, we measure market risk by the ratio of provisions for trading and investment securities to total assets for greater clarity. Empirical studies have shown inconsistent results regarding the relationship between market risk and shareholder value. Fu et al. (2014) found a positive relationship, Fiordelisi and Molyneux (2010) found a negative relationship, while Saif-Alyousfi (2020). We found no evidence of a relationship between market risk and shareholder value, so we do not have a clear expectation of such a relationship.
- Liquidity risk
  Liquidity risk is measured by the ratio of total loans to total deposits. The relationship between liquidity risk and shareholder value is also debated. Hoang et al. (2020) argue that a higher loan-to-deposit ratio can lead to higher bank risk and lower shareholder value. However, Fiordelisi and Molyneux (2010) suggest that maintaining a high loan ratio and loan growth rate can benefit shareholder value. Meanwhile, some studies have found no evidence of a relationship between liquidity risk and shareholder value (Fu et al., 2014; Widjaja & Ariefianto, 2022). Therefore, we do not have a clear expectation of the relationship between liquidity risk and shareholder value.
- Bank size
  Bank size is the natural logarithm of total assets. Bank size is often one of the crucial factors influencing bank efficiency. Some studies suggest that larger banks often have better product advantages and diversification, which reduces credit risk. Additionally, larger banks can benefit from economies of scale, leading to higher shareholder value (Fiordelisi & Molyneux, 2010; Fu et al., 2014). However, other studies argue that smaller banks create more shareholder value (Hoang et al., 2020; Saif-Alyousfi, 2020). They believe that smaller

banks can focus better on managing a limited number of loans, thereby better controlling risks and creating more benefits and shareholder value. In the context of Vietnamese commercial banks, larger banks tend to have better reputations, and their customers are usually of higher quality. Therefore, we expect a positive relationship between bank size and shareholder value.

4) Macroeconomic factors:

- GDP growth rate
  Economic growth plays a vital role in the economy's supply and demand for credit. A rapidly growing economy typically leads to significant credit expansion, increased competition among banks, and a loosening of risk controls, which can result in reduced bank profitability and Tobin's Q (Saif-Alyousfi, 2020). Some other studies also support the inverse relationship between economic growth and shareholder value (Fiordelisi & Molyneux, 2010; Hoang et al., 2020). In the context of Vietnam, the banking system has also faced risk issues during periods of high economic growth. Therefore, we expect an inverse relationship between economic growth and shareholder value.
- Inflation rate
  Inflation is also one of the key macroeconomic variables affecting bank performance. High inflation usually represents a more risky economic environment. Some studies suggest that the impact of inflation on bank performance depends on the bank's ability to predict inflation and adjust interest rates accordingly (Apergis, 2014; Dietrich & Wanzenried, 2014; Saif-Alyousfi, 2020). Incorrect inflation forecasts can lead to inappropriate interest rates and increasing costs. Saif-Alyousfi (2020) found evidence of an inverse relationship between inflation and shareholder value. However, other studies have shown that inflation is not a factor influencing shareholder value (represented by Tobin's Q) (Hoang et al., 2020). In the context of Vietnam, we also believe that inflation challenges the economy and negatively affects bank performance, thereby reducing shareholder value. We expect an inverse relationship between inflation and shareholder value.
- Credit to the private sector
  Credit to the private sector is represented by domestic credit to the private sector (% of GDP). Saif-Alyousfi (2020) found strong evidence of a negative impact of credit to the private sector on shareholder value (represented by Tobin's Q). Saif-Alyousfi (2020) argues that developing credit to the private sector can lead immature banks to bypass ethical barriers by lending to riskier projects and providing more funding to lower-quality clients. However, Naceur and Omran (2011) found evidence of a positive relationship between credit to the private sector and bank performance. In the context of Vietnam, we agree with Saif-Alyousfi (2020). We also expect an inverse relationship between credit in the private sector and shareholder value.

The variables used in the research model are summarized in Table 1.

Table 1. Summary of variables used in the research model

Variables	Definition	Symbol	Expected sign
Dependent variable			
Shareholder value, represented by Tobin's Q	Market value of equity plus book value of debt divided by book value of assets	Tobin's Q	
Independent variables			
Bank efficiency			
Constant returns to scale technical efficiency	Estimated using the DEA method	CRSTE	+
Variable returns to scale technical efficiency	Estimated using the DEA method	VRSTE	+
Bank characteristics			
Return on equity	Net profit after tax divided by equity	ROE	+

Variables	Definition	Symbol	Expected sign
Credit risk	Credit risk is measured by the ratio of loan loss provisions to total loans	CRER	+/-
Market risk	Market risk is measured by the ratio of provisions for trading and investment securities to total assets	MAKR	+/-
Liquidity risk	Liquidity risk is measured by the total loans to total deposits ratio	LIQR	+/-
Bank size	Bank size is defined as the natural logarithm of total assets	SIZE	+
Macroeconomic factors			
GDP growth rate	Annual growth rate of GDP (annual% %)	GDP	-
Inflation rate	Inflation, consumer prices (annual% %)	INF	-
Credit to the private sector	Domestic credit to private sector (% of GDP)	CREPRI	-

Source: The authors compiled.

Data Sources

The dataset includes 23 Vietnamese joint-stock commercial banks from 2006 to 2022. The sample does not include 100% state-owned banks, foreign banks, or branches of foreign banks operating in Vietnam. Additionally, banks involved in mergers and acquisitions during the study period were excluded to limit the impact of abnormal changes in asset structure on the research results. Data related to bank characteristics were calculated using information from the banks' financial reports. Data on macroeconomic factors, including GDP growth rate, inflation rate, and credit to the private sector, were collected from the World Bank. Stock price data used to calculate Tobin's Q for the banks were collected from the Ho Chi Minh City Stock Exchange (HOSE) and the Hanoi Stock Exchange (HNX).

Table 2. Average Technical Efficiency of Vietnam Banks based on CRSTE

Year	No. of banks	No. of efficient banks	Average efficiency	Standard deviation	Minimum Efficiency
2006	23	4	0.84	0.15	0.57
2007	23	5	0.80	0.16	0.61
2008	23	5	0.85	0.12	0.67
2009	23	7	0.89	0.11	0.69
2010	23	7	0.84	0.15	0.52
2011	23	7	0.82	0.17	0.37
2012	23	6	0.84	0.17	0.47
2013	23	6	0.85	0.15	0.54
2014	23	6	0.87	0.11	0.62
2015	23	3	0.86	0.12	0.55
2016	23	6	0.90	0.15	0.44
2017	23	7	0.91	0.10	0.65
2018	23	9	0.94	0.07	0.72
2019	23	8	0.94	0.08	0.75
2020	23	6	0.90	0.10	0.68
2021	23	8	0.92	0.10	0.68
2022	23	12	0.93	0.09	0.75

Notes: Constant returns to scale technical efficiency (CRSTE) were calculated using the DEA method and the Vietnamese DEA add-in for Excel developed by Ngo (2015). Source: Compiled from the author's calculations.

Table 2 and Table 3 present the summary results of constant returns to scale technical efficiency (CRSTE) and variable returns to scale technical efficiency (VRSTE) using the DEA method for Vietnamese commercial banks from 2006 to 2022. Banks with an efficiency score of 1 are considered efficient. The results in Tables 2 and 3 indicate an increasing trend in the number of efficient banks and an improvement in average efficiency. Overall, this suggests that Vietnamese commercial banks are performing better over time.

Table 4 presents descriptive statistics for the variables used in the research model. The data is an unbalanced panel. Notably, the number of Tobin's Q observations is fewer than for other variables because Vietnamese commercial banks were listed and traded on the stock exchanges at different times. The variable constant returns to scale technical efficiency (CRSTE) has a minimum value of 0.37, a maximum of 1.0, and an average of 0.88. In contrast, the variable returns to scale technical efficiency (VRSTE) has a minimum value of 0.52, a maximum of 1.0, and an average of 0.94. A small note on the variable market risk (MAKR): Table 4 displays only two decimal places, and the values of MAKR are very small, so some of the MAKR indicators are nearly zero (except for the maximum value). The mean and median values show no significant differences, indicating that the data are approximately normally distributed and meet the conditions for inclusion in the regression models.

Table 3. Average Technical Efficiency of Vietnam Banks based on VRSTE

Year	No. of banks	No. of efficient banks	Average efficiency	Standard deviation	Minimum Efficiency
2006	23	11	0.95	0.09	0.71
2007	23	9	0.94	0.10	0.65
2008	23	12	0.95	0.09	0.70
2009	23	13	0.94	0.10	0.69
2010	23	11	0.92	0.14	0.52
2011	23	13	0.93	0.12	0.56
2012	23	11	0.93	0.10	0.72
2013	23	9	0.90	0.12	0.62
2014	23	11	0.92	0.11	0.70
2015	23	8	0.89	0.12	0.57
2016	23	11	0.94	0.11	0.58
2017	23	9	0.93	0.09	0.65
2018	23	10	0.94	0.07	0.72
2019	23	14	0.96	0.07	0.77
2020	23	9	0.94	0.09	0.74
2021	23	13	0.96	0.07	0.75
2022	23	14	0.96	0.08	0.76

Notes: Variable returns to scale technical efficiency (VRSTE) was calculated using the DEA method and the Vietnamese DEA add-in for Excel developed by Ngo (2015). Source: Compiled from the author's calculations.

Table 4. Descriptive statistics

Variable	**Obs**	**Mean**	**S.D.**	**Min**	**Median**	**Max**
Tobin's Q	142	0.98	0.06	0.83	0.98	1.15
CRSTE	359	0.88	0.13	0.37	0.92	1.00
VRSTE	359	0.94	0.10	0.52	1.00	1.00
ROE	413	0.11	0.09	-0.56	0.10	0.44
CRER	350	0.01	0.01	0.00	0.01	0.04
MAKR	354	0.00	0.00	0.00	0.00	0.02
LIQR	355	0.91	0.24	0.23	0.89	2.51
SIZE	376	17.92	1.53	11.88	18.09	21.32
GDP	413	0.06	0.01	0.03	0.06	0.08
INF	413	0.07	0.06	0.01	0.04	0.23
CREPRI	413	0.93	0.18	0.60	0.90	1.26

Source: Calculations by the author based on the dataset and using Stata software.

Table 5 describes the correlation matrix among the variables used in the research model. All correlation coefficients are below 0.8, suggesting that the estimation models are unlikely to encounter severe multicollinearity (Gujarati & Porter, 2009).

Table 5. Correlation matrix of variables

	Tobin's Q	CRSTE	VRSTE	ROE	CRER	MAKR	LIQR	SIZE	GDP	INF	CREPRI
Tobin's Q	1.000										
CRSTE	0.283	1.000									
VRSTE	0.063	0.679	1.000								
ROE	0.000	0.153	0.345	1.000							
CRER	0.059	-0.043	0.074	0.062	1.000						
MAKR	-0.259	-0.092	-0.121	-0.375	0.022	1.000					
LIQR	0.094	0.476	0.277	0.108	-0.243	0.052	1.000				
SIZE	0.148	0.108	0.191	0.315	0.472	-0.108	-0.206	1.000			
GDP	-0.305	-0.012	-0.019	-0.022	-0.104	0.004	0.056	-0.152	1.000		
INF	-0.541	-0.193	0.008	-0.012	-0.027	0.210	0.095	-0.364	0.010	1.000	
CREPRI	0.664	0.268	0.089	0.158	0.066	-0.104	0.066	0.529	-0.305	-0.485	1.000

Source: Calculations by the author based on the dataset and using Stata software.

Estimation Methods

The study employs panel data estimation methods, including the fixed effects model (FEM) and the random effects model (REM). The Hausman test is then conducted to choose the appropriate estimation model. We also apply tests to check for heteroscedasticity and autocorrelation. We will use more suitable estimation methods if these issues are present. Additionally, Saif-Alyousfi (2020) suggests that factors affecting bank shareholder value may be biased due to endogeneity and omitted variables. Therefore, Saif-Alyousfi (2020) recommends using the generalized method of moments (GMM) to ensure more reliable estimation results, as this method effectively addresses endogeneity and heteroscedasticity issues. In this case, the lagged values of the independent variables are used as instruments. The GMM method is also used in other studies (Fiordelisi & Molyneux, 2010; Fu et al., 2014). Therefore, we will use the GMM estimation method with instruments that are all independent variables that lag by 1 to 2 years. Moreover, our dataset includes 23 banks (N) over 17 years (T) (from 2006 to 2022). Given the small sample size (N) and the not-too-long period (T), we prioritize the difference GMM method as it is more effective than the system GMM method (Roodman, 2009). The difference GMM method is also one of the choices for estimating the regression model in Saif-Alyousfi (2020).

Results and Discussion

Table 6 presents the results of the impact of bank efficiency on shareholder value using the FEM and REM estimation methods in panel data. The Hausman test indicates that REM is more appropriate than FEM. However, the Breusch and Pagan test results suggest that the estimation models in Table 6 face heteroscedasticity issues, leading to unreliable estimation results.

Table 7 presents the estimation results of the impact of bank efficiency on shareholder value using the two-step difference GMM estimation method. The AB test AR(1) has a p-value of less than 0.05, and the AB test AR(2) has a p-value greater than 0.1 in models 3 and 4. This indicates no second-order autocorrelation. Additionally, the Hansen test has a p-value greater than 0.1, indicating that the instruments used in the model are appropriate. Thus, the estimation results using the two-step difference GMM method in Table 7 are reliable. We will use the results in Table 7 to discuss the research findings.

The estimated coefficients for the CRSTE and VRSTE variables are positive and statistically significant in models 3 and 4 in Table 7. This indicates that constant returns to scale technical efficiency and variable returns to scale technical efficiency are positively related to shareholder value. In other words, bank technical efficiency positively impacts shareholder value. This result aligns with our expectations and with most previous studies (Alsharif, 2021; Fiordelisi & Molyneux, 2010; Fu et al., 2014; Hoang et al., 2020; Sufian & Majid, 2009). The findings of this study suggest that in the context of Vietnam, any improvement in technical efficiency in banking operations plays a crucial role in increasing shareholder value.

Table 6. Impact of bank efficiency on shareholder value using FEM and REM estimation methods

	Model 1				Model 2			
	FEM		REM		FEM		REM	
	Coef.	P-value	Coef.	P-value	Coef.	P-value	Coef.	P-value
CRSTE	0.149***	0.001	0.135***	0.001				
VRSTE					0.138**	0.021	0.124**	0.023
ROE	0.054	0.471	0.027	0.697	0.066	0.390	0.035	0.627
CRER	-1.145	0.204	-1.158	0.168	-0.935	0.308	-0.988	0.247
MAKR	-21.652	0.155	-23.918*	0.090	-28.656*	0.064	-30.233**	0.034
LIQR	-0.097***	0.003	-0.080***	0.007	-0.070**	0.023	-0.056**	0.047
SIZE	0.016	0.172	0.010	0.212	0.016	0.189	0.010	0.219
GDP	-0.538***	0.000	-0.542***	0.000	-0.520***	0.000	-0.524***	0.000
INF	-0.171	0.152	-0.170	0.135	-0.351***	0.003	-0.330***	0.003
CREPRI	0.156***	0.000	0.177***	0.000	0.153***	0.000	0.174***	0.000
_cons	0.519**	0.013	0.617***	0.000	0.507**	0.022	0.606***	0.000
Sample period	2006 - 2022		2006 - 2022		2006 - 2022		2006 - 2022	
Observations	142		142		142		142	
R_Square	0.664		0.662		0.648		0.645	
F stat	24.420		230.290		22.660		216.890	
Prob	0.000		0.000		0.000		0.000	
Hausman Test			0.910				0.960	
Breusch and Pagan test (p-value)			0.000				0.000	
Wooldridge test (p-value)			0.833				0.691	

Notes: The dependent variable is Tobin's Q. The estimation methods used are fixed effects (FEM) and random effects (REM). *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively. Source: Calculations by the author based on the dataset and using Stata software.

Table 7. Impact of bank efficiency on shareholder value using the difference GMM method

	Model 3		Model 4	
	Coef.	P-value	Coef.	P-value
CRSTE	0.052*	0.098		
VRSTE			0.146**	0.013
ROE	0.331***	0.000	0.242***	0.000
CRER	0.420	0.470	-0.409	0.369
MAKR	-13.530**	0.019	-8.831	0.174
LIQR	-0.058**	0.025	-0.071**	0.012
SIZE	0.014*	0.053	0.026***	0.001
GDP	-0.578***	0.000	-0.587***	0.000
INF	-0.428***	0.000	-0.422***	0.000
CREPRI	0.102***	0.000	0.107***	0.000
Sample period:	2006 - 2022		2006 – 2022	
Number of banks	23		23	
Observations:	120		120	
AB test AR(1) p-value	0.045		0.040	
AB test AR(2) p-value	0.778		0.666	
Hansen test (2nd step; p-value)	0.312		0.253	

Notes: The dependent variable is Tobin's Q. The estimation method used is the two-step difference GMM. *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively. Source: Calculations by the author based on the dataset and using Stata software.

The results in models 3 and 4 in Table 7 show that bank characteristics impact shareholder value differently. The regression coefficient for ROE is positive and statistically significant in all models, indicating that a higher return on equity reflects better performance and positively affects shareholder value. This result aligns with our expectations and is consistent with some previous studies (Pennacchi & Santos, 2021; Widjaja & Ariefianto, 2022). The regression coefficient for CRER is not statistically significant in any of the models, indicating no evidence that credit risk affects shareholder value in the context of Vietnamese commercial banks. This finding is similar to previous studies (Fu et al., 2014; Widjaja & Ariefianto, 2022). The regression coefficient for

MAKR is negative and statistically significant in model 3 and insignificant in model 4, indicating that market risk from investing in financial assets causes substantial losses to shareholder value. This result is consistent with Fiordelisi and Molyneux (2010). The regression coefficient for LIQR is negative and statistically significant in all models in Table 7. This supports the view of Hoang et al. (2020) that increasing the loan-to-deposit ratio can lead to higher bank risk and lower shareholder value. The regression coefficient for SIZE is positive and statistically significant, indicating that in the case of Vietnam, larger banks can better leverage economies of scale, achieving more benefits in terms of profits and risks, thus increasing shareholder value. These results are similar to those of previous studies (Fiordelisi & Molyneux, 2010; Fu et al., 2014).

The estimation results in Table 7 also show that macroeconomic factors have distinct impacts on shareholder value. Specifically, the regression coefficient for GDP is negative and statistically significant in all models in Table 7, indicating that high economic growth rates tend to negatively affect bank shareholder value. This finding is consistent with our expectations and with the results of some previous studies (Fiordelisi & Molyneux, 2010; Hoang et al., 2020). The regression coefficient for INF is negative and statistically significant in all models in Table 7. In other words, inflation represents economic challenges and negatively impacts shareholder value. This finding is consistent with some previous studies (Dietrich & Wanzenried, 2014; Saif-Alyousfi, 2020). Finally, the regression coefficient for CREPRI is positive and statistically significant in all models in Table 7. This result contrasts with our expectation that credit to the private sector negatively impacts shareholder value. Instead, credit to the private sector has increased shareholder value, consistent with Naceur and Omran (2011). This can be explained by the fact that increased credit to the private sector may allow banks to expand their reach and attract more customers, thereby creating more benefits and increasing shareholder value.

Robustness Checks

To test the robustness and reliability of the impact of bank efficiency on shareholder value, we use the market-to-book ratio (MB) as an alternative dependent variable for Tobin's Q to represent shareholder value, like the approach of Fu et al. (2014). The regression results of the impact of bank efficiency on shareholder value using the market-to-book ratio (MB) are presented in Table 8. The results in Table 8 are almost entirely consistent with those in Table 7. Thus, the findings on the positive impact of bank efficiency on shareholder value are robust and reliable.

Table 8. Impact of bank efficiency on shareholder value using the market-to-book ratio (MB) as the dependent variable, estimated using the difference GMM method

	Model 5		Model 6	
	Coef.	P -value	Coef.	P -value
CRSTE	0.418**	0.048		
VRSTE			1.658***	0.000
ROE	4.341***	0.000	3.193***	0.000
CRER	6.598	0.498	-1.576	0.879
MAKR	-287.704***	0.000	-227.202***	0.000
LIQR	-0.147	0.315	-0.395*	0.055
SIZE	0.089*	0.098	0.240***	0.003
GDP	-8.118***	0.000	-7.353***	0.000
INF	-4.088***	0.000	-3.605***	0.000
CREPRI	1.028***	0.000	1.089***	0.000
Sample period:	2006 - 2022		2006 - 2022	
Number of banks	23		23	
Observations:	120		120	
AB test AR(1) p value	0.016		0.009	
AB test AR(2) p value	0.160		0.352	
Hansen test (2nd step; p-value)	0.381		0.239	

Notes: The dependent variable is the market-to-book ratio (MB). The estimation method used is the two-step difference GMM. *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively. Source: Calculations by the author based on the dataset and using Stata software.

Conclusion

This study evaluates the impact of bank efficiency on shareholder value in the context of Vietnamese commercial banks. The sample includes 23 banks, with data collected from 2006 to 2022. Technical efficiency was measured using the DEA input cost minimization method, with three input factors: total assets, deposits, and personnel expenses, and three output factors: total loans, income, and profit before tax. We use panel data estimation techniques, including the fixed effects model (FEM), random effects model (REM), and two-step difference generalized method of moments (GMM) to regress the research models. Our results indicate that bank efficiency positively impacts shareholder value.

Furthermore, bank characteristics have distinct impacts on shareholder value; for instance, return on equity and bank size positively affect shareholder value, while market risk and liquidity risk negatively impact shareholder value, and credit risk shows no evidence of impact on shareholder value. Similarly, macroeconomic factors have different impacts on shareholder value, with GDP growth rate and inflation rate negatively affecting shareholder value, while credit to the private sector positively impacts shareholder value. Based on the findings, we recommend that Vietnamese bank managers focus on improving the technical efficiency of their banks. An effective operational policy, minimizing costs, and maximizing the utilization of resources to increase output products and services, will create more value for bank shareholders.

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