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Bank management in a changing world: An empirical examination from an emerging economy

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Abstract

This research examines bank management in a changing world based on an emerging economy. The COVID-19 pandemic has significantly impacted global economies, highlighting the need for effective monitoring of inputs and costs in the banking sector, crucial for economic stability. In Vietnam, the government has prioritized oversight and implemented strategic policies to restructure the banking system, addressing issues like nonperforming loans and the inefficiency of bank management. This study employed Data Envelopment Analysis (DEA) to assess the technical efficiency of 29 Vietnamese banks in 2023 and, more importantly, focused on the input-saving solution for bank management. We found that the average efficiency score of the banks was moderate at 73.24%, with CTG emerging as the best state-owned commercial bank and SHB being considered the top joint-stock commercial bank. Importantly, the study suggested big cuts in inputs, like letting go of 97,625 employees (30.6% of original value) and closing 2,233 branches (24.1%). This could save 48 trillion Vietnamese Dong (VND) in operating costs. Input savings are crucial for improving banking efficiency in the post-pandemic landscape in Vietnam and for other emerging economies.

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1. Introduction

The recent COVID-19 pandemic has thoroughly changed the world (Szczygielski, Charteris, Bwanya, & Brzeszczyński, 2022; WHO, 2023; World Bank, 2021). One important task for all countries and economic sectors is to monitor the inputs and relevant costs, as sales dropped significantly due to the disruptions of the pandemic (Dang, Nguyen, & Carletto, 2023; Hu, Lang, Corbet, & Wang, 2024; Wu, Liu, Guo, Li, & Deng, 2021). In the banking sector, which is the backbone of an economy (Ho, Nguyen, Ngo, & Le, 2021; Ngo & Tripe, 2017) improving the efficiency of banking management, particularly in terms of bank cost, is becoming more important (Le, Ho, Ngo, Nguyen, & Tran, 2022; Nguyen, Le, & Ngo, 2023). There is a vast literature on bank efficiency even before the COVID-19 pandemic (Berger & Humphrey, 1997; Daraio, Kerstens, Nepomuceno, & Sickles, 2020; Fethi & Pasiouras, 2010; Siddiqi, 2006). The number of studies on the resilient and stability of this sector has also been increasing recently (Kryzanowski, Liu, & Zhang, 2023; Takahashi & Vasconcelos, 2024; Yuen, Ngo, Le, & Ho, 2022). Notably, bank cost management was not focused on the literature, with very limited

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studies on cost efficiency (Antunes, Hadi-Vencheh, Jamshidi, Tan, & Wanke, 2024; Fukuyama, Matousek, & Tzeremes, 2020; Ngo & Tripe, 2016; Nguyen & Pham, 2020) but not on how banks should manage their inputs and the associated costs.

For emerging economies such as Vietnam, the banking system plays a vital role in transferring funds from savers to borrowers; the latter will then invest them to create productions and services for the economy (IFC, 2018; Mishkin, 2021; Rose & Hudgins, 2009). Consequently, the performance of the banking sector will influence the other sectors in the economy, and thus, monitoring the banking sector is an important target for the Vietnamese government (FitchRatings, 2022; SBV, 2021). Since 2010s, several strategic policies and regulations, such as the plan to restructure the whole sector (Ngo, 2014; Vietnamese Government, 2012; Vo & Nguyen, 2018) the establishment of the Vietnam Asset Management Corporation, and the efforts to improve the situation of nonperforming loans (Boubaker, Ngo, Samitas, & Tripe, 2024; Le, Šević, Tzeremes, & Ngo, 2022; Nguyen, Tripe, & Ngo, 2018) have been implemented to improve the performance of the Vietnamese banking sector. Although many studies have examined the efficiency and performance of the Vietnamese banking sector (Boubaker et al., 2024; Le, Ngo, Nguyen, & Do, 2024; Martens & Bui, 2024) none has empirically deepened the role of bank management in terms of inputs and cost minimization. This study adds to the body of research on banking efficiency by answering two research questions: (RQ1) how to make banks more efficient by cutting back on things like staff and branches; and (RQ2) how much cost (or efficiency) it can reduce (or improve).

Using the most recent data of 2023 for 29 commercial banks in Vietnam, we empirically found that their technical efficiency of input minimization was moderate at 0.7324, ranging from the lowest of 0.4471 to the highest of 1. More importantly, only five banks were considered fully efficient, with two being state-owned commercial banks (SOCBs) and another three being joint-stock commercial banks (JSCBs). For the inefficient banks, we proposed that they can simultaneously reduce their inputs to improve their efficiency. Lessening inputs, also known as cost-saving measures, was responsible for about 30.6% of all staff, 24.1% of all bank branches, and 21.8% of all operating costs in the banking sector. Such empirical findings are important for the relevant bank managers and policymakers in their decisions not only in Vietnam but also in other emerging economies.

The remainder of the paper is organized as follows. Section 2 provides a brief review of the relevant literature on bank efficiency, with a focus on the Vietnamese banking sector. Section 3 presents the methodology and data. Section 4 then presents and discusses the empirical results, and Section 5 concludes the paper.

2. Literature Review

Since the literature on bank efficiency is rich (e.g., (Ahmad, Naveed, Ahmad, & Butt, 2020; Bhatia, Basu, Mitra, & Dash, 2018; Fethi & Pasiouras, 2010; Paradi & Zhu, 2013; Zopounidis, Galariotis, Doumpos, Sarri, & Andriosopoulos, 2015)) this section focuses on the recent studies on the efficiency and performance of the global and Vietnamese banking sectors, respectively.

2.1. Bank Efficiency Across the Globe: Recent Studies

Charles, Tsolas, and Gherman (2018) developed a satisfying Data Envelopment Analysis (DEA) model to evaluate the efficiency of 14 banks in Peru using a stochastic simulation approach and incorporating Bayesian analysis for peer data mining. The findings revealed significant variation in efficiency scores across Peruvian banks, suggesting potential improvements should focus on enhancing output and reducing costs, although they could not significantly improve bank rankings. However, no specific information or implication was provided on how much costs could be reduced or how much outputs could be enhanced.

The study of Aissia and Ellouz (2021) in contrast, employed the stochastic frontier approach (SFA) to measure the efficiency of 94 Tunisian bank branches from 2007 to 2019. The study sourced data from the banks' activity reports across all 24 Tunisian governorates, revealing that the branches generally exhibit similar efficiency levels. However, branches located in the Northeast governorates achieved the highest efficiency scores, indicating that regional location significantly impacts bank efficiency. Accordingly, locational characteristics such as competitive pressures, transaction costs, and market development are important factors of bank efficiency. Aissia and Ellouz (2021) did not provide any suggestions for improvement, such as reducing inputs or saving costs.

Le, Ho, Nguyen, and Ngo (2021) also used DEA to estimate banking efficiency and employed the Generalized Method of Moments (GMM) for Structural Equation Modeling (SEM) analysis, incorporating the Newey-West method to address heteroskedasticity and autocorrelation. Researchers looked at data from 80 countries between 2013 and 2017 and found that there is a two-way link between fintech credit and bank efficiency. This means that fintech credit tends to grow in banking systems that aren't very efficient, but it also has the potential to make banks more efficient overall. The research consequently suggested that authorities should promote the development of fintech credit globally, as it not only serves as a wake-up call for banks with relatively low-efficiency scores but also facilitates financial inclusion for underserved populations and acts as a substitute for traditional bank lending, particularly for high-risk loans. Although not addressed in Le et al. (2021) it is also noted that fintech comes with a high cost; therefore, balancing costs and benefits should be effectively managed.

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Lee, Li, Yu, and Zhao (2021) followed a metafrontier SFA approach, utilizing the cost function to analyze the impact of fintech on bank efficiency in China (2003 to 2017). It indicated that fintech innovations significantly enhance banks' cost and technological capabilities, with SOCBs exhibiting the lowest cost efficiency. The research highlighted that while innovation is important to enhance banking technology and thus, efficiency, different types of fintech influence banking efficiency in diverse ways. Therefore, it is crucial for Chinese banks to closely monitor the costs associated with fintech investments to ensure they yield maximum benefits. However, this study faces the same problem as Le et al. (2021) in not providing specific solutions and recommendations on the fintech's cost management in the banks.

Gržeta, Žiković, and Tomas Žiković (2023) utilized DEA and dynamic panel data analysis to assess the efficiency and profitability of 433 European commercial banks from 2006 to 2015, focusing on the impacts of the Basel II and III regulations. The study reported that larger banks adapt more effectively to regulatory changes than smaller banks, therefore indicating the need for tailored regulations that consider bank size. Recommendations include size-specific policies to preserve competition in the banking sector, easier borrowing access for small banks during difficult times, and a focus on niche markets for their survival.

2.2. Efficiency and Performance of the Vietnamese Banking Sector

Le (2016) utilized DEA to evaluate the efficiency of Vietnamese commercial banks from 2007 to 2011. The study also employed three-stage least squares (3SLS) for a simultaneous equations model and discusses alternative techniques like bootstrap DEA and SFA. The study's finding revealed that Vietnamese banks function at comparatively low efficiency levels, with a correlation between higher efficiency and reduced risk and increased capital. Additionally, more diversified banks tend to take on greater risks, while improved efficiency often precedes increased bank risk. The study also pointed out important implications for bank supervision and capital requirements, showing how important cost and risk monitoring is in figuring out how efficient a bank is, but it didn't give and specific advise.

Vo and Nguyen (2018) followed a three-step DEA-SFA approach to evaluate the efficiency of 26 Vietnamese banks from 1999 to 2015, focusing on the impact of restructuring policies. The authors revealed that these policies were not effective in improving the efficiency and performance of the Vietnamese banking sector, whereas privatization, mergers, and acquisitions (M&As) showed limited benefits. Instead, transition costs cause efficiency to decline during restructuring, and government intervention leads to increased inefficiency, especially among SOCBs. The study, therefore, recommended that reducing government intervention, fostering competition, and improving cost management are important to enhance bank efficiency. Since it did not analyze the specific costs involved (e.g., staff and facilities), however, the recommendations are directive rather than solutions themselves.

Le et al. (2022) evaluated the efficiency of 26 Vietnamese banks (2008 to 2016), highlighting a decline in efficiency during financial liberalization and sectoral restructure, with non-performing loans (NPLs) significantly affecting bank performance. Notably, medium-sized banks demonstrate greater efficiency compared to large and small banks, and ownership plays a critical role in bank efficiency. The research found that small NPL values can positively impact efficiency, while the restructuring program did not yield the expected improvements. The findings also suggested that bank scale expansion strategies should prioritize enhanced management and governance to foster better efficiency outcomes. Accordingly, cost management should be closely monitored alongside bank expansion.

In their study, Nguyen, Nguyen, Le, and To (2023) first utilized the Principal Component Analysis (PCA) to create a bank stability index and then employed a hierarchical regression method to assess the impact of independent variables in the index. The research examined the effects of bank competition on stability in Vietnam, finding that higher competition is associated with increased bank stability, while shadow banking (i.e., informal lending activities) moderates this relationship by posing additional risks. Factors such as bank size and equity contribute positively to stability, underscoring the importance of bank restructuring and cost management in terms of bank size and network.

Boubaker et al. (2024) employed DEA and Shannon entropy to develop a Composite Performance Index (CPI) for assessing the stability of 45 Vietnamese banks from 2002 to 2020, utilizing CAMELS ratios. It identified varying periods in the development of the Vietnamese banking sector, revealing that the JSCBs are generally more stable than the SOCBs. The findings also highlighted the importance of management quality and risk management in maintaining bank stability, and the CPI can also assist in future analyses of bankruptcy or survival risks.

2.3. Summary

- Most studies in the bank efficiency literature utilized DEA (e.g., (Daraio et al., 2020; Emrouznejad & Yang, 2018; Ho et al., 2021)).
- Managerial and policy implications do not specifically and empirically address the two research questions, RQ1 and RQ2, regarding the inputs reduction and cost savings for the examined banks.
- Given the post-COVID-19 situation, a study on RQ1 and RQ2, as in this study, is thus necessary.

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3. Method and Materials

3.1. Method: Data Envelopment Analysis

As summarized in Section 2.3, DEA is a popular method in the banking efficiency literature. The main reason is because of the nonparametric characteristics of DEA, which allow it to apply to the service sectors, including banks and financial institutions, where the production function is not clear (Le, 2021; Li, Feng, & Tang, 2022; Nguyen, Tran, & Simioni, 2021). Other advantages of DEA include the ability to deal with small samples, the mixture of quantity and quality inputs and outputs, and so on (Panwar, Olfati, Pant, & Snasel, 2022; Sinuany-Stern, 2023; Yu & He, 2020). Since DEA can estimate the optimal efficiency scores and the corresponding values for inputs and outputs of the banks involved, this study utilizes such information to answer the two research questions, RQ1 and RQ2.

Consider a set of N banks being examined, each bank used s inputs x_i $(i = 1,2,..,s)$ to generate m outputs y_r $(r = 1,2,..,m)$ using the same or similar (banking) technology. Following the 'black box' DEA approach (Boubaker & Ngo, 2024; Zhu, 2015) one can estimate the technical efficiency (TE) of the j_0 bank as.

$$TE_{j_0} = \frac{\sum_r^m u_{rj_0} y_{rj_0}}{\sum_i^s v_{ij_0} x_{ij_0}} \qquad (1)$$

Subject to

$$TE_j = \frac{\sum_r^m u_{rj} y_{rj}}{\sum_i^s v_{ij} x_{ij}} \leq 1, j = 1,2,..,N$$
$$u_r, v_i \geq \varepsilon, \forall i, r$$

Where the first constraint guarantees that the TE of any bank cannot exceed unity while the second one imposes the non-negativity condition on the optimal weights u_r and v_i (ε is a very small number, normally 0.000001).

It is noted that DEA measures the relative efficiency of the banks (Antunes et al., 2024) so that each inefficient bank can find one or several efficient ones close to it as the 'peers.' The dual model of Equation 1 is presented in Equation 2, whereas linear programing can be used to estimate the optimal vector of lambdas (λ_j), which represent the multipliers that the j_0 bank takes in accordance with other banks as its peers:

$$TE_{j_0} = \min_{\theta,\lambda} \theta \qquad (2)$$

Subject to

$$\theta x_{ij_0} - \sum_{j=1}^{N} \lambda_j x_{ij} \geq 0$$
$$\sum_{j=1}^{N} \lambda_j y_{rj} \geq y_{rj_0}$$
$$\lambda_j \geq 0, \forall j$$

This study utilizes the information from the optimal vector of lambdas (λ_j) derived from Equation 2 for bank (cost/input) management in the Vietnamese banking sector. Accordingly, the optimal inputs of an inefficient bank j_0 ($TE_{j_0} < 1$) could be calculated as

$$x_{ij_0}^* = \sum_{j=1}^{N} \lambda_j x_{ij_0} \qquad (3)$$

3.2. Data and Variables

Data were extracted from the Vietnamese Banking Database (Le et al., 2022). While the July 2024 update of the original database covers more than 700 bank-year observations (2002-2023) collected from audited annual and financial reports of 45 individual banks in the system, which accounts for more than 90 percent of the Vietnamese banking sector (Le et al., 2024) we only focused on the 2023 data to examine how bank management can help reduce the input cost for the examined banks given the post-COVID-19 situation. It also makes this paper the most updated study on Vietnamese banks using 2023 data.

In particular, we follow a 'hybrid' intermediation approach to argue that banks are intermediaries that use three inputs of Number of employees (NE), Number of branches (NB), and Total operating expenses (TOE) to provide three outputs of Total deposits (TD), Total loans (TL), and Total operating incomes (TOI) – the first two outputs are for the customers and the last one is for the banks themselves. A vast literature (Avkiran, 2009, 2011; Zhou et al., 2019) has used this definition, sometimes referred to as the profit approach. After checking for missing data, we ended up with information from 29 banks, including four SOCBs and 25 JSCBs. The list of the banks is reported in Table 1, while Table 2 presents some descriptive statistics of the variables; the latter is showing that the SOCBs have been dominating the Vietnamese banking sector (SBV, 2022, 2023).

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Table 1. List of banks.

Name	Code	Type
An Binh commercial joint stock bank	ABB	JSCB
Asia commercial joint stock bank	ACB	JSCB
Vietnam bank for agriculture and rural development	AGB	SOCB
Joint stock commercial bank for investment & development of Vietnam	BIDV	SOCB
Bac A joint stock commercial bank	BAB	JSCB
Bao Viet joint stock commercial bank	BVB	JSCB
Vietnam joint stock commercial bank of industry and trade	CTG	SOCB
Vietnam export import commercial joint stock bank	EIB	JSCB
Ho Chi Minh city development joint stock commercial bank	HDB	JSCB
Kien Long commercial joint stock bank	KLB	JSCB
Lien Viet post joint stock commercial bank	LVB	JSCB
Military commercial joint stock bank	MB	JSCB
Vietnam maritime commercial joint stock bank	MSB	JSCB
Nam A commercial joint stock bank	NAB	JSCB
National citizen bank	NCB	JSCB
Orient commercial joint stock bank	OCB	JSCB
Petrolimex group commercial joint stock bank	PGB	JSCB
Vietnam public joint stock commercial bank	PVB	JSCB
South East Asia joint stock commercial bank	SEAB	JSCB
Saigon bank for industry & trade	SGB	JSCB
Saigon – Hanoi commercial joint stock bank	SHB	JSCB
Saigon Thuong Tin commercial joint stock bank	STB	JSCB
Vietnam technological and commercial joint stock bank	TCB	JSCB
Tien Phong commercial joint stock bank	TPB	JSCB
Viet A Joint Stock Commercial Bank	VAB	JSCB
Joint stock commercial bank for foreign trade of Vietnam	VCB	SOCB
Viet capital commercial joint stock Bank	VCPB	JSCB
Vietnam international commercial joint stock bank	VIB	JSCB
Vietnam commercial joint stock bank for private enterprise	VPB	JSCB

Table 2. Descriptive statistics of variables.

Variable	NE	NB	TOE	TD	TL	TOI
All banks						
Minimum	1491.00	18.00	0.57	23.56	19.97	2.58
Average	10986.55	319.86	7.61	406.15	399.90	45.53
Maximum	42083.00	2300.00	30.93	1817.27	1737.20	160.17
04 SOCBs						
Minimum	23493.00	122.00	17.30	1395.70	1270.36	126.29
Average	30042.00	921.75	23.81	1582.14	1508.26	144.31
Maximum	42083.00	2300.00	30.93	1817.27	1737.20	160.17
25 JSCBs						
Minimum	1491.00	18.00	0.57	23.56	19.97	2.58
Average	7937.68	223.56	5.02	217.99	222.56	29.72
Maximum	27042.00	571.00	13.94	567.53	599.58	81.76

Note: NE, number of employees (Persons); NB, number of branches (Unit); TOE, total operating expenses (Trillion VND); TD, total deposits (Trillion VND); TL, total loans (Trillion VND); TOI, total operating incomes (Trillion VND). 1 USD ≈ 24,268.60 VND as of 31/12/2023.

4. Results and Discussions

To examine the efficiency of Vietnamese banks in input/cost management, we follow Charles et al. (2018) to use an input-oriented constant returns to scale DEA model in our empirical analysis. The results reported in Table 3 show that while the averaged banks performed moderately well in 2023 under an efficiency score of 0.7324, or 73.24% efficient, there were variations among the 29 banks being examined, whereas the worst performer only achieved 44.71% efficiency and the best performer reached 100%. In line with previous studies on the Vietnamese banking sector (Martens & Bui, 2024; Nguyen et al., 2023) we also found that the SOCBs, except for AGB as a rural- and agricultural-oriented policy bank (Le et al., 2024) were highly efficient.

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Table 3. Efficiency scores.

JSCBs	TE	JSCBs	TE	SOCBs	TE
ABB	0.541	PGB	0.530	AGB	0.677
ACB	0.723	PVB	0.763	BIDV	0.910
BAB	0.759	SEAB	0.671	CTG	1.000
BVB	0.858	SGB	0.447	VCB	1.000
EIB	0.585	SHB	1.000		
HDB	0.695	STB	0.544		
KLB	0.514	TCB	1.000		
LVB	0.938	TPB	0.637		
MB	0.950	VAB	1.000		
MSB	0.532	VCPB	0.527		
NAB	0.683	VIB	0.687		
NCB	0.697	VPB	0.650		
OCB	0.722				
Number of banks	25			04	
Average	0.706			0.897	
SD	0.168			0.153	
Minimum	0.447			0.677	
Maximum	1.000			1.000	

Note: TE, technical efficiency; SD, standard deviation.

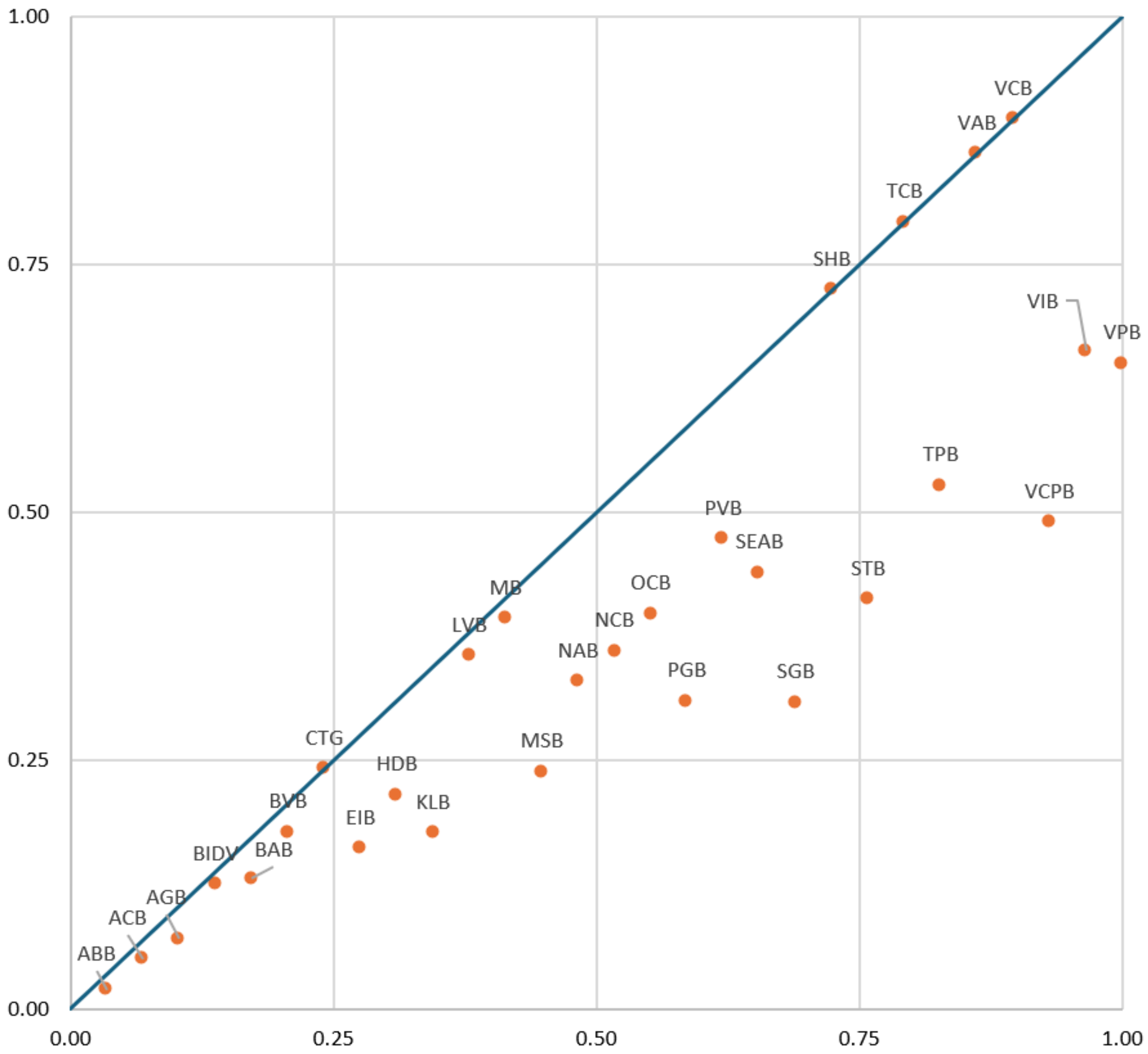

Figure 1. Virtual positions of Vietnamese banks.

Note: The 45-degree blue line represents the efficient frontier. Positions for the banks are calculated from the optimal weights (Derived from Equation 1) to a single virtual input X (The horizontal axis) and a single virtual output Y (The vertical axis).

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More specifically, we are more interested in how peers (i.e., efficient banks on the frontier) improve inefficient banks. Figure 1 illustrates how close the inefficient banks are to the frontier in which the banks farther from the frontier are the least efficient and thus need more attention.

The aim of bank management is to improve the efficiency of banks under the frontier. From an input-orientation DEA viewpoint, it is equivalent to minimize the inputs used but still keep the same levels of outputs. If banks can manage such inputs reduction, they can bring their position to the frontier. They can achieve this by adopting the input management strategies of their peers, as outlined in Table 4. Note that the frequency of being a peer in Table 4 suggests that CTG is the best SOCB while SHB is the best JSCB in the system.

Table 4. Inefficient banks and their peers.

Bank	PEER 1	PEER 2	PEER 3	PEER 4	PEER 5	PEER 6
ABB	CTG (0.027)	SHB (0.15)				
ACB	CTG (0.185)	SHB (0.395)	VCB (0.122)			
AGB	CTG (0.441)	SHB (2.135)	VAB (2.77)			
BIDV	CTG (0.71)	SHB (1.577)				
BAB	CTG (0.014)	SHB (0.229)				
BVB	CTG (0.032)	SHB (0.027)				
EIB	CTG (0.047)	SHB (0.202)				
HDB	CTG (0.263)	SHB (0.357)				
KLB	CTG (0.015)	SHB (0.118)				
LVB	SHB (0.649)					
MB	CTG (0.457)	SHB (0.407)				
MSB	CTG (0.043)	SHB (0.227)	VCB (0.031)			
NAB	CTG (0.097)	SHB (0.141)				
NCB	CTG (0.063)	SHB (0.225)				
OCB	CTG (0.08)	SHB (0.179)				
PGB	CTG (0.021)	VAB (0.064)				
PVB	CTG (0.113)	SHB (0.115)				
SEAB	CTG (0.084)	SHB (0.192)				
SGB	SHB (0.022)	VAB (0.157)				
STB	CTG (0.273)	SHB (0.453)				
TCB	CTG (0.106)	MB (0.222)	PVB (0.11)	SHB (0.208)	TCB (0.218)	TPB (0.069)
TPB	CTG (0.102)	SHB (0.102)	VCB (0.091)			
VCPB	CTG (0.013)	SHB (0.104)				
VIB	CTG (0.213)	SHB (0.17)				
VPB	CTG (0.473)	SHB (0.172)				

Note: The multipliers (λ) are presented inside the brackets.

Utilizing the multipliers λ suggested by DEA (as in Table 4), inefficient banks can estimate how much input they should have, given their peers, and accordingly, how much input they could save. For instance, let us take a look at SGB, which is the least efficient bank in the system with TE=0.4471. Table 4 suggests that SGB should follow both SHB (λ=0.022) and VAB (λ=0.157). Using Equation 3, the inputs of SGB would be:

$$NE_{SGB}^{*} = 0.022NE_{SHB} + 0.157NE_{VAB}$$

$$NB_{SGB}^{*} = 0.022NB_{SHB} + 0.157NB_{VAB}$$

$$TOE_{SGB}^{*} = 0.022TOE_{SHB} + 0.157TOE_{VAB}$$

Table 5 reports the optimal values for the inputs of all examined banks – five efficient banks (i.e., CTG, SHB, TCB, VAB, and VCB) have the original inputs as optimal and thus need no input saving. In summary, the examined banks can reduce their staff by 97,625 persons (accounted for 30.6% of the original number of total employees), shrink their network by 2,233 branches (24.1%), and save about 48 trillion VND in operating expenses (more than a fifth of the original expenses). Particularly, PGB was the bank with the highest level of input saving in terms of NE, while SGB saved the most in both NB and TOE. Given the difficulties in operation and competition of the banking sector, especially in a post-COVID-19 era, such input savings are crucial for Vietnamese banks. After the adjustments, the banks can improve their efficiency and reach the frontier, as in Figure 2.

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Table 5. Optimal inputs and input savings.

Bank	NE	NB	TOE	NE*	NB*	TOE*	ΔNE	ΔNB	ΔTOE
ABB	3760	166	2.25	1592	90	1.22	2168	76	1.03
ACB	13655	372	10.87	9879	270	7.87	3776	102	3.01
AGB	42083	2300	30.93	28471	1557	20.93	13612	743	10.01
BIDV	29997	1110	25.08	27307	1011	20.25	2690	99	4.83
BAB	3680	175	1.83	1765	133	1.39	1915	42	0.44
BVB	1570	24	0.81	959	21	0.69	611	3	0.11
CTG	24595	155	17.30	24595	155	17.30	0	0	0.00
EIB	6005	210	3.14	2423	123	1.84	3582	87	1.30
HDB	16643	352	9.13	8689	245	6.35	7954	107	2.78
KLB	3767	135	1.65	1094	70	0.85	2673	65	0.80
LVB	10627	570	3.50	4056	570	3.50	6571	0	0.00
MB	16324	319	10.49	13782	303	9.96	2542	16	0.53
MSB	6000	263	4.81	3190	140	2.56	2810	123	2.25
NAB	5357	140	3.49	3258	96	2.38	2099	44	1.11
NCB	1954	77	1.24	1361	54	0.86	593	23	0.38
OCB	6816	159	3.17	3086	115	2.29	3730	44	0.88
PGB	1909	18	0.81	626	10	0.43	1283	8	0.38
PVB	5300	109	3.32	3500	84	2.54	1800	25	0.79
SEAB	5508	183	3.61	3263	123	2.42	2245	60	1.19
SGB	1491	89	0.57	383	28	0.26	1108	61	0.32
SHB	6246	571	5.05	6246	571	5.05	0	0	0.00
STB	18514	553	12.89	9545	301	7.01	8969	252	5.88
TCB	11614	304	13.25	11614	304	13.25	0	0	0.00
TPB	8287	134	6.70	5277	86	4.27	3010	48	2.43
VAB	1552	97	0.91	1552	97	0.91	0	0	0.00
VCB	23493	122	21.91	23493	122	21.91	0	0	0.00
VCPB	2568	116	1.41	957	62	0.74	1611	54	0.67
VIB	12253	189	6.61	6301	130	4.54	5952	59	2.07
VPB	27042	264	13.94	12721	172	9.06	14321	92	4.88
SUM	318610	9276	220.69	220985	7043	172.63	97625	2233	48.06
Input saving (%)							30.6%	24.1%	21.8%

Note: NE, number of employees (Persons); NB, number of branches (Unit); TOE, total operating expenses (Trillion VND); * denotes the optimal values and Δ denotes the input saving.

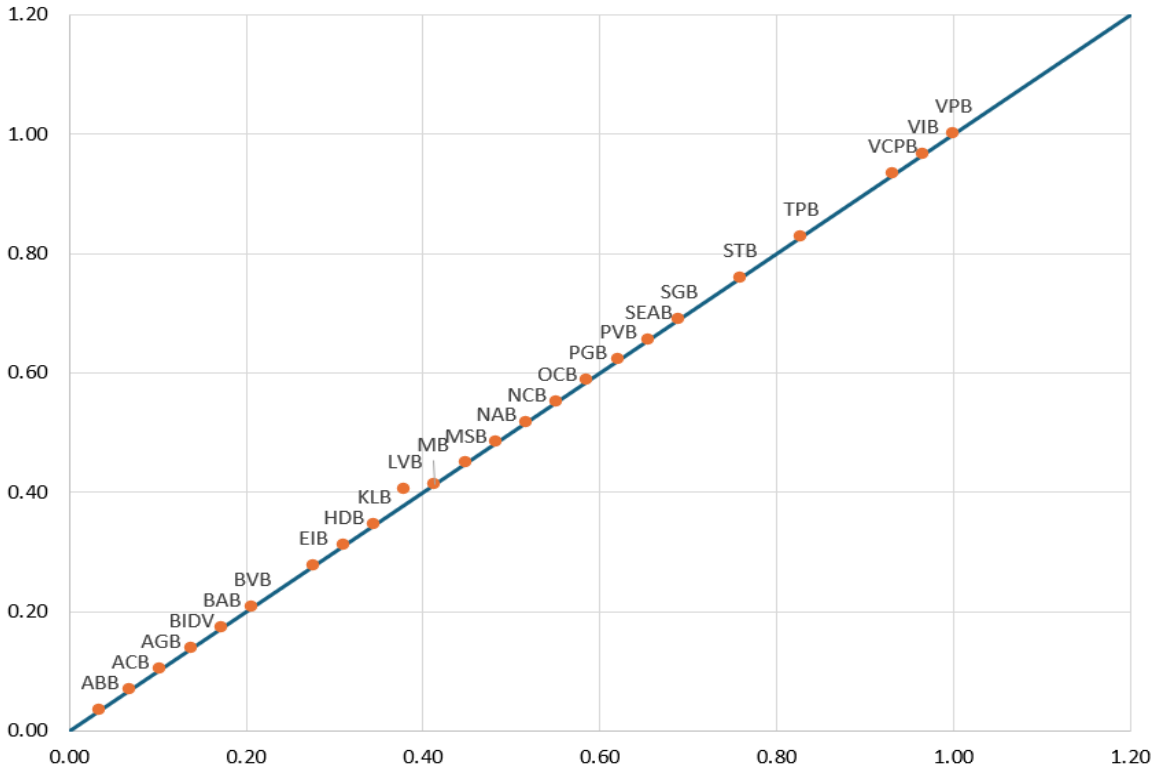

Figure 2. Efficiency improvement for Vietnamese banks after input adjustments.

Note: The 45-degree blue line represents the efficient frontier. Positions for the banks are calculated after input adjustments indicated in Table 5.

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5. Conclusions

The COVID-19 pandemic has profoundly affected global economies, underscoring the importance of monitoring inputs and costs, especially in the banking sector, which is vital for economic stability. Enhancing management efficiency and cost-effectiveness in banks has become crucial, particularly in transitional economies like Vietnam, where the banking system facilitates fund allocation from savers to borrowers. In response, the Vietnamese government prioritizes oversight of this sector and has implemented strategic policies to restructure and stabilize the banking system, including measures to tackle nonperforming loans and ensure resilience and stability in the face of ongoing challenges.

This study used Data Envelopment Analysis (DEA) to evaluate the technical efficiency of 29 Vietnamese banks in 2023. More importantly, it utilized the information from the optimal vector of multipliers (or lambdas) derived from DEA to estimate the optimal inputs and, accordingly, input savings for the inefficient banks so that they can reach the efficient frontier after input adjustments. We found that the averaged efficiency score of the Vietnamese banks was moderate at 73.24%, with the least efficient bank at 44.71% and the most efficient at 100%. In terms of peer status, CTG was identified as the best state-owned commercial bank (SOCB), while SHB was noted as the best joint-stock commercial bank (JSCB). The analysis also suggested that Vietnamese banks could reduce their workforce by 97,625 employees (30.6%) and close 2,233 branches (24.1%), saving approximately 48 trillion VND in operating expenses. PGB was noted for the highest input savings in number of employees, while SGB could save the highest in both bank branches and total operating expenses. These input reductions are vital for enhancing efficiency in the post-COVID-19 banking sector in Vietnam and other emerging economies.

In terms of research contributions and implications, our study reinforces that DEA is a valuable tool for assessing the performance of banking and financial institutions. It also shows that information from peers and optimal input multipliers, which haven't been studied as much in the past, can add to theories about how banks allocate their resources and how they can improve their performance by making small changes to their operational inputs. In terms of practical implications, the specific recommendation to reduce staffing and close bank branches offers practical guidance for Vietnamese banks seeking to optimize their operations. This can lead to immediate cost savings and improved financial health in the Vietnamese banking sector, especially amid the impacts of the recent pandemic.

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