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Measuring the Operational Efficiency of State-Owned Commercial Banks in Vietnam: An Input-Oriented DEA Approach

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Abstract: *This paper evaluates the operational efficiency of state-owned commercial banks in Vietnam during the period 2020–2023 using the input-oriented Data Envelopment Analysis (DEA) method. The study focuses on three major banks – Vietcombank, Vietinbank, and BIDV – by analyzing their labor, fixed assets, and customer deposits as input variables, and net interest income as the output. The findings show that while Vietcombank consistently operates at optimal efficiency, the other two banks demonstrate significant potential for improving input utilization. Overall efficiency scores remain above 0.80, indicating relatively sound performance, yet the results suggest that cost savings of up to 20% could be achieved without reducing output. The study highlights that pure technical efficiency contributes more to overall efficiency than scale efficiency, indicating the need for improved resource management rather than merely expanding size. This research offers valuable insights for bank managers and policymakers in enhancing strategic decisions, especially in the post-pandemic recovery context. It also demonstrates the usefulness of DEA in assessing banking performance and identifying areas for operational improvement.*

Keywords: Bank efficiency, DEA model, Operational performance, State-owned commercial banks

I. INTRODUCTION

Measuring the performance of commercial banks is a process of assessing their ability to provide financial services and manage risks effectively, as well as evaluating their profitability and capacity for sustainable growth. Banks play a crucial role in supporting individuals and businesses, while also contributing positively to the overall economy. In an increasingly competitive environment, operational efficiency has become a key determinant for banks to ensure their survival and long-term development. Performance evaluation is not only essential for bank managers but also serves the interests of various stakeholders. Therefore, research on banking efficiency has emerged as a vital topic in financial and business studies.

In recent years, the Vietnamese banking sector has experienced robust growth and made significant contributions to the national economy. According to the State Securities Commission of Vietnam, several major banks, such as the Joint Stock Commercial Bank for Foreign Trade of Vietnam (Vietcombank), the Vietnam Joint Stock Commercial Bank for Industry and Trade (VietinBank), and the Bank for Investment and Development of Vietnam (BIDV), along with some large private banks, achieved strong profits in 2024. Among them, Vietcombank reported the highest post-tax profit, reaching nearly VND 30 trillion. These state-owned commercial banks play an important role in Vietnam's economy due to their dominant share in the financial system and their critical function in supporting national economic activities.

In addition, the global economy has been facing severe challenges caused by the COVID-19 pandemic, which has raised concerns over production and business disruptions and uneven recovery processes. Several researchers have examined the impact of COVID-19 on the banking sector, providing evidence that the pandemic has significantly affected banking operations and financial performance across the globe (Korzeb & Niedziolka, 2020; Singh & Bodla, 2020). These studies highlight that the outbreak has led to negative consequences in terms of financial stability and performance indicators worldwide. In Vietnam, the emergence of COVID-19 also posed difficulties for policymakers and bank administrators (Minh Sang, 2022). However, the government's adaptive and flexible policies, aimed at effectively controlling the pandemic, created favorable conditions for economic recovery. Consequently, the banking sector maintained its pivotal role in mitigating risks and supporting businesses and citizens through the crisis.

Moreover, Vietnamese banks are facing intense and increasingly fierce competition in the financial market. To survive and achieve sustainable development, banks must operate more efficiently than their competitors. Nhan et al.

(2021) emphasized that efficiency is a significant topic with broad applications across scientific fields, particularly in economics, finance, and accounting. Measuring banking efficiency is thus not only theoretically relevant but also practically meaningful. Research in this area can offer valuable insights that help enhance the banking sector and foster overall economic development.

Over the years, researchers have widely adopted frontier-based approaches to assess bank performance. This modern methodology evaluates a bank's efficiency by comparing its performance with that of peer institutions. Building upon the foundational work of Farrell (1957), Charnes et al. (1978) introduced the Data Envelopment Analysis model under the assumption of constant returns to scale and input minimization (CRSTE). Subsequently, Banker et al. (1987) developed the DEA model further by allowing for variable returns to scale (VRSTE). The difference between CRSTE and VRSTE, if any, reflects scale efficiency (SE).

Nguyen Thu Nga et al. (2017) provided a comprehensive overview of inefficiencies in Vietnamese joint-stock commercial banks using various approaches, including the Cobb-Douglas function, logarithmic functions, the Stochastic Frontier Analysis (SFA), and DEA methods. These studies have made significant contributions to evaluating the performance of Vietnam's banking system. Notably, Nhan et al. (2021) provided a detailed exposition of the DEA methodology and applied it to data from Vietnamese banks during 2014–2017 to explore technical efficiency, resource allocation, and business performance. However, most of these studies are based on outdated datasets (Thanh et al., 2022; Le et al., 2022), which limits their relevance to recent and upcoming market dynamics.

Studying banking performance efficiency helps financial experts and bank managers better understand the key factors influencing efficiency and identify potential strategies for improvement. Such research can inform sound financial decisions and strategic planning, ultimately helping banks achieve sustainable growth and profitability.

The remainder of this paper is structured as follows: The section on "Research Method" presents the data, sample selection, and research methods employed. The "Results and Discussion" section elaborates on the empirical findings on the operational efficiency of state-owned joint-stock commercial banks in Vietnam. Finally, the "Conclusion" section summarizes the key results, outlines the study's limitations, and offers suggestions for future research.

II. RESEARCH METHODOLOGY

2.1. Research Method

This study employs the Data Envelopment Analysis (DEA) method to measure the operational efficiency of state-owned commercial banks in Vietnam. DEA is a modern non-parametric approach that does not require the specification of a functional form to describe the relationship between inputs and outputs in constructing the efficiency frontier. Each unit in the sample, or each bank, is considered a Decision-Making Unit (DMU). The method generates a frontier that envelops the most efficient DMUs, while inefficient ones lie beneath this frontier. Efficiency scores are then computed based on the distance between each DMU and the efficiency frontier. These scores range from 0 to 1, where a score of 1 indicates that the bank lies on the efficiency frontier and is among the most efficient entities in the sample. This allows for the identification of underperforming units and provides insights into potential improvements.

The input-oriented DEA model is applied in three forms: (i) Constant Returns to Scale Technical Efficiency (CRSTE), (ii) Variable Returns to Scale Technical Efficiency (VRSTE), and (iii) Scale Efficiency (SE), which is derived from the difference between CRSTE and VRSTE.

2.2. Research Sample

This study focuses on state-owned joint-stock commercial banks. The analysis is based on secondary data, as follows:

Theoretical foundations are drawn from textbooks, academic monographs, scholarly journals, and previously published studies, all of which provide insights into bank performance.

Quantitative data are collected from the financial statements and annual reports of the selected banks for the period 2020–2023. Although four years is not an extensive time frame, it adequately captures the banks' performance during and after the COVID-19 pandemic, allowing for an assessment of its impact on operational efficiency. The dataset comprises cross-sectional data with 12 observations in total.

Table 1. Summary of Banks in the Research Sample

No	Bank's Name	Code
1	Joint Stock Commercial Bank for Foreign Trade of Vietnam	VCB
2	Vietnam Joint Stock Commercial Bank For Industry And Trade	CTG
3	Joint Stock Commercial Bank for Investment and Development of Vietnam	BID

Source: Compiled by the author

2.3. Variables in the Research Model

According to Tsolas and Charles (2015), the selection of variables in DEA models is highly sensitive; the fewer the variables used, the more reliable the ranking of DMUs based on their efficiency. Following this guidance, the present study limits the number of variables to three inputs and one output for evaluating banking efficiency. The output variable is Net Interest Income. The input variables are Labor, Fixed Assets,and Customer Deposits.These variables are widely recognized in the literature as closely related to a bank's income-generating capacity (Emrouznejad & Amin, 2009; Ngo, 2012; Kao & Liu, 2014; Ullah et al., 2023; Amirteimoori et al., 2024; Yeh, 2025).

Table 2. Variables and Measurement Methods

Variable Type	Name	Definition	Measurement Approach	Unit
Input	Labor	Number of bank employees	Total staff at the end of the fiscal year	Persons
Input	Fixed Assets	Value of fixed assets contributing to operations	Total fixed asset value at year-end	Million VND
Input	Customer Deposits	Total customer deposits	Total deposit value at year-end	Million VND
Output	Net Interest Income	Interest income minus interest expenses	Net interest income is reported at the end of the fiscal year	Million VND

Source: Compiled by the author

The efficiency score ranges from 0 to 1, with values closer to 1 indicating higher operational efficiency. A score of 1 signifies that the bank is operating at optimal efficiency.

2.4. Data Compilation and Processing

After collecting the data, the secondary dataset is compiled into structured tables. Tools such as Excel and Stata 14 are employed to clarify the nature of the data and to operationalize measurement indicators in order to describe the research subjects more effectively.

Efficiency scores for CRSTE, VRSTE, and SE are calculated using the DEAP software version 2.1 developed by Coelli (2005).

III. Results and Discussion

3.1. Descriptive Statistics

Most of the variables included in the DEA model (Table 3) exhibit growth over the years, particularly net interest income. This indicates that the banks are performing well, generating profits for investors, and contributing to national economic development. The variables display relatively consistent values, with no significant disparities between the minimum and maximum, suggesting the suitability and objectivity of the model.

Among the banks in the sample, BIDV reports the highest figures in terms of number of employees, fixed assets, customer deposits, and net interest income, compared to Vietcombank and VietinBank.

Table 3. Descriptive Statistics of Variables in the DEA Model

No.	Bank	Indicator	Unit	2020	2021	2022	2023	Max Value	Min Value	Mean
1	VCB	Labor	Persons	20,062	21,670	22,599	23,493	23,493	20,062	21,956
		Fixed Assets	Billion VND	8,539	8,636	7,985	7,708	8,636	7,708	8,217
		Customer Deposits	Trillion VND	1,032	1,135	1,244	1,396	1,396	1,032	1,202
		Net Interest Income	Billion VND	36,285	42,273	53,246	12,422	53,246	12,422	36,057
2	CTG	Labor	Persons	24,480	25,154	24,830	24,642	25,154	24,480	24,821
		Fixed Assets	Billion VND	10,811	10,496	10,202	10,126	10,811	10,126	10,409
		Customer Deposits	Trillion VND	990	1,162	1,249	1,411	1,411	990	1,203
		Net Interest Income	Billion VND	35,581	41,788	47,792	20,048	47,792	20,048	36,302
3	BIDV	Labor	Persons	26,752	27,223	28,435	23,200	28,435	23,200	26,403
		Fixed Assets	Billion VND	10,422	10,741	10,534	11,096	11,096	10,422	10,698
		Customer Deposits	Trillion VND	1,227	1,380	1,474	1,705	1,705	1,227	1,447

No.	Bank	Indicator	Unit	2020	2021	2022	2023	Max Value	Min Value	Mean
		Net Interest Income	Billion VND	35,797	46,823	56,070	12,639	56,070	12,639	37,832

Source: Compiled and calculated from banks' financial statements by the author

3.2. Measurement Results of Bank Efficiency

The measurement of bank performance using the input-oriented DEA approach under assumptions of variable returns to scale (VRSTE), constant returns to scale (CRSTE), and scale efficiency (SE) is presented in Table 4.

The VRSTE score, which reflects technical efficiency under variable returns to scale, reveals the extent to which scale impacts operational performance. The VRSTE scores of the banks generally improve over the research period, approaching optimal efficiency. For instance, VietinBank's average VRSTE score is 0.93, suggesting that it operates at 93% of its potential efficiency, meaning it could reduce its input usage by 7% while maintaining the same level of output. Similarly, BIDV is operating with 10% input inefficiency.

Table 4. Operational Efficiency Scores of the Banks

No.	Bank	2020	2021	2022	2023	Average
I. Variable Returns to Scale Technical Efficiency (VRSTE)						
1	VCB	1.00	1.00	1.00	1.00	1.00
2	CTG	0.85	0.95	0.95	0.98	0.93
3	BIDV	0.81	0.93	0.92	0.94	0.90
II. Constant Returns to Scale Technical Efficiency (CRSTE)						
1	VCB	1.00	1.00	1.00	1.00	1.00
2	CTG	0.85	0.90	0.84	0.96	0.89
3	BIDV	0.78	0.85	0.88	0.91	0.85
III. Scale Efficiency (SE)						
1	VCB	1.00	1.00	1.00	1.00	1.00
2	CTG	1.00	0.96	0.88	0.98	0.95
3	BIDV	0.96	0.92	0.96	0.97	0.95

Source: DEA analysis using DEAP version 2.1

The CRSTE scores are lower than the VRSTE scores, indicating that inefficiencies are more pronounced when assuming constant returns to scale. Notably, Vietcombank consistently achieves a perfect efficiency score (1.00) across all years and under all assumptions, positioning it as the most efficient bank in the sample throughout the study period.

The scale efficiency (SE) scores of the state-owned commercial banks are relatively high (above 0.90), suggesting that most inefficiencies are due to pure technical inefficiency (VRSTE) rather than scale inefficiencies (SE). This indicates that the contribution of scale to overall technical efficiency is modest, and that input management remains suboptimal.

Moreover, as bank size increases, the complexity of resource management may also increase, making it more difficult to improve pure technical efficiency. BIDV, despite being the largest bank in terms of workforce, fixed assets, total assets, and mobilized capital, records the lowest overall efficiency scores among the three banks.

IV. CONCLUSION

This study provides empirical evidence on the operational efficiency of state-owned commercial banks in Vietnam using the input-oriented DEA approach under assumptions of both constant and variable returns to scale. One notable advantage of this research lies in its application of updated and post-pandemic financial data, which allows for a timely and realistic assessment of banking performance over the period 2020–2023—a time of unprecedented challenges for the global and domestic economy. The analysis reveals that while overall efficiency scores are relatively high (above 0.80), there remains considerable potential for input cost optimization, especially in the cases of VietinBank and BIDV. Vietcombank demonstrates exemplary performance with consistently optimal efficiency scores, highlighting the potential impact of effective resource management strategies.

Despite its strengths, the study has several limitations. First, the DEA method, while robust for efficiency assessment, does not account for external environmental or macroeconomic factors that may influence bank performance. Second, the analysis is limited to three major state-owned banks, which restricts the generalizability of the

findings across the broader Vietnamese banking sector, including private or foreign-invested institutions. Additionally, only financial inputs and outputs were considered, while qualitative indicators such as customer satisfaction or innovation capacity were not included.

Nevertheless, the findings of this study offer practical implications for bank managers and policymakers. The identified efficiency gaps suggest where strategic interventions can be made to enhance operational performance and resource allocation. Moreover, the results may serve as a benchmark for comparative studies or internal performance audits within the banking sector.

Future research could extend this work by integrating stochastic frontier analysis (SFA) to capture the influence of exogenous variables or by incorporating qualitative metrics to provide a more comprehensive view of bank efficiency. Expanding the sample to include joint-stock commercial banks and foreign banks operating in Vietnam would also enhance the robustness and relevance of the findings for broader policy formulation.

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