Comparing Neo and Traditional Banking Efficiency: A Three-Stage DEA Analysis in Indonesia

(Perbandingan Kecekapan Perbankan Neo dan Tradisional: Analisis DEA Tiga Peringkat di Indonesia)

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ABSTRACT

This study aims to compare neo and traditional banking efficiency, as well as the driving factors. A sample of five Indonesian neo banks and five traditional banks from Q1 2021 to Q4 2023 is employed. The method uses a three-stage method using an intermediation approach, incorporating data envelopment analysis (DEA), DEA windows analysis (DEWA), and Tobit regression. The DEA results indicate that traditional banks demonstrate higher efficiency compared to neo banks. PT Bank Tabungan Negara Tbk and PT Bank Rakyat Indonesia Tbk stand out as the most efficient, while PT. Bank Jago Tbk, a neo bank, records the lowest efficiency score. DEWA demonstrates the stability of efficiency levels over the observed period. Tobit regression analysis further reinforces that neo banks are less efficient than traditional banks. Traditional banks, with their refined operations reputations, attract more deposits and loans, resulting in higher efficiency. In contrast, neo banks face challenges due to their steep learning curve and lack of established customer trust. Revamped regulations and strategic partnerships are essential to expanding lending channels for neo banks, potentially through collaborations with traditional banks or mergers.

Keywords: Bank efficiency; neo banking; traditional banking; bank digitalization; Indonesia

JEL: C67, G21, O33

ABSTRAK

Kajian ini bertujuan untuk membandingkan antara kecekapan perbankan neo dan tradisional, serta faktor-faktor yang mempengaruhi. Sampel lima bank neo dan lima bank tradisional di Indonesia dari Q1 2021 hingga Q4 2023 dianalisis untuk mencapai objektif penyelidikan kami. Kajian ini menggunakan kaedah tiga peringkat menggunakan pendekatan pengantaraan, menggabungkan data envelopment analysis (DEA), DEWA windows analysis (DEWA), dan regresi Tobit sebagai metodologi. Penilaian DEA menunjukkan bahawa bank tradisional menunjukkan efisiensi yang lebih tinggi berbanding dengan bank neo. PT Bank Tabungan Negara Tbk dan PT Bank Rakyat Indonesia Tbk menonjol sebagai yang paling cekap, manakala PT. Bank Jago Tbk, sebuah bank neo, mencatat skor kecekapan terendah. DEWA menunjukkan kestabilan tahap kecekapan sepanjang tempoh yang diperhatikan. Analisis regresi Tobit mengukuhkan kesimpulan bahawa bank neo cenderung kurang cekap daripada bank tradisional. Dengan operasi dan reputasi yang kukuh, bank trandisional menarik lebih banyak deposit dan pinjaman, menghasilkan kecekapan yang lebih tinggi. Sebaliknya, bank neo menghadapi cabaran disebabkan keluk pembelajaran yang curam dan kekurangan kepercayaan pelanggan yang kukuh. Oleh itu, peraturan yang diperbaharui dan kerjasama strategik adalah penting untuk memperluaskan saluran pembiayaan bagi bank neo, melalui kerjasama dengan bank tradisional atau penggabungan.

Kata kunci: Kecekapan bank; perbankan neo; perbankan tradisional; pendigitalan bank; Indonesia

JEL: C67, G21, O33

INTRODUCTION

Digitalization in banking has revolutionized service delivery by eliminating the constraints of time and space, enabling customers to perform transactions remotely through the internet (Filotto et al. 2021). Activities such as fund tracking, receiving instant push notifications, transferring money, and checking account balances have become more accessible and efficient. This transformative approach is projected to nearly triple returns on assets while reducing cost-to-income ratios by around 20%, significantly boosting operational efficiency and profitability (Citterio et al. 2024). For customers, digital banking saves time and reduces transactional costs (Windasari et al. 2022), while for banks, it minimizes operational expenses, including expenditures on building maintenance and human resources (Shahid et al. 2022). As a key driver in the evolving financial landscape, neo banks represent a forward-looking model for leveraging digitalization to enhance banking efficiency. These institutions are poised to play a critical role in shaping the future of financial services by embracing innovative technologies and adapting to changing consumer expectations.

However, despite the promise of enhanced efficiency through digitalization, neo banks face multiple challenges that hinder their efficiency. Following Choi et al. (2021), only 5% of neo banks worldwide achieve profitability. For instance, Nubank, a leading neo bank in Brazil, reported losses of USD 165.3 million, with similar trends observed in Indonesia and Taiwan. JP Morgan estimates global neo bank losses could exceed USD 1 billion. Aside from this, their competitive market environment (Shanti et al. 2023), coupled with low customer trust and retention compared to traditional banks, exacerbates their challenges. Moreover, while they prioritize rapid scaling, these efforts often overshadow the development of sustainable revenue streams, as neo banks often focus on niche services (Aggarwal 2021), which may restrict their ability to cross-sell products and achieve economies of scope that traditional banks leverage for higher profitability. This competitive and constrained landscape indicates that only a few neo-banks are likely to achieve profitability in the foreseeable future.

Traditional banks, benefiting from their established frameworks, tend to operate more efficiently and avoid many of the challenges neo banks face. With diversified revenue streams, traditional banks can leverage economies of scope by offering a broader range of financial products (Larsson et al. 2024). Their long-standing presence fosters customer trust and loyalty (Mainardes & Freitas 2023), enabling higher retention and cross-selling opportunities. Unlike neo banks, which often struggle with profitability due to niche service offerings and rapid scaling efforts, traditional banks maintain stable operations as they are supported by robust physical and digital infrastructures that enhance their operational resilience.

Further inefficiencies in the banking sector, whether in neo or traditional banks, can escalate into defaults with severe economic consequences. Defaults may trigger cascading failures, where the collapse of one bank destabilizes others, affecting both stock prices and systemic stability (Zhao et al. 2024). This risk amplifies through practices like securitization, which facilitates risk-sharing but also increases the likelihood of simultaneous failures. Moreover, the default of a "too-big-to-fail" institution could lead to financial crises, rising unemployment, and suppressed demand (Bellia et al. 2022). Addressing these risks is crucial to economic resilience. An efficient banking sector is crucial for economic growth, as it supports liquidity creation and risk management through financial intermediation (Huynh 2024). Banks serve as investment capital pools (Hu 2023), seeking returns, while the banking system aims to attract and allocate capital efficiently to maximize profitability. Consequently, policymakers and regulators closely monitor the sector to ensure its effective functioning.

These dynamics in banking digitalization show that certain aspects of efficiency remain elusive for neo banks, as traditional banks often benefit from well-established architecture. Existing literature predominantly focuses on specific areas such as customer experience (Filotto et al. 2021; Shahid et al. 2022), cost efficiency (Feld et al. 2021; Zhu & Jin 2023), motivation (Bastari et al. 2020; Windasari et al. 2022), and financial inclusion (Ahmed et al. 2024; Basnayake et al. 2024). However, these studies tend to focus on isolated aspects rather than evaluating overall operational, particularly in the context of banks functioning as intermediaries. Moreover, literature often overlooks the factors driving these efficiencies, making it difficult to identify targeted improvements. Without a comprehensive understanding of the determinants of operational efficiency, efforts to address the unique challenges faced by neo banks remain fragmented.

Given the identified gaps, this study investigates the efficiency of neo banking compared to traditional banking in Indonesia while identifying factors that influence this efficiency. To address these objectives, a three-stage methodology is employed. First, banks are categorized into neo and traditional groups, improving upon prior research. Then, Data Envelopment Analysis (DEA), DEA Windows Analysis (DEWA), and Tobit regression are applied. Addressing these gaps would allow more holistic perspective on efficiency within both neo and traditional banking models, fostering targeted strategies for performance enhancement. This providing efficiency insights for policymakers, such as the financial service authority, and enriching the literature on banking digitalization, particularly within the Indonesian context.

Several rationales underpin the selection of Indonesia as the case study for this research. Firstly, neo banking is intrinsically linked to the network effect, wherein the impact, whether beneficial or detrimental, is amplified by the population size. As Indonesia ranks fourth globally in terms of population, it presents a substantial network effect. Additionally, Indonesia has witnessed a remarkable surge in digital payments, with a 300% increase from 2018 to 2019, continuing to rise to 150 million transactions in 2021 (Kasri et al. 2022). This growth is notably significant, especially

when compared to the 82% increase observed in the United States (Goel et al. 2021) and the 33% increase in India (Mate & Kapdi 2021). Therefore, digitalization in Indonesian banking is anticipated to exert a substantial impact on its economy, offering potentially valuable insights for this study.

This first section begins with an introduction detailing the background, objectives, and significance of the research. The second section explores the dynamics of factors influencing bank efficiency and highlights the differences between neo-banks and traditional banks. The third section outlines the data and methodology employed, including the empirical models used for analysis. Results are presented and discussed in the fourth section, providing insights into the findings. Finally, the concluding section offers a summary, implications of the findings, and practical recommendations for stakeholders.

LITERATURE REVIEW

This section can be broadly divided into two key strands. The first strand delves into the conceptual framework of efficiency, examining its foundational elements, and its role in evaluating overall performance. This provides a theoretical basis for understanding how banks optimize inputs and outputs to achieve desired outcomes. The second strand explores the differences in efficiency between neo and traditional banks.

Farrel (1957) conceptualizes efficiency as a combination of technical and allocative dimensions. Technical efficiency involves maximizing output for a given set of inputs or minimizing inputs to achieve a specific output level, while allocative efficiency is achieved by selecting the optimal input combination based on their costs to maximize output. Together, they constitute overall efficiency. In banking, this framework translates into optimizing inputs such as labor, capital, and technology to deliver key outputs like loans, deposits, and financial services. Efficiency is influenced by factors such as managerial decisions, regulatory frameworks, ownership structures, and technological advancements. For instance, a study by Bueno et al. (2024) illustrates how digital banking improves scale efficiency by reducing operational costs and enhancing service delivery, highlighting the role of technological adoption in achieving efficiency. Thus, efficiency in banking reflects the interplay of resource optimization, cost-effectiveness, and service improvement to achieve sustainable financial performance

Generally, the calculation of efficiency using parametric methods requires estimating a cost function as the frontier to evaluate a bank's efficiency level. Before defining this cost function, it is essential to determine the bank's inputs and outputs. To identify this, three approaches are employed (Hadad et al. 2003). The first is an asset approach, which defines output in terms of asset production, reflecting the bank's primary function as a creator of loans. The second, production approach, views banks as producers of deposit accounts and loans, with inputs including labor costs, fixed asset expenditures, and other operational expenses, while outputs are represented by deposits and loans. Lastly, the intermediation approach emphasizes the intermediary role of financial institutions. Inputs such as labor costs, capital, and interest payments on deposits are converted into outputs like loans and financial investments. This approach highlights the primary role of financial institutions in loan creation and underscores the importance of selecting the correct input-output relationship when evaluating financial efficiency.

However, in a specific manner, the efficiency dynamics of neo and traditional banks differ substantially. Neo banks focus on digitalization to streamline operations, yet they face challenges in scaling, regulatory compliance, and establishing trust (Choi et al. 2021). In contrast, traditional banks rely on diversified portfolios and cross-selling opportunities, which enhance profitability and efficiency through broader service offerings (Shin 2022). Moreover, technological adoption in traditional banking complements their established operational frameworks, resulting in higher allocative and technical efficiency scores compared to neo banks (Shahid et al. 2022). Neo banks' niche focus and reliance on burn-rate strategies often limit their ability to match the operational resilience and financial sustainability of traditional banks (T. Pham & Hampel-Milagrosa 2022).

METHODOLOGY

DATA

The sample for this study comprises five traditional banks and five neo-banks. Both groups are selected based on the size of each bank within their respective categories. The study period spans from the first quarter of 2021 to the fourth quarter of 2023, with data collected on a quarterly basis. The datasets are compiled from the respective financial reports of the banks, as well as from the World Bank and Federal Reserve Economic Data (FRED).

DEA involves variables that represent input and output to determine efficiency. Inputs that will be used in this study are wages, fixed assets, and third-party funds. Meanwhile, distributed financing/credit and net income become the outputs. These combinations are considered as an intermediation approach, and it is the most suitable for banking use case due to its business nature (Boďa & Zimková 2021).

In our Tobit regression model, we use a dummy variable as our variable of interest to identify the neo bank, while the DEA results are used as dependent variable. To ensure a comprehensive analysis, we incorporate both bank-specific and

macroeconomic control variables. Bank-specific control variables, such as total assets, Return on Assets (ROA), and Return on Equity (ROE), are included to account for the internal financial performance and scale of each bank, which are critical determinants of efficiency. This approach allows for a more nuanced understanding of the factors influencing bank efficiency, providing a robust analytical framework for our study. These variables will enable us to isolate the impact of being a neo-bank on efficiency from other intrinsic factors. Additionally, we will include macroeconomic control variables like inflation, oil price volatility, and GDP growth to capture the broader economic environment that can influence bank operations and efficiency. Without these controls, any observed relationship might be confounded by these underlying characteristics, leading to biased results.

METHODS

On the first stage, we intend to measure efficiency through the DEA approach. DEA is a nonparametric linear programming method to evaluate the relative efficiency of decision-making units (DMUs) (Charnes et al. 1978). In short, DMUs are homogeneous selected entities that are organized for both input and output (Martín-Gamboa & Iribarren 2021). To determine the efficiency of respective DMUs, it will be determined from the distance between the efficiency frontier. Several studies also used this approach to measure financial institution efficiency (Antunes et al. 2024; Chaoqun et al. 2024; Yeh 2024).

However, the means in the DEA result will be changed due to the competitor and study period. The comparison of relative efficiency between similar DMUs in two or more periods by using DEA is indecipherable. To overcome this shortcoming, DEWA is introduced in the second stage where the DMUs performance is analyzed for certain window periods (Charnes et al. 1984). This method, also referred to as the time-dependent version of DEA, assesses each DMU independently from other observations. Summary statistics, i.e. mean, long distance per period (LDP), and long distance per year (LDY) are used in efficiency trend analysis. By comparing each DMU with alternatives from a specific subset of the panel data, DEWA operates on the assumption that what was "feasible" in the past remains "feasible" indefinitely. This analysis permits the adjustment of historical boundaries, resulting in more consistent and reliable conclusions (AlKhars et al. 2022), enhancing the robustness of the analysis. This approach has been validated by several studies addressing similar concerns (Liu et al. 2023; Ni'mah & Laila 2022; Sánchez-Ortiz et al. 2021).

Given that DEA calculation uses limited upper/lower bound value (from 0 to 1), Tobit regression will be used as the third stage (Tobin 1985). Through this model, DMU_0 can generally be defined as follows:

$$
\begin{aligned}
&y_0^* = \beta' \; x_0 + \varepsilon_0 \\
&y_0 = y_0^* \; \text{if } y_0^* > 0 \text{, and} \\
&y_0 = 0, \quad \text{if not} \dots
\end{aligned}
\tag{1}
$$

Where $\varepsilon_0 \sim N\,(0, \sigma^2)3$, x_0 dan β are vector of explanatory variables and unknown parameters, respectively (Stavarek 2003). The maximum likelihood function, which is notated in L, needs to be maximized to solve β and σ based on observations of explanatory variables and DEA efficiency scores. This can be chosen from following equation:

$$
(2)
$$

$$
L = \prod_{y_0=0}(1 - F_0) \prod_{y_0^*=0} \frac{1}{(2 \prod \sigma^2)^{\frac{1}{2}}} \times e^{-\left[\left(\frac{1}{2\sigma^2}\right)\right](y_0 - \beta x_0)^2}
$$

where

$$
(3)
$$

$$
F_0 = \int_{-\infty}^{\beta x_0/\sigma} \frac{1}{(2\prod)^{1/2}} \; e^{-t^2/2} dt
$$

Where $y = 0$ illustrates 100% efficiency, while $(y>0)$ illustrates inefficiency. F_0 is the standard normal distribution function evaluated on $\beta x_0/\sigma$. Tobit regression has been used in several studies as the complementary of DEA analysis for analyzing bank efficiency (Abidin et al. 2021; Istaiteyeh et al. 2024; Riani & Maulani 2021).

RESULTS AND DISCUSSION

FIRST STAGE – DEA RESULT

TABLE 1 displays the efficiency scores for both neo and traditional banks, with values ranging from 0 to 1. Traditional banks have greater efficiency scores overall than neo banks, indicated by the highest average's score. PT Bank Tabungan

Negara Tbk and PT Bank Rakyat Indonesia Tbk are the most relatively efficient banks with an average efficiency score of 0.97, while PT Bank Neo Commerce is the bank with the relatively lowest efficiency score compared to others.

TABLE 1. DEA result

DMU	Q1 2021	Q2 2021	Q3 2021	Q4 2021	Q1 2022	Q2 2022	Q3 2022	Q4 2022	Q1 2023	Q2 2023	Q3 2023	Q4 2023	Mean
					Neo Bank								
PT Allo Bank Indonesia Tbk	0.76	1.00	1.00	0.58	1.00	1.00	0.96	0.97	0.85	0.86	1.00	0.94	0.91
PT Bank Jago Tbk	0.73	0.31	0.51	0.64	0.68	0.71	0.74	0.85	1.00	0.96	0.87	1.00	0.75
PT Bank Neo Commerce	1.00	1.00	0.81	0.24	0.58	0.46	1.00	0.58	1.00	0.77	0.67	0.65	0.73
PT Bank Digital BCA	1.00	0.97	0.94	0.71	0.69	0.63	0.61	1.00	1.00	1.00	1.00	1.00	0.88
PT Bank Seabank Indonesia	0.29	1.00	1.00	0.30	1.00	1.00	0.98	0.75	0.75	0.79	0.72	0.88	0.79
Mean	0.76	0.86	0.85	0.49	0.79	0.76	0.86	0.83	0.92	0.88	0.85	0.90	0.81
					Traditional Bank								
PT Bank Tabungan Negara Tbk	0.97	0.97	0.97	0.85	1.00	0.98	0.97	0.89	1.00	1.00	1.00	0.97	0.97
PT Bank Mandiri Tbk	1.00	0.98	0.93	0.94	0.94	0.92	0.97	0.93	0.95	0.95	0.97	1.00	0.96
PT Bank Central Asia Tbk	0.91	0.83	0.83	0.84	0.94	0.98	0.98	0.93	1.00	1.00	1.00	1.00	0.94
PT Bank Negara Indonesia Tbk	0.92	0.87	0.83	0.77	0.89	0.89	0.89	0.78	1.00	0.96	0.98	0.93	0.89
PT Bank Rakyat Indonesia Tbk	1.00	0.96	0.91	0.92	0.98	0.98	0.98	0.94	1.00	1.00	1.00	1.00	0.97
Mean	0.96	0.92	0.89	0.87	0.95	0.95	0.96	0.89	0.99	0.98	0.99	0.98	0.94

Source: Compiled by authors

Compared with the counterpart, traditional banking has a longer establishment. This is consistent with Shin (2022) that neo banking is lack of establishment, such as convenience, employee-customer engagement, and security. This further confirmed in Mainardes & Freitas (2023) that customers loyalty is more compelling in traditional banks. Combining good management and greater customer engagement result greater profit for the bank, hence increased efficiency.

SECOND STAGE – DEWA RESULT

These measurements are utilized to determine the stability of each DMU efficiency. Notably, smaller values across these metrics indicate greater stability in the efficiency scores obtained for each DMU.

TABLE 2. DEWA framework

Window 1	Q1 2021	Q2 2021	Q3 2021	Q4 2021	Q1 2022	Q2 2022	Q3 2022	Q4 2022	
Window 2		Q2 2021	Q3 2021	Q4 2021	Q1 2022	Q2 2022	Q3 2022	Q4 2022	Q1 2023
Window 3			Q3 2021	Q4 2021	Q1 2022	Q2 2022	Q3 2022	Q4 2022	Q1 2023	Q2 2023
Window 4				Q4 2021	Q1 2022	Q2 2022	Q3 2022	Q4 2022	Q1 2023	Q2 2023	Q3 2023
Window 5					Q1 2022	Q2 2022	Q3 2022	Q4 2022	Q1 2023	Q2 2023	Q3 2023	Q4 2023

Source: Compiled by authors

The framework of the window DEA analysis is presented in the TABLE 2, reflecting the relative efficiency scores of each bank across all periods and windows. Additionally, TABLE 3 provides the overall efficiency stability scores for both neo and traditional banks.

TABLE 3. DEWA result

DMU	Q1 2021- Q4 2022	Q2 2021- Q1 2023	Q3 2021- Q2 2023	Q4 2021- Q3 2023	Q1 2022- Q4 2023	Mean	SD	LDY	LDP
			Neo Bank						
PT Allo Bank Indonesia Tbk	0.86	0.93	0.92	0.94	0.95	0.92	0.04	0.38	0.36
PT Bank Jago Tbk	0.77	0.78	0.80	0.85	0.85	0.81	0.04	0.49	0.15
PT Bank Neo Commerce	0.73	0.72	0.73	0.70	0.75	0.72	0.02	0.76	0.17
PT Bank Digital BCA	0.83	0.85	0.89	0.96	0.96	0.90	0.06	0.37	0.30
PT Bank Seabank Indonesia	0.80	0.85	0.81	0.85	0.86	0.83	0.03	0.69	0.69
Mean	0.80	0.83	0.83	0.86	0.88	0.84	0.04	0.54	0.33
			Traditional Bank						
PT Bank Tabungan Negara Tbk	0.97	0.98	0.97	0.96	0.98	0.97	0.01	0.15	0.04
PT Bank Mandiri Tbk	0.90	0.89	0.96	0.97	0.96	0.93	0.04	0.69	0.07
PT Bank Central Asia Tbk	0.97	0.94	0.97	0.97	0.98	0.97	0.01	0.20	0.18
PT Bank Negara Indonesia Tbk	0.90	0.88	0.88	0.90	0.92	0.90	0.01	0.23	0.11
PT Bank Rakyat Indonesia Tbk	0.97	0.97	0.98	0.98	0.98	0.98	0.01	0.12	0.06
Mean	0.94	0.93	0.95	0.96	0.96	0.95	0.02	0.28	0.09

Source: Compiled by authors

Given the TABLE 3 above, banks with the most stable efficiency scores are PT Bank Tabungan Negara Tbk and PT Bank Rakyat Indonesia Tbk, whereby both achieve the smallest score of 0.01 standard deviation, PT Bank Negara Indonesia Tbk has the smallest LDP score, while PT Bank Rakyat Indonesia Tbk has the smallest LDY score. The results further indicate that the statistical values for traditional banks are smaller than those for neo banks. This finding reinforces the previous analysis, suggesting that traditional banks exhibit superior efficiency and stability compared to their neo counterparts.

In the subsequent stage, the author categorizes the banks into four quadrants based on their levels of efficiency and stability (Al-Refaie & Lepkova 2023; Rusydiana & As-Salafiyah 2021). Quadrant I comprises banks with both high efficiency and high stability, representing the top performers. Quadrant II includes banks with high efficiency but lower stability. Quadrant III consists of banks characterized by both low efficiency and stability. Quadrant IV includes banks that exhibit low efficiency but high stability. The stability of efficiency is derived from the LDY in the window analysis. TABLE 4 provides detailed information on the quadrant classifications.

TABLE 4. Bank quadrant category

Bank	Efficiency		Stability		Quadrant
Neo Bank					
PT Allo Bank Indonesia Tbk	0.921	High	0.036	Low	II
PT Bank Jago Tbk	0.810	Low	0.038	Low	IV
PT Bank Neo Commerce	0.724	Low	0.016	High	III
PT Bank Digital BCA	0.900	High	0.063	Low	II
PT Bank Seabank Indonesia	0.834	Low	0.025	High	III
Traditional Bank					
PT Bank Tabungan Negara Tbk	0.973	High	0.006	High	I
PT Bank Mandiri Tbk	0.934	High	0.039	Low	II
PT Bank Central Asia Tbk	0.967	High	0.014	High	I
PT Bank Negara Indonesia Tbk	0.897	High	0.014	High	I
PT Bank Rakyat Indonesia Tbk	0.977	High	0.008	High	I

Source: Compiled by authors

The overall result shows that 42% of banks are categorized in the first Quadrant (5 banks), followed by 33% of Quadrant III (4 banks), and 25% of Quadrant IV (3 banks). Furthermore, based on their category, all traditional banks were included in the first quadrant indicating that they had an efficient and stable performance during the observation period. Neo banks were included in quadrants III and IV with details of 4 banks in the third quarter and 3 banks in the fourth quarter. Again, consistent to prior estimation, traditional banks are better than neo banks in terms of efficiency and stability.

POTENTIAL IMPROVEMENT

One advantage of DEA is the ability to identify the sources of inefficiency for each DMU through potential improvement analysis. By comparing actual with projected values, DEA reveals the degree of inefficiency in variables needing adjustment by both neo and traditional banks.

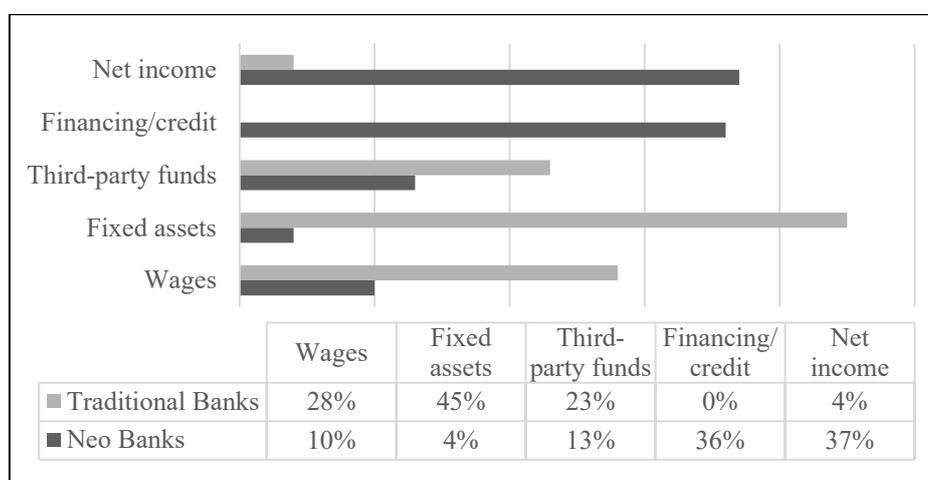|	Wages	Fixed assets	Third-party funds	Financing/credit	Net income
Traditional Banks	28%	45%	23%	0%	4%
Neo Banks	10%	4%	13%	36%	37%

FIGURE 1. Potential improvement comparison
Source: Compiled by authors

In traditional banks, fixed assets significantly contribute to inefficiency, accounting for 45% of the overall bank's efficiency. Fixed assets include tangible items such as an automatic teller machine (ATM), office, vehicle, and other physical infrastructure. Optimizing these assets involves developing alternative strategies to maximize their functionality and ensuring careful consideration before introducing new assets. This approach aims to enhance operational efficiency by effectively managing existing resources and making prudent decisions regarding future investments, given the projected return.

The source of inefficiency for neo banks differs from the traditional ones. Net income (37%), followed by financing/credit (36%) are substantial aspects that contribute to inefficiency. Traditional banks, with refined operations and strong reputations, attract more deposits and lending, leading to higher returns (hence no potential improvement on the FIGURE 1 above). This makes neo banks less competitive in financing due to their steep learning curve and lack of established customer trust (Ulrich-Diener et al. 2023). Given these, neo banks should give priority to their loan quantity and quality and carry out various innovations to increase their financing and operating revenue in the future.

THIRD STAGE – TOBIT REGRESSION RESULT

While prior estimations only calculate efficiency, this approach further elaborates on what factors influence its efficiency. Assessing such factors could support bank decision to build an appropriate strategy for promoting bank efficiency.

TABLE 5. Tobit regression result

	Full	Bank	Macro
Neo bank	-0.194*	-0.204**	-0.228***
	(0.079)	(0.076)	(0.043)
Bank-specific controls			
Bank size	-1.60E-11	-2.15E-11	
	(5.75E-11)	(5.67E-11)	
ROA	6.05***	6.154***	
	(1.774)	(1.771)	
ROE	-0.582	-0.634	
	(0.462)	(0.452)	
Macroeconomic controls			
Inflation	0.023		0.025
	(0.017)		(0.018)
Oil volatility	-0.005		-0.006
	(0.003)		(0.003)
ln GDP	-0.362		-0.251
	(0.244)		(0.252)
Cons	6.635	0.950***	4.96
	(3.771)	(0.0728)	(3.899)
Observation	144	144	144

*, **, and *** show significance in 10, 5, and 1 per cent level, respectively. Parentheses are showing standard error.
Source: Compiled by authors

The TABLE 5 above illustrates the Tobit regression results, highlighting factors influencing bank efficiency. The findings indicate that, on average, neo banks tend to be less efficient compared to traditional banks. This negative and significant relationship with bank efficiency remains consistent across various controls. Neo banks encounter a steep learning curve as they navigate regulatory environments and market competition (Ulrich-Diener et al. 2023). Traditional banks, with their longer establishment periods, have refined operational frameworks and brand recognition. These attributes contribute to long-standing reputations and established customer trust, enabling them to channel more credit effectively. A study by Doan et al. (2020) confirms that such reputation drives customers to borrow and deposit more, thus generating higher returns. Despite their traditional characteristics, traditional banks are not becoming obsolete. They have embraced digitalization in transactions, customer service, and other services. However, traditional banks still maintain physical infrastructure, which contributes to higher transaction costs compared to their neo counterparts.

Among all controls, one variable demonstrating causality is the bank-specific group, specifically the ROA. This metric measures the efficiency with which a bank utilizes its assets to generate earnings. Given that banks primarily derive their revenue from their assets, such as loans and investments, ROA directly reflects the efficiency of asset management. Furthermore, ROA underscores the operational aspect of banking by concentrating on the core activities of lending and investment, aligning closely with the day-to-day operations and strategic decisions within the banking sector. Additionally, approach that employed in DEA, intermediary approach, highlights the critical role of assets in the banking business model, particularly in credit and financing channels.

DISCUSSION

Through three stages of analysis, we find that neo banks are less efficient than traditional banks. Persistent inefficiency in neo banks could undermine their financial stability, potentially leading to higher risks of failure and negatively impacting the broader financial system. Neo banks, by virtue of their operational model, rely heavily on technological infrastructure and real-time data processing. the lack of physical branches and face-to-face customer interactions can exacerbate the speed at which issues escalate, as neo banks often serve a large customer base through interconnected neo platforms. This interconnectedness means that any inefficiency or failure can quickly erode customer trust, trigger mass withdrawals, and destabilize the bank's operations, thereby posing a risk not only to the neo bank itself but also to the broader financial ecosystem. Since the regulatory framework has become a constraint in Indonesia (Israhadi 2024), one approach to overcome inefficiency is to simplify compliance processes for neo banks that can help them overcome the steep learning curve associated with regulatory environment. By doing so, neo banks could have more focus on operational aspects.

Alternatively, given the findings that traditional banks exhibit greater efficiency compared to their neo counterparts, it may be more advantageous to optimize the digital transformation of traditional banks rather than focusing solely on improving neo banks. Traditional banks already possess established operational frameworks, brand recognition, and customer trust, which are critical assets that neo banks lack. By accelerating digital transformation within traditional banks through strategies such as mergers and acquisitions, we can leverage these existing strengths while integrating advanced digital technologies. Mergers can enhance scale and resource allocation, allowing traditional banks to invest more effectively in digital infrastructure and innovation. These arguments are also supported by Adhikari et al. (2023) that acquiring inefficient banks and integrating them with more efficient institutions can lead to better performance outcomes. This is particularly relevant when considering the optimization of digital transformation within traditional banks through mergers and acquisitions. This approach would not only reduce the steep learning curve and regulatory challenges faced by neo banks but also preserve the robust physical and operational networks of traditional banks. Additionally, optimizing digital transformation in traditional banks can lead to improvement in customer experiences, service delivery, and transaction cost efficiency. Thus, rather than exclusively focusing on optimizing neo banks, a more holistic strategy that includes the digital enhancement of traditional banks may yield superior overall efficiency and stability in the banking sector.

CONCLUSION

This study aims to investigate neo-banking efficiency in Indonesia compared with the traditional one using DEA, DEWA, and Tobit regression. Through DEA, this study shows that traditional banks have greater efficiency scores than neo banks. As revealed by DEWA, most of the banks performed efficiently and steadily throughout the observation period, with traditional banks performing better than neo banks. Controlling bank-specific and macroeconomics aspects, Tobit regression result suggests that neo banks tend to be less efficient compared to the counterparts. Given these, our results suggest that traditional banks have better efficiency than neo banks. Through three stages of analysis, we find that neo banks are less efficient than traditional banks, with persistent inefficiency posing risks to financial stability due to their reliance on technological infrastructure and lack of physical branches. This interconnectedness can quickly erode customer trust and destabilize operations. Regulatory constraints in Indonesia further exacerbate these issues.

Policymakers need to prioritize the development of a balanced regulatory framework that accommodates the unique operational models of neo banks while maintaining financial stability. Promoting this hybrid model can enhance efficiency and resilience in the banking sector, support financial inclusion, and ensure stability amid the rapid technological evolution in Indonesia's banking industry. From an industry perspective, particularly neo banks, optimizing the collection of third-party funds and financing can be achieved through digital marketing strategies, financial product diversification, and the use of data analytics and artificial intelligence in credit risk assessment. Collaboration with fintech and e-commerce platforms can also expand market reach, increase third-party funds, and support financing efficiency. Alternatively, optimizing digital transformation in traditional banks through strategies such as mergers and acquisitions can leverage their established brand recognition and customer trust. Traditional banks have the advantage of robust physical and operational networks, which, when combined with advanced digital technologies, can significantly improve customer experience and transaction cost efficiency.

This study acknowledges several limitations that should guide future research. First, the relatively recent emergence of neo-banking compared to traditional banking limits the available data for analysis. A longer data collection period could provide richer insights into the efficiency trends and performance trajectories of neo banks. Future studies could address this limitation by extending the timeframe of analysis as neo banks mature and more data becomes available. Second, there is a substantial disparity in the sizes of neo and traditional banks, reflecting their different establishment periods and market footprints. While this study mitigated size effects by incorporating bank size as a control variable, comparisons among banks of similar sizes could yield more precise insights. Future research should aim for a more balanced dataset with

comparable bank sizes to enhance the validity and robustness of findings. Such efforts would contribute to a more nuanced understanding of efficiency dynamics across the banking spectrum.

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