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# TRENDS IN BANKING EFFICIENCY AND RETURNS TO SCALE: EVIDENCE FROM ASEAN-6 BANKING SECTORS

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**Abstract:** *The present study examines the efficiency and returns to scale of the banking sectors in the six most prominent ASEAN economies. The empirical analysis covers the period from 2013 to 2021, capturing both the pre-pandemic years and the peak of the COVID-19 crisis. The results indicate that the banking sectors of the middle-income countries exhibit higher efficiency levels in comparison to the high- and low-income countries banking sectors. The empirical findings also indicate that the banking sectors of the ASEAN-6 most prominent economies have been adversely affected by the COVID-19 pandemic crisis. We find that most banks have been functioning at the "suboptimal" scale of operations. These banks could either be proportionately smaller or disproportionately larger than ideal. This study also highlights significant policy implications and the necessity of enhancing economic efficiency and stability in the ASEAN-6 banking sectors through effective resource allocation, technology-driven financial services, and regulatory reforms. It recommends embracing best practices from middle-income countries, fostering mergers and acquisitions, digital transformation, and developing customized strategies to cater to the distinct needs of each income group.*

**Keywords:** *Banks, Data Envelopment Analysis, ASEAN-6, Returns to Scale*

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## Introduction

Empirical evidence highlights the crucial role of the banking sector in fostering economic growth and development (Deidda & Fattouh, 2008; Beck et al. 2000). This role is especially pronounced in developing and emerging economies, where financial markets are often underdeveloped or entirely absent (Stulz, 2001). Consequently, banks dominate financial intermediation in these regions, accounting for over 70% of total financial system assets (Sufian, 2011). Given this context, it is reasonable to expect that a well-functioning banking system contributes significantly to economic growth and financial stability (Banna et al. 2020; Levine, 2022). While banks serve as the primary providers of financial services in many emerging economies (Ataullah et al. 2004; Jaffry et al. 2007; Sufian & Habibullah, 2010), more recent evidence points to substantial transformations in the banking sector driven by technological innovation, increased financial inclusion efforts, and tighter regulatory oversight (Le et al. 2019; Nguyen and Du, 2022). Despite these developments, efficiency gaps persist between banks in developing and advanced economies (Sufian and Habibullah, 2010; Berger, 2007). Structural inefficiencies amplified by market imperfections continue to hinder optimal resource allocation and healthy competition. From a microeconomic perspective, such inefficiencies pose systemic risks, as inefficient banks may be driven out of the market, potentially triggering wider financial instability. Therefore, understanding the drivers of bank efficiency in today's rapidly evolving financial landscape remains both relevant and urgent.

Among these challenges, variation in bank size has emerged as a particularly important determinant of performance and efficiency (Alfaihani et al. 2024). The scale at which banks operate plays a crucial role in shaping their operational effectiveness. Larger banks may encounter diseconomies of scale due to bureaucratic complexity and rigid processes, whereas smaller banks may be unable to fully capitalize on cost saving advantages associated with scale economies. Misjudgements by bank managers or regulators, such as overestimating the efficiency of large institutions or underestimating the potential of smaller ones, may result in misguided policies. These can include unnecessary expansion or premature downsizing, both of which risk weakening institutional performance and stifling sectoral development. Recent empirical research underscores the importance of scale efficiency in the banking sectors of emerging economies. For instance, Banna et al. (2020) and Sufian and Kamarudin (2021) highlight the diverse effects of bank size on performance in Southeast Asia, particularly in the context of digital transformation and evolving regulatory standards. Additionally, global disruptions such as the Covid-19 pandemic have significantly altered banking operations and resource strategies, reinforcing the need to reassess scale dynamics in a post pandemic landscape (Mansour et al. 2023).

This study seeks to address existing gaps in the literature by providing a comprehensive assessment of banking efficiency in the ASEAN-6 countries, with a particular emphasis on analysing returns to scale. Unlike many prior studies that utilize country-specific or local frontiers, this research employs a global frontier to construct efficiency scores. At present, empirical evidence on returns to scale in the banking sectors of ASEAN-6 countries from a global perspective remains limited. By offering new insights into banking efficiency and scale economies, this study aims to contribute to a deeper understanding of the structural dynamics shaping financial sector performance in the region.

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## Literature Review

A substantial body of prior research has examined bank efficiency, particularly technical efficiency (TE), in recognition of its critical role in supporting financial sector performance and broader economic development. Technical efficiency refers to a bank's ability to maximize outputs from a given set of inputs, without considering input or output prices. It differs from allocative efficiency, which reflects the ability to use inputs in optimal proportions given their prices, and from cost efficiency, which combines both technical and allocative aspects to reflect overall cost minimization. Understanding these distinctions is essential when evaluating bank performance through different methodological approaches.

Recent studies suggest that a more inclusive financial sector can significantly enhance banks' efficiency scores, especially in developing economies (Ahamed et al. 2021). To better understand the importance of efficiency in banking, it is essential to consider the theoretical underpinnings and measurement methodologies used in past research. Bank efficiency has been measured using a variety of approaches, broadly classified into parametric and nonparametric frontier techniques (De Jarge & Sanz Triguero 2011; Cummins and Weiss 2013; Al Amri et al. 2021). One of the foundational concepts in efficiency analysis originates from Farrell (1957), who introduced a production frontier framework. This concept was later operationalized through the Data Envelopment Analysis (DEA) approach developed by Charnes, Cooper, and Rhodes (1978), commonly referred to as the CCR model.

DEA is a non-parametric linear programming method that constructs a best practice frontier based on observed input output combinations. The CCR model assumes constant returns to scale (CRS), meaning that outputs increase in direct proportion to inputs. The notion of returns to scale refers to how changes in input levels affect output levels. If doubling all inputs leads to a doubling of outputs, the firm exhibits constant returns to scale. If outputs increase more than proportionally, it is said to experience increasing returns to scale, while less than proportional increases indicate decreasing returns to scale. Since perfect competition rarely holds in real world banking markets, models that allow for variable returns to scale (VRS), such as the BCC model (Banker et al. 1984), are often employed to better reflect practical conditions.

Under the VRS assumption, DEA decomposes overall technical efficiency (TE) into two components: pure technical efficiency (PTE), which reflects managerial performance, and scale efficiency (SE), which captures whether a bank is operating at the most productive scale size. This study adopts the VRS-based DEA approach to measure banking efficiency across ASEAN-6 countries, providing a nuanced understanding of efficiency that isolates managerial effectiveness from scale effects. The TE score represents the overall level of banking efficiency, while PTE accounts for operational performance independent of scale, and SE reflects the appropriateness of the bank's size.

When comparing results under CRS and VRS assumptions, differences in TE scores for a given decision-making unit (DMU) signal the presence of scale inefficiency (SIE) (Coelli et al. 1998). Specifically, SIE is calculated by subtracting the VRS PTE score from the CRS TE score. The nature of the SIE, whether a bank experiences increasing returns to scale (IRS) or decreasing returns to scale (DRS), can be determined by solving an additional DEA model under the nonincreasing returns to scale (NIRS) assumption (Sufian 2004; Kamarudin et al. 2015). IRS

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implies that an increase in inputs results in a more than proportional increase in outputs, while DRS suggests diminishing returns (Kamarudin et al. 2015; Kundi & Sharma 2016).

The non-parametric DEA method has become a popular tool for assessing bank efficiency in various country contexts. For instance, DEA has been used to measure efficiency in Latvian banks (Titko et al. 2014), Egyptian banks (Jreisat & Hassan, 2016), Brazilian banks (Staub et al., 2010), Saudi Arabian banks (Assaf et al. 2011), African banks (Mostafa, 2008), Greek banks (Pasiouras, 2008), and Chinese banks (Xu et al. 2015; Ariff & Can, 2008). These studies reinforce the suitability of DEA in capturing cross-country differences in banking efficiency and identifying potential sources of inefficiency. However, none of the studies reviewed originate from ASEAN-6 countries, which may possess distinct institutional structures and governance frameworks. This gap highlights the importance of incorporating region specific literature to enhance contextual relevance. In recent years, DEA has been applied to banks in ASEAN countries, including Malaysia (Sufian 2011; Kamarudin et al. 2017), Indonesia (Hadad et al. 2011), the Philippines (Delis et al. 2011), Singapore (Nguyen and Sarker 2018), and Vietnam (Nguyen and Nghiem 2021). These studies confirm the applicability of DEA in evaluating banking efficiency across ASEAN-6 countries and offer valuable insights into the region's unique financial and regulatory environment. In summary, the DEA methodology, especially under VRS assumptions, provides a robust framework for analysing banking efficiency by distinguishing between technical and scale inefficiencies. This study builds upon the literature by applying this methodology to assess banking efficiency in the ASEAN-6 countries from a global perspective.

**Methodology**

Traditionally, conventional ratios approach has been extensively employed by past studies in indicating efficiency. However, Cummins and Weiss (2013) highlight that the application of the conventional approach to financial ratios was unfavourable as managers generally face difficulties in summarising the mass of statistics. The inefficiency of the ratio approach, which involves market values that have not been objectively assessed, is the first area where financial ratios fall short (Bauer et al. 1998). Second, the ratio technique does not require input prices, and, therefore, the ratios may not serve as performance indicators of banks' efficiency (Berger et al. 1993). Third, using numerous inputs and outputs to better the decision-making process could be limited by the ratio method's one-dimensional approach to services, goods, or processes (Iqbal and Molyneux, 2005).

Thus, a quantitative technique called Data Envelopment Analysis (DEA) is used to assess the relative effectiveness of DMUs when there are several inputs and outputs. It is a non-parametric technique that assesses the efficiency of a set of entities, such as banks, hospitals, or companies, by comparing their performance to a best-practice frontier. DEA is particularly useful when evaluating the efficiency of organizations that operate in a similar industry or sector but have different input-output combinations. It allows for the identification of efficient units and provides insights into the potential improvements that can be made by inefficient units.

Besides, this study analyses bank efficiency within major ASEAN banking sectors using data covering the years 2013 to 2021. This timeframe includes pre-pandemic years and the peak of the COVID-19 crisis enabling a preliminary evaluation of how banks in ASEAN-6 countries have performed. The data for the empirical investigation are sourced from the Fitch Connect

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Database. The selection of the data is based on the data availability. The initial sample consists of 200 banks across six ASEAN countries: 81 banks in Indonesia, 27 in Malaysia, 18 in the Philippines, 5 in Singapore, 26 in Thailand, and 43 in Vietnam. For the purposes of this study, inputs and outputs are defined using a variation of the intermediation or asset approach originally introduced by Sealey and Lindley (1977). Following the framework of Sufian and Habibullah (2010), the input variables include Total Deposits (comprising deposits from both customers and other banks), Physical Capital, and Labour. The output variables consist of Loans (to customers and other banks), Investments, and Net Interest Income.

## Results and Discussions

### The Efficiency of the ASEAN-6 Banking Sectors: An Analysis Based on Levels

The panel data on technical efficiency (TE) of banks in six ASEAN countries from 2013 to 2021, as presented in Table 1, reveals notable disparities and dynamic trends over time. On average, Thailand achieved the highest TE score (0.599), followed by Malaysia (0.587), indicating more efficient utilization of banking resources in these countries. Technical efficiency scores, as derived from the DEA model, range between 0 and 1, where a score of 1 indicates that a bank is fully efficient relative to the best performing peers on the efficiency frontier. Banks with scores below 1 are considered inefficient, as they fall short of the optimal input output ratio benchmarked by the frontier.

In this study, TE is estimated using an output-oriented DEA model, which evaluates how much output a bank can expand without requiring additional inputs. Under this approach, DEA assigns optimal weights to inputs and outputs to construct a best practice frontier, and each bank's performance is assessed relative to this frontier. Therefore, the average TE scores of Thailand and Malaysia, while not indicating full efficiency, reflect relatively better performance compared to their ASEAN counterparts. These findings are consistent with the results of Sufian and Habibullah (2010), who argue that banks in Thailand have effectively performed their financial intermediary functions, particularly in transforming customer deposits into productive loans and investments.

**Table 1: The Efficiency of the ASEAN-6 Banking Sectors: An Analysis Based on Levels (2013-2021)**

| Year | Malaysia | Thailand | Singapore | Vietnam | Indonesia | Philippines |
|---|---|---|---|---|---|---|
| **Panel A: Technical Efficiency** | | | | | | |
| 2013 | 0.512 | 0.517 | 0.523 | 0.434 | 0.389 | 0.341 |
| 2014 | 0.498 | 0.486 | 0.512 | 0.435 | 0.381 | 0.337 |
| 2015 | 0.515 | 0.551 | 0.423 | 0.346 | 0.344 | 0.265 |
| 2016 | 0.545 | 0.582 | 0.409 | 0.404 | 0.332 | 0.271 |
| 2017 | 0.669 | 0.674 | 0.607 | 0.476 | 0.454 | 0.414 |
| 2018 | 0.657 | 0.688 | 0.615 | 0.426 | 0.407 | 0.374 |
| 2019 | 0.621 | 0.666 | 0.455 | 0.537 | 0.459 | 0.391 |
| 2020 | 0.609 | 0.629 | 0.578 | 0.501 | 0.413 | 0.378 |
| 2021 | 0.655 | 0.625 | 0.603 | 0.544 | 0.380 | 0.352 |
| **Mean** | **0.587** | **0.599** | **0.525** | **0.452** | **0.395** | **0.348** |

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| | | | | | | |
|---|---|---|---|---|---|---|
| **Panel B: Pure Technical Efficiency** | | | | | | |
| 2013 | 0.579 | 0.603 | 0.603 | 0.737 | 0.520 | 0.203 |
| 2014 | 0.531 | 0.535 | 0.563 | 0.782 | 0.495 | 0.397 |
| 2015 | 0.598 | 0.676 | 0.513 | 0.765 | 0.515 | 0.435 |
| 2016 | 0.599 | 0.682 | 0.485 | 0.819 | 0.513 | 0.396 |
| 2017 | 0.693 | 0.706 | 0.631 | 0.764 | 0.584 | 0.468 |
| 2018 | 0.688 | 0.734 | 0.649 | 0.772 | 0.557 | 0.438 |
| 2019 | 0.705 | 0.694 | 0.581 | 0.828 | 0.567 | 0.413 |
| 2020 | 0.692 | 0.724 | 0.664 | 0.875 | 0.666 | 0.473 |
| 2021 | 0.711 | 0.680 | 0.692 | 0.874 | 0.642 | 0.445 |
| **Mean** | **0.644** | **0.682** | **0.598** | **0.795** | **0.562** | **0.408** |
| **Panel C: Scale Efficiency** | | | | | | |
| 2013 | 0.888 | 0.841 | 0.865 | 0.630 | 0.799 | 0.217 |
| 2014 | 0.932 | 0.908 | 0.895 | 0.595 | 0.844 | 0.859 |
| 2015 | 0.868 | 0.785 | 0.815 | 0.489 | 0.722 | 0.642 |
| 2016 | 0.904 | 0.818 | 0.822 | 0.509 | 0.702 | 0.732 |
| 2017 | 0.968 | 0.946 | 0.958 | 0.674 | 0.825 | 0.918 |
| 2018 | 0.959 | 0.927 | 0.933 | 0.598 | 0.762 | 0.909 |
| 2019 | 0.892 | 0.958 | 0.869 | 0.678 | 0.853 | 0.961 |
| 2020 | 0.888 | 0.837 | 0.845 | 0.570 | 0.631 | 0.829 |
| 2021 | 0.919 | 0.899 | 0.848 | 0.613 | 0.599 | 0.829 |
| **Mean** | **0.913** | **0.867** | **0.872** | **0.597** | **0.749** | **0.766** |

Source: Author's Calculation

Singapore, despite its status as a high-income country, posted a moderate average TE of 0.525, it plausible to expect that more conservative financial practices, such as stricter risk management protocols, higher capital buffer requirements, and a more cautious lending strategy, which may limit operational flexibility and impact efficiency scores. In contrast, Vietnam, Indonesia, and the Philippines recorded lower average TE values of 0.452, 0.395, and 0.348, respectively highlighting persistent inefficiencies and signalling the need for structural reforms and technological advancement in their banking sectors. A sharp decline in TE is observable almost all countries at the onset of the COVID-19 pandemic in 2020, underscoring the pandemic's negative impact on the ASEAN-6 banking sector. Panel A of Table 2 clearly illustrates this downturn, with most banking sectors experiencing notable efficiency deterioration. This can be attributed to the uncertainty surrounding the pandemic's severity, which led to reduced consumer spending on retail goods and services (Mirzae et al. 2022), and a subsequent decline in investment activity and capital financing (Jiang et al. 2021).

Moreover, the crisis likely impaired banks' financial intermediation functions, as heightened uncertainty and increased asymmetric information discouraged both loan applications and approvals, particularly from quality borrowers. Consequently, banks suffered declines in key income streams such as fees and commissions tied to loan and financing portfolios. Mirzae et al. (2022) further note that declining assets under management during the pandemic contributed to reduced fee-based income, exacerbating the overall negative effect on bank efficiency. These findings reinforce the view that both economic shocks and structural factors, such as regulatory constraints, legacy technology systems, ownership structure, and limited financial

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infrastructure, shape the performance and efficiency of banking sectors across ASEAN-6 countries.

The results from Panel B, which present the Pure Technical Efficiency (PTE) scores, offer valuable insights into the managerial efficiency of the banking sectors. Among all countries, Vietnam recorded the highest average PTE score of 0.795, clearly outperforming its regional peers. This indicates that Vietnamese banks have been the most efficient in utilizing inputs to produce maximum outputs, highlighting superior management capabilities. These findings suggest that Vietnamese banks exhibit relatively stronger managerial efficiency compared to their ASEAN-6 counterparts, potentially due to improved operational strategies and internal governance reforms. This favourable outcome can be attributed to the banks' effective allocation of scarce resources, driven by a strategic focus on reducing operating expenses and embracing digital transformation.

Vietnamese banks have actively leveraged the advancements of the Industrial Revolution 4.0 (IR 4.0), including the adoption of digital banking platforms and technological innovations. This strategic shift has enabled them to streamline operations, enhance customer service, and diversify income streams. Even amid the economic disruptions caused by the COVID-19 pandemic where banks across the region faced declining interest income due to reduced financing activities, Vietnamese banks managed to sustain growth in non-interest income. This was largely due to their proactive use of digital banking applications and expansion into diversified financial services, which helped cushion the impact of the crisis. Thus, the strong PTE performance of Vietnam not only reflects efficient management practices but also showcases the resilience and adaptability of its banking sector in the face of economic uncertainty.

The scale efficiency (SE) results for the most prominent banking sectors in ASEAN-6, as presented in Panel C of Table 2, reveal substantial variation in the ability of banks to operate at an optimal scale. The Malaysian banking sector exhibits the highest average SE score (0.913), indicating only 8.7% scale inefficiency, while Vietnam's banking sector shows the lowest SE score (0.597), reflecting a significant 40.3% scale inefficiency. This wide disparity suggests that while some banking systems are approaching optimal operational scale, others are considerably lagging. A possible explanation for Vietnam's low scale efficiency lies in stringent regulatory frameworks, which may restrict market entry for new banks, impose burdensome processes for foreign banks to expand, and limit operational scope, such as prohibiting foreign bank branches from accepting retail deposits. According to Sufian (2011), such regulatory constraints may force banks to operate below their ideal size, thereby preventing them from leveraging economies of scale.

Supporting this view, Chortareas et al. (2012) find that tighter regulations are linked with reduced cost efficiency, while Wheelock and Wilson (2012) argue that limiting bank growth can lead to significantly higher operational costs, particularly for smaller banks that typically operate under increasing returns to scale (IRS). In the ASEAN-6 context, these findings suggest that banks, especially in countries like Vietnam, could lower their average cost per account by expanding their operational scale. This would allow them to spread fixed costs such as technology infrastructure and compliance systems over a broader customer base, thereby improving efficiency. In sum, while some ASEAN-6 banking sectors have made progress

Volume: 10 Issues: 77 Special Issue [October, 2025] pp. 939 - 950
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toward scale efficiency, others remain hindered by regulatory barriers. Addressing these structural limitations could be vital for enabling banks to optimize their operations and enhance overall performance.

**Development in the Return to Scale (RTS) of the ASEAN-6 Banking Sectors**

Table 2 presents the composition of banks forming the efficiency frontier in the ASEAN-6 banking sectors. Panel A shows notable variation over time, with the highest percentage of efficient banks observed in 2014 (19.88%) and the lowest in 2015 and 2020 (8.33%). The highest number of bank observations on the frontier occurred in 2014 and 2017, while 2015 and 2020 saw the fewest. Panel B highlights that Thailand and Malaysia had the most banks on the efficiency frontier, while the Philippines and Vietnam had the fewest, indicating disparities in sectoral performance across countries. These variations reflect differences in production costs and scale efficiency over time. Some large banks may have experienced decreasing returns to scale (DRS) by expanding beyond the optimal size to meet growing demand or because of excess capacity, particularly during and after the COVID-19 pandemic. The findings suggest that banks operating under constant or decreasing returns may not achieve proportional output gains with increased inputs, and as such, may need to consider scaling down to regain efficiency.

Conversely, small and newly established banks may be operating under increasing returns to scale (IRS) due to their inability to grow to the optimal size quickly. This inefficiency may stem from underutilization of production capacity despite innovation and improved production factors. Encouraging investment in R&D and human capital development in these developing economies could support banks in scaling up effectively and fostering long-term efficiency gains. Ultimately, scale inefficiency rather than poor resource utilization emerges as the primary cause of inefficiency in ASEAN-6 banking sectors. Many banks are operating at a suboptimal scale, either too small (IRS) or too large (DRS). To enhance efficiency, small banks should consider expansion or consolidation to lower costs through economies of scale, while larger banks may need to optimize their size. Regulatory authorities should carefully manage bank mergers to avoid excessive scale, ensuring sustainable performance across the sector.

Volume: 10 Issues: 77 Special Issue [October, 2025] pp. 939 - 950
Journal of Islamic, Social, Economics and Development (JISED)
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**Table 2: Developments in the Returns to Scale of the ASEAN-6 Banking Sectors**

| Panel A: Returns to Scale by Year | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | CRS | | | DRS | | | IRS | | | |
| Year | No of Bank | % Share | | No of Bank | % Share | | No of Bank | % Share | | No of Banks |
| | Observations | r% | c% | Observations | r% | c% | Observations | r% | c% | |
| 2013 | 20 | 11.17 | 10 | 153 | 85.47 | 12.39 | 6 | 3.35 | 6.82 | 179 |
| 2014 | 34 | 19.88 | 17 | 128 | 74.85 | 10.36 | 9 | 5.26 | 10.23 | 171 |
| 2015 | 14 | 8.33 | 7 | 150 | 89.29 | 12.15 | 4 | 2.38 | 4.55 | 168 |
| 2016 | 19 | 11.31 | 9.5 | 145 | 86.31 | 11.74 | 4 | 2.38 | 4.55 | 168 |
| 2017 | 31 | 18.34 | 15.5 | 124 | 73.37 | 10.04 | 14 | 8.28 | 15.91 | 169 |
| 2018 | 22 | 13.33 | 11 | 135 | 81.82 | 10.93 | 8 | 4.85 | 9.09 | 165 |
| 2019 | 23 | 13.69 | 11.5 | 116 | 69.05 | 9.39 | 29 | 17.26 | 32.95 | 168 |
| 2020 | 14 | 8.33 | 7 | 146 | 86.90 | 11.82 | 8 | 4.76 | 9.09 | 168 |
| 2021 | 23 | 13.61 | 11.5 | 140 | 82.84 | 11.34 | 6 | 3.55 | 6.82 | 169 |
| Total | 200 | | 100.0 | 1235 | | 100.0 | 88 | | | 1523 |
| **Panel B: Returns to Scale by Country** | | | | | | | | | | |
| | CRS | | | DRS | | | IRS | | | |
| Country | No of Bank | % Share | | No of Bank | % Share | | No of Bank | % Share | | No of Banks |
| | Observations | r% | c% | Observations | r% | c% | Observations | r% | c% | |
| Malaysia | 43 | 20.57 | 21.5 | 119 | 56.94 | 9.64 | 47 | 22.49 | 53.41 | 209 |
| Thailand | 45 | 22.50 | 21.3 | 138 | 65.92 | 11.90 | 28 | 12.56 | 31.82 | 211 |
| Singapore | 5 | 12.82 | 2.5 | 30 | 76.92 | 2.43 | 4 | 10.26 | 4.55 | 39 |
| Vietnam | 11 | 4.35 | 5.5 | 242 | 96.68 | 18.87 | 0 | 0.00 | 0.00 | 253 |
| Indonesia | 88 | 13.37 | 44.0 | 569 | 86.47 | 46.07 | 1 | 0.15 | 1.14 | 658 |
| Philippines | 8 | 5.23 | 4.0 | 137 | 89.54 | 11.09 | 8 | 5.23 | 9.09 | 153 |
| Total | 200 | | 100.0 | 1235 | | 100.0 | 88 | 5.78 | 100.0 | 1523 |
| r% indicates row wise (relative to the same group i.e., year and country) | | | | | | | | | | |
| c% indicates column wise (relative to the other groups i.e. year and country)<br>**Source**: Author's own calculations. | | | | | | | | | | |

## Conclusions

This research has provided a comprehensive analysis of bank efficiency across the ASEAN-6 economies, with a focus on identifying factors that contribute to variations in technical and scale efficiency. The findings reveal significant differences in efficiency levels, with countries such as Thailand and Malaysia exhibiting higher efficiency compared to the Philippines and Vietnam. These variations are partly attributable to the differences in the regulatory environment, bank size, and market conditions within each country. Notably, the impact of the COVID-19 pandemic and the rapid adoption of digital banking technologies have been critical in influencing the efficiency of banks, highlighting the need for banks to adapt to changing market dynamics.

The analysis also suggests that scale inefficiency, rather than poor resource utilization, is the primary source of inefficiency in the ASEAN-6 banking sectors. Larger banks in these economies are often operating beyond their optimal scale, resulting in decreasing returns to scale, while smaller banks face increasing returns to scale, yet struggle to grow effectively. This underlines the importance of addressing scale issues through consolidation or strategic expansion, as well as the need for careful regulatory oversight to prevent overexpansion of larger banks. Furthermore, the research emphasizes the role of technological innovation, with many banks leveraging digital banking applications to improve efficiency and reduce costs.

Volume: 10 Issues: 77 Special Issue [October, 2025] pp. 939 - 950
Journal of Islamic, Social, Economics and Development (JISED)
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While the findings offer valuable insights, it is important to note that the study is limited by the availability of data and the exclusion of other potentially influential factors, such as the specific institutional and cultural contexts of each country. Future research could expand on these findings by incorporating qualitative data to better understand the regulatory and market forces driving efficiency in the ASEAN-6 banking sector. Additionally, a deeper exploration of the impact of financial inclusion and digital banking on bank performance would provide a more holistic view of the evolving banking landscape in the region. In conclusion, the research provides valuable evidence for policymakers and banking sector stakeholders in ASEAN-6 economies. The findings highlight the need for tailored strategies to improve efficiency, particularly through optimizing bank scale and embracing digital transformation. By addressing scale inefficiency and encouraging innovation, banks can improve their competitive position and contribute to the broader economic development of the region.

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