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A Comparative Study on the Efficiency and Productivity Measurement of Islamic Banks in Indonesia, Malaysia, and Turkey

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Abstract: This study evaluates the efficiency and productivity of Islamic banks in Indonesia, Malaysia, and Turkey by analysing financial data from 27 Islamic banks over the 2013–2019 period using the Data Envelopment Analysis (DEA) and Malmquist Productivity Index (MPI) methods. Input variables include personnel expenses, administrative costs, and deposits, while output variables encompass financing and operational income. The findings reveal distinct efficiency patterns, with Turkey demonstrating the highest average efficiency and Indonesia showing the most substantial productivity growth. Key challenges were identified: financing and operational earnings in Indonesia and Malaysia, and administrative costs in Turkey. Bank BJB Syariah emerged as a benchmark in 2016, with technological advancements and efficiency improvements driving productivity growth, as reflected in the mean TFPCH scores. The Malmquist Index quadrant analysis placed Islamic banks in Indonesia and Malaysia primarily in Quadrants 3, 1, and 4. These insights underscore the need for tailored strategies to enhance performance across varied regulatory and market contexts. The study's implications extend to policymakers, regulators, and stakeholders, offering actionable recommendations for optimising operational frameworks, fostering innovation, and strengthening the role of Islamic banks in sustainable economic development.

Keywords: Islamic Bank, Efficiency, Productivity, DEA, MPI, Indonesia, Malaysia, Turkey

JEL Codes: G21, G28, O33

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INTRODUCTION

Islamic financial systems, grounded in the principles of Islamic Sharia, have witnessed rapid global development over the past few decades. This growth reflects an increasing demand for financial services aligned with Islamic ethical and moral values. The success of Islamic financial systems is evident not only in the growing number of institutions but also in the diversification of the products and services they offer. Public trust in transparency, justice, and sustainability is a cornerstone of this growth, creating a positive momentum for further expansion (Ammar et al., 2022; Asutay, 2012; Marlina et al., 2021; Nabi, 2013; Shahwan, 2014).

In response to global complexity and diverse market demands, Islamic banks have emerged as pivotal entities in the financial landscape. Their significance extends beyond meeting the financial needs of Muslim communities, contributing to sustainable economic development. Governed by principles such as the prohibition of interest (riba) and unethical business practices, Islamic banks are not just financial intermediaries but also instruments for fostering a sustainable economic ecosystem. By providing inclusive financial solutions and fair financial practices, they strengthen community access to financial services, especially in underserved regions, and contribute to equitable economic growth (Ahmed et al., 2015; Al-Roubaie, 2019; Bahrini, 2015; Gundogdu, 2020).

Indonesia, as the largest Muslim-majority country, has experienced significant expansion in its Islamic finance industry (Ascarya et al., 2022; Hersugondo et al., 2021; Marlina et al., 2021; Rusydiana et al., 2019; Mohd Salleh & Rani, 2020). Malaysia, through its proactive efforts in developing Sharia-compliant products, has established itself as a global hub for Islamic finance (Ahmad & Ansary, 2017; Amin et al., 2011; Roslan et al., 2020; Sufian, 2010; Yusof et al., 2021). Turkey, leveraging its rich historical and cultural heritage, has successfully integrated Sharia principles into its financial system (Aysan et al., 2017; Bahrini, 2015; Gün, 2020; Mutlu, 2017; Yanīkkaya & Pabuçcu, 2017).

Despite the rapid growth of Islamic banking, efficiency remains a critical concern. Expansion often introduces operational complexity and demands for higher performance standards. Islamic banks face mounting pressure to optimise their efficiency and productivity, particularly as the popularity of Islamic financial products continues to grow. Efficiency and productivity are not merely internal benchmarks but are integral to fulfilling the sector's broader promise of ethical and sustainable economic development. The issue of efficiency is important not only for the profit sector but also for the non-profit or social sector (Napitupulu et al., 2024).

This study makes two key contributions to the field. Theoretically, it advances the discourse on the efficiency and productivity of Islamic banks by employing a comparative framework that integrates Data Envelopment Analysis (DEA) and the Malmquist Productivity Index (MPI). While previous studies often examine efficiency within individual countries, this research provides a cross-country analysis encompassing Indonesia, Malaysia, and Turkey, shedding light on how internal factors (such as operational innovations and management practices) and external factors (such as regulatory environments and market dynamics) collectively influence bank performance. This multidimensional approach not only fills a significant gap in the literature but also offers a nuanced understanding of the role of context-specific variables in shaping efficiency trends.

Practically, the study provides actionable insights for policymakers, regulators, and industry stakeholders. By identifying efficiency and productivity patterns across different regulatory and market contexts, it equips decision-makers with evidence-based recommendations for enhancing the performance of Islamic banks. Furthermore, the study's findings can guide Islamic financial institutions in optimising their operational frameworks, enabling them to better navigate competitive pressures while maintaining their Sharia compliance and ethical commitments.

The unique novelty of this research lies in its comparative, longitudinal methodology that integrates advanced analytical tools to monitor efficiency and productivity trends over time. By examining how Islamic banks in diverse international settings respond to internal and external challenges, the study contributes to strengthening the role of Islamic banking as a driver of sustainable economic and financial development.

LITERATURE REVIEW

The rapid growth of Islamic banking has prompted a surge of scholarly attention, particularly in regions with significant Islamic financial systems such as Indonesia, Malaysia, and Turkey. Existing literature has contributed substantially to understanding the operational, regulatory, and economic dynamics of Islamic banking across these countries. However, a deeper, critical synthesis of this body of work is necessary to uncover gaps and contextualise this study within the broader discourse.

Islamic Banking in Indonesia

The development of Islamic banking in Indonesia continues to draw significant academic attention. Previous studies have emphasised the pivotal role of regula-

tory frameworks, such as Nastiti & Kasri (2019), who examined how these policies shape financing strategies, and Utama (2019), who provided a historical analysis of Sharia compliance within banking regulations. However, these studies often omit the practical challenges Islamic banks face in balancing compliance with operational efficiency. Ikhwan & Riani (2023) expanded this discourse by analysing efficiency trends during the COVID-19 pandemic, revealing that while stability in efficiency was maintained, there were nuanced differences between Islamic banks in Indonesia and Malaysia. Similarly, Lantara et al., (2022) reviewed the financial states of Islamic banks in Indonesia before and after the pandemic, identifying resilience despite external shocks, although inefficiencies in financing and operational income persist.

Macroeconomic contributions of Indonesian Islamic banks have also been extensively explored. Abduh & Omar (2012) and Setiawan (2019) highlighted their roles in driving sustainability in key sectors, yet detailed insights into how efficiency and productivity trends shape these contributions remain scarce. Marlina et al., (2021) and Rusydiana & Assalafiyah (2021) bridged this gap partially by discussing advancements and setbacks in productivity, linking technological changes to efficiency. Their findings underscore the importance of technological adoption, a recurring challenge for Islamic banks in Indonesia. This is further supported by studies like Mortadza et al., (2024), which highlighted the interplay between institutional quality, efficiency, and stability in Malaysia and identified comparable concerns in Indonesia, particularly regarding institutional frameworks.

Customer-centric studies, such as Yumna (2019), provided insights into financial needs through the Maslahah pyramid, emphasising market alignment. However, these discussions rarely intersect with operational challenges, leaving unexplored avenues for efficiency improvement while adhering to Sharia principles.

Islamic Banking in Malaysia

Malaysia has often served as a benchmark for Islamic banking, with foundational studies by Nasser & Muhammed (2013) and Kunhibava (2012) tracing its robust regulatory evolution. While these works describe Malaysia's legal incorporation of Islamic banking, they lack a comparative lens that might inform practices in jurisdictions like Indonesia or Turkey. Mortadza et al., (2024) addressed this by examining institutional quality and its effects on efficiency and stability, highlighting that regulatory strengths in Malaysia contribute positively but require ongoing innovation to sustain productivity growth.

Research by Haron & Ahmad (2000) and Zainordin et al., (2016) delved into organisational and market challenges, but connections between technological advancements and efficiency remain underexplored. Kamarudin & Kassim (2022) linked Islamic banking to Malaysia's economic growth, yet causative mechanisms, particularly regarding productivity and innovation, remain vague. Rusydiana & As-salafiyah (2021) reinforced these findings, emphasising that technological advancements play a crucial role in overcoming productivity stagnation across ASEAN, including Malaysia.

Islamic Banking in Turkey

Turkey's Islamic banking sector offers a contrasting landscape, characterised by unique challenges and growth potential. Foundational studies, such as Yüksel & Canöz (2017) and Egresi & Belge (2015, 2017), emphasised the sector's contributions to industrial and economic development but often neglected efficiency and productivity metrics. Gulaliyev et al., (2021) extended this perspective with a comparative analysis of the Turkish, Azerbaijani, and Iranian banking sectors, underscoring that efficiency remains a pivotal determinant of competitiveness in Turkey.

Smolo et al., (2024) provided deeper insights by using DEA methodology to measure participation banks' efficiency, identifying technology adoption and resource allocation as critical areas for improvement. Hamarat (2024) reinforced these findings, showing that participation banks in Turkey face inefficiencies relative to conventional banks, driven by limited technological integration and higher administrative costs. Similarly, Kalayci & Tekin (2016) explored macroeconomic linkages but overlooked micro-level analyses of operational performance. Yanıkkaya & Pabuçcu (2017) highlighted constraints like high costs and growth barriers, suggesting that addressing inefficiencies could unlock the sector's potential.

Gaps and Research Relevance

While existing studies provide a robust foundation, they primarily focus on individual countries or isolated aspects of Islamic banking. Cross-country comparative analyses that integrate efficiency and productivity dimensions remain scarce. Moreover, the interaction between technological advancements, regulatory frameworks, and operational performance is insufficiently explored.

This study addresses these gaps by employing Data Envelopment Analysis (DEA) and the Malmquist Productivity Index (MPI) to compare Islamic banks in Indonesia, Malaysia, and Turkey. By incorporating longitudinal data and examining

input-output variables specific to operational efficiency, this research contributes to the academic discourse on the sustainability and competitiveness of Islamic banks in diverse regulatory and market environments.

Theoretical Framework

This study is grounded in the resource-based view and efficiency theory, providing the theoretical foundation for evaluating the performance of Islamic banks in Indonesia, Malaysia, and Turkey. The resource-based view emphasizes the role of internal resources in enabling firms to achieve competitive advantage. For Islamic banks, resources such as human capital, technological infrastructure, and Sharia-compliant expertise are critical for improving operational efficiency and productivity. By analysing input variables like personnel expenses and administrative costs, this study identifies the extent to which these resources are optimally utilised to generate output variables, such as financing and operational income.

Efficiency theory complements this perspective by focusing on the effective allocation of resources to maximise outputs while minimising inputs. In the context of Islamic banking, efficiency is not merely an operational goal but also a strategic imperative given the dual compliance demands of Sharia principles and market competitiveness. Data Envelopment Analysis (DEA) and the Malmquist Productivity Index (MPI) are theoretical tools that align with efficiency theory, as they measure operational performance and productivity over time. These methodologies provide insights into technical, allocative, and total factor productivity changes, offering a holistic view of banking efficiency across the three countries.

Furthermore, this study integrates insights from institutional theory, which explains how regulatory environments shape organisational behaviour and performance. Islamic banks operate within distinct regulatory frameworks that reflect varying levels of Sharia compliance, legal maturity, and market development. Institutional theory underscores the influence of these external factors on the operational dynamics of Islamic banks, making cross-country comparative analysis essential. By combining the RBV, efficiency theory, and institutional theory, this study establishes a comprehensive framework for assessing the efficiency and productivity trends of Islamic banks, contextualising the findings within broader economic and regulatory landscapes.

DATA AND METHODOLOGY

This study applies a quantitative non-parametric approach called Data Envelopment Analysis (DEA). Originally introduced by Abraham Charnes et al., (1978) and later refined by Banker et al., (1984), DEA is used to assess the efficiency and effectiveness of organisational units. This method facilitates the evaluation of productivity or efficiency by considering multiple weighted inputs and outputs, generating a weighted output level from a given input. DEA is widely employed in efficiency studies, particularly to evaluate technical efficiency, including within financial institutions. Additionally, the DEA technique provides valuable insights into Decision-Making Units (DMUs), such as Islamic banks in Indonesia, Malaysia, and Turkey, that may not be utilising their inputs effectively, as well as identifying the underlying causes of inefficiencies in both input and output factors.

The study selected the timeframe of 2013 to 2019 for specific reasons. During this time, there was a notable phase of worldwide economic improvement following the 2008 financial crisis, and it showcasing the consistent expansion of Islamic finance during that period. The study examines how Islamic banks performed during a time when new regulations like Basel III were being enforced to enhance banking stability and when new technologies were being incorporated into financial activities. Moreover, the absence of significant external disruptions, such as the COVID-19 outbreak, enables a more detailed examination of the internal and operational factors influencing bank efficiency and productivity (World Bank, 2021). Although it does not account for newer developments, the chosen timeframe offers a solid foundation for evaluating the effectiveness of Islamic banks in the three countries under investigation.

The selection of Indonesia, Malaysia, and Turkey for the sample is based on their significant roles within the Islamic finance sector. Indonesia, as the largest Muslim-majority country, offers a critical perspective on the influence of Islamic banking in advancing financial inclusion (Ascarya et al., 2022). Malaysia, as noted by Ahmad & Ansary (2017), is recognised as a global hub for Islamic finance, boasting a well-developed regulatory framework and a robust market for Sharia-compliant products. Meanwhile, Turkey provides a unique case of successfully integrating Islamic finance within a secular legal framework, offering valuable insights for implementing Islamic banking in non-Muslim countries (Aysan et al., 2017). These diverse legal, regulatory, and market environments create a rich comparative framework for assessing the efficiency and effectiveness of Islamic banks across varying economic contexts.

This study employs Data Envelopment Analysis (DEA) to evaluate the efficiency of Islamic banks, specifically examining various scaling assumptions. In the Constant Returns to Scale (CRS) framework, the model operates under the assumption that a rise in input will result in a corresponding increase in output, indicating a consistent and straight-line production process. Nonetheless, the Variable Returns to Scale (VRS) method offers a more adaptable interpretation, demonstrating that input alterations can lead to different output levels, recognising that efficiency improvements or setbacks may not consistently correspond. This method is especially important when assessing Islamic banks, as it encompasses the intricacies of their activities, enabling a more thorough examination of performance using the intermediation approach.

In this study, the growth of Total Factor Productivity (TFP) and its components is evaluated using the Malmquist Productivity Index (MPI). It is derived from the Cobb-Douglas production function, which describes how output is relates to input factors like labour and capital. TFP calculates the combined inputs needed to generate a final product, providing a more thorough evaluation of efficiency than approaches that focus on output per worker or per machine. This method offers a more precise understanding of the effectiveness in resource utilisation.

MPI was developed by Caves et al., (1982) based on DEA principles. It consists of two main indices: the Malmquist input volume index and the Malmquist output volume index. The input quantity index measures the efficiency of a specific production unit over two different time periods, t and t+1, utilising the identical reference technology from period k for both periods. This approach enables a comprehensive assessment of productivity changes over time, making it especially valuable for evaluating the effectiveness of Islamic banks.

Likewise, the output quantity index tracks variations in output during identical time frames, aiding in the understanding of how technological advances or other factors impact the efficiency of the banking industry. The Malmquist index considers both input and output changes, making it a reliable tool for measuring productivity growth.

In Islamic banking, an MPI greater than 1 indicates increased productivity, suggesting enhancements in efficiency and technology utilization. Conversely, a value below 1 indicates a decrease in productivity, suggesting potential inefficiencies in resource utilization. When the index is at 1, it means that productivity has remained the same without any notable improvements in efficiency.

FINDINGS

Descriptive Statistics of Islamic Banks in Indonesia, Malaysia, and Turkey

Table 1 presents the descriptive statistics of input and output variables of Islamic banks in Indonesia, Malaysia, and Turkey during the period 2013-2019.

Table 1

Descriptive Statistics of Islamic Banks in Indonesia, Malaysia, and Turkey

Variable	Mean	Min	Max	Std.Dev
Input				
Deposits	88.290.062	11.217	3.020.005.202	335.423.386
Adm. Cost	943.518	154	13.355.544	2.433.330
Salaries Expense	1.963.237	1.578	37.450.479	5.473.004
Output				
Financing	126.439.068	2.768	2.341.578.337	344.214.956
Operating Income	5.115.692	934	80.564.819	14.051.548

Efficiency Panel of Islamic Banks in Indonesia, Malaysia, and Turkey

The Data Envelopment Analysis (DEA) method is applied annually to assess the efficiency of Islamic banks in Indonesia, Malaysia, and Turkey, employing a consistent frontier approach for the analysis. Table 2 presents the average values of Technical Efficiency (TE), Pure Technical Efficiency (PTE), and Scale Efficiency (SE) for Islamic banks across these three nations for the years 2013 to 2019. The data is organised into distinct panels: Panel A for 2013, Panel B for 2014, Panel C for 2015, Panel D for 2016, Panel E for 2017, Panel F for 2018, Panel G for 2019, and Panel H for the entire study period. This structured presentation facilitates a comprehensive understanding of efficiency trends over time, providing critical insights into the operational performance of Islamic banks in different economic environments.

Table 2

Efficiency Panel of Islamic Banks in Indonesia, Malaysia, and Turkey

Years/ Type of Efficiency	Mean	Min	Max	St.Dev
Panel A (2013)				
TE	0,642	0,330	1,000	0,182
PTE	0,710	0,356	1,000	0,185
SE	0,907	0,638	1,000	0,116
Panel B (2014)				
TE	0,654	0,279	1,000	0,179
PTE	0,714	0,296	1,000	0,191
SE	0,922	0,631	1,000	0,101
Panel C (2015)				
TE	0,693	0,266	1,000	0,186
PTE	0,761	0,279	1,000	0,214
SE	0,926	0,535	1,000	0,120
Panel D (2016)				
TE	0,717	0,340	1,000	0,194
PTE	0,780	0,341	1,000	0,183
SE	0,921	0,533	1,000	0,125
Panel E (2017)				
TE	0,692	0,319	1,000	0,213
PTE	0,745	0,320	1,000	0,224
SE	0,937	0,671	1,000	0,104
Panel F (2018)				
TE	0,697	0,240	1,000	0,234
PTE	0,749	0,261	1,000	0,240
SE	0,934	0,676	1,000	0,106
Panel G (2019)				
TE	0,700	0,022	1,000	0,268
PTE	0,774	0,261	1,000	0,224
SE	0,907	0,022	1,000	0,196
Panel H (All Years)				
TE	0,685	0,022	1,000	0,212
PTE	0,748	0,261	1,000	0,211
SE	0,922	0,022	1,000	0,128

The data from the table highlights the performance fluctuations experienced by Islamic banks in Indonesia, Malaysia, and Turkey over the years. The average values for Technical Efficiency (TE), Pure Technical Efficiency (PTE), and Scale Efficiency (SE) reveal interesting trends. In 2013, the lowest TE score of 0.642 was recorded, while the highest was observed in 2016 at 0.717. Similarly, the lowest average PTE score was 0.710 in 2013, and the highest was 0.780 in 2016. Furthermore, the lowest average SE score was noted in 2013 and 2019 at 0.907, with the peak occurring in 2017 at 0.937. These findings shed light on the dynamic nature of the performance of Islamic banks in these countries.

Efficiency Trends of Islamic Banks in Indonesia, Malaysia, and Turkey

The following outlines the efficiency trends of Islamic banks in Indonesia, Malaysia, and Turkey during the research period.

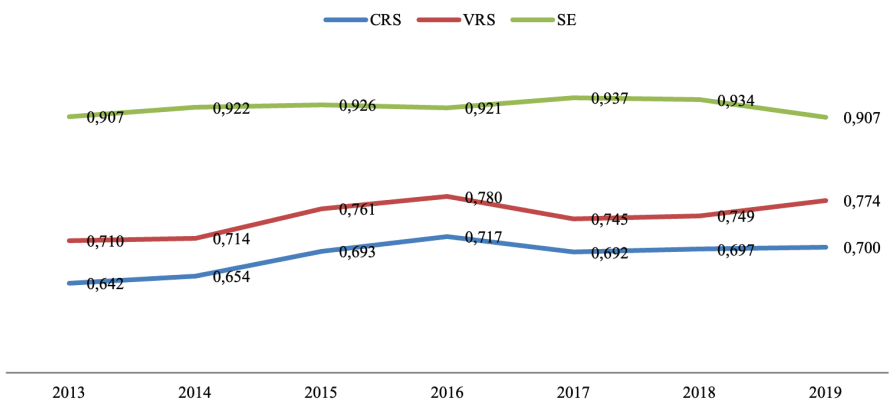

Figure 1. Efficiency Trends of Islamic Banks in Indonesia, Malaysia, and Turkey

The information presented in Figure 1 depicts the efficiency patterns of Islamic banks in Indonesia, Malaysia, and Turkey from 2013 to 2019, showing variations in their performance throughout the years. The assessment revealed that there were varying efficiency levels among all three countries, with similar trends observed under various assumptions. Efficiency decreased in 2014 but steadily increased until 2016. However, in 2017, there was a notable decrease in effectiveness overall, followed by a substantial improvement in 2018 and 2019.

In spite of fluctuations in technical and pure technical efficiency, scale efficiency remained consistent, indicating that the banks maintained an optimal scale of operations despite changes in other efficiency factors. Examining the specific

performance of Islamic banks in different countries reveals clear efficiency trends, offering important information about their operational advantages and areas that require enhancement. These patterns identify banks that exhibited greater efficiency and those that may need specific strategies to improve their performance in the ever-changing financial landscape.

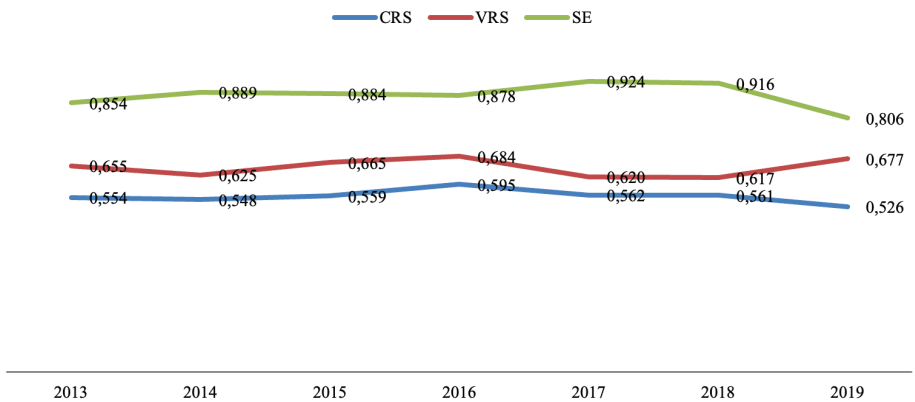

Figure 2. Efficiency Trends of Islamic Banks in Indonesia

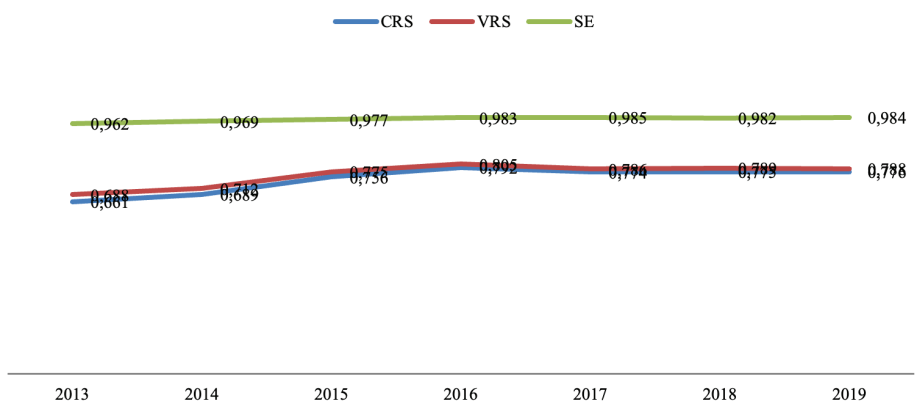

Figure 3. Efficiency Trends of Islamic Banks in Malaysia

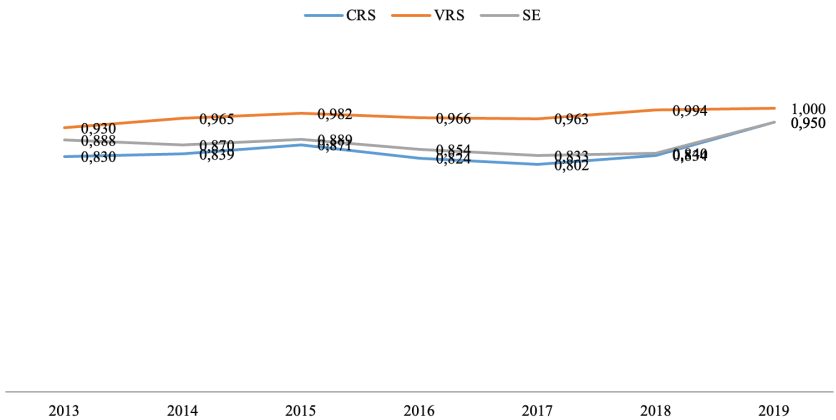

Figure 4. Efficiency Trends of Islamic Banks in Turkey

The three figures above provide an overview of the efficiency of Islamic banks in Indonesia, Malaysia, and Turkey during the research period. It can be observed that overall, the efficiency trends of Islamic banks in these three countries tend to fluctuate while also remaining stable. In Indonesian Islamic banks, the efficiency levels decreased in the periods of 2014 and 2017, with the highest efficiency score occurring in 2016. In Malaysian Islamic banks, efficiency scores showed to an upward trend and stabilised, with the highest efficiency score in the period of 2016. Lastly, in Turkish Islamic banks, the efficiency levels fluctuated and tended to stabilise, with a decrease in efficiency occurring in the period from 2016 to 2017, and the highest efficiency level reached in the period of 2019.

Potential Improvement

The analysis conducted by the DEA evaluates the efficiency levels of units and suggests improvements needed to achieve optimal efficiency. Through the process of conducting a potential improvement analysis, it is feasible to identify the specific variables in needing of optimization. This analysis examines only the latest year, disregarding previous years, in order to understand the target values that must be achieved.

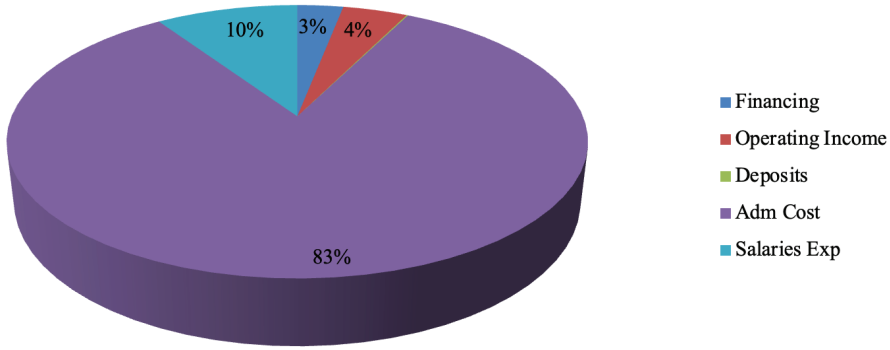

Figure 5. Potential Improvement of Islamic Banks in Indonesia

The figure above illustrates the input and output variables that lead to inefficiency in Indonesian Islamic banks. The root cause of inefficiencies in these banks lies in input variables, particularly administrative costs and salary expenses. Financing and operating income are recognised as the root causes of inefficiency on the output side. The analysis of potential improvements shows that Indonesian Islamic banks need to decrease administrative costs by 83% and salary expenses by 10% in order to achieve optimal efficiency. Moreover, they must boost financing and operating income by 3% and 4%, respectively. Consequently, we can infer that the main reason for inefficiency in Indonesian Islamic banks stems from the input factor of administrative costs.

Next, the following are the results of the potential improvement analysis for Islamic banks in Malaysia.

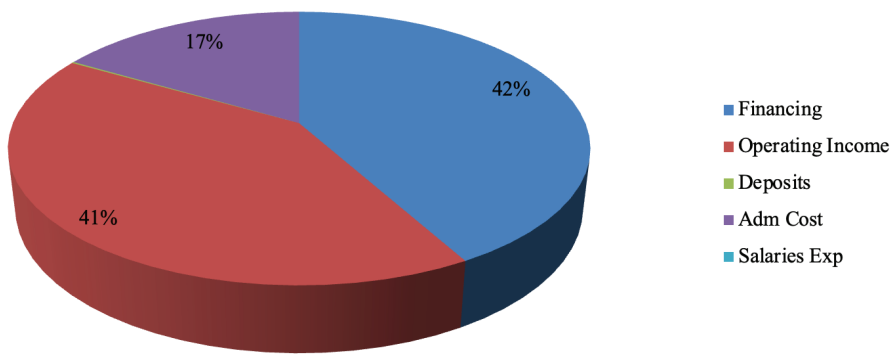

Figure 6. Potential Improvement of Islamic Banks in Malaysia

As in the previous analysis, the inefficiency in Malaysia's Islamic banks primarily stems from input variables such as administrative costs and output variables like operating income and financing. To enhance their efficiency, these banks need to reduce administrative costs by 17% and increase operating income and financing by 41% and 42%, respectively. This suggests that the greatest inefficiency for Malaysian Islamic banks lies in the financing output variable.

Furthermore, the following is the potential improvement for Islamic banks in Turkey, which has the highest efficiency level.

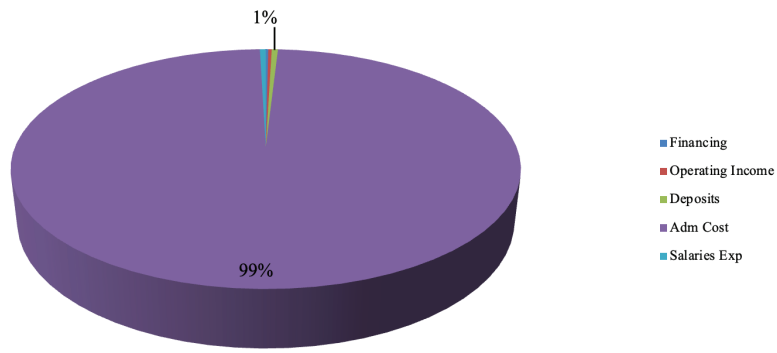

Figure 7. Potential Improvement of Islamic Banks in Turkey

To achieve optimum efficiency, based on the potential improvement results, Islamic banks in Turkey need to reduce administrative costs and deposits by 99% and 1%, respectively. This indicates that the main cause of the suboptimal efficiency level of Islamic banks in Turkey comes solely from the input variables of administrative costs and deposits. Therefore, it is crucial for Islamic banks in Turkey to pay attention to these two aspects. Similarly, other Islamic banks in Indonesia and Malaysia should also address the main causes of their low efficiency levels.

Benchmarking

The figure illustrates benchmarking, indicating five Islamic banks in Indonesia, Malaysia, and Turkey that serve as references for other banks, especially those yet to achieve optimal efficiency. Based on frontier analysis, it was found that Bank BJB Syariah in the 2016 period had the highest number of references, totalling 112. Subsequently, the bank with the next highest references was Bank Victoria Syariah in the 2019 period, with a total of 80 references. This was followed by Albaraka Türk Katılım Bankası'nı in the 2013 period with 78 references, RHB Islamic Bank Berhard in the 2018 and 2019 periods with a total of 116 references. This

explains that, individually, Islamic banks in Indonesia, Malaysia, and Turkey exhibit efficient conditions, and the efficiency of Islamic banks at the end of the research period is better than at the beginning.

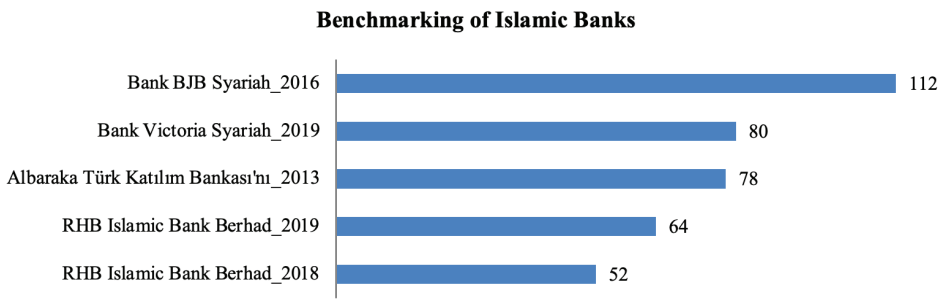

Figure 8. Benchmarking of Islamic Banks in Indonesia, Malaysia, and Turkey

Productivity of Islamic Banks in Indonesia, Malaysia, and Turkey

The table below present the results of the analysis using the Malmquist Productivity Index (MPI) of Islamic banks in Indonesia, Malaysia, and Turkey, which are the subjects of observation in this study.

Table 4

Average Malmquist Index Scores of Islamic Banks in Indonesia, Malaysia, and Turkey per Year

Year	EFFCH	TECHCH	PECH	SECH	TFPCH
2013-2014	1,224	0,525	1,142	1,072	0,643
2014-2015	0,871	1,263	0,985	0,885	1,100
2015-2016	1,016	1,059	0,919	1,105	1,076
2016-2017	1,123	0,854	1,144	0,982	0,959
2017-2018	1,000	1,208	0,996	1,003	1,208
2018-2019	1,045	1,439	1,032	1,012	1,504
Mean	1,041	1,007	1,033	1,007	1,048

The table above highlights the variations in total factor productivity (Tfpch) of Islamic banks in Indonesia, Malaysia, and Turkey, along with the key contributing factors—technological change (Techch) and efficiency change (Effch)—over the

study period. Based on the Malmquist Productivity Index (MPI) results for 27 Islamic banks across these three countries, it is evident that productivity trends fluctuated on a yearly basis. The overall average productivity showed an increase (1.048), primarily driven by technological advancements (1.007) and improvements in efficiency (1.041). These figures suggest that efficiency improvements have had a more pronounced influence on the productivity of Islamic banks in Indonesia, Malaysia, and Turkey.

A closer examination of the data reveals that productivity levels reached their lowest point (0.643) between 2013 and 2014 during the study period. This decline was largely due to a significant drop in technological innovation (0.525), although there was a notable improvement in efficiency (1.224). Following this period, productivity began to rise from 2014 to 2016, with respective values of (1.100) and (1.076). The increase in productivity was primarily attributed to technological advancements, with values of (1.263) and (1.059) for each corresponding year. However, efficiency experienced a decline in the 2014-2015 period (0.871), which subsequently recovered to 1.016 in the 2015-2016 period. This dynamic highlights the varying contributions of technology and efficiency to the overall productivity gains in the Islamic banking sector across these nations.

From 2016 to 2017, productivity levels decreased once more decreased to (0.959), due to a decline in technological advancement (0.854), while efficiency improvement continued to rise (1.123). Productivity levels rose to (1.208) in the period from 2017 to 2018 and to (1.504) from 2018 to 2019. The increase in productivity during both time frames is mainly due to advancements in technology and efficiency improvements, which also showed upward trends. The efficiency change values for these time frames were (1.000) and (1.045), with technological change rising to (1.208) and (1.439) for each period, respectively.

Further analysis can be observed from the productivity trends of Islamic banks in Indonesia, Malaysia, and Turkey, as depicted in the figure below.

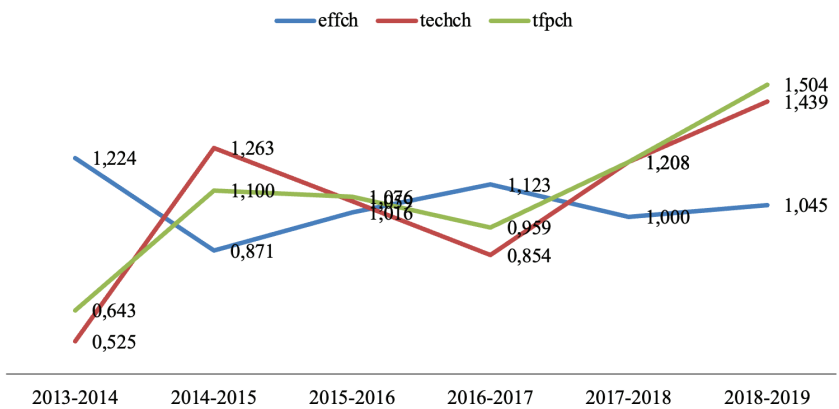

Figure 9. Productivity Trends of Islamic Banks in Indonesia, Malaysia, and Turkey

The figure shows that the productivity trends of Islamic banks in Indonesia, Malaysia, and Turkey fluctuate annually. Productivity (tfpch) increased during 2014-2015 but saw a significant drop in 2016-2017 before rising again between 2017-2019. A similar pattern is observed in technological change (techch), with declines in 2013-2014 and 2016-2017. Efficiency change (effch) decreased during 2014-2015 and 2017-2018.

In conclusion, it can be stated that technological advancements have a significant impact on improving productivity, as well as contributing to the decrease in productivity levels of Islamic banks in Indonesia, Malaysia, and Turkey. Consequently, these banks need to focus on incorporating technology into their operations in order to enhance productivity levels.

Malmquist Index Quadrants

During this phase, Islamic banks in Indonesia, Malaysia, and Turkey will be sorted into four quadrants according to their efficiency and technological advancements, indicated as either high or low. Efficiency and technology values will be evaluated in comparison to the industry average, with values above the industry average categorised as high and values below categorised as low. Islamic banks in Quadrant 1, with high efficiency and technology levels are considered to have a strong technological development. Quadrant 2 includes banks with advanced technology but poor efficiency. In Quadrant 3, banks are known for their high efficiency but lack of advanced technology. Finally, Quadrant 4 consists of banks that are classified as having low levels of technology and efficiency.

Table 5

Malmquist Index Quadrants of Islamic Banks in Indonesia, Malaysia, and Turkey

Quadrant 1 (High Efficiency, High Technology)	**Quadrant 2 (Low Efficiency, High Technology)**
Bank Victoria Syariah	
Maybank Syariah Indonesia	
OCBC Al-Amin	
Panin Dubai Syariah	
PIB Berhad	
RHB Islamic Bank Berhad	
Türkiye Finans Katılım Bankası AŞ	
Ziraat Katilim Bankasi Aş	
Quadrant 3 (High Efficiency, Low Technology)	**Quadrant 4 (Low Efficiency, Low Technology)**
Affin Islamic Bank Berhad	Bank Muamalat Malaysia Berhad
Al Rajhi Bank Berhad	CIMB Islamic Berhad
Albaraka Türk Katılım Bankası'nı	HLB Islamic Berhad
Bank BJB Syariah	KFHM Berhad
Bank Islamic Malaysia Berhad	Kuveyt Türk Katilim Bankasi Aş
Bank Mega Syariah	
Bank Syariah Bukopin	
BCA Syariah	
BMI	
BNIS	
BRIS	
BSM	
HSBC Amanah Berhad	
Maybank Islamic Berhad	

The table shows that most Islamic banks in Indonesia, Malaysia, and Turkey fall into quadrant 3, with 14 banks, followed by 8 in quadrant 1 and 5 in quadrant 4. This indicates that few banks in these countries demonstrate high productivity or fully adopt new technologies. However, efficiency levels remain relatively high, as evidenced by the banks' presence in quadrants 1 and 3, showing strong efficiency in their operations.

Findings

This study reveals several critical findings that offer valuable insights for practitioners and policymakers in the Islamic banking sector. The analysis of the efficiency of Islamic banks in Indonesia, Malaysia, and Turkey highlights significant differences across the three countries. Turkish Islamic banks consistently demonstrate higher average efficiency compared to their Indonesian and Malaysian counterparts. This finding aligns with the studies of Ada & Dalkiliç (2014), Ikhwan & Riani (2023), and Smolo et al., (2024), which suggest that Turkish banks maintain strong performance in efficiency. However, the findings also show that Indonesian and Malaysian Islamic banks experience fluctuations in efficiency, consistent with the observations of Rusydiana & Marlina (2018) and Ikhwan & Riani (2023), who report occasional efficiency declines in these countries.

The inefficiencies observed in Indonesian and Malaysian Islamic banks are primarily related to financing and operational income. These inefficiencies reflect broader issues in resource allocation and operational management, as previously noted by Ascarya & Yumanita (2008). Lantara et al., (2022) confirm that the COVID-19 pandemic exacerbated these challenges, particularly in Indonesia, highlighting the need for better funding and cost management practices. On the other hand, Turkish banks face issues with administrative costs, stemming from inefficiencies in resource utilisation and operational management (Yanikkaya & Pabuçcu, 2017; Ikhwan & Riani, 2023). These findings underline the necessity of country-specific approaches to addressing inefficiencies in Islamic banking operations.

A particularly noteworthy discovery in this study is the identification of the highest levels of efficiency at Bank BJB Syariah in 2016 and Bank Victoria Syariah in 2019. These benchmarks provide valuable insights for other Islamic banks in the region, reinforcing Noor et al., (2022) emphasis on the need for continuous improvements in operational efficiency, especially during economic disruptions (Chowdhury & Haron, 2021). Additionally, Mortadza et al., (2024) highlight the interplay of institutional quality and stability in Malaysia's Islamic banking sector, suggesting that enhancing institutional frameworks could bolster operational efficiency.

The study also examines productivity trends using the Malmquist Productivity Index (MPI), revealing a general upward trajectory in productivity for Islamic banks, driven by improvements in efficiency and technology adoption. While fluctuations in productivity were observed during 2013-2014, the overall peak in productivity occurred in 2018-2019, mirroring the findings of Jubilee et al., (2021), Nugrohowati et

al., (2020), and Hamarat (2024), who emphasise the role of technological innovation in boosting productivity. However, the results also indicate a decline in technological advancements during certain periods, emphasising the ongoing challenge of technology adoption in Islamic banking (Ahmed, 2013; Rusydiana & Assalafiyah, 2021).

Furthermore, the Malmquist quadrant analysis reveals that the majority of Islamic banks in Indonesia, Malaysia, and Turkey are positioned in quadrant 3, with 14 banks falling into this category. Additionally, eight banks are located in quadrant 1, while five banks are in quadrant 4. This distribution suggests that, despite relatively high efficiency levels across the region, only a limited number of banks achieve high productivity, particularly those effectively utilising technological innovations. Gulaliyev et al., (2021) emphasise that comparative performance analysis across regions can offer deeper insights into these discrepancies, while Smolo et al., (2024) illustrate that banks leveraging Data Envelopment Analysis (DEA) approaches tend to better identify operational bottlenecks and efficiency gaps.

The implications of these findings are far-reaching. The study underscores the need for Islamic banks in Indonesia, Malaysia, and Turkey to focus on enhancing their operational efficiency and productivity, particularly through the adoption of digital tools such as AI, blockchain, and fintech solutions. These technologies have the potential to streamline processes, reduce administrative costs, and optimise resource allocation. For policymakers and banking executives, the results emphasise the importance of creating an environment that fosters technological innovation while improving management practices in areas such as financing and administrative cost control. Regular performance evaluations and the adoption of best practices will be essential for maintaining competitiveness and delivering high-quality services in a rapidly evolving financial landscape.

While this study provides valuable insights, it also has some limitations. The analysis is based on financial data from 2013 to 2019, which does not capture the effects of recent technological advancements or regulatory changes that may have influenced the performance of Islamic banks. Additionally, the study focuses on only three countries, which limits the generalisability of the findings. Future research should address these gaps by incorporating more recent data and expanding the scope to include other regions, such as the Middle East or North Africa, to better understand the global dynamics of Islamic banking. Moreover, future studies could explore the role of emerging technologies like AI and blockchain in improving Islamic banking operations and examine how regulatory changes impact the performance of Islamic banks across different countries.

CONCLUSION

This study provides valuable insights into the efficiency and productivity of Islamic banks in Indonesia, Malaysia, and Turkey. The findings reveal fluctuations in efficiency over the years, with Turkish Islamic banks generally outperforming their counterparts in Indonesia and Malaysia. The sources of inefficiencies vary by country, with Indonesian and Malaysian banks primarily facing challenges in financing and operational income, while Turkish banks struggle with administrative costs. Additionally, technological advancements and efficiency improvements have driven productivity growth, particularly toward the end of the research period. However, the analysis indicates that Islamic banks still need to focus more on adopting technology to enhance their overall productivity.

The implications of this study are significant for both practitioners and policymakers. Policymakers can use these findings to design targeted regulations that address country-specific inefficiencies, such as encouraging technological adoption in Indonesia and Malaysia and improving resource allocation to reduce administrative costs in Turkey. For Islamic financial institutions, this research emphasizes the importance of operational improvements and technological investments to enhance competitiveness and better serve diverse market demands. Additionally, these findings contribute to the academic discourse by advancing our understanding of the dynamic efficiency and productivity trends within the Islamic banking sector in diverse regulatory and market environments.

This study is not without limitations. The analysis relies on financial data from 2013 to 2019, which may not fully reflect the impacts of recent technological innovations or regulatory changes. Furthermore, the study focuses on three specific countries, limiting its generalisability to other regions with different economic and regulatory contexts. The use of DEA and MPI methods, while effective, could be complemented by other techniques to provide a more holistic view of performance.

Future research should address these limitations by incorporating more recent data to evaluate the impacts of post-2019 developments, including technological innovations such as AI and blockchain. Expanding the scope of the analysis to include Islamic banks in other regions, such as the Middle East or North Africa, could offer a more comprehensive global perspective. Additionally, examining the interplay between regulatory frameworks and efficiency trends could provide deeper insights into optimising Islamic banking operations in various socio-economic contexts.

By addressing these gaps, future studies can build on the findings of this research to further enhance the contribution of Islamic banks to sustainable economic growth and financial inclusion.

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