Received: 20 March 2024; Revised: 12 May 2024; Accepted: 19 June 2024

THE ROLE OF FINANCIAL INCLUSION IN ISLAMIC BANK EFFICIENCY: EVIDENCE FROM ASIAN OIC COUNTRIES

Taufiq[1*]
Razali[2]
[1,2]IAIN Lhokseumawe, Aceh, Indonesia
[*]*Corresponding Email: taufiqmahmud@iainlhokseumawawe.ac.id*

ABSTRACT – The role of financial inclusion in determining the efficiency of Islamic banks remains understudied despite its significance. This study seeks to bridge this gap by introducing financial inclusion as a novel variable influencing Islamic bank performance. Analyzing panel data from Sharia banking across OIC Asian countries from Q3 2018 to Q1 2023, the research employs random effect model regression analysis (GLS) to assess the impact of financial inclusion on two efficiency measures, operational and cost efficiency. The analysis reveals that financial inclusion positively impacts cost efficiency but negatively affects operational efficiency. This indicates that financial inclusion in these banks is low due to factors such as high participation of low-income customers, interest rate restrictions, and limited product offerings by Islamic banks. In addition, cultural and economic factors also contribute to this trend. To enhance cost efficiency, it is recommended that Islamic banks improve service accessibility for customers. Furthermore, operational efficiency is positively influenced by capital adequacy, loans, profitability, and bank size, while negatively affected by banking risk. Policymakers should focus on strengthening financial infrastructure and legal systems to promote greater financial inclusion. Bank managers are advised to exercise caution in loan issuance to avoid inefficiencies, and identifying key efficiency factors is crucial for developing effective strategies for sustainability in Islamic banking.
Keywords: Efficiency, CAR, Financial Inclusion, Loan, Risk, Profitability, Bank Size

ABSTRAK – Peran Inklusi Keuangan dalam Efisiensi Bank Syariah: Bukti dari Negara-negara OKI di Asia. *Walaupun dianggap penting, peran inklusi keuangan syariah dalam menentukan efisiensi bank syariah masih belum banyak dikaji. Oleh karena itu, penelitian ini bertujuan untuk menguji pengaruh variabel inklusi keuangan syariah terhadap efisiensi bank syariah di negara-negara Organisasi Kerjasama Islam (OKI) yang ada di Asia dari kuartal 3-2018 sampai kuartal 1-2023. Penelitian ini mengumpulkan data panel dari sejumlah bank syariah di negara-negara tersebut untuk kemudian dilakukan analisis regresi dengan random effect model (GLS), menggunakan dua ukuran efisiensi, yaitu efisiensi operasional dan efisiensi biaya. Hasil penelitian menunjukkan bahwa inklusi keuangan berdampak positif terhadap efisiensi biaya tetapi berdampak negatif terhadap efisiensi operasional. Hal ini berarti bahwa rendahnya inklusi keuangan pada perbankan syariah disebabkan oleh sejumlah faktor seperti tingginya jumlah nasabah berpenghasilan rendah, pembatasan suku bunga, dan kurangnya variasi produk yang ditawarkan oleh bank syariah. Selain itu, faktor budaya dan ekonomi juga berperan signifikan terhadap hasil ini. Untuk meningkatkan efisiensi biaya, disarankan agar bank syariah meningkatkan aksesibilitas layanan bagi pelanggan. Selain itu, efisiensi operasional dipengaruhi secara positif oleh kecukupan modal, pinjaman, profitabilitas, dan ukuran bank, sementara dipengaruhi secara negatif oleh risiko perbankan. Pembuat kebijakan harus fokus pada penguatan infrastruktur keuangan dan sistem hukum untuk mendorong inklusi keuangan yang lebih baik. Pihak bank disarankan untuk berhati-hati dalam penerbitan pinjaman untuk menghindari inefisiensi, dan mengidentifikasi faktor-faktor utama yang dapat meningkatkan efisiensi sehingga dapat merumuskan strategi keberlanjutan bagi perbankan syariah.*
Kata Kunci*: Efisiensi, CAR, Inklusi Keuangan, Pinjaman, Risiko, Profitabilitas, Ukuran Bank*

INTRODUCTION

In recent decades, banking efficiency has emerged as a critical focus in developing regions, particularly Asia (Ullah, 2020). While some studies suggest that a robust banking sector significantly contributes to economic growth in countries reliant on external funding (Mirzaei & Moore, 2019), the role of financial inclusion in enhancing banking efficiency remains underexplored. This gap in the literature is concerning, as evaluating banking efficiency is not only a key topic in economic and financial studies but also essential for shaping policies that influence individual behavior and regulatory frameworks (Burki & Ahmad, 2011; Ho et al., 2021). Efficient banks, defined as those that generate optimal outcomes from available resources, are vital for driving economic development (Siregar et al., 2023; Ullah et al., 2023).

Banks play a pivotal role in advancing a nation's financial system by facilitating essential transactions such as deposits, transfers, and loans (Chang et al., 2021). Profitable banks can invest in innovative financial technologies, thus enhancing financial development. However, many developing countries face significant challenges in financial development, leading to high costs and inefficiencies within the banking sector (Ozili & Ndah, 2021).

Table 1. Global Islamic Financial Services Industry (IFSI) by Sector and Region (USD billion) in 2022

Region	Islamic Banking Asset	Islamic Funds Assets	Share (%)
Gulf Cooperation Council (GCC)	1,342.9	24.1	53.6%
South-East Asia (SEA)	307.2	32.8	23.3%
Middle East and South Asia (MESA)	478.3	62.9	18.6%
Africa	49.6	1.9	1.7%
Others	71.2	14.9	2.7%
Total	2,249.2	136.6	100.0%

(Source: Islamic Financial Services Industry, 2024)

Interestingly, despite facing ongoing challenges in the global financial environment, the Islamic Financial Services Industry (IFSI) remains robust and resilient, showing structural advancements as demonstrated in Table 1. The economic recovery and financial stability in different jurisdictions where Islamic finance is practiced pose a significant test. In 2022, the IFSI experienced a 6.9% growth in assets, highlighting its strong capitalization,

profitability, liquidity, customer financing, and contribution to economic recovery. The Islamic banking sector has also seen improved financing margins and operational efficiency thanks to the rapid digital transformation following the impact of COVID-19 (Islamic Financial Services Industry 2024).

Notably, despite the global economic slowdown, the assets of the Islamic banking sector in the Gulf Cooperation Council (GCC) region grew by 10.8% by the end of 2022, compared to 16.3% in 2021. The South-East Asia (SEA) region maintained its second position with a growth rate of 6.9% in 2022, recovering from a negative growth of -4.0% in 2021. Sharia banking assets in the Middle East and South Asia (MESA) region experienced a slight increase of 0.1% in 2022, while "other" regions recorded growth of 3.6%. The African region, however, saw a decline of -14.8% in 2022 due to significant currency depreciation in Sudan, following a growth of 19.2% in 2021.

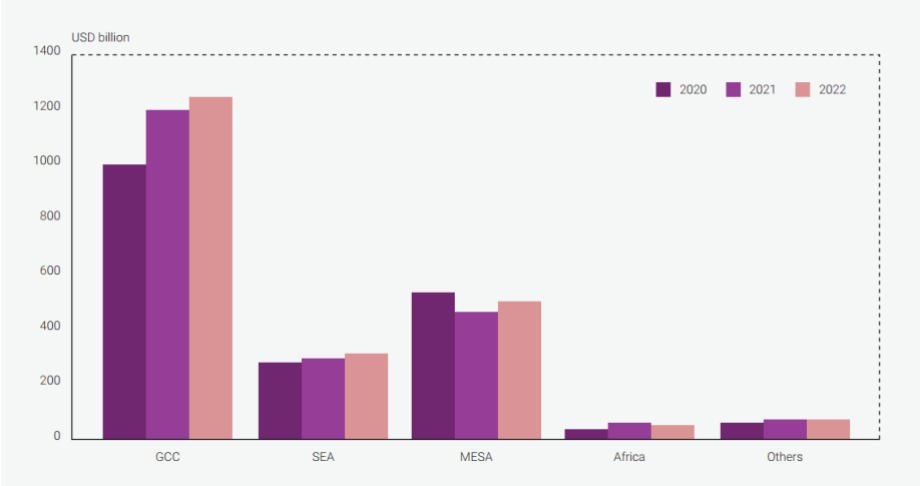

Figure 1. Regional Islamic Banking Assets (USD billion) (2020–2022)
(Source: Islamic Financial Services Industry, 2024)

The growth of the Sharia banking sector can be attributed to several factors, including an increase in market share in various countries, highlighting its emergence as a promising player in the financial sector (Bitar et al., 2020; Hidayati et al., 2017). Islamic banks differentiate themselves from conventional banks through their commitment to ethical practices, avoiding activities deemed harmful or unethical (Abdul-Majid et al., 2010). Therefore, Islamic banks offer an alternative approach to addressing diverse financial challenges.

Several studies have explored the relationship between specific factors and bank efficiency. However, current research often overlooks the crucial role of

financial inclusion. Instead, studies tend to focus on traditional factors such as capital adequacy, loan size, or bank size. Furthermore, many studies rely on a single efficiency metric, failing to capture the multifaceted nature of this concept. For instance, Sufian et al. (2016) highlighted the importance of robust capital structures in mitigating bankruptcy costs and reducing funding expenses. This perspective is supported by Řepková (2015) and Saeed et al. (2020), although Nasution et al. (2020) offer a contrasting view.

Similarly, Batir et al. (2017) found a correlation between lending activities and operational efficiency, suggesting that effective management in this area allows for competitive loan terms and increased market share. Anto et al. (2021) observed that the management costs for large and small loans are comparable in areas such as audit and notary fees. Risk management is another crucial factor. Saeed et al. (2020) determined that increased risk-taking negatively impacts cost efficiency, while Isnurhadi et al. (2021) attributed inefficiency to poor management and inadequate risk management practices. Bank size also plays a role, with larger banks typically demonstrating greater efficiency due to easier access to capital and improved resource management capabilities (Puspasari, 2020; Saeed et al., 2020; Majdina et al., 2019).

This study argues for the inclusion of new factors in evaluating bank efficiency, particularly financial inclusion, which is essential for inclusive growth. The central question is how financial inclusion affects bank efficiency. Financial inclusion involves providing all adults in a society with access to appropriate financial services that meet their needs and are offered at affordable rates (Demirguc-Kunt et al., 2017). It is seen as a process that enhances the quantity, quality, and efficiency of financial services (Babajide et al., 2015). A well-functioning financial system is more resilient to banking crises, exhibits greater stability, and is better equipped to withstand shocks without disrupting the payments system.

However, financial inclusion can present challenges in monitoring branch operations across large geographical areas, potentially impacting bank operational efficiency. Despite this, studies suggest that the benefits of financial inclusion can outweigh the costs, leading to overall improvements in banking efficiency. Some research indicates that offering financial products and services to disadvantaged companies or customers can carry risks and increase the potential for bankruptcy (Vo & Nguyen 2021; Ahamed et al. 2021; Banna and Alam 2020), others, such as Le et al. (2019), suggest a negative impact.

Islamic banks place a strong emphasis on promoting financial inclusion across various aspects of their services. Financial inclusion, which encompasses services like mobile banking, SMS banking, ATM facilities, and formal accounts, is a key focus for these institutions (Jahan et al., 2019). The overall efficiency of the Islamic banking sector relies on providing easily accessible financial services through financial inclusion to the wider community. The issue of financial inclusion has garnered significant attention from academics, researchers, and stakeholders (Banna & Alam, 2020).

As illustrated in Table 1 and Figure 1, Asia is projected to experience the fastest growth in Islamic banking in the coming decades. However, despite this favorable position and rapid growth, policymakers must address the lack of access to financial services within the region. Statistics indicate that over one billion people in Asia lack access to formal financial services, with only 27% of adults in developing Asian countries having an account at a formal financial institution. While various initiatives have been implemented to promote financial inclusion in Asia, significant challenges persist due to the region's diverse social and demographic landscape (Le et al., 2019). Consequently, the level of financial inclusion in Islamic countries must be considered when developing models (Kim et al., 2018).

Despite its importance, not many studies have been conducted investigating the impact of financial inclusion on Islamic banking efficiency, as highlighted by Kharabsheh (2023). Therefore, this study examines the influence of financial inclusion on the efficiency of Islamic banks in OIC member countries in Asia, employing dual metrics for a comprehensive analysis. The findings may provide valuable insights for policymakers and financial institutions seeking to leverage financial inclusion to enhance Islamic banking performance, particularly in addressing the lack of formal financial services for over one billion individuals in Asia.

This paper is structured into five sections. The first section introduces the research problem and outlines the objectives of the study, followed by a comprehensive review of the relevant literature. The next section details the data sources and explains the research methodology employed, and presents and analyzes the empirical findings. In the last section, this paper provides the conclusion and recommendations of the study.

LITERATURE REVIEW

Financial Inclusion and Bank Efficiency

A significant body of research has examined factors influencing bank efficiency, though few studies consider financial inclusion as a determinant. Financial inclusion is typically analyzed in relation to financial performance and stability (Ahamed & Mallick, 2019; Chahadah et al., 2020; Issaka Jajah, Anarfo, & Aveh, 2022; Shihadeh et al., 2018; Vo et al., 2021; Ibrahim & Rosniar, 2024). Despite its relevance, bank efficiency is often overlooked. The literature addressing bank efficiency can be broadly classified into studies using the financial ratio approach, Stochastic Frontier Analysis (SFA), and Data Envelopment Analysis (DEA). Studies discussing the direct link between financial inclusion and efficiency are scarce, and existing research typically treats cost efficiency and operational efficiency separately.

Various approaches to measuring financial inclusion are employed in the literature. Saputra & Abdul-Majid (2018) analyzed the impact of bank branches on cost efficiency using SFA across 70 countries between 2008 and 2016, finding that a larger number of branches increases cost efficiency, while more ATMs reduce bank fees. Ozili (2021) explored financial inclusion and risk, showing that formal accounts boost cost efficiency, but digital financial products like credit and debit cards reduce efficiency. In Jordan, Kharabsheh (2023) found that financial inclusion positively affects net interest income and negatively affects operational costs, with no effect on operating income. In India, Yadav et al. (2022) found that private sector banks are more efficient than public sector banks, a finding echoed by Agarwala et al. (2023), who used DEA to show public sector banks in India are more efficient in achieving financial inclusion goals.

Further, Mia et al. (2019) applied DEA to Bangladeshi microfinance institutions and found widespread operational inefficiency. Cong et al. (2021) revealed regional disparities in China's financial inclusion, while Mavlutova et al. (2022) identified a positive correlation between financial services intensity and reduced operational costs in European countries. Khan et al. (2022), using an efficiency index, found no significant link between financial inclusion and efficiency across developed and developing countries. Le et al. (2019) found a negative relationship between financial inclusion and efficiency in 31 Asian nations. Finally, Banna & Alam (2020) used DEA to show a positive correlation

between financial inclusion and efficiency in Islamic banks across Asia and the Middle East.

Bank-Specific Factors and Bank Efficiency

The literature also extensively explores bank-specific factors that influence efficiency. Banna & Alam (2020) highlighted the positive impact of bank size, capitalization, and profitability on efficiency, while Mia et al. (2019) showed that average loan balance and return on assets (ROA) contribute positively to efficiency, though bank age has a negative effect. Kharabsheh (2023) found that ROA and capital adequacy positively impact efficiency, while liquidity and bank size negatively influence efficiency. Yin et al. (2020), using SFA, also identified bank size and capital adequacy as positive determinants of efficiency, with asset growth reducing efficiency.

Several studies confirm the influence of capitalization. Saeed et al. (2020) demonstrated a positive relationship between capital adequacy and efficiency in Islamic banks using Seemingly Unrelated Regression (SUR). Similarly, Řepková (2015) found that higher capital adequacy improved efficiency in Czech banks, while Nasution et al. (2020) reported a negative impact of capital adequacy on the efficiency of state-owned banks in Indonesia.

Loan quality also plays a crucial role in bank efficiency. Batir et al. (2017) found a positive correlation between loan quality and efficiency in Turkish banks, while Anto et al. (2021) showed that the loan-to-asset ratio positively affects efficiency in ASEAN countries. Sufian et al. (2016) noted that bank risk is positively related to efficiency in Malaysian banks, calling for more effective risk management policies.

In terms of profitability, Goswami et al. (2019) and Riani & Maulani (2021) found a positive relationship between ROA and bank efficiency in India and Indonesia, respectively. However, Řepková (2015) and Majdina et al. (2019) reported no significant impact. Bank size also generates mixed results. While Lotto (2019) found that larger banks are more operationally efficient in Tanzania, Nainggolan et al. (2022) found a negative relationship between bank size and efficiency in Indonesia. This contradiction is further supported by Ereta et al. (2020) and Batir et al. (2017).

Research Gaps

Several weaknesses in the literature highlight the need for further research, particularly concerning the link between financial inclusion and efficiency in Islamic banks across OIC countries in Asia. Previous studies offer inconsistent findings, particularly on factors like capital adequacy, loan size, profitability, risk, and bank size. Additionally, the lack of focus on Asian Islamic banks underscores the need for more targeted research. Addressing these gaps could lead to a better understanding of how financial inclusion influences cost and operational efficiency in Islamic banking within the region.

METHODOLOGY

Research Design and Approach

This study adopts a quantitative research approach, rooted in the deductive paradigm, to test hypotheses regarding the relationship between financial inclusion, bank-specific factors, and bank efficiency in Islamic banks across Asia's Organization of Islamic Cooperation (OIC) member countries. The quantitative method is chosen to objectively measure the relationship between the variables using statistical tools, ensuring rigor in testing theoretical concepts against real-world data.

Population and Sampling

The population for this study includes all Muslim-majority countries in Asia that are members of the OIC. Due to data limitations, a purposive sampling method was employed to select a representative sample. The criteria for inclusion are as follows:

1. The country must be a member of the OIC and located in Asia.
2. The country must publish Islamic banking data from 2018 Q3 to 2023 Q1 on the official Islamic Financial Services Board (IFSB) website.

Based on these criteria, the selected sample consists of seven countries: Saudi Arabia, Brunei Darussalam, Indonesia, Oman, Kuwait, Pakistan, and Palestine. From these countries, 133 data points were collected from quarterly reports available on the IFSB website (www.ifsb.org).

Data Collection and Variables

This study uses secondary data from the IFSB for the period 2018 Q3 to 2023 Q1. The data consists of key variables related to financial inclusion, bank-specific factors, and bank efficiency. The two dependent variables are:

1. Operational Efficiency (OE): Measured as non-interest expenses divided by non-interest income.
2. Cost Efficiency (CE): Measured as non-interest expenses divided by total assets.

The independent variables include:

1. Financial Inclusion (LnATM): Measured as the natural logarithm of the total number of ATMs in each country.
2. Capital Adequacy Ratio (CAR): Measured as the ratio of total equity to total assets.
3. Loan Share (LOAN): Measured as the ratio of loans to total assets.
4. Profitability (ROA): Measured by Return on Assets (net profit divided by total assets).
5. Bank Risk (Z-Score): Measured using the formula (ROA+CAR)/σ(ROA).
6. Bank Size (LnSIZE): Measured as the natural logarithm of total assets.

The operational definitions for these variables are summarized in Table 2.

Data Analysis Technique

This study employs panel data regression to assess the impact of financial inclusion and bank-specific factors on the efficiency of Islamic banks. Panel data allows for the combination of time-series and cross-sectional data, providing a richer dataset and minimizing the risk of collinearity among variables (Gujarati, 2012).

Three tests are conducted to determine the appropriate panel data model:

1. Chow Test: To determine whether the fixed effect model is better than the common effect model.
2. Hausman Test: To compare the fixed effect model and the random effect model.

3. Lagrange Multiplier Test: To evaluate the choice between the random effect model and the common effect model.

Following the tests, the study uses a random effect model based on Generalized Least Squares (GLS) to address potential issues with classical assumptions, such as heteroscedasticity and autocorrelation. This model was chosen to provide more consistent and efficient estimates for panel data analysis, as GLS accounts for variances in the cross-sectional units and time dimensions.

Addressing Endogeneity

Endogeneity issues may arise in panel data analysis, particularly when key variables are omitted, leading to biased or inconsistent estimates. To minimize potential endogeneity, this research includes key variables—capital adequacy, financial inclusion, loan share, bank risk, profitability, and bank size—that are known to influence bank efficiency. This helps in ensuring robust and reliable results, aligning with methods used in previous studies (Lotto, 2019).

Regression Models

The study uses two distinct models to examine the relationship between financial inclusion, bank-specific factors, and efficiency:

1. Model 1: Focuses on operational efficiency (OE) and is specified as:

$$OE_{it} = \alpha + \beta_1 lnATM_{it} + \beta_2 CAR_{it} + \beta_3 Loan_{it} + \beta_4 ROA_{it} + \beta_5 ZScore_{it} + \beta_6 Size_{it} + \varepsilon_{it} \quad (1)$$

2. Model 2: Focuses on cost efficiency (CE) and is specified as:

$$CE_{it} = \alpha + \beta_1 lnATM_{it} + \beta_2 CAR_{it} + \beta_3 Loan_{it} + \beta_4 ROA_{it} + \beta_5 Zscore_{it} + \beta_6 Size_{it} + \varepsilon_{it} \quad (2)$$

Where:

- *i* indexes the country,
- *t* represents the year (time period),
- ε_{it} is the stochastic error term, and
- α is a constant term.

Variable Operationalization

Table 2 outlines the operational definitions of the variables used in this research, along with their respective notations and measurements, all sourced from IFSB data.

Table 2. Variable Operationalization

Variable	Notation	Measurement	Source
Operational Efficiency	OE	Non-interest expense to non-interest income	IFSB (Islamic Financial Services Board)
Cost Efficiency	CE	Non-interest expense to total assets	IFSB
Financial Inclusion	LnATM	Natural logarithm of total ATMs	IFSB
Capital Adequacy Ratio	CAR	Total equity to total assets	IFSB
Loan Share	LOAN	Loans to total assets	IFSB
Profitability	ROA	Net profit to total assets	IFSB
Bank Risk	Z-Score	(ROA + CAR) / δ ROA	Isnurhadi et al. (2021)
Bank Size	LnSIZE	Natural logarithm of total assets	Lotto (2019)

(Source: Data Processed, 2024)

RESULTS AND DISCUSSION

Regression Diagnostics

Before conducting the regression analysis, a series of diagnostic tests were performed to ensure the model's validity, following the methodology outlined by Lotto (2019). One of the key diagnostic tests conducted is the multicollinearity test, which assesses whether the independent variables are highly correlated with one another. Multicollinearity occurs when two or more independent variables exhibit a high degree of correlation, potentially distorting the regression estimates and leading to unreliable results.

In this study, the correlation matrix was calculated to check for multicollinearity, and the results are presented in Table 3. According to the data, the highest correlation observed among the independent variables is 0.716, which is between Return on Assets (ROA) and financial inclusion (LnATM). Although this correlation is relatively high, it does not exceed the threshold of 0.80, which is generally considered problematic in regression

analysis. Therefore, we can conclude that multicollinearity is not a serious issue in this model, allowing the analysis to proceed with confidence.

Table 3. Correlation Matrix Between Independent Variables

	CAR	**LnATM**	**Loan**	**Z-Score**	**ROA**	**Size**
CAR	1	0.641	-0.211	0.280	0.562	-0.379
LnATM	0.641	1	-0.023	0.429	0.716	-0.185
Loan	-0.211	-0.023	1	0.015	-0.283	0.300
Z-Score	0.280	0.429	0.014	1	0.231	0.285
ROA	0.562	0.716	-0.283	0.231	1	-0.129
Size	-0.379	-0.185	0.300	0.285	-0.129	1

(Source: Data Processed, 2024)

Descriptive Statistics

This section provides a detailed summary of the descriptive statistics for all the variables used in the research, giving insight into their distribution, central tendency, and variability. Table 4 presents two key variables, Operational Efficiency (OE) and Cost Efficiency (CE). OE measures the cost management of Islamic banks relative to their revenue. The data shows an average operational efficiency of 0.766 across the sample, with a minimum value of 0.204 and a maximum of 2.713. This wide range indicates significant variation in how efficiently banks in the sample manage their operations, from very efficient to highly inefficient institutions. CE has an average value of 0.023, reflecting the ratio of non-interest expenses to total assets. The minimum value of 0.0028 suggests that some banks are exceptionally cost-efficient, while the maximum value of 0.116 indicates others have relatively higher operating costs.

Independent Variables

Capital Adequacy Ratio (CAR) measures the financial health of banks by comparing equity to total assets. In the sample, the average CAR is 0.179, with a range from 0.132 to 0.263. This suggests that, while some banks are operating with minimal capital buffers, others maintain higher levels of equity relative to their assets. Financial Inclusion (LnATM), as measured by the number of ATMs, shows considerable variation across the sample. The average number of ATMs is 2,060, with a minimum of 32 and a maximum of 8,386. The large disparity reflects the differences in the scale of banking infrastructure across the OIC Asian countries.

Loan Size, represented by the ratio of loans to total assets, has an average f 0.615, indicating that loans constitute more than half of the total assets on average. The minimum value is 0.275, and the maximum is 0.887, showing that loan portfolios vary significantly in size, reflecting the diverse lending strategies across banks. Bank Risk (Z-Score), which combines profitability and capital adequacy to assess the likelihood of bank failure, has an average of 43.50. The range, from 6.62 to 90.36, suggests that while some banks face significant risk, others are far more stable.

Return on Assets (ROA), a measure of profitability, has an average value of 0.015 (1.5%), indicating modest returns on assets across the sample. The minimum value of -0.011 suggests that some banks are operating at a loss, while the maximum value of 0.037 reflects banks with strong profitability. Bank Size, measured as the natural logarithm of total assets, averages 13.92, with a range from 9.27 to 22.06. This highlights the diverse scale of Islamic banks in the sample, with some being small and others operating at a much larger scale.

Table 4: Descriptive Statistics

Variables	Mean	Maximum	Minimum	Std. Dev.	Observations
Operational Efficiency (OE)	0.766	2.713	0.204	0.487	133
Cost Efficiency (CE)	0.023	0.116	0.0028	0.0179	133
Capital Adequacy Ratio (CAR)	0.179	0.263	0.132	0.027	133
Financial Inclusion (LnATM)	2.060	8.386	32	2.728	133
Loan Size	0.615	0.887	0.275	0.161	133
Bank Risk (Z-Score)	43.50	90.36	6.62	25.09	133
Return on Assets (ROA)	0.015	0.037	-0.011	0.008	133
Bank Size (LnSIZE)	13.92	22.06	9.27	3.74	133

(Source: Data Processed, 2024)

Model Specification Testing

Following the examination of model specifications in Tables 5 and 6 (not included here), the Random Effects Model was identified as the most suitable for this research. This model is estimated using the Generalized Least Squares (GLS) method, which addresses specific challenges inherent in the data. The GLS method meets the standard assumptions in OLS and produces BLUE

estimates (Gujarati, 2012). Additionally, the descriptive statistics in Table 4 show that some maximum observation values far exceed the average, making OLS regression invalid due to violations of classical assumptions such as normality, heteroscedasticity, and autocorrelation caused by extreme values. Given the need to use these observations and the limited published data, the GLS method is applied to overcome these violations (Rivai, 2021).

Regression Results

This section presents the findings from the regression analysis using the Generalized Least Squares (GLS) technique. The results explore the impact of various independent variables on operational efficiency and cost efficiency of Islamic banks in OIC Asian countries.

Operational Efficiency (Model I)

The regression results, displayed in Table 5, examine the determinants of operational efficiency. Several key factors significantly influence operational efficiency, either positively or negatively. Capital Adequacy Ratio (CAR) has a positive and statistically significant effect on operational efficiency at the 1% significance level. A one-unit increase in CAR leads to an improvement in operational efficiency by 4.697 units. This result indicates that better-capitalized banks are more operationally efficient, possibly due to their ability to absorb shocks and reduce financial distress, leading to smoother operations.

Loan Size shows a positive and highly significant relationship with operational efficiency, also at the 1% level. A one-unit increase in loans boosts operational efficiency by 1.645 units. This suggests that banks with larger loan portfolios are able to leverage their assets more effectively, improving operational performance. Profitability (ROA) is positively associated with operational efficiency but is significant only at the 10% level. A one-unit increase in ROA increases operational efficiency by 12.75 units. Although this relationship is weaker, it suggests that more profitable banks tend to operate more efficiently, likely due to better resource management and profit optimization.

Financial Inclusion (LnATM) has a negative and significant effect on operational efficiency at the 5% level. Each additional ATM results in a 0.066 unit decrease in operational efficiency. This counterintuitive finding could indicate that while expanding ATM networks increases accessibility, it also raises operational costs without a proportional increase in efficiency. Bank Risk

(Z-Score) negatively impacts operational efficiency, with a statistically significant effect at the 1% level. An increase in bank risk by one unit reduces operational efficiency by 0.0055 units. This aligns with the expectation that higher risk leads to inefficiencies, as banks may need to divert resources toward risk management instead of core operations.

Bank Size (LnSize) shows no significant effect on operational efficiency, although it has a positive coefficient. A one-unit increase in size would theoretically increase efficiency by 0.0121 units, but the result is not statistically significant, suggesting that bank size alone does not directly enhance operational efficiency in this context.

Table 5. Panel Data Regression Results (Model I)

Variables	**Coefficient**	**T-Statistic**	**Probability**
Constant	-0.788238**	-2.297614	0.0232
Financial Inclusion (LnATM)	-0.066410**	-2.076311	0.0399
Capital Adequacy (CAR)	4.696382***	2.797894	0.0060
Loan Size (Loan)	1.644504***	7.224607	0.0000
Bank Risk (Z-Score)	-0.005476***	-3.433730	0.0008
Profitability (ROA)	12.74661*	1.964971	0.0516
Size (Size)	0.012199	1.121442	0.2642
Adjusted R-Square	**0.300687**		
F-Statistic	**10.45943***		
F-test (p-value)	**0.0000**		
Hausman test (p-value)	**0.1341**		
Breusch-Pagan (p-value)	**0.0001**		
Note: Significance levels are noted as follows: ***1%, **5%, *10%.			

(Source: Data Processed, 2024)

Cost Efficiency (Model II)

In Table 6, the results of the cost efficiency model are displayed. This model examines the same set of variables but focuses on their impact on the cost efficiency of Islamic banks. Capital Adequacy Ratio (CAR) has a positive and highly significant effect on cost efficiency at the 1% level. An increase in CAR by one unit results in a 0.474 increase in cost efficiency, emphasizing the importance of a strong capital base for managing costs effectively. Financial Inclusion (LnATM) also shows a positive and significant impact on cost efficiency at the 1% level. Each additional ATM increases cost efficiency by 0.0048 units, contrary to its effect on operational efficiency. This suggests that

the expansion of ATM networks may optimize certain cost structures even though it negatively affects operational efficiency.

Loan Size is positively and significantly related to cost efficiency at the 1% level. A one-unit increase in loans improves cost efficiency by 0.0128 units, indicating that a larger loan portfolio helps banks spread fixed costs and achieve better cost management. Bank Risk (Z-Score) has a negative and significant effect on cost efficiency at the 1% level. Each one-unit increase in risk reduces cost efficiency by 0.0005 units, highlighting the detrimental impact of higher risk on cost control and efficiency.

Profitability (ROA) has a negative and significant relationship with cost efficiency at the 1% level, unlike its positive effect on operational efficiency. A one-unit increase in ROA decreases cost efficiency by 0.365 units, possibly due to trade-offs between pursuing profitability and managing operational costs effectively. Bank Size (LnSize) has a positive and significant effect on cost efficiency at the 1% level. A one-unit increase in size leads to a 0.0025-unit improvement in cost efficiency, suggesting that larger banks benefit from economies of scale in cost management.

Table 6. Panel Data Regression Results (Model II)

Variables	**Coefficient**	**T-Statistic**	**Probability**
Constant	-0.108713***	-17.16930	0.0000
Financial Inclusion (LnATM)	0.004826***	8.174879	0.0000
Capital Adequacy (CAR)	0.474397***	15.31308	0.0000
Loan Size (Loan)	0.012856***	3.060172	0.0027
Bank Risk (Z-Score)	-0.000502***	-17.05902	0.0000
Profitability (ROA)	-0.365388***	-3.051889	0.0028
Size (Size)	0.002539***	12.64688	0.0000
Adjusted R-Square	**0.667275**		
F-Statistic	**45.12068***		
F-test (p-value)	**0.0000**		
Hausman test (p-value)	**0.1809**		
Breusch-Pagan (p-value)	**0.0001**		
Note: Significance levels are noted as follows: ***1%, **5%, *10%.			

(Source: Data Processed, 2024)

Discussion

Financial Inclusion and Operational Efficiency

The study found that financial inclusion significantly negatively affects operational efficiency. Operational efficiency is achieved when maximum profits are attained with minimal operational costs, but the negative relationship observed can be attributed to several factors. First, increased financial inclusion often involves incorporating more low-income customers into the banking system, which can introduce inefficiencies. Le et al. (2019) argue that such inclusion can increase information asymmetries, contributing to inefficiencies that are difficult to overcome.

Additionally, the negative impact may stem from regulatory constraints, such as interest rate caps, that impose pressure on banking operations. These constraints may prevent banks from covering total operational costs, resulting in inefficiency. As noted by Mia et al. (2019), even though the expansion of banking services to more customers generally improves operational efficiency, in this context, the banks may face challenges in effectively serving low-income populations without compromising efficiency.

In Muslim-majority countries, financial inclusion is also tied to the expansion of relatively costly products, such as those offered by Islamic banks. According to Saputra and Abdul-Majid (2018), Islamic banks, being relatively new in the financial market and having limited equity, face challenges in expanding operations effectively. This leads to higher costs in providing inclusive financial services. The tendency to expand services in financially excluded areas may also arise due to government policies and cultural factors, as Agarwala et al. (2023) suggest. This drives up operational costs, which in turn reduces operational efficiency.

To mitigate these inefficiencies, banks need to focus on reducing the gap between inputs and outputs. This can be achieved through the adoption of advanced technologies and enhancing employee productivity (Yadav et al., 2022). Implementing more efficient tracking mechanisms for ATM operations across geographically dispersed areas may also help reduce agency problems, which otherwise exacerbate inefficiencies (Kharabsheh, 2023). High labor costs and changes in consumer behavior due to technological advancements also contribute to the inefficiencies experienced in expanding financial inclusion (Nasution et al., 2020).

Financial Inclusion and Cost Efficiency

While financial inclusion negatively affects operational efficiency, the findings show that it positively influences cost efficiency. Cost efficiency refers to the bank's ability to minimize costs while maximizing outputs. Islamic banks must emphasize cost efficiency to maintain profitability and remain competitive. As Islamic banks grow, their focus on improving cost efficiency through the expansion of services like ATMs and other financial inclusion tools is essential. These services, being widely accessible, help absorb the risks posed by broader financial access (Isnurhadi et al., 2021).

The benefits of ATMs, such as overcoming limitations posed by traditional branch offices (e.g., limited business hours and high labor costs), also play a role in enhancing cost efficiency (Siregar et al., 2023). By automating processes and reducing dependency on manual operations, banks can reduce overhead costs, thus boosting efficiency (Berger, Hasan, and Zhou, 2010). Moreover, greater financial inclusion typically correlates with lower costs for the bank, as services such as ATMs provide affordable financial access to the public while reducing the operational costs incurred by banks (Allen et al., 2016). Thus, inclusive finance allows banks to tap into cheaper sources of funding, enhancing their overall cost efficiency.

Capital Adequacy Ratio (CAR) and Efficiency

The positive relationship between CAR and both operational and cost efficiency is in line with standard financial theory. A higher CAR signals a bank's stronger ability to absorb losses, thereby reducing its risk exposure and increasing its efficiency (Lotto, 2019). The results echo the findings of Le (2020) and Lema (2017), who argue that banks with higher capital adequacy are better equipped to avoid bankruptcy, lower their funding costs, and improve operational efficiency. These banks have more equity in their capital structure, which helps cushion against economic downturns.

In developing countries, where macroeconomic conditions are often unstable, a robust capital base is particularly critical. It enhances depositor security, shields banks from financial crises, and improves the bank's overall resilience (Sufian et al., 2016). These findings align with studies by Nainggolan et al. (2022) and Puspasari (2020), which demonstrate that a strong capital foundation helps mitigate potential future losses, promoting greater bank efficiency.

Islamic banks, in particular, benefit from maintaining higher capital adequacy due to the specific nature of their portfolios, which are largely equity-financed. As opposed to conventional banks that may struggle with liquidity and high-interest rates, Islamic banks find it easier to adjust their capital base and manage risks efficiently (Majdina et al., 2019; Sari et al., 2024; Nisak & Ibrahim, 2014).

Loan Size and Efficiency

The positive impact of loan size on both operational and cost efficiency reflects banks' ability to specialize in lending and financing, which promotes efficient operations. When banks extend more loans, they can improve their return rates and economies of scale, thereby becoming more efficient (Jiménez-Hernández et al., 2019). Efficient lending operations allow banks to manage their activities at lower costs, which leads to offering more attractive loan terms, thus increasing market share (Batir et al., 2017).

As the scale of loans increases, so does the bank's ability to generate income and improve profitability, further reinforcing operational efficiency (Anto et al., 2021). Banks that efficiently manage their loan portfolios can optimize their capital, ensuring more effective fund distribution and contributing to economic stability (Majdina et al., 2019).

Bank Risk and Efficiency

Banking risk negatively affects both operational and cost efficiency, as confirmed by the results. High-risk exposure leads to increased operational costs and inefficiency, particularly in Islamic banks where financing risks are prominent (Isnurhadi et al., 2021). High financing risks disrupt banking operations and liquidity, which in turn decreases the bank's efficiency in resource utilization (Majdina et al., 2019). Policymakers need to take more effective measures to mitigate excessive risk exposure and promote more efficient risk management within the banking sector (Sufian et al., 2016).

The findings are consistent with the bad management hypothesis, which posits that poorly managed banks with high-risk profiles are often inefficient (Sultana and Rahman, 2020). Banks facing higher market risks may cut back on risk management resources, further exacerbating inefficiencies in their operations (Ab-Hamid et al., 2017).

Profitability (ROA) and Efficiency

Profitability, as measured by return on assets (ROA), has a positive influence on operational efficiency but a negative impact on cost efficiency. The positive effect on operational efficiency suggests that highly profitable banks can better manage assets and improve operational performance. Higher profitability enables banks to attract more customers, increase fund mobilization, and reduce risks (Nasution et al., 2020; Puspasari, 2020).

However, the negative effect on cost efficiency indicates that banks with higher profits may incur greater costs in maintaining profitability, as they allocate more resources toward operations. This supports findings by Sultana and Rahman (2020) that highly profitable banks in developing economies often experience higher costs to sustain profit levels.

Bank Size and Efficiency

Bank size positively influences cost efficiency, but it does not significantly impact operational efficiency. Larger banks are generally better equipped to manage resources, adopt new technologies, and achieve economies of scale, which translates to higher efficiency (Puspasari, 2020). However, the lack of influence on operational efficiency may stem from unproductive assets that do not contribute to operational performance (Nainggolan et al., 2022).

Larger banks may also focus on expanding traditional services rather than innovating with financial inclusion offerings, which limits their operational efficiency improvements. Despite this, larger banks have the advantage of adapting more readily to new regulatory environments, unlike smaller banks that face profitability challenges under stricter regulations (Gržeta et al., 2023).

CONCLUSION

This research examines the key determinants of operational and cost efficiency in Islamic banks within OIC member states in Asia from Q3 2018 to Q1 2023, using Generalized Least Squares (GLS) analysis. The study found that Capital Adequacy Ratio (CAR) is positively linked to both operational and cost efficiency, indicating that well-capitalized banks enhance overall efficiency. Financial Inclusion has a mixed impact; it negatively affects operational efficiency due to increased participation of low-income customers but positively impacts cost efficiency by providing cost-effective financial access.

Loan Size is positively correlated with both efficiencies, as efficient loan management leads to higher returns and stronger processes. Banking Risk negatively affects both efficiencies, with high-risk exposure increasing operational costs. Profitability (measured by Return on Assets) positively influences operational efficiency, showing that more profitable banks manage assets better. Bank Size positively influences both efficiencies, as larger banks manage resources better, adopt new technologies, and benefit from economies of scale.

The findings provide important insights for Islamic banking institutions in Asia, particularly in OIC countries, highlighting the need to manage capital, loan portfolios, and risk exposures to enhance efficiency. The positive link between financial inclusion and cost efficiency underscores the importance of expanding inclusive banking services as a strategy to reduce costs and boost access to financial services. For policymakers, strengthening financial inclusion initiatives by improving financial infrastructure and legal frameworks could drive more significant efficiency gains in the banking sector. Encouraging technology adoption in banking operations can further enhance efficiency and improve customer access to financial services. For bank management, maintaining an optimal capital adequacy ratio and effectively managing risk is crucial for improving both operational and cost efficiency. Expanding the scope of financial inclusion services, while ensuring adequate controls and risk mitigation, can enhance bank performance.

This study acknowledges several limitations. Future studies should consider expanding the dataset to incorporate more countries and data over a longer period for a more comprehensive view of bank efficiency. Analyzing bank size as a moderating factor by differentiating large and small banks may yield more precise insights into the relationship between size and efficiency. Using a broader financial inclusion index to assess the varying dimensions of inclusion could offer a deeper understanding of its impact on bank efficiency. Further exploration of how technology adoption and institutional frameworks can improve the efficiency of Islamic banks, particularly in the context of financial inclusion, is also recommended.

REFERENCES

Abdul-Majid, M., Saal, D. S., & Battisti, G. (2010). Efficiency in Islamic and conventional banking: An international comparison. *Journal of Productivity Analysis*, 34(1), 25–43. https://doi.org/10.1007/s11123-009-0165-3

Ab-Hamid, M. F., Abdul-Rahman, A., Abdul-Majid, M., & Janor, H. (2017). Bank market risk and efficiency of commercial banks in Malaysia. *Jurnal Pengurusan*, 51(1), 1-12. https://doi.org/10.17576/pengurusan-2018-51-21

Abreu, E. S., Kimura, H., & Sobreiro, V. A. (2019). What is going on with studies on banking efficiency? *Research in International Business and Finance*, 47, 195–219. https://doi.org/10.1016/j.ribaf.2018.07.010

Agarwala, N., Maity, S., & Sahu, T. N. (2023). Efficiency of Indian banks in fostering financial inclusion: An emerging economy perspective. *Journal of Financial Services Marketing*. https://doi.org/10.1057/s41264-022-00203-7

Ahamed, M. M., & Mallick, S. K. (2019). Is financial inclusion good for bank stability? International evidence. *Journal of Economic Behavior & Organization*, 157, 403–427. https://doi.org/10.1016/j.jebo.2017.07.027

Ahamed, M. M., Ho, S. J., Mallick, S. K., & Matousek, R. (2021). Inclusive banking, financial regulation and bank performance: Cross-country evidence. *Journal of Banking & Finance*, 124, 106055. https://doi.org/10.1016/j.jbankfin.2021.106055

Allen, F., Demirguc-Kunt, A., Klapper, L., & Martinez Peria, M. S. (2016). The foundations of financial inclusion: Understanding ownership and use of formal accounts. *Journal of Financial Intermediation*, 27, 1–30. https://doi.org/10.1016/j.jfi.2015.12.003

Alrafadi, K. (2020). Efficiency and determinants in Libyan banks. *Archives of Business Research*, 8(4), 1–16. https://doi.org/10.14738/abr.84.8002

Anto, R., Pangestusti, I. R. D., & Purwandari, E. N. (2021). Determinants of bank efficiency in ASEAN5: Size as a control variable. *Universal Journal of Accounting and Finance*, 9(4), 542–547. https://doi.org/10.13189/ujaf.2021.090402

Babajide, A. A., Adegboye, F. B., & Omankhanlen, A. E. (2015). Financial inclusion and economic growth in Nigeria. *International Journal of Economics and Financial Issues*, 5(3), 629–637. https://doi.org/10.38157/business-perspective-review.v2i2.149

Banna, H., & Alam, M. R. (2020). Islamic banking efficiency and inclusive sustainable growth: The role of financial inclusion. *Journal of Islamic Monetary Economics and Finance*, 6(1). https://doi.org/10.21098/jimf.v6i1.1089

Batir, T. E., Volkman, D. A., & Gungor, B. (2017). Determinants of bank efficiency in Turkey: Participation banks versus conventional banks. *Borsa Istanbul Review*, *17*(2), 86–96. https://doi.org/10.1016/j.bir.2017.02.003

Berger, A. N., Hasan, I., & Zhou, M. (2010). The effects of focus versus diversification on bank performance: Evidence from Chinese banks. *Journal of Banking & Finance*, 34(7), 1417–1435. https://doi.org/10.1016/j.jbankfin.2010.01.010

Bitar, M., Pukthuanthong, K., & Walker, T. (2020). Efficiency in Islamic vs. conventional banking: The role of capital and liquidity. *Global Finance Journal*, 46, 100487. https://doi.org/10.1016/j.gfj.2019.100487

Burki, A. A., & Ahmad, S. (2011). The impact of bank governance on bank performance in Pakistan. *The Lahore Journal of Economics*, 16(Special Edition), 271–300. https://doi.org/10.35536/lje.2011.v16.isp.a12

Chahadah, A. R. A., El Refae, G. A., & Qasim, A. (2020). The impact of financial inclusion on bank performance: The case of Jordan. *International Journal of Economics and Business Research*, 20(4), 483. https://doi.org/10.1504/IJEBR.2020.111096

Chang, H.-Y., Liang, L.-W., & Liu, Y.-L. (2021). Using environmental, social, governance (ESG) and financial indicators to measure bank cost efficiency in Asia. *Sustainability*, 13(20), 11139. https://doi.org/10.3390/su132011139

Cong, L., Xi-Hua, L., Jiao, W., Sorana, V., & Anda, I. M. (2021). Financial inclusion in China: Has input-output efficiency improved? *Economic Computation and Economic Cybernetics Studies and Research*, 55(2), 43–60. https://doi.org/10.24818/18423264/55.2.21.03

Demirguc-Kunt, A., Klapper, L., & Singer, D. (2017). Financial inclusion and inclusive growth: A review of recent empirical evidence. *Financial*

Inclusion and Inclusive Growth: A Review of Recent Empirical Evidence (April). https://doi.org/10.1596/1813-9450-8040

Devi, A., & Firmansyah, I. (2020). Efficiency determinant analysis in Islamic bank in Indonesia. *Muqtasid: Jurnal Ekonomi dan Perbankan Syariah*, 11(2), 104–116. https://doi.org/10.18326/muqtasid.v11i2.104-116

Ding, N., Fung, H.-G., & Jia, J. (2020). Shadow banking, bank ownership, and bank efficiency in China. *Emerging Markets Finance and Trade*, 56(15), 3785–3804. https://doi.org/10.1080/1540496X.2019.1579710

Duguma, G. J., & Han, J. (2021). Effect of deposit mobilization on the technical efficiency of rural saving and credit cooperatives: Evidence from Ethiopia. *Annals of Public and Cooperative Economics, 92*(4), 621–647. https://doi.org/10.1111/apce.12296

Ereta, A. E., Bedada, E. Y., & Gutu, T. G. (2020). Determinants of banks' cost efficiency: A case study of selected commercial banks, Ethiopia. *Jurnal Perspektif Pembiayaan dan Pembangunan Daerah, 8*(3), 231–244. https://doi.org/10.22437/ppd.v8i3.9368

Garza-García, J. G. (2012). Determinants of bank efficiency in Mexico: A two-stage analysis. *Applied Economics Letters, 19*(17), 1679–1682. https://doi.org/10.1080/13504851.2012.665589

Goswami, R., Hussain, F., & Kumar, M. (2019). Banking efficiency determinants in India: A two-stage analysis. *Margin: The Journal of Applied Economic Research, 13*(4), 361–380. https://doi.org/10.1177/0301574219868373

Gržeta, I., Žiković, S., & Žiković, I. T. (2023). Size matters: Analyzing bank profitability and efficiency under the Basel III framework. *Financial Innovation, 9*(1), 43. https://doi.org/10.1186/s40854-022-00412-y

Gujarati, N. D. (2012). *Dasar-dasar ekonometrika*. Jakarta: Salemba Empat.

Hidayati, N., Siregar, H., & Pasaribu, S. H. (2017). Determinant of efficiency of the Islamic banking in Indonesia. *Buletin Ekonomi Moneter dan Perbankan, 20*(1), 29–48. https://doi.org/10.21098/bemp.v20i1.723

Ho, T. H., Nguyen, D. T., Ngo, T., & Le, T. D. Q. (2021). Efficiency in Vietnamese banking: A meta-regression analysis approach. *International Journal of Financial Studies, 9*(3). https://doi.org/10.3390/ijfs9030041

Ibrahim, A., & Rosniar, R. (2024). Does Intellectual Capital Efficiency Translate into Financial Performance for Islamic Banks in Indonesia? Evidence from the Pre-Pandemic Period. *Qeios*. https://doi.org/10.32388/CHBTCM.2

Idowu, E. E., & Andrew, E. O. E. (2020). Determinants of operating efficiency of Nigeria's banking sector. *Palarch's Journal of Archaeology of Egypt/Egyptology, 17*(7), 13151–13166.

Islamic Financial Services Industry. (2024). *Islamic financial services industry stability report*. Malaysia.

Isnurhadi, I., Adam, M., Sulastri, S., Andriana, I., & Muizzuddin, M. (2021). Bank capital, efficiency and risk: Evidence from Islamic banks. *Journal of Asian Finance, Economics and Business, 8*(1), 841–850. https://doi.org/10.13106/jafeb.2021.vol8.no1.841

Issaka Jajah, Y., Anarfo, E. B., & Aveh, F. K. (2022). Financial inclusion and bank profitability in sub-Saharan Africa. *International Journal of Finance & Economics, 27*(1), 32–44. https://doi.org/10.1002/ijfe.2135

Jahan, S., De, J., Jamaludin, F., Sodsriwiboon, P., & Sullivan, C. (2019). *The financial inclusion landscape in the Asia-Pacific region: A dozen key findings*. WPIEA2019079.

Jiménez-Hernández, I., Palazzo, G., & Sáez-Fernández, F. J. (2019). Determinants of bank efficiency: Evidence from the Latin American banking industry. *Applied Economic Analysis, 27*(81), 184–206. https://doi.org/10.1108/AEA-09-2019-0027

Khan, M. A., Siddique, A., & Sarwar, Z. (2020). Determinants of non-performing loans in the banking sector in developing state. *Asian Journal of Accounting Research, 5*(1), 135–145. https://doi.org/10.1108/AJAR-10-2019-0080

Khan, N., Zafar, M., Okunlola, A. F., Zoltan, Z., & Robert, M. (2022). Effects of financial inclusion on economic growth, poverty, sustainability, and financial efficiency: Evidence from the G20 countries. *Sustainability, 14*(19), 12688. https://doi.org/10.3390/su141912688

Kharabsheh, B. (2023). Does financial inclusion affect banks' efficiency? *Montenegrin Journal of Economics, 19*(4). https://doi.org/10.14254/1800-5845/2023.19-4.11

Kim, D.-W., Yu, J.-S., & Hassan, M. K. (2018). Financial inclusion and economic growth in OIC countries. *Research in International Business and Finance, 43*, 1–14. https://doi.org/10.1016/j.ribaf.2017.07.178

Le, T. T. D. (2020). Determinants of retail banking efficiency: A case of Vietcombank branches in the Mekong-Delta region. *The Journal of Asian Finance, Economics and Business, 7(7)*, 439–451. https://doi.org/10.13106/jafeb.2020.vol7.no7.439

Le, T.-H., Chuc, A. T., & Taghizadeh-Hesary, F. (2019). Financial inclusion and its impact on financial efficiency and sustainability: Empirical evidence from Asia. *Borsa Istanbul Review, 19(4)*, 310–322. https://doi.org/10.1016/j.bir.2019.07.002

Lema, T. Z. (2017). Determinants of bank technical efficiency: Evidence from commercial banks in Ethiopia. *Cogent Business & Management, 4(1)*, 1268356. https://doi.org/10.1080/23311975.2016.1268356

Lotto, J. (2019). Evaluation of factors influencing bank operating efficiency in Tanzanian banking sector. *Cogent Economics & Finance, 7(1)*, 1664192. https://doi.org/10.1080/23322039.2019.1664192

Majdina, N., Munandar, J. M., & Effendi, J. (2019). The determinant factors of efficiency on Islamic banking and conventional banking in Indonesia. *Jurnal Keuangan dan Perbankan, 23(3).* https://doi.org/10.26905/jkdp.v23i3.3157

Mavlutova, I., Spilbergs, A., Verdenhofs, A., Natrins, A., Arefjevs, I., & Volkova, T. (2022). Digital transformation as a driver of the financial sector sustainable development: An impact on financial inclusion and operational efficiency. *Sustainability, 15(1)*, 207. https://doi.org/10.3390/su15010207

Mia, M. A., Pellegrina, L. D., Van Damme, P., & Wijesiri, M. (2019). Financial inclusion, deepening and efficiency in microfinance programs: Evidence from Bangladesh. *The European Journal of Development Research, 31(4)*, 809–835. https://doi.org/10.1057/s41287-018-0188-6

Mirzaei, A., & Moore, T. (2019). Real effect of bank efficiency: Evidence from disaggregated manufacturing sectors. *Economica, 86(341)*, 87–115. https://doi.org/10.1111/ecca.12238

Nainggolan, R., Sari, D. W., & Wasiaturrahma, W. (2022). Analysis of the effect of bank size, credit risk, and capital adequacy on cost efficiency of

banks in Indonesia (SFA method). *Jurnal Ekonomi dan Bisnis, 25(2),* 321–336. https://doi.org/10.24914/jeb.v25i2.4825

Nasution, S., Siregar, H., & Novianti, T. (2020). Efficiency analysis of Bank BUMN BUKU Empat and its determinant in Indonesia. *Jurnal Aplikasi Manajemen, 18(1),* 95–104. https://doi.org/10.21776/ub.jam.2020.018.01.09

Nisak, B., & Ibrahim, A. (2014). Analisis Manajemen Risiko Pembiayaan Musyarakah Pada Baitul Qiradh Bina Insan Mandiri Banda Aceh. *Share: Jurnal Ekonomi dan Keuangan Islam, 3*(1). https://doi.org/10.22373/share.v3i1.1054

Ozili, P. K. (2021). Has financial inclusion made the financial sector riskier? *Journal of Financial Regulation and Compliance, 29(3),* 237–255. https://doi.org/10.1108/JFRC-08-2020-0074

Ozili, P. K., & Ndah, H. (2021). Impact of financial development on bank profitability. *Journal of Economic and Administrative Sciences.* https://doi.org/10.1108/JEAS-07-2021-0140

Patra, B., Padhan, P. C., & Padhi, P. (2023). Efficiency of Indian banks – Private versus public sector banks: A two-stage analysis. *Cogent Economics & Finance, 11(1).* https://doi.org/10.1080/23322039.2022.2163081

Phan, H. T., Anwar, S., & Alexander, W. R. J. (2018). The determinants of banking efficiency in Hong Kong 2004–2014. *Applied Economics Letters, 25(18),* 1323–1326. https://doi.org/10.1080/13504851.2017.1420870

Puspasari, A. (2020). Bank specific factors affecting the efficiency of regional development bank in Indonesia. *JIMFE (Jurnal Ilmiah Manajemen Fakultas Ekonomi), 6(2).* https://doi.org/10.34203/jimfe.v6i2.2325

Řepková, I. (2015). Banking efficiency determinants in the Czech banking sector. *Procedia Economics and Finance, 23,* 191–196. https://doi.org/10.1016/S2212-5671(15)00367-6

Riani, D., & Maulani, D. (2021). Determinants of banking efficiency for commercial banks in Indonesia: Two-stage data envelopment analysis. *Integrated Journal of Business and Economics, 5(3),* 258. https://doi.org/10.33019/ijbe.v5i3.369

Rivai, A. (2021). The effect of digital banking technology on bank efficiency and employee demand in Indonesian banking industry. *Volatiles & Essential Oils, 8(6),* 1029–1048.

Saeed, M., Izzeldin, M., Hassan, M. K., & Pappas, V. (2020). The inter-temporal relationship between risk, capital and efficiency: The case of Islamic and conventional banks. *Pacific-Basin Finance Journal, 62,* 101328. https://doi.org/10.1016/j.pacfin.2020.101328

Saputra, M. F. H., & Abdul-Majid, M. (2018). Financial inclusion and bank efficiency. In *Proceedings of the 1st Unimed International Conference on Economics Education and Social Science* (pp. 1294–1300). SCITEPRESS.

Sari, N., Ibrahim, A., Muzammil, M., & Muksal, M. (2024). Managing Financing Risk of Islamic Banking Products in Indonesia: A Value at Risk Approach. *Jurnal Ilmiah Islam Futura, 24*(1), 213-240. https://doi.org/10.22373/jiif.v24i1.17693

Shihadeh, F. H. A., Guan, J., ul Haq, I., & Wang, X. (2018). Does financial inclusion improve the banks' performance? Evidence from Jordan. *Global Tensions in Financial Markets, Research in Finance, 34,* 117–138. https://doi.org/10.1108/S0196-382120170000034005

Siregar, B. G., Lubis, A., & Salman, M. (2023). Efisiensi operasional bank umum syariah. *Jurnal Penelitian Ekonomi Akuntansi (JENSI), 7*(2), 264–278.

Sufian, F., Kamarudin, F., & Nassir, A. M. (2016). Determinants of efficiency in the Malaysian banking sector: Does bank origins matter? *Intellectual Economics, 10(1),* 38–54. https://doi.org/10.1016/j.intele.2016.04.002

Sultana, I., & Rahman, M. M. (2020). Determinants of bank cost efficiency: Empirical evidence from Bangladesh. *International Journal of Banking and Finance, 15.* https://doi.org/10.32890/ijbf2020.15.1.9931

Thi My Phan, H., Daly, K., & Akhter, S. (2016). Bank efficiency in emerging Asian countries. *Research in International Business and Finance, 38,* 517–530. https://doi.org/10.1016/j.ribaf.2016.07.012

Ullah, S. (2020). Role of corporate governance in bank's efficiency in Pakistan. *Studies in Business and Economics, 15(1),* 243–258. https://doi.org/10.2478/sbe-2020-0018

Ullah, S., Majeed, A., & Popp, J. (2023). Determinants of bank's efficiency in an emerging economy: A data envelopment analysis approach. *PLOS ONE, 18(3),* e0281663. https://doi.org/10.1371/journal.pone.0281663

Vo, D. H., & Nguyen, N. T. (2021). Does financial inclusion improve bank performance in the Asian region? *Asian-Pacific Economic Literature, 35(2),* 123–135. https://doi.org/10.1111/apel.12330

Vo, D. H., Nguyen, N. T., & Van, L. T. H. (2021). Financial inclusion and stability in the Asian region using bank-level data. *Borsa Istanbul Review, 21(1),* 36–43. https://doi.org/10.1016/j.bir.2020.06.003

Yadav, M., Sahu, T. N., & Maity, S. (2022). Financial inclusion and bank efficiency: Evidence from data envelopment analysis. *Colombo Business Journal, 13(1),* 141–169. https://doi.org/10.4038/cbj.v13i1.92

Yin, H., Yang, J., & Lu, X. (2020). Bank globalization and efficiency: Host- and home-country effects. *Research in International Business and Finance, 54,* 101305. https://doi.org/10.1016/j.ribaf.2020.101305