AT-TIJARAH: Jurnal Penelitian Keuangan dan Perbankan Syariah
Volume 7, Issue 1, July-Desember 2025
P-ISSN : 27215482
E-ISSN :2745-5696
PBS IAIN Lhokseumawe

APA YANG MENDORONG EFISIENSI BPRS? KAJIAN INKLUSI, KARAKTERISTIK, DAN FAKTOR MAKROEKONOMI

WHAT DRIVES BPRS EFFICIENCY? A STUDY OF FINANCIAL INCLUSION, BANK CHARACTERISTICS, AND MACROECONOMIC FACTORS

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Abstract

Islamic Rural Banks (BPRS) in Indonesia face persistent challenges in achieving optimal operational efficiency, which is crucial for their sustainability and ability to serve the unbanked population. However, the factors driving this efficiency remain underexplored, especially in relation to financial inclusion, internal bank characteristics, and macroeconomic dynamics. This study aims to examine whether financial inclusion, bank-specific factors (capital adequacy ratio, profitability, and default risk), and macroeconomic variables (inflation and exchange rate) influence the operational efficiency of BPRS, as measured by the Operating Efficiency Ratio (OER). Utilizing time series data from January 2014 to June 2024 and applying the ARDL approach, the results reveal that only the exchange rate (in the short term) and capital adequacy ratio (in the long term) significantly affect efficiency. In contrast, financial inclusion, profitability, default risk, and inflation do not show a statistically significant impact in either time frame. Practically, these findings indicate that BPRS managers should prioritize strengthening internal capital structures and managing exposure to exchange rate fluctuations, rather than relying solely on expanding financial inclusion or profitability improvements to enhance efficiency. Theoretically, the results highlight the limited role of financial inclusion in directly boosting operational performance without sufficient institutional readiness, and underscore the

importance of internal and short-term external factors in shaping efficiency. This research contributes to the limited empirical literature on Islamic rural banking by integrating financial inclusion, risk, and macroeconomic perspectives in a dual short- and long-term framework, specifically within the underexplored context of BPRS. The insights provided are valuable for policymakers and Islamic bank managers in formulating effective strategies to optimize efficiency.
Keyword : *Operational Efficiency; Financial Inclusion; Bank-Specific factors; Macroeconomics.*

Abstrak

Bank Pembiayaan Rakyat Syariah (BPRS) di Indonesia menghadapi tantangan berkelanjutan dalam mencapai efisiensi operasional yang optimal, yang sangat penting bagi keberlanjutan dan kemampuannya melayani masyarakat unbanked. Namun, faktor-faktor yang mendorong efisiensi ini masih kurang dieksplorasi, terutama terkait inklusi keuangan, karakteristik internal bank, dan dinamika makroekonomi. Penelitian ini bertujuan untuk menguji apakah inklusi keuangan, faktor spesifik bank (rasio kecukupan modal, profitabilitas, dan risiko gagal bayar), serta variabel makroekonomi (inflasi dan nilai tukar) memengaruhi efisiensi operasional BPRS yang diukur dengan Operating Efficiency Ratio (OER). Dengan menggunakan data deret waktu dari Januari 2014 hingga Juni 2024 dan pendekatan ARDL, hasil penelitian menunjukkan bahwa hanya variabel nilai tukar (dalam jangka pendek) dan rasio kecukupan modal (dalam jangka panjang) yang berpengaruh signifikan terhadap efisiensi. Sebaliknya, inklusi keuangan, profitabilitas, risiko gagal bayar, dan inflasi tidak menunjukkan pengaruh signifikan baik dalam jangka pendek maupun panjang. Secara praktis, temuan ini mengindikasikan bahwa manajemen BPRS perlu memprioritaskan penguatan struktur permodalan internal dan pengelolaan risiko fluktuasi nilai tukar, daripada hanya mengandalkan perluasan inklusi keuangan atau peningkatan profitabilitas untuk meningkatkan efisiensi. Secara teoretis, hasil ini menyoroti peran terbatas inklusi keuangan dalam mendorong kinerja operasional tanpa kesiapan institusional yang memadai, serta menegaskan pentingnya faktor internal dan eksternal jangka pendek dalam membentuk efisiensi. Penelitian ini berkontribusi pada literatur empiris yang masih terbatas mengenai perbankan syariah pedesaan dengan mengintegrasikan perspektif inklusi keuangan, risiko, dan makroekonomi dalam kerangka jangka pendek dan panjang, khususnya pada konteks BPRS yang masih jarang diteliti. Temuan ini memberikan masukan berharga bagi pembuat kebijakan dan manajer bank syariah dalam merumuskan strategi optimalisasi efisiensi..
Kata kunci: Efisiensi Operasional; Inklusi Keuangan; Faktor Spesifik Bank; Makroekonomi.
DOI: 10.52490/at-tijarah.v7i1.6027

INTRODUCTION

Inclusive and sustainable economic development has become a critical agenda for developing countries, including Indonesia (Kamran et al., 2023; Ramadhan & Fauzi, 2023). Within this framework, the financial sector plays a pivotal role as an intermediary capable of stimulating the real economy and fostering economic growth (Ofoeda et al., 2024). One of the key indicators of an effective financial intermediation system is banking efficiency, as efficient banks can channel funds to society at lower costs and provide better service quality. Efficiency becomes even more crucial for Islamic Rural Banks (BPRS) in Indonesia, which operate in regions with unique societal characteristics and economic challenges (Masrizal et al., 2023).

Research on banking efficiency has often focused on larger, conventional banks, with less attention given to smaller, specialized institutions like Islamic Rural Banks (BPRS) (Abdul-Majid et al., 2010; Jatmiko, 2017; Noversyah et al., 2022). However, these microfinance institutions are vital in advancing financial inclusion, especially in

rural and underserved areas, providing essential financial services to populations excluded from conventional banking (Hassan, 2015). Despite their relatively small operational scale, BPRS significantly expands access to financial services for the unbanked and underbanked populations. Evaluating the factors influencing BPRS efficiency is critical from the internal bank perspective and external factors such as financial inclusion and macroeconomic conditions (Adelaja et al., 2024).

Empirical data reinforce the importance of these variables. For example, Razali et al. (2024) found that financial inclusion positively affects cost efficiency but can negatively impact operational efficiency in Islamic banks across OIC countries, including Indonesia, due to the dominance of low-income clients and limited product accessibility. In Indonesia, the operational efficiency ratio (BOPO) of Islamic microfinance institutions remains relatively high, indicating ongoing efficiency challenges despite growth in third-party funds and microfinancing. The 2024 National Survey on Financial Literacy and Inclusion (SNLIK) by OJK and BPS reports Indonesia's financial inclusion index at 75.02%, below the 98% national target for 2045, while the financial literacy index is 65.43%. This gap between inclusion and literacy can hinder the efficiency of BPRS, as lower literacy levels may lead to inefficient use of financial services (Otoritas Jasa Keuangan, 2024)

The internal characteristics of banks, including risk aversion, profitability, and default risk, also play crucial roles in shaping operational efficiency (Devi & Firmansyah, 2020; Kamarudin et al., 2019; Lotto, 2018, 2019; Silvan, 2024). BPRS with high-risk aversion may adopt conservative lending practices, reducing their ability to maximize profit, which could, in turn, impact efficiency (Avinadav & Bunker, 2022). On the other hand, high profitability typically reflects a bank's capacity to generate returns on assets, which can help cover operational costs and improve efficiency (Lotto, 2018). However, higher default risks can have a negative impact by increasing the risk of non-performing loans (NPLs), which require more resources to manage and reduce overall efficiency. The balance between risk management and profitability is crucial for BPRS, which must ensure that it remains financially sustainable while serving communities with limited access to formal financial services (Zamore et al., 2023). Supporting this, Zamore et al. (2023) found that higher non-performing financing (NPF) and operational inefficiency (BOPO) significantly reduce BPRS performance, while capital adequacy ratio (CAR), although significant, can negatively affect performance if not optimally managed. Other studies confirm that risk profile (NPF & FDR), profitability (ROA), and capital (CAR) are statistically significant determinants of BPRS efficiency, with higher ROA linked to improved efficiency, while high NPF and BOPO increase the risk of financial distress.

Lastly, macroeconomic factors, including inflation and exchange rates, can significantly influence the operational efficiency of BPRS (Chen & Lu, 2021; Fang et al., 2019; Ilmiani & Meliza, 2022; Mamonov et al., 2024). High inflation can increase operational costs, reduce public purchasing power, and reduce demand for financial products (Hang et al., 2020). The latest inflation data from the Central Bureau of Statistics (BPS) shows that Indonesia's inflation rate reached 3.05% in March 2024, the highest in seven months (Sulaiman & Suroyo, 2024). This increase was driven by rising food prices during Ramadan, which put pressure on the operational costs of BPRS and affected the purchasing power of consumers, particularly in rural areas where

inflationary pressures are often more pronounced. Additionally, fluctuations in exchange rates can create uncertainty in financial markets and impact the stability of BPRS, especially if they have foreign-denominated liabilities or exposure to international financial markets (Al-Thaqeb et al., 2022).

Empirical studies support these observations. Fakhrunnas et al. (2022) demonstrated that inflation and other macroeconomic variables significantly affect the efficiency of Islamic banks in Indonesia, where rising inflation increases costs and non-performing financing. Exchange rate volatility similarly affects operational stability, especially for banks with foreign currency exposure. Recent analyses indicate that exchange rate, CAR, and ROA contribute positively to BPRS financial stability, while credit risk and inflation negatively impact efficiency.

The challenge of maintaining operational efficiency while pursuing social objectives, such as promoting financial inclusion, is unique to Islamic Rural Banks. One significant issue in banking efficiency is the trade-off between social goals and financial performance (Wijesiri et al., 2019). Islamic banks, including BPRS, are often tasked with balancing profit generation with fulfilling social responsibilities in line with Islamic principles. This creates additional challenges in ensuring that financial products remain accessible to low-income communities without compromising the sustainability and profitability of the institution (Wanof, 2023). The cost of delivering services in rural areas and the relatively small scale of operations can further exacerbate these efficiency challenges. Therefore, BPRS must find innovative ways to maintain efficiency while fulfilling financial and social missions (Hakim & Ab Rahim, 2024). On average, the efficiency level of BPRS in Indonesia, as measured by Stochastic Frontier Analysis (SFA), reached 81.41% in 2011–2012, with considerable variation among banks. Most BPRS are categorized as moderately efficient, but a notable proportion remain inefficient, highlighting the ongoing need for improvements in both internal management and adaptation to macroeconomic dynamics.

The issue of banking efficiency is the relationship between financial inclusion and efficiency (Banna et al., 2023; Khan et al., 2022; Kharabsheh, 2023; Mavlutova et al., 2022). As the reach of financial services expands, especially in rural areas, more individuals and businesses can access financial products, which can drive up transaction volumes and reduce costs (Ndung'u, 2018). This increase in transactions can directly enhance banks' operational efficiency. In the case of BPRS, financial inclusion plays a pivotal role, as these banks are specifically tasked with providing access to financial services for rural populations otherwise excluded from mainstream banking (Akasumbawa et al., 2024). When financial inclusion levels rise, so too can the efficiency of these institutions, as they gain access to a larger customer base and operating costs per customer decrease (Ozili, 2021).

According to the 2024 National Survey on Financial Literacy and Inclusion (SNLIK) by the Financial Services Authority (OJK) and BPS, Indonesia's financial inclusion index stands at 75.02%, improving but falling short of the 98% target set for 2045 (Otoritas Jasa Keuangan, 2024). This gap highlights a significant opportunity for BPRS to expand its role in driving financial inclusion in rural areas. However, a key challenge is that financial literacy remains low, with a financial literacy index of 65.43%. This discrepancy between inclusion and literacy affects the efficiency of BPRS,

as lower literacy can result in inefficiencies in the utilization of financial services (Otoritas Jasa Keuangan, 2024).

This research aims to empirically analyze the impact of financial inclusion, bank characteristics, and macroeconomic factors on the efficiency of BPRS in Indonesia. By examining these factors comprehensively, this study seeks to contribute to the literature on microfinance banking, particularly in Islamic finance. It also aims to provide practical insights for policy-makers and BPRS management. It enables them to design strategies that improve efficiency and financial inclusion, fostering sustainable economic development in Indonesia's rural and underserved areas.

THEORETICAL FRAMEWORK AND HYPOTHESIS

The concept of banking efficiency is rooted in the broader discourse of financial intermediation, which refers to the process by which banks mobilize savings and allocate credit to productive sectors of the economy. In this context, efficiency implies banks' ability to minimize costs while maximizing outputs, such as financial services delivery. Three main theoretical perspectives underpin the analytical framework of this study: Intermediation Theory, Efficiency Theory, and Financial Development Theory (Alam et al., 2022; Ashraf, 2018; Musau et al., 2017; Sulaiman & Suroyo, 2024). Intermediation Theory posits that financial institutions are intermediaries between savers and borrowers, facilitating resource allocation and liquidity transformation (Gbadebo, 2024). Efficient intermediation reduces transaction costs and information asymmetries, creating a more effective and inclusive financial system (Okello Candiya Bongomin et al., 2018). In the context of Islamic Rural Banks, efficiency is essential for reaching underserved rural populations, offering Shariah-compliant financial services with minimal costs.

Efficiency Theory, particularly X-efficiency theory emphasizes managerial behavior and the internal organization of firms in determining cost-efficiency (T. Ayoola et al., 2023). It posits that inefficiencies may not always stem from technological constraints but from managerial inefficiencies, poor risk assessment, or operational rigidities (Aral et al., 2023). In the case of BPRS, which operates in niche markets with limited infrastructure and human resources, such internal factors play a substantial role in determining performance. Financial Development Theory highlights the role of a well-functioning financial system in fostering economic growth. It argues that inclusive and efficient financial systems promote resource allocation, increase investment, and stimulate entrepreneurship. When banks such as BPRS operate efficiently within an inclusive financial ecosystem, they can play a transformative role in local economic development and poverty alleviation (Erlando et al., 2020).

Financial Inclusion and Efficiency

Financial inclusion is critical to bank efficiency, especially in rural and underserved regions (Jain et al., 2024). As more individuals and small enterprises gain access to formal financial services, banks benefit from an expanded depositor and borrower base, leading to higher transaction volumes and reduced average costs. This scale effect enhances cost efficiency as fixed costs, such as administrative expenses and staffing, are spread over more clients. In the case of BPRS, which often faces high

operational costs due to its localized nature and the small scale of transactions, greater financial inclusion can significantly improve operational leverage (Pomeroy et al., 2020).

Moreover, financial inclusion can reduce information asymmetry by integrating more individuals into formal financial systems where their financial behaviors can be tracked and assessed. This facilitates more accurate risk profiling and credit scoring, reducing default rates and enabling better portfolio management (Berhanu Lakew & Azadi, 2020). As BPRS strives to balance its social mission with sustainability, financial inclusion enhances both outreach and efficiency, ensuring that expanding access does not come at the cost of operational viability (Mia et al., 2019). Thus, the proposed hypothesis is as follows:

H_1: Financial inclusion positively impacts the efficiency of Islamic Rural Banks in Indonesia.

Bank Characteristics and Efficiency

The level of capital adequacy reflects a bank's buffer against financial shocks and its risk-taking behavior (Berhanu Lakew & Azadi, 2020). According to the theory of risk-return trade-offs, highly capitalized banks tend to be more conservative in their lending practices. While this prudence protects against potential losses, excessive risk aversion may hinder revenue-generating opportunities (Alimuddin, 2020). For BPRS, which often rely on murabahah and other profit-and-loss sharing contracts, being overly risk-averse may limit financing activity, particularly in risky sectors, such as agriculture and microenterprises (Wasiaturrahma et al., 2020). Conversely, sufficient capital levels can also be considered a facilitator of efficiency when managed optimally. A well-capitalized BPRS has more freedom to innovate, absorb short-term losses, and invest in systems that reduce operational inefficiencies. However, if the capital buffer leads to managerial complacency or unnecessarily conservative lending, it may reduce efficiency through underutilization of available financial resources (Jokipii & Milne, 2011). Thus, the proposed hypothesis is as follows:

H_2: Risk Aversion significantly impacts Islamic Rural Banks' efficiency in Indonesia.

Profitability, often measured by Return on Assets (ROA), directly indicates how efficiently a bank uses its assets to generate earnings. High profitability suggests effective cost management, prudent financial intermediation, and successful asset-liability matching (Guzel, 2021; Subagio et al., 2024). In the case of BPRS, a higher ROA may imply that the institution is successfully deploying its limited resources, translating into better efficiency ratios. In addition, profitability enables banks to reinvest in technology, human capital, and infrastructure—factors that further enhance operational efficiency (Rekik et al., 2018). For BPRS, which frequently operates in resource-constrained environments, profitability provides the necessary cushion to navigate financial shocks and expand outreach without compromising cost-effectiveness. Thus, the relationship between profitability and efficiency will likely be strongly positive (Petria et al., 2015). Thus, the proposed hypothesis is as follows:

H_3: Profitability positively impacts the efficiency of Islamic Rural Banks in Indonesia.

High levels of non-performing financing are a significant impediment to efficiency. When borrowers fail to repay their obligations, banks incur costs not only in terms of lost income but also due to the additional resources required for monitoring,

collection, and legal proceedings (Sari et al., 2022). The challenge of operating credit risk is particularly acute serves BPRS, which operates on trust-based contracts and often serves informal sectors with less collateral. Moreover, elevated NPF ratios reduce the availability of funds for new financing, forcing banks to either retain excess liquidity or borrow at higher costs. Both scenarios impair efficiency by reducing income-generating potential while maintaining or even increasing operational expenses. Therefore, strong risk management and credit appraisal mechanisms are vital for maintaining low default rates and ensuring efficiency in BPRS operations (Muhammad, 2019). Thus, the proposed hypothesis is as follows:

H_4: Default risk negatively impacts the efficiency of Islamic Rural Banks in Indonesia.

Macroeconomic Factors and Efficiency

Inflation poses a dual challenge to banking efficiency. On the one hand, it increases banks' operating costs, wages, utilities, and other overheads which can erode profit margins if not accompanied by proportional income growth. On the other hand, inflation reduces the real value of repayments received from borrowers, especially in long-term contracts, diminishing real income (Naili & Lahrichi, 2022). For BPRS, inflation also affects their clients' purchasing power, leading to reduced demand for financing and increased risk of default. This macroeconomic pressure is particularly problematic for institutions that work with low-income clients in rural areas whose consumption patterns are susceptible to price changes (Jiménez-Hernández et al., 2019). As a result, inflation is expected to hurt negatively and impact BPRS efficiency through supply-side and demand-side channels (Ilmiani & Meliza, 2022). Thus, the proposed hypothesis is as follows:

H_5: Inflation negatively impacts the efficiency of Islamic Rural Banks in Indonesia.

Although BPRS are domestically oriented and rarely engage in foreign currency transactions, exchange rate volatility can still affect their efficiency indirectly. For instance, fluctuations in the rupiah may impact the prices of imported goods and inputs, increasing operational and living costs for clients and thereby reducing repayment capacity. Additionally, macroeconomic instability signaled by exchange rate fluctuations can affect depositor confidence and liquidity management (Wulandari & Harjito, 2021). Furthermore, depreciation in currency value can increase inflationary pressure, further compounding its adverse effect on efficiency. Therefore, stable exchange rates contribute to a predictable business environment, which is essential for rural banks' effective planning and operation (Mamonov et al., 2024). Thus, the proposed hypothesis is as follows:

H_6: The exchange rate negatively impacts the efficiency of Islamic Rural Banks in Indonesia.

RESEARCH METHOD

Data and Variables

This study adopts a quantitative approach utilizing monthly time series data from January 2014 to June 2024. The data are secondary and sourced from credible institutions,

including the Financial Services Authority, Bank Indonesia (BI), and the Ministry of Trade of the Republic of Indonesia. The dependent variable in this research is the operational efficiency of Islamic Rural Banks (BPRS), measured by the Operating Expense to Operating Income (OER) ratio, where a lower ratio indicates higher efficiency. The independent variables consist of financial inclusion (measured by the Financial Inclusion Index), bank-specific characteristics (Capital Adequacy Ratio, Return on Assets, and Non-Performing Financing), and macroeconomic factors (inflation rate and exchange rate).

Table 1. Variable Measurement

Variable	Definition	Measurement	Notation	Source
Dependent	Banking Efficiency	Ratio of Operating Expenses to Operating Income	OER	Financial Services Authority (OJK)
Variable Interest	Financial Inclusion	Financial Inclusion Index	FII	Financial Services
Bank Characteristics	Risk Aversion	Ratio of Equity to Total Assets	CAR	Authority (OJK)
&	Profitability	Ratio of Return On Assets	ROA	
Macroeconomics				
Factors	Default Risk	Ratio of Non-Performing Financing	NPF	
	Inflation	Consumer Price Index	INF	Bank Indonesia
	Kurs	Exchange Rate (US$)	EXC	Ministry of Trade of the Republic of Indonesia

Source: Compiled by Authors, 2025

Technic Analysis

The analysis is conducted systematically using the Autoregressive Distributed Lag (ARDL) model, which is appropriate due to its ability to accommodate variables with different integration orders (I(0) and I(1)) and to examine both long-run equilibrium relationships and short-run adjustments within a single framework (Banda, 2021). The procedure begins with unit root tests using the Augmented Dickey-Fuller (ADF) or Phillips-Perron (PP) methods to ensure that none of the variables are integrated at order two (I(2)), as this would invalidate the ARDL approach. Once stationarity is confirmed, bounds testing is performed to determine the existence of cointegration among the variables. If cointegration is present, the ARDL model is estimated to obtain both long-run and short-run coefficients, with the optimal lag length selected based on the Akaike Information Criterion (AIC).

Short-run dynamics are further analyzed using an Error Correction Model (ECM), where the error correction term (ECT) coefficient indicates the speed of adjustment

toward the long-run equilibrium. The coefficient of the ECT is expected to be negative and statistically significant, confirming the existence of a long-term relationship (Abel et al., 2023). The general form of the ARDL model used in this study is as follows:

$$\Delta OER_t = \alpha_0 \sum_{i=1}^{p} \alpha_{1i} \Delta OER_{t-i} + \sum_{i=1}^{q2} \alpha_{2i} \Delta FII_{t-i} + \sum_{i=1}^{q3} \alpha_{3i} CAR_{t-i} + \sum_{i=1}^{q4} \alpha_{4i} ROA_{t-i} + \sum_{i=1}^{q5} \alpha_5 \Delta NPF_{t-i} + \sum_{i-1}^{q6} \alpha_6 \Delta INF_{t-i} + \sum_{i-1}^{q7} \alpha_7 \Delta EXC_{t-i} + \beta_1 OER_{t-i} + \beta_2 FII_{t-i} + \beta_3 CAR_{t-i} + \beta_4 ROA_{t-i} + \beta_5 NPF_{t-i} + \beta_6 INF_{t-i} + \beta_7 EXC_{t-i} + V_{1t}$$

The mathematical triangle notation (Δ) represents the first-difference operator, and $V1t$ denotes the white noise disturbance term. Once a cointegration relationship is established, the ARDL approach can be represented using an Error Correction Model (ECM) as follows:

$$\Delta Y_t = \alpha_0 \sum_{i=1}^{p} \alpha_{1i} \Delta Y_{t-i} + \sum_{i=1}^{q2} \alpha_{2i} \Delta FII_{t-i} + \sum_{i=1}^{q3} \alpha_{3i} \Delta CAR_{t-i} + \sum_{i=1}^{q4} \alpha_{4i} ROA_{t-i} + \sum_{i=1}^{q5} \alpha_5 \Delta NPF_{t-i} + \sum_{i-1}^{q6} \alpha_6 \Delta INF_{t-i} + \sum_{i-1}^{q7} \alpha_7 \Delta EXC_{t-i} + \theta ECT_{t-i} + \varepsilon_{t-1}$$

where θ epresents the adjustment coefficient, and ECT denotes the error correction term. The variable Y refers to the three dependent variables used in this study, abbreviated as Y for simplicity. The coefficient of the error correction term is expected to be negative and statistically significant as confirmation of the presence of a long-run cointegration relationship. Throughout the modeling process, diagnostic tests are conducted to validate the results, including stability tests (Badshah & Bulut, 2020). The ARDL method is chosen for its flexibility in handling variables with mixed integration orders, its suitability for small sample sizes in time series analysis, and its ability to simultaneously analyze both short-run and long-run relationships. This systematic approach ensures a robust empirical analysis of the determinants of BPRS efficiency in Indonesia.

RESULT AND DISCUSSION

Descriptive Statistics

Table 2 presents the descriptive statistics of the study variables over 126 monthly observations from January 2014 to June 2024. The Operating Efficiency Ratio (OER) shows a mean of 87.09 with a wide range from 56.51 to 94.09, indicating notable differences in operational performance across Islamic rural banks. The Financial Inclusion Index (FII) ranges from a very low 0.0041 to 2.657, with a mean of 1.16, highlighting disparities in financial access that may affect bank efficiency. Among bank-specific factors, the Capital Adequacy Ratio (CAR) averages 22.84, suggesting generally

strong capital buffers, while the average Non-Performing Financing (NPF) rate is 8.79%, pointing to potential credit risk challenges. Macroeconomic indicators also reflect relevant dynamics; for instance, inflation averages 3.74% with a peak of 8.36%, which may pressure bank operations. These variations reinforce the relevance of ARDL to assess the influence of financial inclusion, bank characteristics, and macroeconomic conditions on efficiency.

Table 2. Descriptive Statistics

Variable	Mean	Max.	Min.	Std. Dev.	Obs.
OER	87.088	94.087	56.51	3.518	126
FII	1.16	2.657	0.0041	0.838	126
CAR	22.837	33.26	17.99	2.897	126
ROA	2.203	2.81	1.51	0.313	126
NPF	8.794	11.79	5.91	1.374	126
INF	3.738	8.36	1.32	1.715	126
EXC	14056.6	16421	11404	1079.8	126

Source: Data processed, 2025

Unit Root Test

Based on the results presented in Table 3, all variables in this study are stationary after the first difference, as indicated by both the Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) tests. This confirms that none of the variables are integrated at order two, satisfying the core assumption for applying the ARDL model, which allows for a mix of I(0) and I(1) variables but not I(2). The unit root tests demonstrate consistency across both methods, ensuring the robustness of the stationarity assessment. This finding justifies the next step of conducting cointegration testing and estimating the ARDL model, as the data fulfill the prerequisite for time series analysis involving variables with different levels of integration.

Table 3. Unit Root Test Result

Variable	Augmented Dickey-Fuller		Phillips-Perron	
	Level	First Difference	Level	First Difference
OER	-4.992220***	-13.39038***	-8.611958***	-25.79768***
FII	-0.630713	-10.75551***	-1.191207	-13.83907***
CAR	-2.814780*	-15.76107***	-3.808890***	-16.25161***
ROA	-3.917064***	-11.35948***	-3.599462***	-17.69721***
NPF	-1.908358	-10.66252***	-2.051777	-12.15017***
INF	-2.758073*	-8.872932***	-2.756359*	-8.702032***
EXC	-1.601268	-12.85245***	-1.133275	-14.09887***

Note: *, **, ***, denote significant at 1%, 5%, and 10%
Source: Data processed, 2025

Bound Test

Table 4 presents the results of the ARDL Bound Test for cointegration. The F-statistic value of 4.216663 exceeds the upper critical bound at all significance levels (1%, 5%, and 10%). This indicates that there is a long-run cointegration relationship among the variables. The result confirms that the variables move together in the long run, justifying using an Error Correction Model (ECM) within the ARDL framework to estimate both short-run dynamics and long-run equilibrium relationships.

Table 4. Bound test Cointegration

F-statistic	K	Significant Level	Critical Bounds		Cointegration
			Lower Bound I(0)	Upper Bound I(1)	
4.216663	6	1%	2.88	3.94	Yes
		5%	2.27	3.28	Yes
		10%	1.99	3.99	Yes

Source: Data processed, 2025

Short Run and Long Run

Table 5 presents both short-run and long-run estimation results of the ARDL model. The coefficient of the error correction term (CointEq(-1)) is negative and statistically significant at the 1% level, confirming a valid long-run relationship among the variables. This suggests that any short-term disequilibrium will be corrected toward the long-run equilibrium at an adjustment speed of approximately 39.8% per month.

In the short run, only a few variables significantly affect operational efficiency (OER). Specifically, CAR at lag four and EXC (exchange rate) at the level and lags significantly impact OER. This implies that capital adequacy and exchange rate dynamics play a role in improving short-term efficiency. In the long run, among all the variables, only CAR has a significant positive influence on OER, highlighting the crucial role of capital adequacy in sustaining the long-term operational efficiency of Islamic rural banks in Indonesia. These findings suggest that improving capital strength is key for immediate and sustained efficiency gains.

Table 5. Short-run and Long-run Estimation results

Variables	Coeff.	t-Statistic	Prob.
OER(-1)	0.235110***	2.892594	0.0046
OER(-2)	0.148085**	2.026000	0.0453
OER(-3)	0.218810***	2.810209	0.0059
FII	0.584657	1.532866	0.1283
CAR	0.106311	0.752692	0.4533
CAR(-1)	-0.230411	-1.421714	0.1580
CAR(-2)	-0.094389	-0.558077	0.5780
CAR(-3)	0.096196	0.585673	0.5593
CAR(-4)	0.417585***	2.861358	0.0051
ROA	0.309097	0.284036	0.7769
NPF	0.406967*	1.799381	0.0748

INF	-0.024385	-0.118490	0.9059
EXC	0.002078***	2.808211	0.0059
EXC(-1)	-0.006064***	-6.296971	0.0000
EXC(-2)	0.004085***	5.200241	0.0000
CointEq(-1)	-0.397995***	-5.397993	0.0000
Variables	**Coeff.**	**t-Statistic**	**Prob.**
FII	1.469008	1.549399	0.1243
CAR	0.741948**	2.034995	0.0443
ROA	0.776636	0.275728	0.7833
NPF	1.022543	1.591742	0.1144
INF	-0.061269	-0.118948	0.9055
EXC	0.000249	0.287002	0.7747
C	54.75072**	2.296643	0.0236

Note: *, **, ***, denote significant at 1%, 5%, and 10%
Source: Data processed, 2025

Figure 1 presents the model stability test using the Cumulative Sum (CUSUM) method. The results indicate that the graph does not cross the boundary lines. This suggests that the model used in this study is valid, unbiased, stable, and can be reliably used as a basis for policy recommendations.

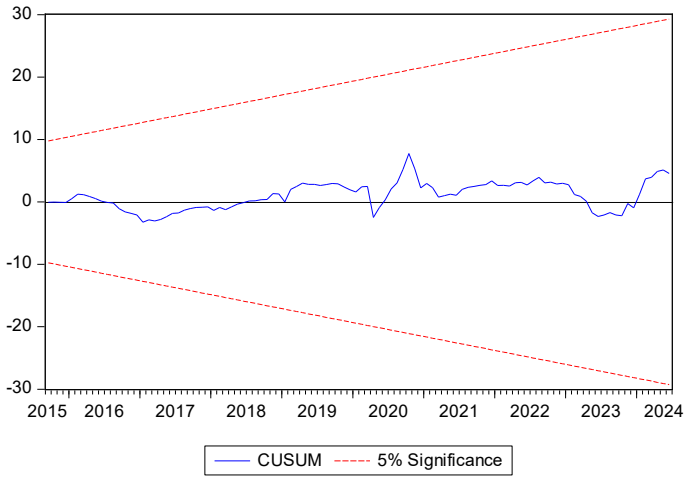

Figure 1. CUSUM Test

Discussion

The results of this study show that financial inclusion does not have a significant effect on the operational efficiency of Islamic rural banks (BPRS) in either the short or long term. This finding can be attributed to the fact that financial inclusion, as a process aimed at expanding access to financial services, typically takes a considerable amount of time to produce measurable impacts on efficiency. In its early stages, the expansion of financial inclusion may even increase operational burdens, as banks are required to reach more remote areas, develop tailored products for underserved communities, and incur higher financial literacy costs (Le et al., 2019). Nevertheless, although not statistically significant in the short term, the positive long-term coefficient of financial inclusion suggests its strategic potential. For BPRS, the expansion of outreach may serve as a long-

term investment that supports increased transaction volumes, customer diversification, and revenue growth through economies of scale. Thus, while efficiency gains may not yet be visible within the limited period of this analysis, financial inclusion remains an important and relevant strategy for long-term institutional development (Muthia et al., 2020). This research is supported by research conducted by Le et al. (2019) that financial inclusion does not affect the operational efficiency of banking.

Capital adequacy ratio (CAR) has a significant effect on operational efficiency in the long run. This highlights the essential role of strong capital reserves in sustaining the efficiency of BPRS institutions. Adequate capital allows banks to absorb operational losses, build investor and depositor confidence, and gain the flexibility to expand without over-reliance on external funding (Wanjagi et al., 2024). This is particularly important for BPRS, which operate predominantly in rural areas with relatively higher financing risks. Hence, CAR becomes a strategic factor in maintaining efficiency under risk pressure. Conversely, the lack of significance of CAR in the short term may be explained by the internal mechanisms of BPRS operations. Additional capital may not be immediately utilized optimally, especially if the bank lacks a clear expansion strategy or faces managerial capacity limitations. In other words, a high CAR does not automatically translate into greater efficiency unless accompanied by efficient and innovative business strategies (Lotto, 2018).

Return on assets (ROA), as an indicator of bank profitability, does not significantly affect operational efficiency in either the short or long term. This implies that high profitability is not necessarily aligned with efficiency (Jahan, 2020). In the context of BPRS, higher profits may stem from wider financing margins, but this does not automatically reflect efficient resource utilization. Due to limited scale and technological access, BPRS often incur high operating costs, which can obscure the relationship between ROA and efficiency. Furthermore, the social role of BPRS in empowering local economies may lead them to prioritize sustainability and inclusiveness over technical efficiency. In practice, BPRS may take decisions that are not financially optimal in the short term but are aligned with the broader objectives of the maqasid al-shariah. As such, it is unsurprising that ROA does not emerge as a primary determinant of efficiency in the BPRS context (Duho et al., 2020).

Non-performing financing (NPF) demonstrates a positive and significant short-term impact on operational efficiency, although this relationship does not persist in the long run. This finding may seem counterintuitive, given that high NPF is generally associated with poor financing quality and reduced efficiency. However, in the context of BPRS, an increase in NPF may be linked to managerial adjustments or strategic financing shifts that temporarily raise risks but lead to internal improvements in risk control and operational management. In the long run, the lack of significance of NPF may reflect the ability of BPRS to manage and mitigate financing risks through community-based approaches. Strong relational and local ties between BPRS and their clients may help minimize the long-term effects of problematic financing (Priyadi et al., 2021). This also suggests that long-term efficiency is more influenced by structural factors such as cost management and growth strategies rather than credit quality alone (Shamshur & Weill, 2019).

Inflation was found to have no significant effect on the operational efficiency of BPRS, in both the short and long term. This result aligns with literature indicating that Islamic microfinance institutions like BPRS are relatively resistant to short-term macroeconomic fluctuations. This may be due to the fact that most transactions are conducted at small scale and short maturity, making the direct impact of inflation on operating costs and income rather limited. Moreover, the profit-and-loss sharing principle in Islamic financing tends to be more adaptable to changing economic conditions, including inflationary pressures. In this scheme, risks are shared between clients and banks, so inflation-related burdens are not borne solely by the institution. This may explain why inflation does not show a statistically significant effect on BPRS operational efficiency (Mawardi et al., 2021).

Exchange rate volatility shows a significant effect on operational efficiency in the short term, but not in the long run. This may be because currency fluctuations can immediately affect the cost of imported capital goods or technologies used by BPRS, and may influence market sentiment and short-term macroeconomic stability. While BPRS do not operate directly in foreign currencies, they may still be exposed to exchange rate risks indirectly—through prices of goods, operating costs, or impacts on the real sectors served by BPRS (Demir & Razmi, 2022). In the long term, however, this relationship appears to diminish, likely because BPRS operate primarily in local contexts using domestic currency. Their reliance on social and community networks rather than international trade insulates them from long-term global currency exposure (Retnasih, 2023). Therefore, the long-term statistical insignificance of exchange rate effects reflects the limited exposure of BPRS to global exchange rate risks.

CONCLUSION

This study reveals that the operational efficiency of Islamic Rural Banks (BPRS) in Indonesia is primarily influenced by the exchange rate (EXC) in the short term and the capital adequacy ratio (CAR) in the long term, while other factors such as financial inclusion (FII), profitability (ROA), non-performing financing (NPF), and inflation (INF) do not show significant effects in either time frame. These findings are in line with theoretical expectations that emphasize the critical role of internal structural strength and responsiveness to macroeconomic fluctuations, particularly capital management and exchange rate volatility, rather than relying solely on profitability or the expansion of financial access. However, the study's quantitative approach does not capture qualitative aspects such as managerial quality, organizational culture, or spiritual values that are central to the ethos of Islamic banking, and its focus on BPRS in Indonesia limits the generalizability of the results to other Islamic banking contexts. Future research should consider comparative analyses across different countries and develop efficiency measures that incorporate the values of maqasid al-shariah, ensuring that efficiency in Islamic banking is assessed not only from an economic perspective but also in terms of its broader social and spiritual objectives.

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