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PERSISTENCE OF ISLAMIC BANKS' EFFICIENCY AMID ECONOMIC SHOCKS

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Abstract

The aim of this work is the evaluation of the technical efficiencies of Islamic banking institutions in Indonesia and the determinants of efficiencies during the specific economic shock period of 2020 to 2023. Data from the years 2017 to 2023 are utilized in the study. Using the quantitative approach, Data Envelopment Analysis (DEA), the Islamic banks were evaluated to determine their technical efficiencies. The Islamic banks' efficiencies were evaluated using Tobit Regression. The outcome indicated that sharia compliant banking in Indonesia is not technically efficient and that there is variation across the years in the efficiencies. As for the explanation for the efficiencies, the investigation indicated that BOPO negatively impacted efficiencies while FDR positively impacted efficiencies. In addition, the results indicated that inflation did not have as great of an effect. The efficiencies were impacted negatively by the pandemic as the economic shock of the COVID-19 virus created a greater economic shock. In this case, the relationship for the economic shock of the Russia-Ukraine conflict was not demonstrated. The Islamic banks ' efficiency during the economic shocks provide academic contributions and current literature.

Keywords: *Bank Efficiency; Economic Shocks; Data Envelopment Analysis*

Abstrak

Tujuan dari penelitian ini adalah evaluasi efisiensi teknis lembaga perbankan syariah di Indonesia dan determinan efisiensi selama periode guncangan ekonomi spesifik dari tahun 2020 hingga 2023. Data dari tahun 2017 hingga 2023 digunakan dalam studi ini. Dengan menggunakan pendekatan kuantitatif Data Envelopment Analysis (DEA), bank-bank syariah dievaluasi untuk menentukan efisiensi teknis mereka. Efisiensi bank-bank syariah dievaluasi menggunakan Regresi Tobit. Hasilnya menunjukkan bahwa sektor perbankan syariah Indonesia tidak efisien secara teknis dan terdapat variasi efisiensi antar tahun. Mengenai penjelasan efisiensi, analisis menunjukkan bahwa BOPO berdampak negatif pada efisiensi sementara FDR berdampak positif pada efisiensi. Selain itu, hasilnya mengindikasikan bahwa inflasi tidak memberikan dampak yang signifikan. Efisiensi terdampak negatif oleh pandemi karena guncangan

ekonomi akibat virus COVID-19 menciptakan guncangan ekonomi yang lebih besar. Dalam kasus ini, hubungan untuk guncangan ekonomi akibat konflik Rusia-Ukraina tidak terbukti. Efisiensi bank-bank syariah selama guncangan ekonomi memberikan kontribusi akademis dan literatur terkini.

Kata kunci: Efisiensi Bank; Guncangan Ekonomi; Data Envelopment Analysis

INTRODUCTION

Most recently, both the global and Indonesian economies have experienced a multitude of economic shocks at the same time. As explained Xie & Li, 2024, economic shocks are the result of a one-time change of a market equilibrium cycle due to external and unanticipated disturbances to the economic system picture. The global economy has recently endured two major financial setbacks: the COVID-19 pandemic and the conflict in Ukraine. The International Monetary Fund (IMF, 2021)reported in 2021 that the pandemic led to a contraction in worldwide economic output of 3.1% and a decline in the volume of global trade by 8.2% (IMF, 2021). Domestically, Indonesia also experienced a pandemic-induced economic slowdown, with its growth rate decreasing from 5.02 % in 2019 to 2.97 % in 2020 (BPS, 2020). Consequently, the COVID-19 crisis significantly impeded economic operations across both international and national financial markets (Ahmed et al., 2023; Hanif et al., 2021; Ji et al., 2020).

The 2020 global pandemic and ongoing Russia-Ukraine crises have caused all phases of the economy worldwide (Bilal et al., 2024; Yudaruddin & Lesmana, 2024; Hoque & Zaidi, 2020). Indonesia and the global economy are vigorously influenced by the increase in fuel prices, including in the banking sector (Pattinussa et al., 2022). Sharia banks are pressured by the lack of funding, non- performing investments, and the reduction of third-party resources due to the constriction of mobility and the slowdown of economic activities (Alabbad & Schertler, 2022). On the other hand, trade has been disrupted by the conflict, and the spike in fuel prices has led to a reduction in profitability and an increase in risk to the banks of other countries (Danisman et al., 2021; Boubaker et al., 2023). Mixed results have been seen in Islamic banking. The literature proposes that Islamic banks are more efficient and stable than conventional banks during times of critical (Abdulla and Ebrahim, 2022; Wijana and Widnyana, 2022), while others claim the opposite (Ghouse et al, 2022; El-Chaarani et al, 2022). These contradictory findings open the door for more empirical investigation, especially in Muslim-majority, dual banking system entrepreneurs, like Indonesia, to assess the methods Islamic

banks deploy to manage assets, profitability, and efficiency during global shocks.

The pivotal position of banks in the economy in relation to the stability of the economy measures banks' efficiency important to researchers, bank managers, and policymakers (Mai et al., 2023). Focusing on the Indonesian context, Islamic banks have shown a gradual but steady enhancement in performance over the past few years. This improvement is clearly demonstrated in key efficiency and profitability metrics. For instance, the Operating Expense to Operating Income (BOPO) ratio of Islamic Commercial Banks improved in cost efficiency by declining from 85.5% in 2020 to 77.26% in 2024. Profitability also gained strength as demonstrated by the improvement in the net return on total assets (ROA) of 1.4% in 2020 to 1.98% in 2024 (OJK, 2024). This suggests that Islamic banks can better manage the operational components related to costs in order to survive the external economic shocks by increasing the operational efficiency of the bank. A myriad of methods exist to measure banks' performance, most significantly the use of financial ratios like BOPO, ROA, ROE, etc., and also through frontier approaches like Data Envelopment Analysis (DEA) and Stochastic Frontier Analysis (SFA).

Furthermore, calculating effectiveness within the DEA framework necessitates the precise definition of relevant input and output variables. The current study adopts the intermediation perspective for the selection of these DEA model variables. Under this approach, total assets and third-party funds (*Dana Pihak Ketiga*, or DPK) are designated as the input variables, as these metrics represent the collective resources managed and deployed by the banking institution. (Ikhwan & Riani, 2022). In that case, product variables are financing and operating income as they indicate the bank's performance in funds distribution and income generation (Boubaker et al., 2023). The choice of these variables is in line with the works of others (Abdul-Wahab & Haron, 2017; Firdaus & Hosen, 2014), who stressed the relevance of the intermediation function in the determination of the bank's efficiency.

Furthermore, understanding the measurable impacts of efficiency-determining variables is necessary, in addition to gaining full awareness of the efficiency. In prior research, bank performance is said to be dependent on attributes of both the environment and the institution itself(Achi, 2023). For instance, financial indicators and the management of the institution represent the internal attributes, while the surrounding economic environment, such as inflation and economic shocks, typifies the external attributes (Banya & Biekpe, 2018). In this light, variables such as ROA, total assets, NPF, FDR, and indicators of GDP, inflation, and economic shocks are used by the prior

research (Achsani & Saptono, 2016; Alqahtani et al., 2017; Istaiteyeh et al., 2024; Shawtari et al., 2018).

In conducting efficiency research on Islamic banks (Majdina et al., 2019) conjectured that assets and CAR positively impacted performance, and that ROA and NPF had no significant impact on the banks competency. Continuing on, Nguyen et al. (2023), examining Islamic bank efficiency across 15 countries from 2005 to 2020, confirmed that total assets impact performance levels positively. Conversely, ROA and GDP were concluded to not to significantly affect performance levels.

This research presents an original analysis of the technical efficiency of Islamic banks specifically examined through the lens of recent global economic shocks, namely the COVID-19 pandemic and the Russia-Ukraine conflict. While the existing literature has addressed bank performance during the COVID-19 period, no prior study has quantitatively assessed the efficiency of Islamic banks spanning both the initial pandemic phase and the subsequent period impacted by the war**.** This analysis of efficiency across these two distinct yet connected disruptive events thus fills a crucial gap in the financial literature. Moving forward, this research does not stop at the static analyses of the bank's performance. It uses a longitudinal approach with which Data Envelopment Analysis (DEA) and Tobit regression is used to determine the internal factors (e.g., BOPO, FDR) and the macroeconomic (e.g., inflation, crisis dummies) shocks in the Islamic banks' competency. Selecting a country such as Indonesia with a dual banking system and the largest Muslim population worldwide lends Islamic banking literature even greater relevance. The contribution of the current research is also both methodological and empirical, as, for the first time, critical modelling is integrated with efficiency estimation, which can also be directed towards policymakers and practitioners, highlighting the fact that Islamic banks can be efficient in crises.

LITERATURE REVIEW

Bank Efficiency Concept

Investigation regarding banking efficacy has been prevalent within Islam and traditional banking literature. The theory of the Firm under which this research study is situated is based on the premise that businesses are considered to be the most efficient when they can maximize output and minimize costs of input utilization (Coase, 1937). Building on this theory (Farrell, 1957) first introduced the notion of allocative and technical efficiencies and developed a mechanism to measure how efficiently a firm is able to convert inputs into outputs. Several other authors (Fare et al., 1985; Sufian et al., 2013) built upon and expanded the concepts of Farrell, and

introduced them to the banking sector, measuring the efficiency of banks in terms of output and multiple inputs.

Within the scope of Islamic banking, efficiency has two dimensions. One dimension is technical, which is concerned with the extent to which banks utilize their inputs to produce financial and investment products (Rosman et al., 2014; Sufian et al., 2013). The other dimension, which is unique to Islamic banking, is shariah-based, wherein values such as ethics, social welfare, and socio-economic development are incorporated (Mohammed et al., 2008). Consequently, the performance in Islamic banking is viewed as cost and output efficiency, along with the attainment of socio-economic development and stability, as well as social justice and equilibrium (Iqbal & Mirakhor, 2007).

At an accelerating pace in the last few years, Islamic banks have been developing. Islamic banks, however, have had to deal with several economic shocks during this time such as the global financial crisis 2007, COVID-19, and the Russia-Ukraine war. As a result, there have been numerous studies prior to this one focusing on the Islamic banks performance during these economic shocks. The first of these studies is Rosman et al. (2014) on the 2007 global financial crisis and the efficiency of 79 Islamic banks in the MENA region. The results of the research showed that of the Islamic banks, a substantial number were able to continue with normal business operations during the crisis.

The study by Nguyen et al. (2023)employed DEA to analyze the performance of 78 Islamic banks across 15 countries spanning the years 2005 to 2020, thus incorporating the entire COVID-19 pandemic period. Their findings suggest that Islamic banks maintained a moderate level of efficiency throughout this timeframe. Critically, the research demonstrated the flexibility of Islamic banks in navigating the economic challenges presented by the pandemic. Similarly, Boubaker et al. (2023) investigated the performance of 49 Islamic banks across 10 countries with the specific aim of assessing their response to the COVID-19 pandemic. The outcomes of their analysis indicated a positive impact on the Islamic financial system relative to post-COVID-19 development. Furthermore, the relative efficiency of Islamic banks versus conventional banks within the MENA region was explored by Bakour (2023), whose data covered the years both *before and during* the pandemic. The results of this comparative study asserted the increased competency of Islamic banks when benchmarked against traditional banks during the pre- and post-COVID-19 periods.

The next in this list of studies (Nguyen et al., 2023) uses DEA to analyze the performance of 78 Islamic banks in 15 countries between 2005 and 2020, which of course includes the COVID-19 pandemic. The results of the study indicate that Islamic banks were moderately efficient during the period in

question. Also, it showed that the Islamic banks were quite flexible during the economic difficulties posed by COVID-19. The same Boubaker et al. (2023) study also investigated the performance of 49 Islamic banks. These 49 banks belonged to 10 countries, and the purpose of the study was to assess the performance of these banks during the COVID-19 pandemic. The results of the studies show that the Islamic financial system was positively impacted relative to the post COVID-19 developments. Also, the relative efficiency of Islamic banks and traditional banks within the MENA region spanning the years before and during the COVID-19 pandemic was also studied Bakour (2023). The results of this study have confirmed the increased competency of Islamic banks relative to traditional banks in the period before and after the COVID-19 pandemic. The results are consistent with Rehman (2021), which posits that during the COVID-19 emergency, Islamic banks outperformed conventional banks. Thus, it can be concluded that, as Farooq and Zaheer (2015) suggested, Islamic banks demonstrate higher levels of resilience during economic shocks than traditional bank

Bank Efficiency Measurement Approach

A common way to assess bank efficiency in banking literature is through the use of the non-parametric and parametric approaches, the former being DEA and the latter being SFA (Pasha, 2024). The parametric method approach has some drawbacks, such as, specific detailing of the functional efficiency boundaries and the need for larger sample sizes(Li, 2014; Pasha, 2024). However, in contrast to this, the non-parametric approach is more sample size efficient and is also flexible in how the competency level is measured, as more than one input or product variable can be used to determine the efficiency level (Ngo & Le, 2019).

Thus, this flexibility in considering different inputs makes the non-parametric DEA method appear to be the most preferred method of evaluating bank performance in the literature regarding performance of bank (Musa et al., 2020; Nguyen et al., 2023). Its flexibility also extends to the variables in that some measurements of efficiency can be purely technical, meaning that it does not factor in the ranges of some of the variables (Masrizal et al., 2023). Thus, the use of DEA as the evaluation technique for efficiency has been used in other studies, and the current study also employs this methodology (Abdul-Wahab & Haron, 2017; Ben Mohamed et al., 2021; Boubaker et al., 2023; Majeed & Zanib, 2016; Mezzi, 2018).

HYPHOTHESIS

Factors Affecting the Efficiency of Islamic Banks

Operating Expenses Operating Income (BOPO)

The ratio of operational costs to income (BOPO) is one of the measures used by Bank Indonesia to determine the operational efficiency of a bank (M. Choudhry et al., 2022). However, considering banks as intermediary institutions, there is an array of inputs and outputs banks utilize in their operations. Therefore, it can be argued that the BOPO ratio does not capture the bank performance in all aspects (Wahyuni et al., 2023). The fact that the BOPO can be used as the sole measure of a bank perfoemance is in the sense that it provides a one-sided view of efficiency (Firdaus & Hosen, 2014).

The present study analyzed the degree of BOPO ratio and operational efficiency of the banks in determining the banks' technical competency. The presence of a high BOPO ratio negatively impacts the bank's capacity to control and manage operational costs as income is earned, and thus it affects the bank's performance (Lutfiana & Yulianto, 2015) and (Fathony, 2012), The BOPO ratio was shown to significantly negatively influence the Islamic banks competency. Hence, the proposed hypothesis is as follows. H1. BOPO harms the efficiency of Islamic banks.

Financing to Deposit Ratio (FDR)

The Financing-to-Deposit Ratio (FDR) is a crucial financial metric for Islamic banks, measuring the total amount of financing extended against the bank's total volume of funds collected from third parties (Sufian & Noor, 2009). Empirically, Sufian and Noor (2009) noted a positive correlation between financing activity and profits, reinforcing the bank's fundamental function as a financial intermediary within the Islamic banking system

Consequently, a bank's efficiency is often positively associated with its financing volume. This link has been consistently validated in the literature: (Ikhwan & Riani, 2022) affirmed a positive impact of the FDR on the technical efficiency of Islamic banks, and similarly, Wahab (2015) established the FDR ratio's efficacy as an indicator of a bank's proficiency in the optimal allocation of its available funds. Given that the core business activity of Islamic banks revolves around the provision of funds, the FDR is expected to be a primary determinant of their overall performance and efficiency. H2. FDR has a positive effect on the efficiency of Islamic banks.

Inflation

Inflation is the general increase in prices of goods and services in a specified period. In Economics, inflation has an impact on financial assets and monetary instruments in general; it can, for instance, influence the total return

on an investment and the profitability of a bank (Abaidoo & Anyigba, 2020). As pointed out by Ben Naceur and Ghazouani (2009), inflation determines bank efficiency in that it… is characterized by increase in rates of inflation which, in turn, impact the progress of an economy adversely. This, ultimately, has an effect on the performance of the banking sector.

According to Nguyen et al., (2023) study, Islamic banks, all else being equal, could have a better performance when inflation is low, while inflation rate affects competency inversely. Such findings are consistent with (Fang et al, 2019) study, which posits that inflation being high demand for financial services may decline, leading to lower banking efficiency. Thus, the following hypothesis may be put forward. H3. Inflation has a negative effect on the efficiency of Islamic banks

Economic Shocks

Economic shocks explain unexpected occurrences that have a wide-ranging influence on the economy. These include the Russia-Ukraine conflict, and the COVID-19 pandemic, among others. Such occurrences have a global economic impact, hence the banking sector, which is a crucial part of the economy, is also subject to unanticipated changes.

First, the COVID-19 pandemic caused shocks to the economy that impacted the capacity of banks to operate, including withdrawals, greater risks of loss, and limitations in the financing that could be dispersed (Alabbad & Schertler, 2022). Simultaneously, the Russia-Ukraine conflict is, of course, conflict poorly impacts the economy (Antonakakis et al., 2017). Some contrived works have attempted to research the reaction of financial markets to wartime conditions. Most of these works agree that there is a tendency for the financial markets to develop a negative reaction during times of war or conflict between countries (T. Choudhry, 2010; Hudson & Urquhart, 2014; Schneider & Troeger, 2006). Therefore, the conclusions of the aforementioned studies support the proposition that shocks to the economy have a negative impact on the performance and efficiency of banks. Therefore, the hypothesis is proposed. H4. COVID-19 has a negative effect on the efficiency of Islamic banks. H5. Russia-Ukraine conflict has a negative effect on the efficiency of Islamic banks

METHOD

Research Design and Sample

This research employs a two-stage methodology, utilizing the Data Envelopment Analysis (DEA) framework to evaluate the technical efficiency of Indonesian Islamic banks, followed by Tobit regression to identify the key determinants influencing those efficiency scores. The study population

encompasses all Islamic banks that held operational licenses within Indonesia during the period of analysis. A purposive sampling method was applied to select the final sample, adhering to the following strict criteria: (1) The bank must have been officially registered and overseen by the Financial Services Authority (OJK). (2) The bank must have consistently published complete and timely annual financial statements throughout the entire study period, spanning 2017 to 2023. (3) The bank must possess all requisite financial data necessary for the successful execution of both the DEA and Tobit regression models. A total of thirteen Islamic banks satisfied these conditions, forming the final sample for the analysis. These institutions are specifically enumerated in Table 1.

Table 1. Banks Sample

No	Bank Name
1	Bank Syariah Indonesia
2	Bank Aladin Syariah
3	Panin Dubai Syariah
4	BTPN Syariah
5	Bank Aceh Syariah
6	BPD Riau Syariah
7	BPD NTB Syariah
8	Bank Muamalat
9	Victoria Syariah
10	BJB Syariah
11	Mega Syariah
12	KB Bukopin
13	BCA Syariah

Source: OJK (2024)

Data Envelopment Analysis (DEA) Approach

DEA is a non-parametric technique that is based on linear programming and first proposed by (Charnes et al., 1978), The main purpose of the DEA method, as stated by (Cook & Seiford, 2009), is to estimate the production frontier of a decision-making unit that uses several inputs to produce several outputs. This is a useful method to assess efficiency in many sectors, including the banking sector, therefore making the DEA method a useful approach to efficiency evaluation.

This research uses the Constant Return to Scale (CRS) assumption and analyses technical efficiency (TE) through an input-oriented DEA model. The CRS assumption is perhaps the most suitable one to apply when making a comparative investigation among decision-making units (DMUs) of differing magnitude; it assumes that all of the units are functioning at an

optimal scale (Charnes et al., 1978; Cooper et al., 2007). In the case of Indonesian Islamic banking, where one major bank (i.e., Bank Syariah Indonesia) and one micro bank (i.e., Bank Aladin Syariah) operate simultaneously, the CRS is more suitable to carry out a more coherent cross-sectional analysis of technical efficiency (Abdul-Wahab & Haron, 2017; Firdaus & Hosen, 2014). In addition, the research is justified in focusing on technical efficiency rather than separating it with pure technical efficiency (PTE) and scale efficiency (SE) as the goal is to evaluate the total managerial effectiveness of the firm in converting the resources at his/her disposal without isolating the size factors. The input-oriented approach is seen as more suitable as in times of economic downturn (i.e., COVID-19), banks are more inclined to adjust downwards the input (e.g., funding, operational scale) than to expand products (Masrizal et al., 2023; Ngo & Le, 2019). The CRS model gives rise to the following basic DEA equation.

$$\text{Max} \quad h_s = \sum_{i=1}^{m} u_i y_{is} \tag{1}$$

$$\text{Subject to: } \sum_{i=1}^{m} u_i y_{ir} - \sum_{j=1}^{m} v_j x_{jr} \leq 0 \quad ; \quad r = 1, \dots, N \tag{2}$$

$$\sum_{j=1}^{m} v_j x_{js} = 1, \; u_i, v_j \geq 0$$

The product of this equation shows that the objective function is to maximize the product subject to the constraint that the input is equal to 1, and hence the product is greater than the input, and the output is less than or equal to 0. As such, the banks may function at or below the levels of technical efficiency (Firdaus & Hosen, 2014).

The DEA technique does not just identify which of the two models is CRS or VRS (Constant Returns to Scale or Variable Returns to Scale). Similarly, in assessing the measurement orientation, either an input or an output measurement efficiency is considered. An input-oriented approach is one in which consumption of input is mitigated for a given output level, which is achieved by a proportional scaling of input reductions while output levels are maintained. In contrast, the output-oriented model indicates that product levels are maximized for a given input level (Cook & Seiford, 2009; Majeed & Zanib, 2016).

For this reason, an input-oriented CRS model is used in this research. This is that banks are capable of reducing more inputs as opposed to increasing outputs, which is important in competitive situations and also reduces economic shock (Ngo & Le, 2019). For this reason, an input-oriented CRS model is used in this research. This is that banks are capable of reducing more inputs as opposed to increasing outputs, which is important in

competitive situations and also reduces economic shock (Cooper et al., 2007) (Equation 3):

$$\min_{\theta,\lambda} \theta$$
$$subject\ to\ \theta x_0 - X\lambda \geq 0 \quad (3)$$
$$Y\lambda \geq y_0, \lambda \geq 0$$

Where x*0 and y*0 are input and product column vectors for a given DMU. For all DMUs, X and Y are the input and product vector matrices, λ is the intensity variable column vector that represents linear combinations of DMUs, while θ is the objective function, which represents a radial contraction factor that can be applied to the input of the given DMU (Paradi et al., 2018).

Input and Product Variables

The academic literature offers a dual framework for selecting the input and output variables necessary to assess bank efficiency: the production approach and the intermediation approach (Boďa & Piklová, 2018). First, the production approach, this perspective conceptualizes banks as service firms that process transactions for the public. It focuses on the activities involved in payment processing and financial management (Abdul-Wahab & Haron, 2017). Second, the intermediation approach, conversely, this approach regards banks as financial intermediaries that primarily mobilize funds by collecting deposits from savers and extending credit (loans) to borrowers (Achsani & Saptono, 2016). Table 2 shows the input and output variable. This study adopts the intermediation approach. This choice is justified because it directly aligns with the primary funding and lending function of commercial banks and reflects the dominant methodology used in efficiency studies, particularly within the context of developing nations (Abdul-Wahab & Haron, 2017; Istaiteyeh et al., 2024; Nguyen et al., 2023). Consequently, the specific selection of input and output variables in this research is consistent with established precedents in the field (Abdul-Wahab & Haron, 2017; Firdaus & Hosen, 2014; Masrizal et al., 2023; Nguyen et al., 2023).

Tobit Regression

The concept of Tobit calculation in its entirety is attributed to the works of James Tobin 1958. In Tobit regression, the independent variables are thought to be censored. On the other hand, the dependent variable is censoring data or has an upper and or lower valued limit. (Firdaus & Hosen, 2014). Istaiteyeh et al. (2024) argue that Tobit regression could examine the efficiency score and a number of efficiency score determinants. This study is just like Masrizal et al. (2023), considers Tobit model because of the fact that the dependent variable's data is of the censored type. This study is more suited to use the Tobit model because of the fact that Ordinary Least Squares (OLS) regression would lead to biased estimations when applied to censored data (Fathony,

2012). Equation (4) and the operational definition (Table 3) of the variables Evans used in the Tobit regression.

$$EFT_{it} = \beta_0 + \beta_1 BOPO_{it} + \beta_2 FDR_{it} + \beta_3 INFLASI_{it} + \beta_4 COVID19_{it} + \beta_5 RUSSIAUKRAINE\ CONFLICT_{it} + \varepsilon \quad (4)$$

Table 2. Operational Definition of DEA Variables

Variables Input	Description of Variables
Third Party Funds	Total funds collected by the bank from the public
Total Assets	Total assets held by the bank include total cash, receivables, total investments, and other assets
Variables Output	**Description of Variables**
Total Financing	Total financing disbursed by the bank based on contracts
Operating Income	Total revenue generated from the main activities of banks

Sources: Authors (2025)

Table 3. Operational Definition of Tobit Variables

Variable	Description of Variables
Technical Efficiency	Technical efficiency value from the investigation using DEA
BOPO	Ratio of operating expenses to operating income of Islamic banks
FDR	The ratio of the amount of financing disbursed to party funds
Inflation	A general increase in prices for goods and services over a period of time
COVID-19	Variable economic shocks, caused by the COVID-19 pandemic. Represented by Dummy variable, (1 = COVID-19 period, and 0 = other than that period)
Russia-Ukraine Conflict	Variable economic shocks, caused by the Russia-Ukraine conflict in 2022. Represented by Dummy variable (1 = Russia-Ukraine conflict period, and 0 = other than that period)

Source: Authors (2025)

An LLR test is possible to check the validity of the Tobit model (Cooper et al., 2011; William H. Greene, 2012). The test contrasts a log-likelihood function with all the independent variables to the log-likelihood function that excludes the independent variables (Raharjanti & Widiharih, 2005). The LLR asssesment is distributed normally to a chi-square, the degrees of freedom being the number of independent variables in the regression. The outcome from the LLR test indicates that a model with independent variables is more appropriate to use than a model without independent variables, which means that the Tobit model is appropriate for use (William H. Greene, 2012).

RESULTS AND DISCUSSION

Technical Efficiency of Islamic Banks in Indonesia

The technical efficiency of Islamic banks in Indonesia from 2017-2023 is estimated using DEA and the input-oriented CRS model. The DEA approach

assigns these performance levels of 0 to 1 to show a bank's efficiency level. A bank achieving the maximum level of competency (1) would be classified as efficient since it is said to manage its inputs and outputs optimally. Conversely, a bank is considered inefficient if its performance score is lower than 1 (or near 0). The analysis is based on the Theory of the Firm, which states that to perform optimally, a firm would want to maximize product and minimize input cost, all things equal (Coase, 1937). Hence, the DEA competency score indicates to what extent each of the Islamic banks in Indonesia satisfies this ideal of input–output efficiency.

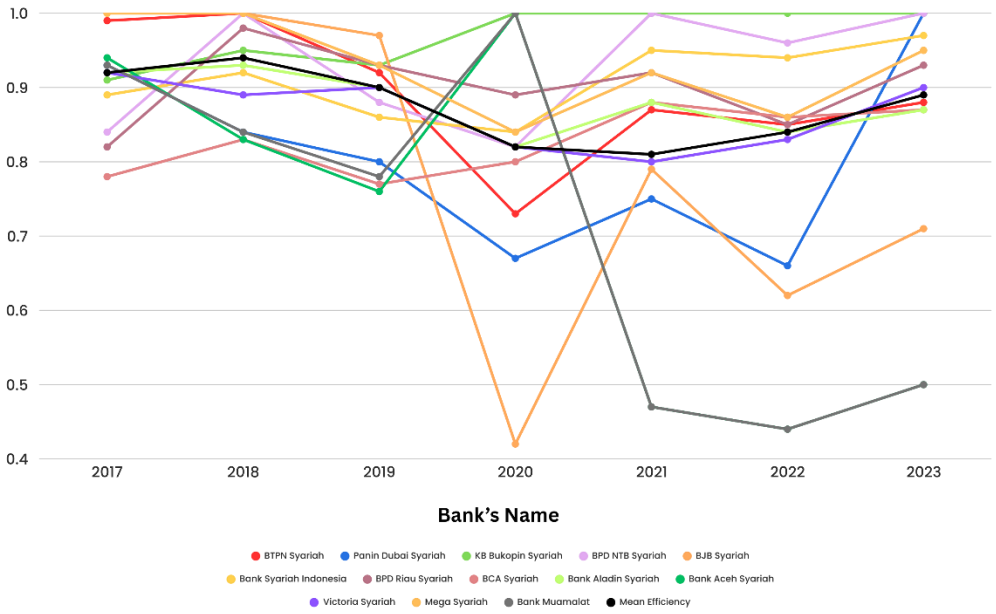

Figure 1. Efficiency Trend of Islamic Banks
Source: Max-DEA, Data Processed (2025)

The average technical efficiency of Indonesian Islamic banks varied between 2017 and 2023, and the results of the study showed that the average performance of the banks during the study period remained below the efficiency frontier (1.00). A notable average competence decline occurred during the study period between 2019 and 2021>. This period coincides with the competency average decline as the COVID-19 crisis impacted the economy. In turn, the 2022 and 2023 average efficiencies of the Islamic banks indicate that these Islamic banks had completed the recovery period from COVID-19. In summary, it can be concluded that Indonesian Islamic banks remained inefficient during the period of study, as their average performance was below 1.00.

As can be seen from the efficiency trend graph in Figure 1, there was a very stable average performance of Islamic banks in Indonesia within the period from 2017-2019. This, however, changed in the period of 2020-2021 as

there was a significant decline in efficiency across the banks. This was as a result of the COVID-19 emergency that had a negative effect on the banking sector, including Islamic banking in Indonesia. However, the level of decline was not as significant for most banks in this period. In fact, some of the banks, such as BTPN Syariah, KB Bukopin Syariah, and BPD NTB Syariah, were able to maintain their performance within the range of the maximum efficiency score (1.00).

However, since Muamalat Bank and Bank Aladin Syariah are some of the banks that saw a significant decline in efficiency during that time period, they viewed the situation under considerable stress. As per the analysis, BTPN Syariah was able to exhibit a noticeable degree of uniformity in its competency from 2017 to 2023. The bank achieved the highest performance score of 1.00 each year, even during the COVID-19 pandemic economic disruptions of 2020-2021. This implies that BTPN Syariah possessed effective operational management, flexible actions to adapt to new business situations, and fortitude to handle economic downturns. This consistency illustrates BTPN Syariah's operational technical performance and economic stability of a bank of its class and kind in the industry, and especially the segment in the Ultra Micro loan. BTPN Syariah's resilience and stability was because of its ultra-micro business model lending. The ultra-micro business model lending was emergency-proof. Support also came from strict position and loan control operational strategies and Community Officers, which the bank deployed to provide field support to bank customers during locking and operational banking lending activities (Bank BTPN Syariah, 2022). The research previously conducted paints a similar scenario (Habibullah et al., 2024; Hasibuan et al., 2023) where BTPN Syariah's financial performance during the COVID-19 pandemic was documented to be good.

Islamic banks with low and inconsistent technical efficiency, such as Bank Muamalat, are an exception. From 2020 to 2023 was a significant drop in the stability of Bank Muamalat's performance scores. 2022 was the lowest, with a productivity score of 0.44. This score indicates that Bank Muamalat's ability to make the most of its resources may be affected by some operational inefficiencies, some management problems, or perhaps even by the COVID-19 pandemic. Among other banks, Muamalat experienced the lowest efficiency score, and Bank Aceh Syariah demonstrated even lower performance. Starting from 2017-2019, Syariah Bank Aceh had the lowest performance score. Starting from 2020-2023, the bank experienced a drastic increase in its competency. This increase demonstrates performance improvement and a response to the challenge.

In the years 2022 and 2023, most of the banks showed progressively positive performance. The banks even achieved the best efficiency

performance score of 1.00, meaning that their performance had improved remarkably. This demonstrates that the performance of these banks has improved remarkably after the pandemic. Overall, the findings indeed point out that the COVID-19 pandemic had a negative economic impact. Most Islamic banks, however, demonstrated positive economic resilience by a fast recovery from the COVID-19 pandemic. Therefore, Islamic banks in Indonesia demonstrated a positive response to economic disruption.

Factors Affecting Islamic Banks' Efficiency in Indonesia

Concerning the findings of the Tobit regression analysis. It is discovered that there are variables that influence the degree of competency, while some do not. Consequently, the estimation results of the variables affecting efficiency using Tobit regression analysis are displayed in Table 4.

Table 4. Tobit Regression Results

Variable	Coefficient	Std. Error	z-Statistic	Prob.
C	0.935191	0.068102	13.73221	0.0000
BOPO	-0.000788	0.000270	-2.913996	0.0036*
FDR	0.000863	0.000241	3.583080	0.0003*
Inflation	-0.007929	0.017654	-0.449148	0.6533
COVID-19	-0.083860	0.043095	-1.945919	0.0517**
Russia-Ukraine Conclict	0.060742	0.055491	1.094629	0.2737

Note: Sign (*): Significance at 5% level; (**): Significance at 10% level
Sources: E-Views 12, Data Processed (2025)

Operating Expenses Operating Income (BOPO)

In particular, the Tobit regression analysis guarantees that the BOPO ratio can lower the operational efficiency of Islamic banks. It follows that a decrease in the BOPO ratio is associated with greater performance; that is, banks can contain operational costs in relation to their operational income. On the other hand, an increase in the BOPO ratio is associated with less efficiency, in the sense that banks have less control over the operational costs in relation to their revenues (Endahsari & Sudarmawan, 2024).

There is no contradiction to what is already accepted knowledge about the BOPO ratio assigned by Bank Indonesia as the measure of operational efficiency for Islamic banks. That is, a lower BOPO ratio is preferred as it indicates the bank financial performance is better in that the bank earns more income in relation to its operating expenses (Munika, 2022). This also confirms the theory (Munika, 2022) that effective operational cost management is a significant determinant of a bank's overall efficiency.

The current analysis concurs with the earlier studies having negative correlation BOPO ratio. For instance, earlier studies(Lutfiana & Yulianto, 2015; Riani & Maulani, 2021; Sufian & Noor, 2009) has shown in workplace settings in resource uncompetency committing high multipliers in the financial management ratios for BOPO of the respective banks. Thus, the results of the study not only confirm the previous conclusions of the academic dissertation or thesis but also the BOPO ratio for the Islamic banks as an indicator of the banks performance.

Financing to Deposit Ratio (FDR)

The finding confirms that banks with relatively higher BOPO ratios are less efficient in managing their resources. Consequently, this study not only aligns with previous research but also validates the real-world significance of BOPO as a key measure of Islamic bank efficiency (Miah & Uddin, 2017). his underscores the vital intermediary function of Islamic banks, transferring funds from surplus to deficit areas, thereby solidifying their contribution to sustainable financial development within the economic system (Al-Farisi, A.S, Hendrawan, 2010; Ascarya & Yumanita, 2008).

This finding can be explained by the phenomenon that banks can optimally disperse financing to achieve better returns from productive endeavours. An increase in financing also boosts the abilities of banks to use their resources more effectively, which further enhances their operational efficiency (Ikhwan & Riani, 2023). With respect to Islamic banking, the distribution of financing is crucial to the progress of the real sector. It also solidifies the banks' intermediary roles (Trianto & Masrizal, 2021). Nevertheless, this situation comes with potential downsides. A high FDR tends to increase the Non-Performing Financing (NPF) ratio, which may cause liquidity problems and hinder banks from resource optimization (Firdaus & Hosen, 2014; Priyadi et al., 2021). Hence, grounded theory states that the performance gains on financing must also be accompanied by more risk, control, and supervision to make it effective (Hosen & Rahmawati, 2016).

These findings coincide with the findings from earlier studies (Ikhwan & Riani, 2022; Khairunnisa, 2018; Pambuko, 2016; Wahab, 2015), which found that FDR positively correlates with the efficiency of Islamic financial institutions. In the same vein Suwigyo and Musdholifah (2019) , it was argued that the increase in financing leads to higher profitability of the bank, and in turn, leads to higher competency. Therefore, the findings also imply that an expand in FDR leads to an increase in efficiency of banks, but effective risk management to control the NPF is also crucial.

Inflation

It has been established that the phenomenon of inflation external to the bank does not significantly influence the performance of the sharia banks. The results of the examination indicate that the increases or decreases in inflation do not have a statistically significant effect. This demonstrates a relatively Islamic bank. Also, in recent evidence (Gazi et al., 2024), and other macroeconomic shocks, the performance of Islamic banks was stable all along. This finding can also be explained by the phenomenon that inflation primarily affects banks through the operating costs and the financing portfolio. Managed inflation increases operational costs pertaining to capital, risk management, and repayment abilities of customers, which causes higher levels of Non-Performing Financing (NPF) (Zuhri & Khairunnisa, 2023). In this regard, the statistical test that there was no marked direct effect does not imply that extended conditions of inflation would not indirectly affect efficiency by way of diminished purchasing power and demand for banking products. Hence, there is a need for inflationary conditions in banking supervision to be adaptive and continuous.

These finding aligns with studies by Pambuko (2016) Shawtari et al. (2018), who also highlighted the insubstantial effect of inflation on the efficacy of Islamic banks. Recent publications also uphold the aforementioned observation of an insubstantial connection between inflation and the efficiency of banks, like Albania et al. (2025) regarding Islamic banks in Indonesia. However, unlike these publications, Fang et al., (2019) and Le and Ngo, (2020) reported the reverse, stating inflation negatively impacted the performance due to reduced demand for banking services, which in turn lowers efficiency. Hence, the impact of inflation on the efficiency of Islamic banks is unresolved and requires further examination. Thus, inflation can also disrupt banking and overall financial stability, which requires consideration by policymakers and practitioners.

Economic Shocks

The final variable examined pertains to external economic shocks, specifically those induced by the COVID-19 outbreak and the Russia-Ukraine war. The hypothesis testing yielded divergent findings: The COVID-19 pandemic exerted a significant negative influence on the operational efficiency of Indonesian Islamic banks. Conversely, the Russia-Ukraine conflict showed no measurable effect on their efficiency. This suggests that the geopolitical turmoil did not directly obstruct the banks' performance. Consequently, the magnitude and specific characteristics of global disruptions are decisive factors in shaping their effects on the efficiency of the Islamic banking sector.

The decline of the performance during the COVID-19 crisis can be explained by the worldwide economy's downturn, which reduced financing activity and increased the likelihood of default. The research is Hassan et al., (2021) in complete agreement with the fact that the COVID-19 pandemic has created considerable challenges in the Islamic financial sector, especially as a result of decreased real economic activity and a simultaneous increase in the likelihood of nonperforming financing. Within a grounded theory framework, Islamic banks' efficiency is adversely impacted by the external shocks, as their model is anchored to the real economy with profit-sharing arrangements (Beck et al. 2013). Nonetheless, the conservative features of Islamic banks, including asset-based financing and risk-sharing, permit them to retain a level of liquidity and a positive financial equilibrium over the long term (Chapra, 2009).

While the effect of the Russia-Ukraine conflict on Indonesia is small, the explanation of it should be guided by the absence of Indonesia's direct exposure to the conflict. Overall, the consequences of the conflict describe the rise of energy and food prices, which is not a direct operational disruption of the system of Islamic banking. According to the theory of global geopolitical connectedness, the influence of conflict is more intense on the financial sector of the countries that are directly involved through trade and investment with the conflict-affected countries (Bekaert et al., 2011). Hence, the absence of substantial trade and financial relations of Indonesia with Russia and Ukraine explains why Islamic banks continue to operate efficiently.

This research indicates that there is some decline in bank efficiency as a result of COVID-19. Definite impacts and declines in branch and bank performance during the COVID-19 period as a result of declining economic activity and increasing credit risk are noted by Ghouse et al. (2022) and El-Chaarani et al. (2022) As opposed to the Russo-Ukrainian conflict, which indicates that the Islamic Banks of Indonesia did not suffer direct impacts of the war, this conflict from the Russo-Ukrainian war also indicates that this situation Iraq Islamic Banks did not have the impacts from the war to any great degree which also reduces the economic shocks directly indicating the exposure to economic shocks is the main variable in determining Islamic Banks in Indonesia efficiency.

Impact of Economic Shocks on the Islamic Banks' Efficiency in Indonesia

The efficiency of Islamic Banks has been determined through the assessment of technical performance, and the economic shocks from 2020 to 2023 have been analyzed as well. The average efficacy performance of Islamic banking in Indonesia is shown in the figure 2.

According to the graph, there was a marked decrease in the mean effectiveness of Islamic banking in Indonesia in the year 2020. The performance statistics for the banking sector for 2020 had plummeted to 0.82, compared to 0.90 in 2021. This coincided with the first negative economic shock derived from the COVID-19 Virus in Indonesia in 2020. Furthermore, the effects from the Tobit regression indicated that the efficiency changes had been predominantly explained by the COVID-19 dummy variable (1 was for the COVID-19 Pandemic, and 0 was for the Pre-Pandemic). Thus, from the two different analyses, it appears that the negative economic shocks resulting from the COVID-19 pandemic were the primary cause of the mean efficiency decrease in the Islamic financial systemin Indonesia in 2020 and in early 2021.

To minimize the number of active cases of COVID-19, the government has placed a number of social restrictions during the pandemic. These restrictions include the Enforcement of Restrictions on Community Activities (PPKM) and the Large-Scale Social Restrictions (PSBB). While these restrictions have been effective in lowering the number of active COVID-19 cases in Indonesia (Coordinating Ministry for Economic Affairs, 2021), they have also harmed the economy, particularly the real sector. Due to the restrictions, almost all economic activities in the country came to a standstill. This is evidenced by the economic contraction of 5.32 percent during the second quarter of 2020 in Indonesia (BPS, 2020). This highlights the fact that Indonesia experienced negative economic progress, otherwise referred to as deflation, as a result of COVID-19 in the year 2020.

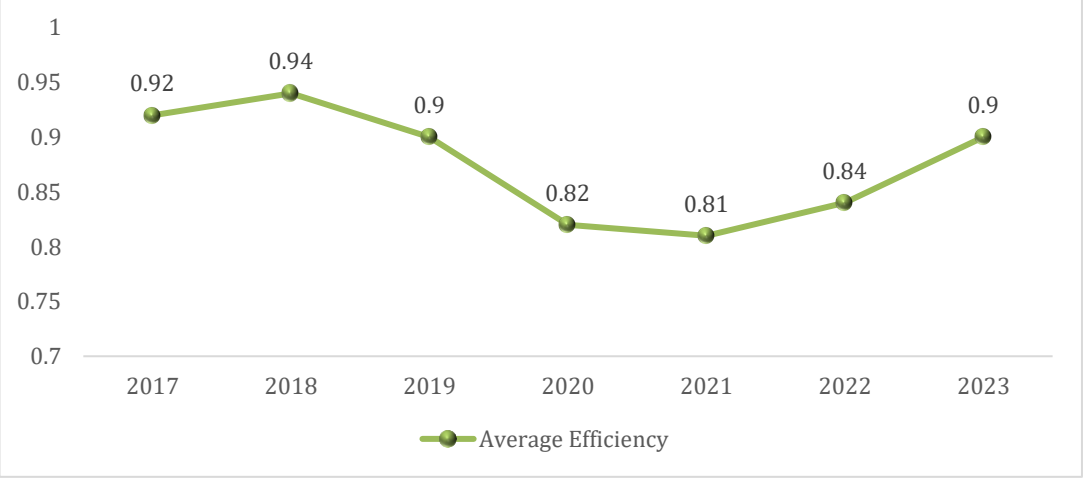

Figure 2. Average Efficiency of Islamic Banking in Indonesia
Source: Max-DEA, Data Processed (2025)

Islamic banks have been negatively impacted by COVID-19, given the nature of their financing activities in the banking sector. When community activities are restricted, banks have little to no operational activities, given that

the real sector is adversely impacted. This environment has decreased the operational activities of the Islamic banks, as evidenced by the reduction in their financial ratios. There has been a deceleration in the growth of Islamic banking financing activities to 8.08% in the year 2020 as compared to the 10.89% growth in the previous year (OJK, 2021). Moreover, the progress in 0.16% for investment financing in the year 2020 was a considerable reduction in growth as compared to 14.84% growth in 2019 (OJK, 2021).

Furthermore, deposit (funds) from the public (DPK) growth has also slowed, particularly in the current accounts. In the year 2020, current accounts increased by 17.44% compared to the prior year, 2020 growth of 32.24% (OJK, 2021). Islamic banks also have a low profitability, and 2020 had an ROA of 1.54% which was a reduction from the prior year of 1.83% (OJK, 2021). Therefore, it can be observed that this drop in Islamic banks' profitability can be attributed mainly to the drop in financial ratios, which in turn affected the operational efficiency of the banks during the pandemic.

Despite the negative impact of COVID-19 in general on efficacy, Islamic banks in Indonesia have demonstrated their resilience and commitment to improving their performance. So, as Figure 1 above illustrates, the average efficiency of Indonesian Islamic banks improved from 2022 to 2023 and reflects their commitment to overcoming the economic shock of COVID-19. In 2022, Islamic Banks also had the ability to adapt and perform positively despite still being in the COVID-19 pandemic, as reported by OJK (OJK, 2023).

The next economic shock is the ongoing Russia-Ukraine conflict. In the DEA efficiency analysis, in Figure 1, the average performance of Indonesian Islamic banks, during the Russia-Ukraine conflict (2022-2023), improved significantly from 0.84 in 2022 to 0.90 in 2023. This indicates that the Russia-Ukraine conflict did not affect the performance of Islamic banks in Indonesia. This is also supported by the results of the Tobit regression analysis, where the Russia-Ukraine conflict period, as represented by a dummy variable (1 during the conflict period and 0 during the non-conflict period), did not affect the performance of Islamic banks in Indonesia.

Various reasons can account for the results of this particular study. For one, due to the fact that Indonesia did not directly participate in the conflict, the region of differences was far enough that the influence was not too pronounced within the Islamic financial systemin Indonesia. Ultimately, Indonesian Islamic banks can be said to have been able to manage the effects of the conflict. Nevertheless, the loss in conflict by the Indonesian economy can be considered, although the effects are not of great magnitude. On a global scale, the conflict has had an influence on international trading activities, the volatility of energy commodities, and the dynamics of global financial markets (Bank Indonesia, 2022).

In particular, one effect that Indonesia is experiencing is the depreciation of the Rupiah. As stated in the report by Bank Indonesia (2022), the rupiah depreciated by 0.42% between the end of 2021 and March 2022, which is also the period when the Russian invasion of Ukraine started. This results in a shock to the global economy, which in turn affects the exchange rate of the rupiah. Although the effect is not significant, it shows that the exchange rate of the rupiah can withstand global turmoil, especially that surrounding war.

Moreover, the rise of oil prices due to the war also puts a strain on the economy of the country. In the report by the Ministry of Energy and Mineral Resources, the Ukraine-Russia conflict has also impacted the global supply of crude oil, thereby increasing the prices of crude oil in the international market in March 2022. The price of crude oil produced in Indonesia increased to USD 113.50 per barrel, which is USD 17.78 higher than the price of USD 95.72 per barrel that has been the price over the last 14 years (Ministry of Energy and Mineral Resources, 2022). The country, being a large importer of oil, will negatively impact the trade balance due to the rise in inflation that is often associated with oil.

Furthermore, disruptions to Indonesia's international trade activities are also a result of this conflict. As an example, trade Indonesia conducts with Russia suffers extreme declines in exports and imports. Overall, trade activities are a deficit of USD 204.6 million, a USD 13.5 million deficit with Ukraine in the period of Feb- March 2022 (BPS, 2022).

There is no conflict affecting the efficiency of Islamic banking directly, but the economic impact is great. The conflict is likely to further impair the economy and also the future economic activities and performance of the banking sector. The disruption of international trade, higher oil prices, and the increased geopolitical tension are going to slow down the world economy and cause a further decline in the interest of the investors. As a result, there is no need to provide additional empirical data to explain the great extent of macroeconomic effects of the conflict on the competency of the Islamic banks. The potential of this conflict is great enough to warrant being highly anticipated.

A research project that investigated the effects of economic shocks on the productivity of Islamic banks in Indonesia concludes that while economic shocks are of concern for the economy, not all economic shocks would influence the Islamic banks performance. Also, Islamic Banking in Indonesia demonstrates an excellent degree of persistence in experiencing economic shocks such as economic instability. Islamic banks, during the COVID-19 pandemic, experienced a shock that constrained their efficiency, but they were able to adapt to the shock and, during the recovery phase, became more

efficient. This demonstrates the robust and adaptable nature of sharia compliant bankingto withstand economic challenges on a global scale.

CONCLUSION

The empirical findings of this study, based on the computed average efficiency scores of Indonesian Islamic banks, generally demonstrated operational inefficiency across the entire research period. During the COVID-19 pandemic, performance scores for these banks recorded a significant decline. Interestingly, in the subsequent period marked by the Russia-Ukraine conflict, a divergent trend was observed. While global studies indicated Islamic banks' incompetence during this geopolitical event, the Indonesian Islamic banks showed relative competency, suggesting they managed external shocks effectively during the conflict era. In addition, this study focuses on the performance of Islamic banks in Indonesia. The results indicate that inflation has a significant impact on the Indonesian Islamic banks' performance, leading to increased performance. However, the study also observed improvements in the overall productivity of some of the researched Islamic banks.

The results of this thesis can assist Islamic banks and regulators in dealing with economic shocks to increase their performance through better intermediation and financing. The evident limitation of this study results from its data sample; this study only surveyed Islamic banks in Indonesia so its results cannot be applied in other countries. More diversified methods like Stochastic Frontier Analysis (SFA) and the Thick Frontier Approach (TFA) to study efficiency would also be instrumental in obtaining better results. Lastly, the study of the sources of efficiencies in Islamic banks can be enriched by including non-financial factors of the bank with respect to its management and corporate governance in order to draw further insights into the efficiencies of Islamic banks.

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