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STABILITY OF ISLAMIC BANK EFFICIENCY IN INDONESIA AND MALAYSIA: HAS COVID-19 MADE ANY DIFFERENCE?

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ABSTRACT

This study examines whether COVID-19 has affected the stability of Islamic banking efficiency in Indonesia and Malaysia using the Data Envelopment Window Analysis (DEWA) using data from 2017 to 2022. The findings indicate that Islamic banks in Malaysia exhibit a higher level of efficiency and stability as compared to their counterparts in Indonesia across all three efficiency measures, namely Technical Efficiency (TE), Pure Technical Efficiency (PTE), and Scale Efficiency (SE). In addition, the findings show that Islamic banks in both countries have stable efficiency performance over the period under investigation and hence the Covid-19 pandemic has not affected their efficiency levels. From the analysis, we further note that financing and labor costs are the main sources of inefficiency in Malaysian Islamic banks while fixed assets and operating revenue contribute the most to Indonesian Islamic banks' inefficiency.

Keywords: Islamic banks, Efficiency, Stability, Indonesia, Malaysia.
JEL classification: C14; G20; G21; G28.

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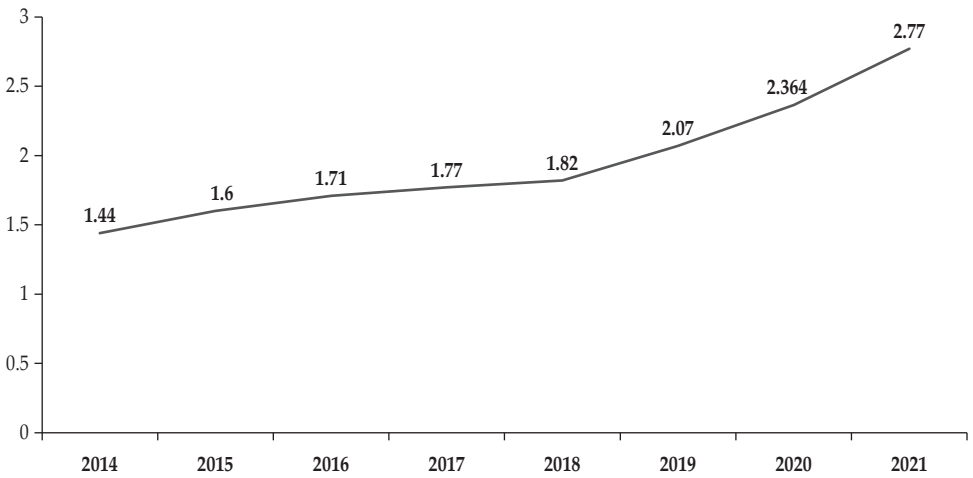
I. INTRODUCTION

The recent Covid-19 crisis, which started at the end of 2019, triggered a global recession and affected all financial and economic sectors. The banking sector is no exception to this adverse effect. Indeed, there is an expanding list of research focusing on the influence of Covid-19 on the behavior of banks. In this regard, one strand of the research investigates how the pandemic has affected banks, which include the effects of on bank stock prices (Demirgüç-Kunt et al., 2021), the loan spreads of syndicated loans Hasan et al., (2021), lending (Boubakri et al., 2023, Acharya & Steffen 2020), and depositors' behavior (Elnahass et al., 2021). The spread of Covid-19 negatively impacts accounting and market performance, as well as financial stability. In order to take the necessary preventative measures, it is crucial to investigate how the Covid-19 pandemic has impacted the efficiency of Islamic bank.

The Covid-19 pandemic has brought pervasive disruptions and stress to the banking industry. Yet, interestingly in 2020, the total Islamic banking assets increased by 10.7 percent to US$ 2.36 trillion, slowing only slightly from 2019's growth of 11.4%. Further, the global Islamic banking sector continued its rapid expansion in 2021, expanding by 17% to US$2.77 trillion (Refinitiv Islamic Finance Development Report 2022). Despite being affected by the pandemic; the Islamic banking sector has proven its resilience. Still, Islamic banking industry needs continue to maintain their performance in terms of efficiency and stability to face the numerous challenges in the future.



Sources: Refinitiv Islamic Finance Development Report 2022

Figure 1.
Islamic Banking Assets (in trillion U.S. dollars)

The banking stability during the Covid-19 pandemic has drawn increasing attention from scholars. Mansour et al. (2021) investigate the response of Islamic banks to the Covid-19 pandemic. Safiullah (2021) state that capital responses to the risk-taking behaviour of institutions during a financial crisis differ from normal

economic conditions. Further, Risfandy & Pratiwi (2022), Ghouse et al., (2022), Ünlü et al., (2022), Mirzaei et al., (2022), Alabbad & Schertler (2022), and Boubaker et al., (2022) assess the performance and efficiency of Islamic banking institutions in order to determine how they can maintain their performance and resilience in the wake of the Covid-19 pandemic. Overall findings support the view that efficient banks are more resilient during crises and highlight the significance of bank regulatory reforms that increase efficiency to withstand the negative effects of the most recent Covid-19 crisis.

As a result, Islamic banking must maintain its efficiency level for preserving financial stability (Phan et al., 2019). Bank efficiency must be evaluated so that banks can behave sensibly in avoiding risk in their operational activities, increasing their competitiveness, and expanding their market share (Izzeldin et al., 2021). Therefore, it is necessary to conduct further investigation evaluating the efficiency of Islamic banking. This study will employ Malaysia and Indonesia as its research subjects. The two countries have effectively implemented a dual banking system, with Malaysia and Indonesia emerging as the leading countries with a fully-fledged Islamic banking system operating alongside the conventional banking system (Ismail et al., 2013). Given that the majority of existing research on the topic of efficiency, particularly in these two countries, is conducted during the global financial crisis, and that the topics covered in the small number of previous studies are diverse, we propose conducting a new study. Ascarya & Yumanita (2008), Laila et al., (2018), Rani & Kassim (2020) are among the existing studies. However, in addition to covering vastly different topics, none of the existing studies address the Islamic banking efficiency during the Covid-19 crisis.

The goals of this article are twofold, to investigate the efficiency of Islamic banks in Indonesia and Malaysia and, to compare the stability and resilience of Islamic banks in both countries across period including during the Covid-19 pandemic. To analyze and compare the efficiency and its stability of Islamic banking in Indonesia and Malaysia, this study applies Data Envelopment Analysis (DEA), which is then expanded by DEA Window analysis.

The research will be structured as follows. The next section reviews related literature. Then, section 3 describes the data and research methodology employed in this study. The analysis and discussion of results will be described in section IV. The conclusion and recommendations based on the research findings are included in the final section.

II. LITERATURE REVIEW

2.1. Impact of Covid-19 on Banks

Businesses around the world have felt the economic and non-economic effects of the Covid-19 outbreak. Numerous studies have examined the effects of Covid-19 on economic activity (Behera et al., 2023; Qadri et al., 2023; Shabir et al., 2023). According to Boubakri et al., (2023), business profits and financial performance during the Covid-19 pandemic witnessed significant declines. According to Sunarsih et al., (2022), Islamic banks revise their risk management strategies in order to be better prepared for future crises. According to Ünlü et al., (2022), the Covid-19 pandemic has a negative impact on supply and demand of products,

as well as the quality of supply chains. In the face of such uncertainty, firms may be able to improve their financial performance by employing more effective and efficient financial management (Mirzaei et al., 2022). According to Fuad et al., (2022), the Covid-19 has halted many activities of the financial and nonfinancial sectors, with its deleterious effects at the global scale.

As a consequence of the Covid-19 impact, supply and demand shocks have been felt in nearly all economies. As banks play key roles in the efficient flow of funds between various economic sectors, these disruptions have posed significant problems, particularly in terms of long-term liquidity (Sunarsih et al., 2022) and capital movements (Mansour et al., 2021).

During the lockdowns, bank deposit growth has slowed (Shabir et al., 2023). Moreover, the maturing advances resulting from the pandemic have made it difficult for borrowers to repay these funds to banks. This has resulted in nonperforming loans for banks, which is yet another challenge for them. Consequently, the increase in non-performing loans has an effect on other financial ratios. The pandemic has a devastating impact on the finance sectors of all global economies (Qadri et al., 2023).

Adverse disruptions can also exert influence on the relationship between risk and stability. In their research, Mahdi & Abbes (2018) examine the interrelationship among capital, risk, and liquidity in the context of the Global Financial Crisis. According to Elnahass et al., (2021), it has been established that the Covid-19 pandemic has a detrimental impact on the financial performance of the global banking system, while simultaneously elevating the levels of risk involved. Moreover, the study conducted by Park & Shin (2021) reveals that there has been a significant capital outflow from emerging economies due to concerns regarding the stability and security of banks during the current pandemic. According to a study conducted by Elnahass et al., (2021), countries with a greater proportion of Islamic institutions exhibit a reduced impact of the pandemic on banking stability.

2.2. Previous Study

There has been a growing interest in bank efficiency. There are numerous methods for measuring bank efficiency performance, one of which is the Data Envelopment Analysis (DEA). Generally, studies on the efficiency of Islamic banks can be divided into two groups: (1) the single-country focus, such as Pakistan (Majeed & Zanib, 2016), Egypt (Jreisat et al., 2018), Turkey (Ünlü et al., 2022), Malaysia (Mokhtar, 2008; Abdul-Majid et al., 2011; Abdullah et al., 2019; Kamarudin et al., 2019; Faizal et al., 2018), Indonesia (Widiarti et al., 2015; Farandy et al., 2017; Puteh et al., 2018; Rani et al., 2020; Octrina & Mariam, 2021; Rusydiana & As-Salafiyah, 2021); and (2) the comparative analyses of Islamic banks efficiency across countries, which include among others ASEAN (Chowdhury & Haron, 2021; Nguyen, 2018; Rosman et al., 2014), GCC (Belanès et al., 2015; Ben Mohamed et al., 2021; Hussien et al., 2019), and MENA (Sufian et al., 2009; Hamdi et al., 2019; Noor et al., 2020; El-Chaarani et al., 2022; Mateev et al., 2023).

From the literature, a number of studies have focused on assessing the performance and efficiency of Islamic banks for Malaysia and Indonesia. Mokhtar (2008) investigates the financial performance of the Malaysian fully-fledged

Islamic banks and Islamic windows for the period of 1997 to 2008. The findings reveal improvement in the overall efficiency of the Islamic banking industry over the period. In addition, while the fully-fledged Islamic banks exhibited more efficiency compared to Islamic windows, they demonstrate lower efficiency levels in comparison to conventional banks. Faizal et al., (2018) examines the performance of Islamic institutions (IBs) in Malaysia between 2008 and 2015. Using the DEA, they find that domestic Islamic banks are more efficient than the majority of domestic conventional banks and outperform international Islamic banks. Kamarudin et al., (2019) investigate the revenue efficiency of the Islamic banking sector in Malaysia from 2006 to 2015. The results indicate that the revenue efficiency of domestic Islamic institutions in Malaysia is lower than that of the foreign counterparts.

Puteh et al., (2018) discover that Islamic banking in Indonesia is inefficient, based on data from 2012 to 2016. They conclude that the inefficiency is due to the bank's excessive operating expenses relative to its operating income. Octarina & Mariam (2021) evaluate the efficiency of Islamic banking in Indonesia from 2011 to 2019 using a total sample of 11 samples. The results suggest that there are only two banks that are nearly fully efficient, but the results do not indicate that Islamic banks in general perform efficiently. The results also suggest that bank size, Capital Adequacy Ratio (CAR), Non-Performing Finance (NPF), and Financing to Deposit Ratio (FDR) are the factors influencing Islamic banking efficiency in Indonesia. Ikhwan & Riani (2022) discover that the efficiency level of Indonesian banks dropped in 2020. The findings reveal that ROA and FDR have a considerable impact on banking efficiency. To improve their efficiency, Indonesian banks should maintain and increase their bank profitability and financing distributions. In contrast, Rusydiana & As-Salafiyah (2021) use the DEA Window Analysis to compute the efficiency scores of Indonesian Islamic banks from 2011 to 2020. During the research period, 12 Islamic banks in Indonesia maintain consistent levels of efficiency.

Another group of studies conduct a comparative analysis of the performance and efficiency of Islamic banks in Indonesia and Malaysia, employing the methodology of Data Envelopment Analysis (DEA). Ascarya & Yumanita (2008) conduct an evaluation of Islamic banks in Malaysia and Indonesia over the period of 2000-2007. The findings of the study suggest that the overall efficiency of Islamic banking in Indonesia exceeds that of its counterpart in Malaysia. The study conducted by Kamarudin et al., (2017) examines the levels of technical efficiency (TE), pure technical efficiency (PTE), and scale efficiency (SE) within local and foreign Islamic banks operating in several Southeast Asian nations from 2006 to 2014. The findings indicate that local Islamic banks exhibit a superior degree of total efficiency (TE) in comparison with foreign Islamic banks. Furthermore, Laila et al. (2018) measure and evaluate the efficiency of Islamic banks in Malaysia and Indonesia using a sample of six Islamic banks in Malaysia and ten Islamic banks in Indonesia for the period of 2010-2016. They find that Islamic banks in Indonesia score higher than Islamic banks in Malaysia. However, the majority of Islamic banks have maintained their efficiency, while others have encountered a slight decline.

In addition, Rani & Kassim (2020) compared the efficiency of Islamic banks in Indonesia and Malaysia from 2012 to 2018 using DEA Window Analysis. Based on the findings, it appears that Islamic banks in Indonesia have higher intertemporal efficiencies than Islamic banks in Malaysia. Furthermore, the stability of efficiency clearly demonstrates that the efficiencies of Islamic banks in Indonesia are more stable than those of Islamic banks in Malaysia, both in TE and PTE. Furthermore, a recent study conducted by Riani & Ikhwan (2022) assesses and evaluates the operational efficiency of Islamic and conventional banks in Indonesia and Malaysia throughout the period from 2015 to 2020. It demonstrates that the Covid-19 pandemic has had a detrimental effect on the operational efficiency of banks in Indonesia and Malaysia. The study additionally demonstrates that Indonesian banks exhibit a higher level of efficiency in comparison to their Malaysian counterparts.

These previous works show there are different results and conclusions, which can be due to different sample periods, econometric methods, and approaches used. As the issue of efficiency remains important, a novel study comparing the intertemporal efficiency during the current economic crisis is required. Therefore, this study aims to address this issue by conducting DEA window analysis on 28 Islamic banks in Indonesia and Malaysia from 2017 to 2022 to capture the stability change before and during Covid-19 pandemic.

III. METHODOLOGY

3.1. Method

In a seminal study on efficiency, Farrell (1957) categorizes efficiency into two: allocative efficiency and technical efficiency. The technical efficiency can be achieved either by maximizing output with a given number of inputs or by minimizing inputs to produce certain number of outputs while allocative efficiency is the results from selecting the set of inputs subject to their prices in order to maximise outputs. When both technical and allocative efficiency are combined, the overall efficiency will be achieved. There are several methods to measure efficiency, either parametric or non-parametric, one of the most commonly used is the Data Envelopment Analysis (DEA).

The DEA is a nonparametric method to evaluate DMU's performance in terms of its efficiency, relative to other similar DMUs, whereby all the DMUs lie on or below the frontier efficiency. Due to the nonparametric nature of the DEA, no assumptions about the production function are required. In addition, the DEA generates the production function based on the observed data, minimizing misspecification. This method can also be used to determine how an inefficient DMU can improve its performance to become efficient through the potential improvement analysis. Mathematically, the DEA model can be represented as:

$$Efficiency\ of\ DMU_0 = \frac{\sum_{k=1}^{p} v_k y_{k0}}{\sum_{j=1}^{m} u_j x_{j0}}$$

where p = different outputs, m = different inputs, y_{k0} = amount of output k produced by DMU_0 and x_{j0} =amount of output *j* consumed by DMU_0.

The DEA is first developed by Charnes et al (1978) and then extended by Banker et al (1984) to examine the relative efficiency based on multiple inputs and outputs. There are two DEA models which are frequently employed, namely Charnes, Cooper, and Rhodes (CCR) model and the Banker, Charnes, and Cooper (BCC) model (Coelli, 1996). The CCR model assumes that every DMU operates with constant return to scale (CRS) assumption, measuring the overall efficiency (OE=Technical Efficiency X Allocative Efficiency). In addition, the BCC model assumes that every DMU may operate with variable return to scale (VRS) assumption, measuring the technical efficiency. Furthermore, the Technical Efficiency (TE) consists of Pure Technical Efficiency (PTE) and Scale Efficiency (SE) (TE = PTE X SE). Therefore, the overall efficiency can be broken down into OE=AE X PTE X SE).

The DEA result is relative to its competitor. This means that the result will change for different samples and study periods. Then, the intertemporal analysis needs to be applied in order to compare the efficiency trend (the efficiency changes over time). To overcome this DEA's shortcoming, Charnes et al., (1984) then develop the DEA window analysis (DEWA) concept, where the DMUs performance is analyzed for certain window periods. According to Ascarya & Masrifah (2022). the DEA Window analysis is the most important DEA application in the context of Islamic and finance literature.

The DEWA is an extension of DEA that can measure the DMU's performance over periods by treating it as a different entity. This concept is also called the time-dependent version of DEA. The essential concept of the DEWA is to consider each DMU separately from other data items in the observations. In addition, every DMU is compared not with the complete data set, but just with alternatives from a specific subset of panel data. DEWA assumes that what was "feasible" in the past will continue to be "feasible" indefinitely. Consequently, the consideration of time in the window analysis is mainly concerned with the average properties over the period covered by a window (Tulkens & Eeckaut, 1995). Furthermore, the DEA window analysis allows for the shifting of historical boundaries, and as a result, it produces more consistent and reliable conclusion (Sueyoshi et al., 2017). Hence, the efficiency scores obtained using this technique are more accurate.

Campisi & Costa (2008) note various advantages of the DEWA, one of which is the ability to compare the efficiency of multiple DMUs to benchmarks based on their optimal performance. This method is preferable and helps estimate the relative effectiveness of the DMU (Shawtari et al., 2018). The DEWA is based on the concept of moving averages, which are then used to determine the performance trends of each unit over time. The DMU in different periods is treated as different DMUs. In this study, the DEWA analysis is used to examine the Islamic banks' efficiency trend or the level of their efficiency from time to time. As suggested by Cooper et al. (2011), the result of the window analysis can be used to analyse relative efficiency stability using a variety of summary statistics. This study includes several summary statistics such as Mean, Long Distance per Year (LDY), and Long Distance Per Period (LDP).

3.2. Data

This study examines and compares the efficiency of 28 Islamic banks in Indonesia and Malaysia during 2017-2022 period. Following Ascarya & Yumanita (2008), Kamarudin et al., (2016), Rani & Kassim (2020), and Rusydiana & As-Salafiyah (2021), we adopt an intermediary approach. Considering Islamic banks are intermediary institutions, this study uses fixed assets (x1), third-party funds (x2), and labor costs (x3) as the input variables, and total financing (y1) and operating revenues (y2) as the output variables. The data are gathered from annual reports and financial statements of each bank. Figure 1 below shows the model development of this study.

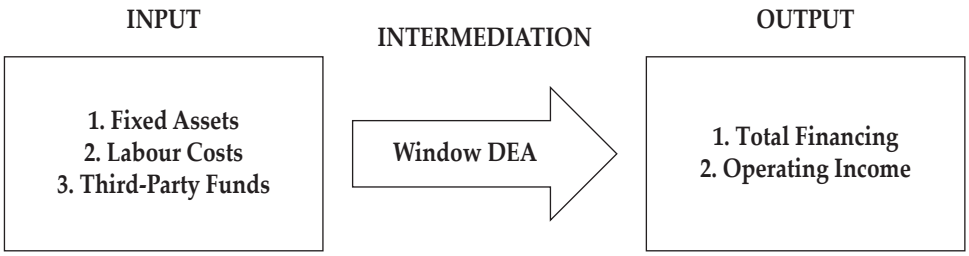


Figure 2.
Model Development

IV. RESULT

4.1. Statistical Descriptive

Descriptive statistics of the variables for both Malaysia and Indonesia are presented in Table 1. Some important issues can be drawn from the table. Almost all variables in both countries fluctuate but tend to increase over the six-year period. However, as the 2020 Covid-19 pandemic start to spread in Indonesia and Malaysia, we observe reduction in few variables. In Malaysia, there was a decrease in the labor cost and operating revenue from 2019 to 2020, while in the case of Indonesian Islamic banks the decrease was only in the operating revenue. Interestingly, all of Indonesia's input and output variables experience a sharp increase in the 2021 and 2022 periods. This may be due to the merger of 3 government-owned Islamic banks which notably has the largest scale (BNIS, BRIS, and Mandiri Syariah) to become BSI (Bank Syariah Indonesia).

Table 1.
Descriptive Statistics of Input and Output Variables

Malaysian Islamic Bank					
Year	**Fixed Asset**	**Labor Cost**	**Third-Party Funds**	**Operating Revenue**	**Total Financing**
2017	8.317.764	48.591.099	7.689.297.154	196.062.805	7.429.106.536
2018	8.644.301	51.562.322	8.401.490.700	239.015.775	8.178.267.691
2019	9.193.142	50.466.119	8.815.715.640	247.414.264	8.718.093.166
2020	9.459.596	43.262.576	9.288.206.675	209.751.613	9.299.567.103
2021	9.118.131	58.277.381	10.194.983.671	277.218.002	10.118.900.386
2022	9.904.841	54.178.764	10.432.267.901	289.017.830	9.774.380.697
Indonesian Islamic Bank					
Year	**Fixed Asset**	**Labor Cost**	**Third-Party Funds**	**Operating Revenue**	**Total Financing**
2017	31.193.508	33.656.359	243.447.237	13.575.655	365.209.613
2018	35.580.095	33.211.398	217.730.701	14.675.817	357.103.477
2019	37.734.608	38.567.341	286.375.653	22.909.066	464.647.099
2020	46.839.820	39.824.853	406.437.151	20.424.004	499.557.187
2021	58.018.892	51.045.356	478.053.103	36.311.264	606.614.182
2022	55.848.866	49.083.080	517.815.225	42.316.686	684.789.981

4.2. DEA Window Result

The Window DEA analysis is used to examine the efficiency stability of DMUs over time. It measures the bank's efficiency level in several moving windows in terms of its mean, Long Distance per Year (LDY), and Long Distance per Period (LDP). The "Mean" column displays the average of each bank's scores. Then, the "LDY" column exhibits the maximum disparity across bank scores across distinct time intervals within a given year. The column labelled "LDP" signifies the largest disparity seen among bank scores for the entire duration. This measurement is employed to assess the stability of efficiency for each DMU.

The Window DEA results are presented as an efficiency score from 0 to 1. A score of 1 indicates that the bank's input and output variables are optimally managed. However, if the efficiency score is less than 1, it may imply that the bank is inefficient or has not optimally controlled its input and output variables. Various calculations of Islamic bank's efficiency and stability will be presented in terms of Technical Efficiency (TE) with Constant Return to Scale (CRS) assumption, Pure Technical Efficiency (PTE) with Variable Return to Scale (VRS) assumption, and Scale Efficiency (SE) by dividing the CRS and VRS assumption.

4.2.1. TE Stability of Indonesia and Malaysian Islamic Banks

Table 2 shows the results of the Technical Efficiency (TE) based on the window DEA. We also include Mean, LDP, and LDY to demonstrate the efficiency stability of Islamic banks in Indonesia and Malaysia. The results show that Islamic banks in Malaysia are more efficient and stable than Islamic banks In Indonesia technically, as reflected by the higher Malaysian Islamic banks average efficiency score of 0.73

as compared to that of Indonesia of 0.51. In addition, Malaysian LDY and LDP scores are 0.17 and 0.26 respectively, smaller than Indonesian LDY and LDP with corresponding scores of 0.33 and 0.36. Furthermore, the analysis finds that the most technically efficient and stable Islamic bank is Maybank Islamic Berhad with an average efficiency score of 1 followed by LDY and LDP scores of 0.

Table 2.
TE Stability of Indonesia and Malaysian Islamic Banks

DMU	2017-2019	2018-2020	2019-2021	2020-2022	Mean	LDY	LDP
Malaysian Islamic Bank							
Affin Islamic Bank	0,54	0,82	0,84	0,84	0,76	0,10	0,37
Al Rahji Banking and Investment Corporation	0,36	0,64	0,66	0,67	0,58	0,43	0,67
Alliance Islamic Bank	0,58	0,74	0,74	0,73	0,70	0,09	0,26
Bank Islam Malaysia	0,60	0,69	0,72	0,76	0,69	0,07	0,20
Bank Muamalat Malaysia	0,48	0,59	0,62	0,67	0,59	0,07	0,24
CIMB Islamic Bank	0,74	0,84	0,92	0,95	0,86	0,23	0,30
Heong Long Islamic Bank	0,87	0,81	0,70	0,72	0,78	0,32	0,32
HSBC Amanah Malaysia	0,66	0,89	0,83	0,83	0,80	0,19	0,39
Kuwait Finance House	0,59	0,61	0,55	0,61	0,59	0,09	0,11
Maybank Islamic	1,00	1,00	1,00	1,00	1,00	0,00	0,00
MSBS Bank	0,30	0,16	0,19	0,23	0,22	0,47	0,47
OCBC Al-Amin Bank	0,68	0,76	0,77	0,78	0,75	0,12	0,17
Public Islam Bank	0,79	0,82	0,81	0,81	0,81	0,02	0,03
RHB Islamic Bank	0,87	0,90	0,87	0,86	0,87	0,05	0,07
Standard Chartered Saadiq	0,99	0,91	0,83	0,84	0,89	0,27	0,27
Mean	0,67	0,75	0,74	0,75	0,73	0,17	0,26
Indonesian Islamic Bank							
Bank Aceh Syariah	0,58	0,51	0,43	0,39	0,48	0,20	0,20
Bank BNI Syariah (BSI)	0,31	0,30	0,31	0,31	0,30	0,20	0,20
Bank BPD NTB Syariah	0,76	0,99	0,99	0,99	0,93	0,69	0,69
Bank BRI Syariah (BSI)	0,25	0,31	0,33	0,35	0,31	0,10	0,19
Bank Jabar Banten Syariah	0,14	0,17	0,18	0,28	0,19	0,29	0,40
Bank Mega Syariah	0,31	0,39	0,52	0,67	0,47	0,80	0,80
Bank Muamalat Syariah	0,25	0,20	0,17	0,18	0,20	0,19	0,25
Bank Panin Dubai Syariah	0,74	0,88	0,93	0,99	0,88	0,45	0,45
Bank Syariah Bukopin	0,35	0,41	0,43	0,42	0,40	0,21	0,22
Bank Syariah Mandiri (BSI)	0,33	0,38	0,39	0,35	0,36	0,19	0,21
BTPN Syariah	0,84	0,83	0,86	0,81	0,83	0,43	0,43
Bank Victoria Syariah	0,87	0,80	0,83	0,89	0,85	0,51	0,51
BCA Syariah	0,49	0,52	0,44	0,46	0,48	0,10	0,15
Mean	0,48	0,51	0,52	0,55	0,51	0,33	0,36

4.2.2. PTE Stability of Indonesia and Malaysian Islamic Banks

Table 3 presents the resulst of the Pure Technical Efficiency (PTE) Stability employing the window DEA for Islamic banks in Indonesia and Malaysia. In line with the previous results, the Window DEA on Pure Technical Efficiency (PTE) shows that Islamic banks in Malaysia are more stable and efficient than Indonesia with the highere average efficiency level, and lower LDY and LDP scores. Malaysian Islamic banks average efficiency scores is 0,79 higher than Isamic banks in Indonesia. In addition, Malaysian LDY and LDP scores are 0.20 and 0.30 respectively, which are smaller than those for Indonesian banks with corresponding scores of 0.44 and 0.48. Maybank Islamic Berhad remains the most efficient and stable PTE with the fully efficient and stable performance during the observation period.

Table 3.
PTE Stability of Indonesia and Malaysian Islamic Banks

DMU	2017-2019	2018-2020	2019-2021	2020-2022	Mean	LDY	LDP
Malaysian Islamic Bank							
Affin Islamic Bank	0,76	0,83	0,85	0,84	0,82	0,11	0,17
Al Rahji Banking and Investment Corporation	0,40	0,69	0,73	0,72	0,64	0,48	0,68
Alliance Islamic Bank	0,63	0,75	1,00	0,99	0,84	0,11	0,44
Bank Islam Malaysia	0,92	0,94	0,92	0,88	0,92	0,15	0,15
Bank Muamalat Malaysia	0,63	0,67	0,68	0,72	0,68	0,07	0,13
CIMB Islamic Bank	0,78	0,87	0,93	0,97	0,89	0,22	0,30
Heong Long Islamic Bank	0,88	0,81	0,71	0,72	0,78	0,31	0,31
HSBC Amanah Malaysia	0,91	0,91	0,85	0,86	0,88	0,17	0,20
Kuwait Finance House	0,68	0,71	0,71	0,70	0,70	0,09	0,11
Maybank Islamic	1,00	1,00	1,00	1,00	1,00	0,00	0,00
MSBS Bank	0,42	0,17	0,22	0,26	0,27	0,80	0,80
OCBC Al-Amin Bank	0,73	0,77	0,78	0,79	0,77	0,09	0,13
Public Islam Bank	0,92	0,86	0,82	0,81	0,86	0,13	0,81
RHB Islamic Bank	0,88	0,90	0,88	0,86	0,88	0,05	0,07
Standard Chartered Saadiq	1,00	0,99	0,83	0,84	0,92	0,26	0,26
Mean	0,77	0,79	0,79	0,80	0,79	0,20	0,30
Indonesian Islamic Bank							
Bank Aceh Syariah	0,58	0,52	0,43	0,46	0,50	0,20	0,20
Bank BNI Syariah (BSI)	0,33	0,34	0,52	0,70	0,47	0,76	0,76
Bank BPD NTB Syariah	0,78	1,00	0,99	0,99	0,94	0,67	0,67
Bank BRI Syariah (BSI)	0,31	0,39	0,57	0,76	0,51	0,57	0,77
Bank Jabar Banten Syariah	0,19	0,21	0,20	0,30	0,22	0,30	0,34
Bank Mega Syariah	0,32	0,40	0,54	0,68	0,49	0,75	0,75
Bank Muamalat Syariah	0,77	0,80	0,59	0,40	0,64	0,68	0,85
Bank Panin Dubai Syariah	0,76	0,91	0,95	0,99	0,90	0,41	0,41
Bank Syariah Bukopin	0,48	0,54	0,51	0,46	0,50	0,20	0,21
Bank Syariah Mandiri (BSI)	0,85	0,87	0,86	0,88	0,86	0,30	0,30
BTPN Syariah	0,84	0,83	0,87	0,82	0,84	0,43	0,43
Bank Victoria Syariah	0,99	1,00	0,97	0,89	0,96	0,32	0,32
BCA Syariah	0,55	0,56	0,45	0,47	0,51	0,11	0,19
Mean	0,60	0,64	0,65	0,68	0,64	0,44	0,48

4.2.3. Scale Efficiency of Indonesian and Malaysian Islamic Banks

Table 4 shows the Scale Efficiency stability results of Indonesian and Malaysian Islamic banks. Scale Efficiency (SE) scores are calculated by dividing the TE based on the CRS by the PTE based on the VRS. The maximum score is 1 or fully scale efficient, so CRS scores would be less or equal to VRS scores. The results show that the average Scale Efficiency (SE) stability of Malaysian Islamic banks is 0.92, higher than that of Islamic banks in Indonesia at 0.80. The most scale-efficient Islamic bank is the Maybank Islamic berhad with fully efficient score of 1.

Table 4.
SE of Indonesian and Malaysian Islamic Banks

DMU	TE	PTE	SE
Malaysian Islamic Bank			
Affin Islamic Bank	0,76	0,82	0,93
Al Rahji Banking and Investment Corporation	0,58	0,64	0,91
Alliance Islamic Bank	0,70	0,84	0,83
Bank Islam Malaysia	0,69	0,92	0,75
Bank Muamalat Malaysia	0,59	0,68	0,87
CIMB Islamic Bank	0,86	0,89	0,97
Heong Long Islamic Bank	0,78	0,78	1,00
HSBC Amanah Malaysia	0,80	0,88	0,91
Kuwait Finance House	0,59	0,70	0,84
Maybank Islamic	1,00	1,00	1,00
MSBS Bank	0,22	0,27	0,81
OCBC Al-Amin Bank	0,75	0,77	0,97
Public Islam Bank	0,81	0,86	0,94
RHB Islamic Bank	0,87	0,88	0,99
Standard Chartered Saadiq	0,89	0,92	0,97
Mean	0,73	0,79	0,92
Indonesian Islamic Bank			
Bank Aceh Syariah	0,48	0,50	0,96
Bank BNI Syariah (BSI)	0,30	0,47	0,64
Bank BPD NTB Syariah	0,93	0,94	0,99
Bank BRI Syariah (BSI)	0,31	0,51	0,61
Bank Jabar Banten Syariah	0,19	0,22	0,86
Bank Mega Syariah	0,47	0,49	0,96
Bank Muamalat Syariah	0,20	0,64	0,31
Bank Panin Dubai Syariah	0,88	0,90	0,98
Bank Syariah Bukopin	0,40	0,50	0,80
Bank Syariah Mandiri (BSI)	0,36	0,86	0,42
BTPN Syariah	0,83	0,84	0,99
Bank Victoria Syariah	0,85	0,96	0,89
BCA Syariah	0,48	0,51	0,94
Mean	0,51	0,64	0,80

4.3. Additional Analysis

Here, the average efficiency of Islamic banking institutions in Indonesia and Malaysia is compared using the Shapiro-Wilk test. The Shapiro-Wilk is a statistical test used to determine whether a continuous variable has a normal distribution. The null hypothesis (H0) states that the variable has a normal distribution, whereas the alternative hypothesis (H1) states that the variable does not have a normal distribution.

Table 5.
Results of Normality Tests

Shapiro–Francia W test for normal data					
Variable	**Obs.**	**W′**	**V′**	**z**	**Prob>z**
TE Indonesia	13	0.87633	2.435	1.561	0.05927
TE Malaysia	15	0.97328	0.578	-0.969	0.83369
PTE Indonesia	13	0.88737	2.218	1.397	0.08122
PTE Malaysia	15	0.90731	2.004	1.227	0.10999
SE Indonesia	13	0.79403	4.055	2.456	0.07003
SE Malaysia	15	0.89412	2.289	1.461	0.07195

Table 5 presents the normality tests result, which demonstrate that the TE, PTE, and SE achievement for Islamic banks in Indonesia and Malaysia are normally distributed, as all data are not significant at the 5% significance level or $p > 5\%$.

4.4. Potential Improvement

In addition to producing efficiency scores, the DEA approach is also capable of suggesting potential improvements, or the amount of improvement required to be fully efficient. The analysis of potential improvement is conducted using the most recent observations, the result of which is presented in the Figure 3.

It can be seen that both countries have different input and output variables which must be prioritized for improvement in the future in order to achieve efficiency. In order to enhance their operational efficiency, banks that exhibit inefficiencies may consider adjusting their input and output variables in accordance with the percentages indicated in Figure 3. This adjustment can be achieved through optimising the utilisation of input variables or enhancing the attainment of output variables.

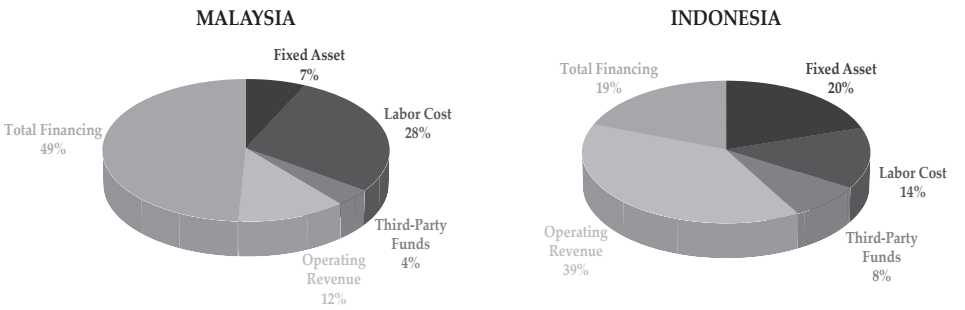


Figure 3.
Potential Improvement Result

In the case of Islamic banks in Malaysia, total financing (49%) and Labor Cost (28%) are the main sources of inefficiency from output and input variables respectively. According to the result, Islamic banks in Malaysia should minimize their budget on salaries to achieve efficiency in the future. However, minimizing the allocated budget for human resources is another suggestion. Islamic banks could increase their human resource performance by conducting training and education for every management level of Islamic banks. In addition, improvement in total financing can be done by optimizing the use of technology and digital services, so the financing given to the customer can be increased.

However, Indonesian Islamic banks need to pay more attention to the use of their Fixed Asset (20%) and the operating revenue achievement (39%) to achieve full efficiency. Fixed assets refer to tangible assets that are owned by banks, including but not limited to offices, ATMs, vehicles, and other such items. The optimisation of fixed assets can be achieved through the selection of alternative strategies that aim to maximise the functionality of current assets. Additionally, it is advisable to exercise caution when considering the addition of new assets in the future. Furthermore, various innovations and creativity must be carried out by Islamic banks in Indonesia to increase their operating revenue in the future.

4.5. Analysis

The efficiency stability measures using the Window DEA show that Islamic banks in Malaysia are more efficient than Islamic banks in Indonesia in Technical Efficiency (TE), Pure Technical Efficiency, and Scale Efficiency (SE). These findings are consistent with Wong & Deng (2016) who find that the TE and PTE of Islamic banks are higher than Islamic banks in Indonesia. The same results are also shown by Chowdhury, et al., (2021), where Malaysian Islamic banks have stable and higher efficiency scores among Islamic banks in Southeast Asia. However, the result contradicts Rani & Kassim (2020), who find that Islamic banks in Indonesia are more stable and efficient than those in Malaysia. The difference in findings could happen because of differences in the selection of variables and observation periods. This study includes the pandemic period, which has not been discussed by previous literature in the context of the efficiency and stability of Islamic banking in Indonesia and Malaysia.

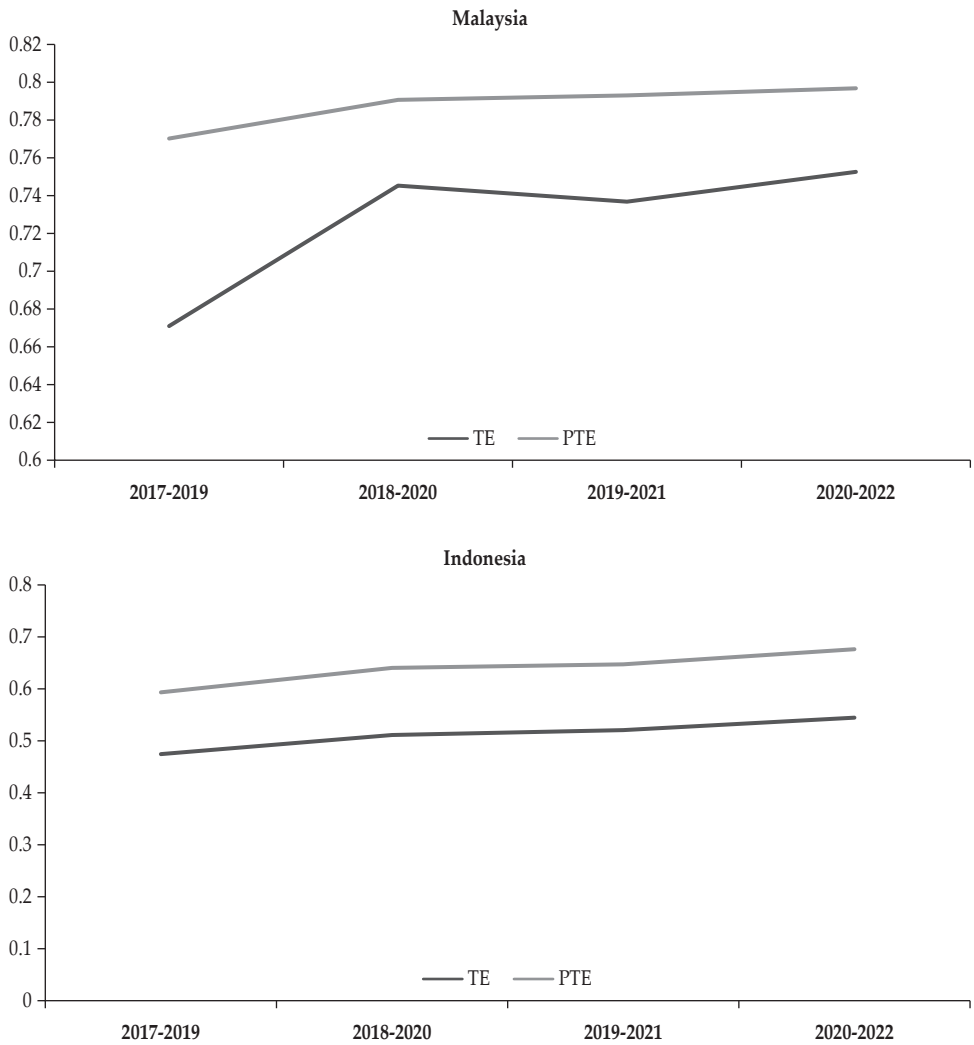


Figure 4.
Efficiency Stability Trend of Islamic Banks

Figure 4 shows the trend and performance comparison between Islamic banks in Indonesia and Malaysia during the observation period. It demonstrates that in both countries the performance and the average efficiency levels are relatively stable before and during the Covid-19 period. This result is consistent with several previous findings whereby Islamic banks are able to maintain their performance during various crises. According to Hudaefi & Badeges (2022), Islamic banks are considered to be better equipped to absorb macroeconomic shocks. This is due to the inherent structural advantages of Islamic banking transactions over conventional banking practices. Shariah-compliant Islamic banking products and contracts help to reduce financial system uncertainty (Audah & Kasri, 2020). In addition, Profit and Loss Sharing (PLS) principles can assist Islamic banks in being

more stable than interest-based systems, which can result in extreme fluctuations in rates of return, inflation, and other economic fundamentals (Ouerghi, 2014).

V. CONCLUSION AND RECOMMENDATION

In general, Islamic banks in Malaysia are more efficient and stable than Islamic banks in Indonesia in all three efficiency measures - TE, PTE, and SE. In addition, the findings show that Islamic banks in both countries has stable efficiency performance before and during the Covid-19 pandemic. Furthermore, the potential improvement outcome can aid Islamic banks in both countries in assessing their level of efficiency attainment. Through an examination of the primary source of inefficiency, practitioners of Islamic banking can discern the variables that warrant prioritisation. Based on the potential improvement result, financing and labor costs are the main sources of inefficiency in Malaysian Islamic banks, whereby fixed assets and operating revenue contribute the most to Indonesian Islamic banks' inefficiency.

From the input side, Islamic banks need to evaluate and optimize the existing fixed asset and labor costs and reconsider when adding them in the future. Furthermore, from the output side digitalization in product and services can be tried as an effort to reduce cost, increase customer satisfaction, and increase the revenue earned. Overall, the management needs to evaluate existing policies and procedures in order to improve efficiency achievement and maintain stable performance. It also needs supports from the policymakers for guidance and supervision to improve the Islamic bank's performance. Improving the human resources quality and providing product innovations are also needed to provide more varied choices for customers, so that the financing may be more optimal.

As this study only covers the observation period until 2022, further study needs to be conducted by expanding data and information in the upcoming years in the post-pandemic periods. The research method is also suggested to be upgraded by using a two-stage DEA analysis to identify the determinants of Islamic banking efficiency. In addition, further studies using different methods are also needed to strengthen the results.

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