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The Efficiency of Indonesian and Malaysian Sharia Bank in the Shadow of Covid-19 Pandemic: DEA Window Analysis

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Abstract

The Pandemic conditions can lead to various problems that can trigger financial distress and inefficiency, especially in the banking sector. In recent decades, there has been a rapid increase in sharia banking, and the importance of this sector to the economies of several countries. The assessment of sharia bank's efficiency will become important as efficiency reflects the banks' performance. This study aims to analyze the stability of sharia bank efficiency in Indonesia and Malaysia using the Data Envelopment Analysis (DEA) dan DEA Window method. This study uses 2015 to 2020 as a research period, especially to look at the stability efficiency of Indonesia and Malaysian Sharia Bank in the Covid-19 pandemic era. The result showed that Indonesia is better than Malaysia in terms of efficiency stability. However, both show a similar pattern, where there is a decrease in the average level of efficiency during the Covid-19 pandemic. From the perspective of efficiency stability analysis through several summary statistics such as its Standard Deviation (SD), Long Distance per Period (LDP), and Long Distance per Year (LDY), the sharia bank with the most relatively stable value of efficiency scores is Maybank Islamic Berhad, then followed by BRI Syariah and BSM.

Keywords: *Bank Efficiency, Stability, Window DEA, Indonesia, Malaysia.*

Abstrak

Kondisi Pandemi dapat menimbulkan berbagai permasalahan yang dapat memicu financial distress dan inefisiensi, khususnya di sektor perbankan. Dalam beberapa dekade terakhir, telah terjadi peningkatan pesat dalam perbankan syariah, dan pentingnya sektor ini bagi perekonomian beberapa negara. Penilaian efisiensi bank syariah menjadi penting karena efisiensi mencerminkan kinerja bank. Penelitian ini bertujuan untuk menganalisis kestabilan efisiensi bank syariah di Indonesia dan Malaysia dengan menggunakan metode Data Envelopment Analysis (DEA) dan DEA Window. Penelitian ini menggunakan tahun 2015 hingga 2020 sebagai periode penelitian, khususnya untuk melihat efisiensi stabilitas Bank Syariah Indonesia dan Malaysia di era pandemi Covid-19. Hasil penelitian menunjukkan bahwa Indonesia lebih baik dari Malaysia dalam hal stabilitas efisiensi. Namun keduanya menunjukkan pola yang sama, dimana terjadi penurunan rata-rata tingkat efisiensi selama pandemi Covid-19. Dari perspektif analisis stabilitas efisiensi melalui beberapa rangkuman statistik seperti Standar Deviasi, Long Distance per Period (LDP), dan Long Distance per Year (LDY), bank syariah dengan rasio paling tinggi nilai skor efisiensi yang stabil adalah Maybank Islamic Berhad, kemudian diikuti oleh BRI Syariah dan BSM.

Kata Kunci*: Efisiensi Bank, Stabilitas, Window DEA, Indonesia, Malaysia*

Introduction

The world is faced with the outbreak of the COVID-19 pandemic which has triggered a severe crisis for global markets and has become a major concern of economic policy[1]. All economic players are experiencing an unprecedented crisis because of the widespread global spread of the coronavirus. The impact on economic development and financial stability is difficult to predict due to the unique character of this crisis but must be addressed urgently. For many countries, this will depend on their ability to restart economic activity while still efficiently managing public health hazards. Exogenous shocks to financial institutions, such as banks, have prompted them to prepare for the challenges of a highly demanding and diverse future. The emergence of this crisis has had an impact on the activities of banks in countries[2].

Banks are required to maintain profitability, cost-effective financial operations, and maintain capital requirements so that banking services can continue to operate amid a pandemic. The impact of COVID-19 on the banking industry sector is triggered by the large number of business owner customers who have difficulty paying bank obligations, resulting in bad loans. One of the main consequences of COVID-19 on the banking industry is an increase in the ratio of non-performing loans (NPL) and funding freezes[3]. However, unlike the 1997/1998 Asian financial crisis, the problem for the banks this time is more a loan deterioration than a tight liquidity problem. To prevent the possibility of bad credit, banks began to channel credit very carefully. Due to the inability of customers to pay, some institutions, especially small-scale banks, have seen an increase in cases of bad loans. The occurrence of bad credit cases in several banks is a symptom that bank operations are in bad condition.

Despite these constraints, there are high expectations that banks will not only survive financial system shocks but will also become active contributors to broader economic solutions, assisting the government in mitigating the recessive factors affecting the economy caused by pandemic risks. Various policies issued by governments in various countries aim to maximize banking efficiency so that they can be more optimal in realizing financial prosperity and economic equity, especially in the era of the COVID-19 pandemic, where most countries in the world are affected[4]. Either through the restructuring process for customers affected by COVID-19, by increasing the financing period, or by providing a grace period of 3-6 months in the future[5].

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Based on the above-mentioned situation, evaluating a bank's efficiency will become essential, as efficiency reflects a firm's performance and has been seen as a key factor for stakeholders in creating rational strategic decisions to minimize the risk level of banking operations. Efficiency is a crucial issue for banks because it can measure bank performance[6]. Efficiency is measured to determine bank performance, particularly during the Covid-19 pandemic. Pandemic conditions can cause several consequences, including financial distress and inefficiency.

Rosniar and Takidah[7] explain the definition of efficiency in an Islamic view is an effort to increase profits by maximizing the output obtained and managing inputs optimally without any party being wronged (harmed) either by other people or by nature. The primary purpose of the banking industry is financial intermediation. The implementation of financial intermediation in sharia banks can be observed in the bank's capacity to convert savings received primarily from household economic units into credit or loans for companies and others to invest in real estate, machinery, and other capital goods. According to Buchory[8], the implementation of financial intermediation has an impact on the performance of banks. This implies that a bank's financial performance will be favorable if it can perform its intermediary function effectively.

In recent decades, there has been a rapid increase in Sharia banking, and the importance of this sector to the economies of several countries[9]. So it is important to have a greater understanding of efficiency and its drivers. Sharia banking activities are experiencing rapid development internationally through the Middle East, South Asia, and Southeast Asia[10]. Southeast Asia is becoming an important part of the Islamic world's finances given its rapid and sustainable growth[11]. Indonesia and Malaysia are two countries that encourage the growth of the Sharia banking and finance industry in Southeast Asia[12]. There are similarities in the political economy of Indonesia and Malaysia, where both

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countries are trying to develop a banking structure under the dual banking system, where the sharia and conventional sectors operate in tandem[13].

The Islamic finance industry in Malaysia has been around for more than three decades[14]. Following the adoption of the Sharia banking Act in 1983, the country's first Sharia bank was established, and as the Islamic financial system became more and more popular, more and more Islamic financial institutions were established. Malaysia's track record of nearly 30 years in developing a strong domestic Islamic finance industry provides the country with an increasingly strong foundation for financial system stability. As of December 2019, Malaysia's total Sharia banking assets reached USD 254 billion, with total funds placed at 38.0 percent of total banking sector deposits (Bank Negara Malaysia, Financial Report 2019).

In 1992, Bank Muamalat Indonesia was created as the first Sharia bank in Indonesia. The Sharia banking industry develops based on religious beliefs and the risk-sharing concept, with a number of prerequisites including transparency and accountability, good governance, contract enforcement, effective monitoring, well-structured economic institutions, and efficient financial markets[15]. In Indonesia, the Sharia banking industry has grown to become an important part of the national financial industry and a supporter of economic progress. According to Global Islamic Finance Report (2019), Indonesia's Islamic finance industry was first positioned above other Islamic countries in the Islamic Financial Country Index (IFCI) with a score of 81.93.

Studies that focus on measuring the efficiency of Sharia banks within countries, during the COVID-19 pandemic, have never been conducted. Does the presence of covid have an impact on the efficiency level of these banks. Furthermore, this was the first study to employ a specific tool, using Data Envelopment Window Analysis, to estimate the efficiency scores of Indonesia and Malaysia Sharia banks during the economic downturn due to the pandemic. The two countries have emerged as Asian Sharia centers and sources of reference on the current Sharia developments, particularly Sharia banking in ASEAN. This research is important because it can be used as a guideline for both countries to improve their weaknesses, the objective of strengthening the banking structure in times of a weak economy can be achieved and banks can accelerate recovery.

Literarature Review

Sharia banks are financial institutions that operate and create products in accordance with Sharia law. Mit Gamr Bank, founded in Egypt in 1963, was the start of the global growth of Sharia banking. In addition, in 1975, Dubai Sharia

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bank became the first commercial bank to offer sharia services. The first Sharia banking in Southeast Asia was formed in Malaysia in 1983 by Bank Islam Malaysia Berhad[16]. Southeast Asia has become an essential element of global Islamic finance due to the quick and stable growth of the Islamic finance industry.

According to Puspitasari et al[17], the Sharia banking and finance industry has advanced significantly to become a viable and competitive global alternative to conventional financial systems. Sharia banking and financial institutions have established themselves in important regions such as the Middle East, Southeast, and Southeast Asia. ASEAN countries have different levels of Sharia banking development. Malaysia is the ASEAN country that has developed Sharia banking the most rapidly, while Indonesia is also working to strive to establish Sharia banking. In Malaysia, the method is state-driven, whereas, in Indonesia, Sharia banking is more market-driven[18].

In the Islamic financial system, equity participation, profit, and loss sharing, all play a major role[19]. The essential component of Islamic financial contracts is profit and loss sharing[20]. Because Islamic finance is based on risk-sharing, it can absorb any severe economic shocks due to risk-sharing instruments that payoffs are solely based on a company's profitability. According to Sharia banks have demonstrated the ability to achieve a complementary relationship between clients' social well-being and the banks' financial efficiency.

Devi and Firmansyah[21] state that is critical for a business entity to sustain its financial performance by maintaining a high degree of efficiency to be stable in its operations. It does not show the usage of resources beneath the proportions in general, so there will be no waste. Therefore, the need for operational costs as an input bank can be appropriate to achieve profit. In the end, the output will be achieved well and show a good level of efficiency. Efficiency at the bank will demonstrate the bank's ability to maximize production using existing resources.

According to Farrell (1957), efficiency is divided into two categories: technical efficiency and allocative efficiency. Technical efficiency measures a company's capacity to manage the quantity of input it has to achieve a variety of outputs. Second, allocative efficiency measures a company's capacity to optimize input consumption based on price structure and manufacturing technology; these metrics are referred to as economic efficiency. When a company uses

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technology and proper market pricing to reduce manufacturing costs, it is said to be efficient[22].

In addition, referring to Karim (2003), the concept of allocation efficiency or Pareto efficiency has previously been formulated in Islamic economics. Allocation efficiency explains that if all resources have been allocated, then an efficient allocation has been achieved. The concept of Islamic economics also encourages efforts to increase endowments (increase the production possibility frontier). The distribution and allocation of resources are carried out with maximum benefit with equal or unequal endowments. With both conditions can achieve equity and efficiency simultaneously.

The efficiency of financial institutions such as banks may be evaluated through their operations, which explains the relationship between the bank's input and output. The production approach, the intermediation approach, and the asset approach are the three categories of activities that are commonly classified[23]. The production approach defines banking as the creation of services for depositors and borrowers using all available resources, including labor and physical capital. Under the intermediation approach, banking activities are described as an intermediary entity that transfers money borrowed from depositors into money lent to borrowers. The third method is a combination of the preceding two. It includes certain specifics of the bank's activities, such as risk management, information processing, and other forms of agency problems, into a modified classical theory of the firm.

The study of the efficiency of the banking sector has become an important part of the banking literature, both with parametric and non-parametric techniques. Most studies have been conducted using the DEA method to evaluate bank efficiency in various countries. Although the normal version of DEA has been widely used in earlier studies, this study employs a novel version of DEA, namely DEA Window Analysis, to assess the comparison of Sharia banking efficiency in Indonesia and Malaysia. One of the non-parametric methods for estimating the performance of the Decision-Making Unit (DMU) in comparison to the frontier is DEA Window Analysis[24]. This method has various advantages, including the ability to compare the organization to benchmarks for a variety of entities using optimal performance theory. Furthermore, this approach has no functional form and can use a large number of inputs and outputs. This method is preferable as well, and it may be used to measure DMU efficiency in a relative sense[25].

Ascarya and Yumanita[26] conducted a study to compare the efficiency of Sharia banking in Malaysia and Indonesia. The study's findings revealed that

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banks in Malaysia have an efficiency score of 92 percent. However, because technical efficiency is still poor, overall efficiency remains at 74 percent. Only 40 percent of Sharia banks in Malaysia were efficient between 2002 and 2004, with only large Sharia banks being more efficient than small ones. While the overall efficiency value of 85 percent was reached due to an increase in the size of good efficiency, technical efficiency, on the other hand, is higher than in Malaysia. In Indonesia, the efficiency of Sharia banks has dropped from 86 percent in 2002 to 58 percent in 2005. In general, Indonesia's most efficient Sharia banks are those that have been around for a long time.

Then, using the DEA Window Analysis approach, Alayya and Nugraha[27] compare the operational stability of Indonesian Sharia banks in post-spin-off research from 2013 to 2017. The results show that among the numerous banks in the research sample, BRI Sharia is the most efficient and stable bank. This demonstrates the efficiency idea, which emphasizes the efficient use of certain company inputs to attain maximum output levels. In this scenario, BRI Sharia can maximize production by utilizing inputs such as TPF and labor costs to achieve maximum output, such as financing and operating income.

Shawtari et al. [28]conducted a similar study utilizing DEA Window Analysis to compare the efficiency of conventional and Sharia banks. The panel regression results reveal that conventional banks have a greater pure technical efficiency than Sharia banks. Sharia banks, on the other hand, have a higher efficiency scale than conventional tires. Loans/financing, non-interest income/liquidity, and GDP are all elements that determine the type of efficiency. Both conventional and Sharia banks have distinct influencing variables, depending on the factors that influence them.

Nailah and Rusydiana[29] conduct a study to assess the stability and efficiency of the ASEAN region's Sharia banking industry. During the period from 2013 to 2018, this research examined 12 Sharia banks in Indonesia, Malaysia, Brunei Darussalam, and Thailand. DEA Window Analysis was used to do the analysis. Malaysia has the highest average efficiency in 4 distinct periods, with 96 percent, whereas Indonesia has a 67 percent average efficiency. Thailand has a very consistent average efficiency of 100 percent, while Brunei Darussalam's average efficiency is 55 percent, which is lower than other countries. Bank Islam Malaysia Berhad and Sharia bank of Thailand are two Sharia banks with good stability. Meanwhile, Bank Mega Syariah and Bank Islam Brunei Darussalam are Sharia banks in difficulty. In general, Sharia banks in ASEAN have maintained a stable performance, even though the majority of them remain inefficient.

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Furthermore, Pantas[30] used a two-stage DEA window analysis approach to analyze the efficiency of Sharia banks in Indonesia and Malaysia and examine the factors of their efficiency from 2015 to 2019. This study uses 13 Indonesian Sharia banks and 16 Malaysian Sharia banks. The Sharia bank's efficiency in managing resources is inefficient, according to the first test stage utilizing the DEA Window Analysis. The CAR, ROA, NPF, and FDR have no substantial impact on the efficiency of Indonesian Sharia banking, according to the second research procedure utilizing the Tobit model. Though CAR has a strong positive effect on Malaysian banking efficiency, NPF has a significant impact on the efficiency of Malaysian Sharia banks. This research suggests that banking industry players increase their efficiency, primarily to improve the quantity of money channeled more toward the production sector, and so increase the Sharia banking industry's market share in both countries.

Methodology

This study uses a non-parametric quantitative approach, Data Envelopment Analysis (DEA). DEA was developed by Charnes et al.[31] then Banker et al.[32] expanded the DEA, which serves to measure the efficiency and productivity of business units. The DEA method can provide information about the Decision-Making Unit (DMU) (in this context, sharia banks in Indonesia and Malaysia), which does not use efficient inputs and causes inefficiencies, both in input and output variables. In addition, this method can provide information about the number of inputs and outputs that must be adjusted to achieve maximum efficiency. DEA is one of the methods commonly used by researchers. This method is able to produce efficiency scores that reflect input and output variables (Yildirim, 2015).

In DEA two basic models can be used, namely Charnes, Cooper & Rhodes (CCR) models and Banker, Charnes & Rhodes (BCR) Models. The CCR model is used with the assumption that changes in the value of output produced by DMU will always be equal to the proportion of adding a certain output value. This is in line with the Constant Return to Scale (CRS) assumption that the production function is fixed. Whereas the BCR model assumes changes in the output value generated by DMU are different for each proportion of change in the value of a particular input. This is in line with Variable Return to Scale (VRS), which means that each input does not necessarily produce the same output. VRS model assumes that the ratio between input and output increment is different, which means that the addition of input x times will not cause the output to increase by x times, it can be smaller or larger. In this paper, sharia banking efficiency is calculated by comparing the CRS and VRS models, with the intermediation approach which was adopted to reflect the activities of Islamic banks.

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However, the result of DEA efficiency is relative. DEA is usually used to analyze cross-sectional data, where a DMU is compared with all other DMUs over the same period, other words, the role of time is ignored. When the data set increases, the measurement results tend to be different. To overcome these problems, window DEA Analysis is introduced. DEA window analysis or often referred to as DEWA is an extension of DEA or a time-dependent version of DEA. DEWA can measure the performance of a DMU over time by treating it as a different entity in each period. The main idea of the DEA window analysis is to think of each DMU as a DMU distinct from each data entry into the observation. Furthermore, each DMU is not compared with the entire data set but only with alternatives from a particular subset of panel data. Window analysis has based on the assumption that what was "feasible" in the past will remain "feasible" forever. Therefore, the treatment of time in the window analysis is more about the average properties over the period covered by a window[33].

This method has several advantages including the ability to evaluate efficiency relative to benchmarks for several companies based on optimal performance for each organization. This method is superior and helps estimate the efficiency of DMU in a relative sense[34]. DEA Window Analysis works on the principle of moving averages which later detect the performance trends of each unit over time. Each DMU in a different period is processed like a different data. DMU performance in certain periods compared to other periods in the same DMU performance unit. This analysis can be used to increase the number of data points in the analysis so that it can be used for smaller sample sizes. In using this DEWA some variation can be used, namely the number of periods included in the analysis (in this study 5 years). This analysis can be used to observe a period, which covers the entire study period.

As recommended by Cooper et al.[35], the table of window analysis results can be used for the analysis of relative efficiency stability through several summary statistics such as Standard Deviation (SD), Long Distance per Period (LDP), and Long Distance per Year (LDY). These three measurements can be used as an analysis of the efficiency stability achieved by each DMU. Standard deviation is the standard deviation that measures the difference in the average level of efficiency of the DMU for each window, the smaller the standard deviation value, indicating the more stable the efficiency value achieved by each DMU. Long-Distance per all Periods (LDP) describes the largest difference from the efficiency figures in the entire observation period. The smaller the LDP value indicates the more stable the efficiency value achieved by each Islamic bank, and vice versa. The last one is Long-Distance per Year (LDY). LDY shows the largest difference from the efficiency rate in one year. Similar to the LDP, the smaller the

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LDY value indicates the more stable the efficiency value achieved by each DMU, and vice versa.

This study focuses on the efficiency analysis of 30 Indonesian and Malaysian Sharia Banks in the 2015-2020 period. This period was chosen to be able to capture trends in banking efficiency, which the DEA Window requires several periods. In addition, the observation period was selected to capture and compare the behavior of Sharia banks before and during the pandemic period. The input variables used in this study are fixed assets, labor cost, dan third party-funds, whereas the output variables used are total financing and operating revenues. The selection of input-output variables is in line with Sufian[36], and Ascarya & Yumanita[37]. Data related to the input and output variables used were obtained from the financial statements and annual reports of each bank The analytical tool is the MAXDea 8 software. The efficiency score should range between zero and one. The radial distance from the projected production limit to the considered DMU is reflected in the efficiency score[38]. Before analyzing the efficiency score of Indonesian insurance, an overview of the data used in this study will be presented. Table 1 provides the descriptive statistics of the input and output variables of Indonesian insurance for the 2015 to 2020 period.

Table 1. Statistical Descriptive of Indonesian Insurances (in a million)

Variable	max	min	average	stdev
Input				
Fixed Asset	$231.840.618,74	$25.248,39	$19.572.102,10	$40.452.901,35
Labor Cost	$421.869.316,19	$530.337,08	$29.588.112,11	$45.559.106,63
TFP	$42.039.082.746,17	$2.773.427,25	$4.602.892.617,87	$6.998.064.704,09
Output				
Operating Revenue	$1.246.088.878,15	$2.217.440,62	$166.712.874,11	$200.125.172,20
Total Financing	$51.806.495.306,90	$359.163,42	$4.695.707.387,78	$ 8.022.192.228,47

Among the input variables, third-party funds are the variable with the most significant number compared to others. The average third-party funds are $4.602.892.617,87, with the highest value being $42.039.082.746,17 and the lowest being $2.773.427,25. Meanwhile, based on the output variable, the average of total financing is greater than operating revenue which is $4.695.707.387,78 compared to $166.712.874,11. The highest value of total financing is $51.806.495.306,90, while the lowest is $359.163,42.

Result

Table 2 present the efficiency level of 30 Sharia Banks in Indonesia and Malaysia during the 2015-2020 period using the Data Envelopment Analysis. The results will be displayed through an efficiency score with a range of 0-1 A score

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of 1 describes the bank's ability to manage its input and output variables already optimal. Meanwhile, if the efficiency score is further away from 1 it can be indicated that the bank is inefficient or has not managed its input dan output variable optimally. Dataset was running using Variable Return to Scale models, with an input approach.

Table 2. Indonesia and Malaysian Sharia Banking Efficiency Scores

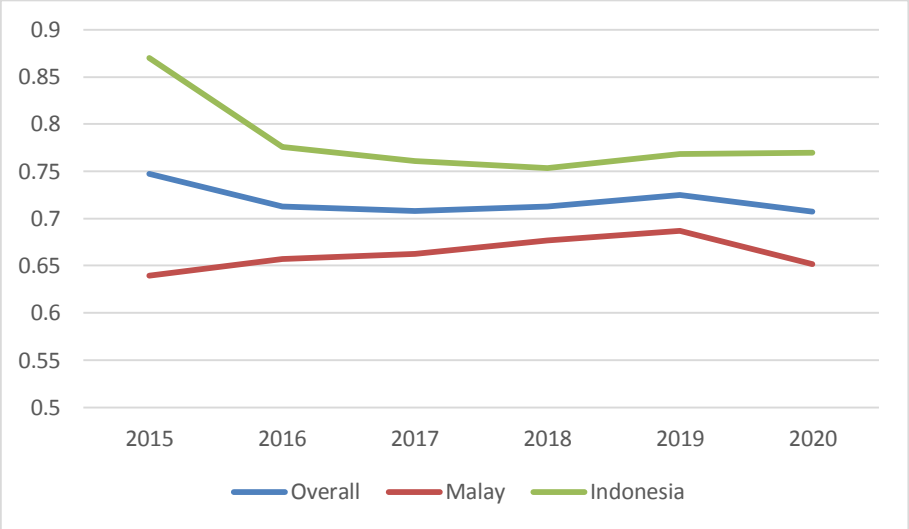
Decision-Making Unit	2015	2016	2017	2018	2019	2020	RTS
Affin Islamic Bank Berhad	0,432	0,598	0,626	0,565	0,646	0,637	Decreasing
Al Rahji Banking and Investment	0,400	0,358	0,317	0,363	0,387	0,350	Decreasing
Alliance Islamic Bank Berhad	0,470	0,512	0,587	0,441	0,577	0,532	Increasing
AmBank Islamic Berhad	1,000	1,000	0,979	0,897	0,757	0,690	Increasing
Bank Aceh Syariah	1,000	0,544	0,695	0,685	0,642	0,559	Decreasing
Bank BNI Syariah (BSI)	0,841	0,795	0,865	0,743	0,688	0,585	Decreasing
Bank BPD Nusa Tenggara Barat Syariah	1,000	0,902	1,000	1,000	0,748	0,746	Decreasing
Bank BRI Syariah (BSI)	0,975	1,000	0,976	1,000	1,000	1,000	Decreasing
Bank Islam Malaysia Berhad	0,554	0,608	0,663	0,654	0,721	0,705	Decreasing
Bank Jabar Banten Syariah	0,864	0,747	0,679	0,680	0,696	0,677	Decreasing
Bank Mega Syariah	0,663	0,742	0,757	0,684	0,744	0,800	Decreasing
Bank Muamalat Malaysia Berhad	0,398	0,442	0,461	0,497	0,498	0,538	Decreasing
Bank Muamalat Syariah	0,946	0,745	0,694	0,579	0,556	0,506	Decreasing
Bank Panin Dubai Syariah	1,000	0,810	0,753	0,653	0,703	0,803	Decreasing
Bank Syariah Bukopin	0,919	0,840	0,753	0,822	0,814	0,924	Decreasing
Bank Syariah Mandiri (BSI)	0,944	0,940	1,000	1,000	1,000	1,000	Decreasing
BTPN Syariah	0,917	0,893	0,559	0,626	1,000	0,939	Decreasing
Bank Victoria Syariah	0,748	0,588	0,668	0,716	0,749	0,773	Increasing
BCA Syariah	0,366	0,369	0,360	0,362	0,420	0,466	Decreasing
CIMB Islamic Bank Berhad	0,655	0,680	0,662	0,714	0,758	1,000	Increasing
Heong Long Islamic Bank Berhad	0,567	0,533	0,544	0,592	0,609	0,609	Decreasing
HSBC Amanah Malaysia Berhad	0,743	0,741	0,755	0,828	0,761	0,632	Decreasing
Kuwait Finance House Berhad	0,361	0,370	0,434	0,475	0,413	0,367	Decreasing
Maybank Islamic Berhad	1,000	1,000	1,000	1,000	1,000	1,000	Constant
Maybank Syariah Indonesia	1,000	0,950	0,891	1,000	1,000	1,000	Increasing
MSBS Bank Berhad	0,639	0,678	0,557	0,865	0,956	0,897	Decreasing
OCBC Al-Amin Bank Berhad	0,546	0,557	0,651	0,493	0,527	0,396	Increasing
Public Islam Bank Berhad	0,815	0,680	0,671	0,668	0,664	0,695	Increasing
RHB Islamic Bank Berhad	0,723	0,762	0,765	0,776	0,768	0,772	Increasing
Standard Chartered Saadiq Berhad	0,930	1,000	0,929	1,000	0,953	0,602	Increasing
Mean	**0,747**	**0,713**	**0,708**	**0,713**	**0,725**	**0,707**	

Maybank Islamic Berhad is the only bank that achieves the maximum efficiency score, with a relative efficiency score equal to 1. While Bank Muamalat Malaysia Berhad is the only bank that shows an increasing efficiency trend during the study period. Table 2 also shows the Return to Scale (RTS) result of each bank. RTS is an indicator to describe how well the bank's ability to produce its output. In the relationship between production factors or inputs with the level of production or output, RTS describes the response of output to a proportional change in input. Based RTS result, 20 of the 30 banks studied experienced a

Decreasing Return to Scale (DRS) condition This indicates that an increase in all inputs in the same amount causes a disproportionate increase in total output, this occurs when the increase in output is smaller than the added input. This result also indirectly confirms a decrease in the efficiency level of all banks in 2020 or during the COVID-19 pandemic.

Based on the result, the overall average efficiency of Indonesian and Malaysian Sharia Banks fluctuated during the study period. The average efficiency trend showed an interesting point. The average efficiency of Sharia Banking experienced a sharp decline from 2015 until 2017. Then there was an increase in 2018 and 2019, and down again in 2020, which is the year that covid-19 began to spread in Indonesia and Malaysia. The spread of COVID-19 has already affected banking activities in many countries, and it has triggered precautionary reactions on the part of the depositors (eg, withdrawal rates) and counterparties of financial intermediaries (eg, reducing market funding)[39]. The efficiency trend of Indonesia and Malaysian Sharia Banking can be seen in the following graph:

Figure 2. Average Efficiency Trend of Indonesia and Malaysian Sharia Banking

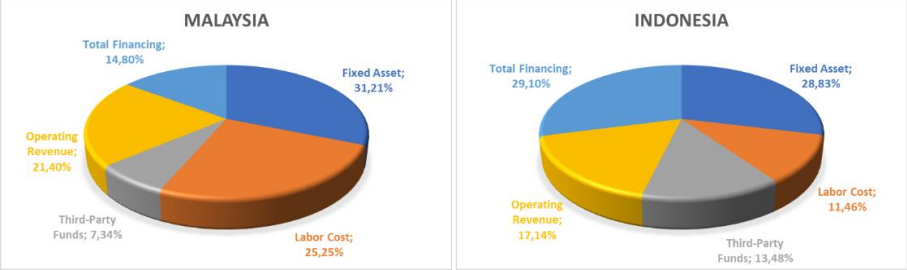


Potential Improvement

Besides being able to produce efficiency values, the DEA method can also produce potential improvements or the level of improvement needed to achieve optimal efficiency values. So, it can be known which variables need to be optimized. Analysis of potential improvement is examined using the last year of observation and is carried out separately from previous years, to describe the real value that must be achieved. This analysis is comparing the projection value to the real value or current data available. The results of the measurement of potential improvement can be seen in the following graph:

[39] Richard Baldwin and Beatrice Weder di Mauro. *Economics in the Time of COVID-19: A New eBook*. Human Vaccines and Immunotherapeutics, (2020), p. 123.

Figure 3. Potential Improvement



It can be seen that fixed assets (32,21%) and labor costs (25,25%) are the main sources of the inefficiency of Sharia banks in Malaysia, while total financing (29,10%) and fixed asset (28,83%) are the main causes of Indonesian sharia banks inefficiency. Inefficient banks need to adjust their input and output variables by the percentage shown in Figure 3, either by optimizing the use of input variables or improving the achievement of output variables.

Sharia banks in Malaysia need to pay more attention to their fixed asset costs. Fixed assets are tangible assets owned by banks such as offices, ATMs, vehicles, and others. Optimizing fixed can be done by choosing a different strategy to maximize the existing asset's functions and one should be more careful in adding assets in the future. Furthermore, Indonesian sharia banks need to improve their total financing in order to achieve efficient performance in the future. According to Sharia Banking Statistics (2020), the Overall Indonesian sharia Bank's Finance to Deposit Ratio (FDR) decreased from 77,91% in 2019 to 76,36% in 2020. This shows that bank financing is weakening during the pandemic period. Islamic banks need to improve their financing in the future to achieve a maximum efficiency level.

Window Analysis

Since the DEA window analysis method can capture a general picture or general trend of the development of Indonesian and Malaysian Sharia banks, the authors report the average overall efficiency for each bank in each window in table5. The "Mean" column represents the average of all scores for each bank. The standard deviation for each bank's score is described in the "SD" column. The "LDY" column shows the most significant difference between bank cores in different windows in the same year. The "LDP" column refers to the largest difference between bank cores over the entire period. This measurement is used to measure the stability efficiency of each DMU. The smaller the number of the four values above, the more stable the efficiency obtained per DMU[40] Below is the result of the DEA window analysis for Indonesia and Malaysian Banking for the period of 2015 to 2020.

[40] Nailah Nailah, and Aam Slamet Rusydiana. *Efficiency and Stability of Islamic Banking in Asean: Dea Window Analysis*, Tazkia Islamic Finance and Business Review, 14(1), (2020), pp. 1–19.

Table 3. Window DEA of Indonesia and Malaysian Sharia Banks

DMU	2015-2017	2016-2018	2017-2019	2018-2020	Mean	SD	LDY	LDP
Malaysian Islamic Banks								
Affin Islamic Bank Berhad	0,55	0,60	0,75	0,83	0,682	0,129	0,200	0,438
Al Rahji Banking and Investment Corporation	0,51	0,35	0,48	0,70	0,510	0,142	0,304	0,390
Alliance Islamic Bank Berhad	0,65	0,51	0,61	0,75	0,631	0,097	0,273	0,342
AmBank Islamic Berhad	1,00	0,99	0,71	0,83	0,880	0,139	0,699	0,341
Bank Islam Malaysia Berhad	0,64	0,66	0,73	0,75	0,693	0,053	0,665	0,195
Bank Muamalat Malaysia Berhad	0,45	0,47	0,56	0,62	0,526	0,079	0,082	0,226
CIMB Islamic Bank Berhad	0,69	0,71	0,74	0,23	0,593	0,240	0,039	0,109
Heong Long Islamic Bank Berhad	0,56	0,57	0,65	0,72	0,625	0,070	0,087	0,178
HSBC Amanah Malaysia Berhad	0,75	0,79	0,90	0,90	0,836	0,077	0,184	0,257
Kuwait Finance House Berhad	0,40	0,44	0,55	0,75	0,535	0,161	0,280	0,401
Maybank Islamic Berhad	1,00	1,00	1,00	1,00	1,000	-	-	-
MSBS Bank Berhad	0,68	0,70	0,86	1,00	0,809	0,150	0,134	0,443
OCBC Al-Amin Bank Berhad	0,61	0,60	0,59	0,57	0,592	0,017	0,036	0,156
Public Islam Bank Berhad	0,74	0,69	0,68	0,69	0,699	0,028	0,014	0,166
RHB Islamic Bank Berhad	0,75	0,77	0,88	0,90	0,825	0,077	0,142	0,196
Standard Chartered Saadiq Berhad	0,97	0,98	1,00	0,92	0,964	0,036	0,071	0,071
Indonesian Islamic Banks								
Bank Aceh Syariah	0,77	0,68	0,71	0,66	0,702	0,048	0,042	0,441
BNI Syariah	0,86	0,84	0,78	0,68	0,791	0,082	0,045	0,323
BPD NTB Syariah	0,97	1,00	0,94	0,89	0,950	0,047	0,096	0,177
BRI Syariah	1,00	0,99	1,00	1,00	0,998	0,004	0,023	0,023
Bank Jabar Banten Syariah	0,85	0,79	0,73	0,75	0,781	0,053	0,037	0,231
Bank Mega Syariah	0,84	0,82	0,79	0,82	0,818	0,023	0,047	0,160
Bank Muamalat Syariah	0,88	0,73	0,67	0,60	0,721	0,121	0,047	0,431
Bank Panin Dubai Syariah	0,88	0,82	0,61	0,66	0,743	0,131	0,154	0,266
Bank Syariah Bukopin	0,86	0,88	0,89	0,97	0,900	0,046	0,055	0,207
Bank Syariah Mandiri	1,00	0,99	1,00	1,00	0,997	0,006	0,036	0,036
BTPN Syariah	0,86	0,75	0,82	0,91	0,836	0,068	0,109	0,415

Bank Victoria Syariah	0,67	0,68	0,74	0,97	0,765	0,142	0,212	0,391
Bank BCA Syariah	0,37	0,40	0,48	0,64	0,470	0,122	0,250	0,293
Maybank Syariah Indonesia	1,00	0,98	0,99	1,00	0,991	0,011	0,064	0,064

The result of the calculation of the DEA Window analysis for Indonesian and Malaysian sharia banks during the 2015-2020 period can be seen in the table above. From the perspective of efficiency stability analysis through several statistical summaries such as standard deviation (SD), Long Distance per Period (LDP), and Long Distance per Year (LDY), the most stable efficiency scores are Maybank Islamic Berhad, then followed by BRI Syariah and BSM. Maybank Islamic Berhad achieved the smallest score of 0.00 in all several statistics and the highest score of 1 on average efficiency value. Next, BRI Syariah has a statistical value of 0.04 for SD, 0.02 for LDY, and 0.02 for LDP. Meanwhile, BSM has a statistical value of 0.06 for SD, 0.03 for LDY, and 0.03 for LDP. In addition, both BRI Syariah and BSM have an average efficiency value of 0.99 or higher than most other banks.

In addition, to evaluate the banking performance, the authors try to classify the banks based on their level of efficiency and stability into four quadrants. Quadrant 1 consists of banks with a high level of efficiency and stability of efficiency. In other words, the bank is categorized as top performance. Quadrant 2 consists of banks with a high level of efficiency but less stability. Quadrant 3 consists of banks with low levels of efficiency and stability. Quadrant 4 consists of banks that produce a low level of efficiency but are high in stability. The efficiency column is derived from the average efficiency level in the window analysis results, whereas the stability of the efficiency column is generated from the Long Distance per Year (LDY) in the window analysis result. Table 4 shows the details of the quadrant categories.

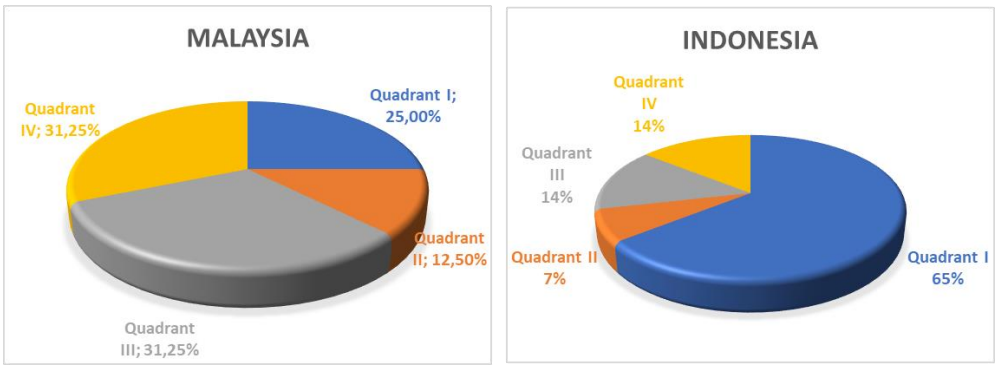
Table 4. Sharia Bank Quadrant Category

Sharia Bank	**efficiency**		**stability**		**quadrant**
Affin Islamic Bank Berhad	0,682	Low Efficiency	0,200	Low Stability	III
Al Rahji Banking and Investment	0,510	Low Efficiency	0,304	Low Stability	III
Alliance Islamic Bank Berhad	0,631	Low Efficiency	0,273	Low Stability	III
AmBank Islamic Berhad	0,880	High Efficiency	0,699	Low Stability	II
Bank Islam Malaysia Berhad	0,693	Low Efficiency	0,665	Low Stability	III
Bank Muamalat Malaysia Berhad	0,526	Low Efficiency	0,082	High Stability	IV
CIMB Islamic Bank Berhad	0,593	Low Efficiency	0,039	High Stability	IV
Heong Long Islamic Bank Berhad	0,625	Low Efficiency	0,087	High Stability	IV
HSBC Amanah Malaysia Berhad	0,836	High Efficiency	0,184	Low Stability	II
Kuwait Finance House Berhad	0,535	Low Efficiency	0,280	Low Stability	III

Maybank Islamic Berhad	1,000	High Efficiency	0,000	High Stability	I
MSBS Bank Berhad	0,809	High Efficiency	0,134	High Stability	I
OCBC Al-Amin Bank Berhad	0,592	Low Efficiency	0,036	High Stability	IV
Public Islam Bank Berhad	0,699	Low Efficiency	0,014	High Stability	IV
RHB Islamic Bank Berhad	0,825	High Efficiency	0,142	High Stability	I
Standard Chartered Saadiq Berhad	0,964	High Efficiency	0,071	High Stability	I
Bank Aceh Syariah	0,702	Low Efficiency	0,042	High Stability	IV
Bank BPD NTB Syariah	0,950	High Efficiency	0,096	High Stability	I
Bank Muamalat Syariah	0,721	Low Efficiency	0,047	High Stability	IV
Bank Victoria Syariah	0,765	High Efficiency	0,212	Low Stability	II
Bank BRI Syariah (BSI)	0,998	High Efficiency	0,023	High Stability	I
Bank BNI Syariah (BSI)	0,791	High Efficiency	0,045	High Stability	I
Bank Syariah Mandiri (BSI)	0,997	High Efficiency	0,036	High Stability	I
Bank Jabar Banten Syariah	0,781	High Efficiency	0,037	High Stability	I
Bank Mega Syariah	0,818	High Efficiency	0,047	High Stability	I
Bank Panin Dubai Syariah	0,734	Low Efficiency	0,154	Low Stability	III
Bank Syariah Bukopin	0,900	High Efficiency	0,055	High Stability	I
BCA Syariah	0,470	Low Efficiency	0,250	Low Stability	III
BTPN Syariah	0,836	High Efficiency	0,109	High Stability	I
Maybank Syariah Indonesia	0,991	High Efficiency	0,064	High Stability	I

As shown in Table 4 above, the greater quadrant is Quadrant I (high efficiency and stability) with a total of 13 banks or 43% of the whole quadrant. Next Quadrant III and IV both consist of 7 banks, then followed by Quadrant II consists of only 3 banks. Overall, most Indonesian and Malaysian Banks belong to the quadrant which means that banking is considered the top performance. This quadrant explains that the sharia banking performance tends to be efficient, and stable at these efficient in the last 5 years. They need to keep this performance and improve it in the next years to remain efficient and stable. The analysis then continued by comparison in the quadrant analysis between Indonesia and Malaysian Sharia Banking. The result is provided in the figures below:

Figure 4. Comparison between Indonesian and Malaysian Sharia Banks



Based on the figure above, Indonesian Sharia Banks are considered to be better than Malaysian Sharia Banks in terms of efficiency and stability. It can be explained by the greater quadrant in the Indonesian bank being quadrant I compared to the greater quadrant in Malaysia which are quadrants III and IV. The result of this analysis is in line with the study conducted by Pantas et al (2021) and Rani et al (2020). Indonesian Sharia Banks are considered more efficient because they are better able to manage credit risk which overshadows banks compared to Malaysia. In contrast to Hosen and Muhari (2018), they found that in comparison to Sharia banks in Indonesia, Malaysian Sharia banks are more sound since they have more liquidity instruments in 2012, 2013, and 2014 (liquidity and sensitivity to market risks).

Conclusion and Recommendation

The result of this study shows that the average efficiency level of Indonesian and Malaysian Banks (both conventional and Islamic) fluctuated throughout the study period of 2015-2020. Interestingly, this study found that the efficiency level of Indonesian and Malaysian Banking overall showed an increasing trend from 2017 until 2019 but decreased in 2020. This result confirms that the COVID-19 pandemic significantly affected the bank's performance, in terms of efficiency. This result was then strengthened by the RTS which indirectly confirms a decrease in the efficiency level of all banks in 2020.

The potential improvement result can assist sharia banks in Indonesia and Malaysia to evaluate their efficiency achievement. By referring to the main source of inefficiency, sharia bank practitioners can identify which variables are the priority to be improved and get more attention. Based on the potential improvement analysis, fixed assets are the main sources of Malaysian banks' inefficiency. The fixed asset costs can be lowered by collaboration between sharia banks and parent banks or by choosing a different strategy to maximize the existing asset's functions. Islamic banks in Malaysia also need to be more careful in adding assets in the future.

The potential improvement results also show that total financing is the main source of Indonesian banks' inefficiency. One of the causes of inefficient financing distribution is the competition with peer-to-peer lending financial technology (fintech) which has recently become increasingly widespread. In the

covid-19 era, customer needs are increasingly complex, and technological changes occur quickly. Islamic banks in Indonesia must be able to respond well to this condition in terms of technological and digital services, so they can improve the total financing given to the customers

From the perspective of efficiency stability analysis through several summary statistics such as standard deviation (SD), Long Distance per Window (LDW), Long Distance per Period (LDP), and Long Distance per Year (LDY), the bank with the most relatively stable value of efficiency scores is Maybank Islamic Berhad, then followed by BRI Syariah and BSM. This study also found that the majority of Indonesia and Malaysian Sharia Banks are in Quadrant I. it means that the sharia banking performance tends to be efficient, and stable at these efficient in the last 5 years. They need to keep this performance and improve it in the next years to remain efficient and stable. In terms of comparison between Indonesia and Malaysian Sharia Banks, Indonesia are considered to be better than Malaysia in term of efficiency stability. It can be explained by the greater quadrant in the Indonesian bank being quadrant I compared to the greater quadrant in Malaysia which are quadrants III and IV.

Recommendations for practitioners include the need to enhance the quality of human resources in the sharia banks and develop new insurance products to give clients more diversified options and achieve higher efficiency performance. Academics are urged to continue updating Indonesia and Malaysian Sharia Banks' efficiency information and statistics, particularly in 2021, since the pandemic has not ended. More studies may provide ideas to increase efficiency performance, with varied updates depending on the conditions. Recommendations to regulators include the importance of enhancing the overall quality of insurance, particularly its efficiency.

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