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Efficiency Analysis of Islamic Banks in Indonesia*

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Abstract

After the economic crisis of 1998, Islamic banking experienced significant growth in Indonesia. With the enactment of Law Number 21, Year 2008 concerning Sharia Banking issued on July 16, 2008, the development of the national Islamic Banking industry has an increasingly adequate legal basis and will encourage its growth even faster. Although there have been considerable developments in the Islamic banking sectors worldwide, very little attention has been given to the efficiency of its operations. Apart from focusing on the Islamic banks' expansion, it is important to examine their efficiency level to ensure sustainability and competitiveness. This research is conducted to investigate the technical efficiency of Islamic banks in Indonesia. The sample consists of 10 banks in Indonesia from 2011 to 2016. This study employed the Data Envelopment Analysis (DEA) method to measure banks' efficiency with a specification of input and output variables. An overall view of the results indicates 85% for technical efficiency, 97.3% for pure technical efficiency, and 86.1% for scale efficiency. The majority of Islamic banks have been operating at the right scale of operations and keep increasing or decreasing which indicates its efficiency of performance. The inefficiency of Indonesian Islamic banks shows that it has not been optimal in managing output compared to inputs, therefore it is necessary to enlarge the customer base of financing products in accordance with shariah principles.

Keywords: Islamic Banks, Data Envelopment Analysis, Efficiency, Input-Output, Indonesia

1. Introduction

Islamic banking, also referred to as Islamic finance or shariah-compliant finance, refers to finance or banking activities that adhere to shariah (Islamic law). Islamic banks are the main providers of Shariah-compliant services and are being entrusted with the majority of Islamic capital / financial assets, which likewise makes financial stability depends on their success. Islamic banking has been the major driver of industry growth over the past decade, taking the largest share of financial assets. This leads to extensive discussion on the Islamic banks' efficiency (Alam & Al-Amri, 2020). Moreover, the bank's objective is to minimize costs and maximize revenues and profits. As such, continuous evaluation of overall performance in terms of the general costs, revenue, and profit efficiency is essential for the survival of banks in the current competitive environment. Islamic banks' activities differ in substance and form from conventional banks' operations and thus, face a different risk profile (Mohd Noor et al., 2020). Indonesia ranks number 4 in the list of countries by population, with a population of 270.6 million. It is also the country that has the world's largest Muslim population. They constitute over 87% of the country's overall population.

Islamic bank in Indonesia was established in 1992 through the establishment of Bank Muamalat Indonesia (BMI). The establishment of Islamic banks in Indonesia is considered late as compared to other Muslim-majority countries. BMI was established on the initiation of the Indonesian Ulema Council (MUI), the Association of Indonesian Moslem Intellectuals (ICMI), and Muslim entrepreneurs who later received support from the Government of the Republic of Indonesia. Thus, on May 1, 1992, BMI officially operated as the first bank doing business based on sharia principles in Indonesia. The emergence of the Islamic bank was a positive response from the government with the issuance of various regulations. Started from the Legislation of Act Number 7 of 1992 concerning Islamic banking, this Act served as the front gate for bank operations with a profit-sharing system. This law was then amended by Legislation Number 10 of 1998, which explicitly mentions the term "bank based on sharia principles". The establishment of Law No. 21, Year 2008, on Islamic Banking has given a gateway for the implementation of shariah economic in Indonesia. Although there have been considerable developments in the Islamic banking sectors worldwide, very little attention has been given to the efficiency of its operations. Apart from focusing on the Islamic banks' expansion, it is important to examine their efficiency level to ensure sustainability and competitiveness (Bakri et al., 2017). Puteh et al. (2018) concluded that Sharia banking in Indonesia has not been efficient during the last five years, that is, 2012–2016. This can be seen from the range of banking efficiency ratios. The average level of Islamic banking efficiency ranged between 89.73% and 94.16%. Inefficient sharia banks can make policy improvements. Therefore, the ultimate objective of this study is to examine the efficiency of Islamic banks in Indonesia from 2011 to 2016.

2. Literature Review

2.1 Concept of Efficiency

Efficiency can be used as a signal to appraise a bank's progress, accomplishment, and success. Efficiency also can be applied as the indicator of the bank's performance (Mokhtar et al., 2008). Efficiency is a peak level of performance that uses the least amount of inputs to achieve the highest amount of output. Efficiency requires reducing the number of unnecessary resources used to produce a given output including personal time and energy (Rahman et al., 2016). In addition, efficiency is known as the relationship between input resources that banks used to produce the output with minimal cost and maximum profits. Farrell (1957) and Mokhtar et al. (2008) concluded that efficiency is the firm's ability to implement its plans using the smallest possible expenditure of resources. It is an important factor in the firm's effectiveness, this being the ease and degree of success with which the firm is able to accomplish its aims. Kumbhakar and Lovell (2000) stated that organizational efficiency is a measure of the relationship between organizational inputs (resources) and outputs (goods and services provided) and in simple terms, the more output firms can achieve with a given amount of inputs or resources, the more efficient they are.

2.2 Bank Efficiency

The overall productivity of a bank depends on four components of efficiency classification (Sherman & Zhu, 2006). First, technical efficiency, which is the effectiveness with which a given set of inputs is used to produce an output. A bank is said to be technically efficient if it is producing the maximum output from the minimum quantity of inputs, such as labor, capital, and technology. Second, scale efficiency expresses whether a firm is operating at its optimal size. Scale efficiency is defined as the ability of each company to operate as close to its most productive scale size as possible and is calculated using data. A unit is scale efficient when its size of operations is optimal so that any modifications on its size will render the unit less efficient. Third, price efficiency is when efficiency can be increased with lower price inputs such as human capital and material without sacrificing the quality (Sharif et al., 2018). Last, allocative efficiency is a measure of the optimal mix of several inputs to produce products or services, such as banks incorporating automatic teller machines (ATM) and Internet banking for capital-labor trade-offs to increase efficiency. Allocative efficiency represents an optimal

distribution of goods and services to consumers in an economy, as well as an optimal distribution of financial capital to firms or projects among investors. Under allocational efficiency, all goods, services, and capital is allotted and distributed to their very best use. Cooper et al. (2004) stated that allocative efficiency means that every good or service is produced up to the point where the marginal benefit is equal to marginal cost. The marginal cost is the cost of producing one additional item and is used to pinpoint the optimal economy of scale. The marginal benefit is the greater enjoyment created by producing one additional piece. Operating under allocative efficiency ensures the correct resource allotment in terms of consumer needs and desires. Virtually all resources (i.e., factors of production) are limited; therefore, it is essential to make the right decisions regarding where to distribute resources to maximize value.

2.3 Islamic Banks' Efficiency

Havid and Setiawan (2015) investigated the efficiency of Indonesian Islamic Banks by employing the Data Envelopment Analysis (DEA) approach, the determinants of banks' efficiency, and non-performing financing (NPF). The authors further examined the inter-temporal relationships between bank efficiency and non-performing financing (NPF) of Indonesian Islamic banks. The finding revealed that none of the Islamic banks were consistently efficient for all periods of research by technical efficiency (OTE), pure technical efficiency (PTE), and scale efficiency (SE). The overall results showed that the efficiency of Islamic banks is affected significantly by return on assets (ROA), operational efficiency ratio (OER), and inflation rates (INF), while financing to deposit ratio (FDR), capital adequacy ratio (CAR), size, and GDP growth rate had an insignificant effect on bank efficiency.

Yildirim (2015) used DEA for the efficiency measurements while using the Malmquist total factor productivity index to measure the total factor productivity change. This study involved 4 Islamic banks operating in Turkey and 13 Islamic banks operating in Malaysia. Half of these Islamic banks operating in Turkey and Malaysia meet the technical productivity (CCR) value. In other words, half of these Islamic banks are able to use their total assets and total equities efficiently. It was found that the Technical Efficiency Change (EFFCH) value of the Islamic banks was never recorded above 1 for any time period. Furthermore, it was found that the Islamic banks are unlikely to reach the production limit

Rahman and Rosman (2013) empirically examined and compared the efficiency of selected Islamic banks in Middle Eastern and North African (MENA) countries (including Gulf Cooperation Countries) and Asian countries. The efficiency scores were measured using data envelopment analysis based on the intermediation approach. The study found that the main source of technical inefficiency among the Islamic banks is the scale of their operations. The Islamic banks, in general, achieved a high score for pure technical efficiency, indicating that the banks' management was able to efficiently control costs and use the inputs to maximize the outputs regardless of scale effects. On an average, Islamic banks from Asian countries were found to be relatively more efficient than those in MENA countries. Interestingly, most of the efficient Islamic banks were from Gulf Cooperation Countries

Islam et al. (2013) compared the efficiency of Islamic banks of the South-East region (SER) and South Asian region (SAR). Data envelopment analysis (DEA) was used to explore the contributions of technical and efficiency changes to the growth of productivity in Islamic banking by using inferential statistics and efficiency (CRS &VRS) applying the generalized output-oriented Malmquist index for the years 2009-2011. They found that the efficiency of Southeast Asian Islamic banks was higher than South Asian Islamic banks. They suggested that the smaller the size of Islamic banks in Southeast Asia, the more efficient the banks in generating outputs from inputs.

3. Research Data and Methodology

Data was collected from Orbis Bank Focus from 2011-2016. The study used the input-output orientation variables concerning the efficiency of Islamic banks from 2011 to 2016; (i) Total Loans, (i) Total Investments, (iii) Total Deposits, (iv) Total Fixed Assets, and (v) Total General & Administration Expenditure. The econometric frontier approach – DEA (Data Envelopment

Analysis) – allows the use of multiple inputs/outputs without imposing any functional form on data or making assumptions of inefficiency. Using DEA, data collected was integrated more accurately to measure the technical efficiency of Islamic banks in Indonesia.

3.1 Data Envelopment Analysis (DEA)

Data envelopment analysis (DEA) is a linear programming-based technique for measuring the relative performance of organizational units where the presence of multiple inputs and outputs makes comparisons difficult. DEA is a nonparametric method in operations research and economics for the estimation of production frontiers. It is used to empirically measure the productive efficiency of decision-making units (DMUs). DEA is a performance measurement technique that can be used for evaluating the relative efficiency of decision-making units (DMU's) in organizations. Here a DMU is a distinct unit within an organization that has flexibility with respect to some of the decisions it makes, but not necessarily complete freedom with respect to these decisions.

The DEA methodology in this study follows an input-oriented (intermediation) approach since commercial banks are considered as acting as financial intermediaries, and the inefficiency levels are identified as a proportional reduction of inputs. In this study, we will calculate DEA efficiency scores by using the DEA method. We measure three types of efficiency (1) Technical Efficiency (TE), (2) Pure Technical Efficiency (PTE), and (3) Scale Efficiency (SE).

The DEA method of evaluating efficiency is based on Farrell (1957) and continued by Charnes et al. (1978) and Banker et al. (1984). The origins of DEA can be traced to the seminal paper by Charnes et al. (1978). They operationalized, through linear programming (LP), the notion of using empirical data from operating units to measure their comparative performance. They developed the model under the assumption of a Constant Returns to Scale (CRS) production technology, i.e. when an increase in the production resources results in a proportional increase in the output (Coelli et al., 1998).

Following Farrell (1957), Charnes et al. (1978) developed the DEA model based on CRS, which referred to the CCR model as a method of benchmarking and to measure the performance as well as the efficiency of each Decision-Making Unit (DMU). Named after its developer Chames, Cooper, and Rhodes (CCR), the CCR model is the first and fundamental DEA model, built on the notion of efficiency as defined in the classical engineering ratio. The CCR ratio model calculates an overall efficiency for the unit in which both its pure technical efficiency and scale efficiency are aggregated into a single value. The obtained efficiency is never absolute as it is always measured relative to the field. The Chames et al. (1978) article marked the birth of DEA, and despite the numerous modified models that have appeared, the CCR model is still the most widely known and used of DEA models.

In the basic DEA model, the efficiency rating is derived as the optimal ratio of the sum of weighted outputs to inputs with any restrictions on the weights. The weights for the ratio are determined by restricting the ratios for all DMUs to be less than or equal to unity. The original CCR model was extended by Banker et al. (1984) (BCC) to incorporate variable returns to scale (VRS). Consequently, the CCR and BCC models are the two basic models that are usually associated with DEA. Banker et al. (1984) proposed that VRS breaks down total TE into two parts. The first is TE under VRS or Pure Technical Efficiency (PTE) and it is related to how managers are able to use DMUs' given resources. The second is SE and it means investigating scale economies by operating at a point where the production frontier shows CRS. If the TE and PTE scores of a specific DMU are different, it indicates the presence of scale inefficiency.

3.2 Input-Output Variables

Our analysis uses a variant of the intermediation approach by following the commonly accepted intermediation proposed by Sealey and Lindley (1977). Under the intermediation approach, financial institutions are viewed as intermediating funds between savers and investors (Ismail et al. 2017). In our case, the intermediation approach is used where Islamic banks produce services through the collection of deposits and other liabilities, and in turn, these funds are invested in productive sectors of the

economy, yielding returns uncontaminated by usury (riba). This approach regards total deposits, total fixed assets, total general and administration expenditures as inputs, while total loans and total investments are treated as output variables. Bhattacharya et al. (1997) and Sathye (2001) adopted this approach to examine bank efficiency.

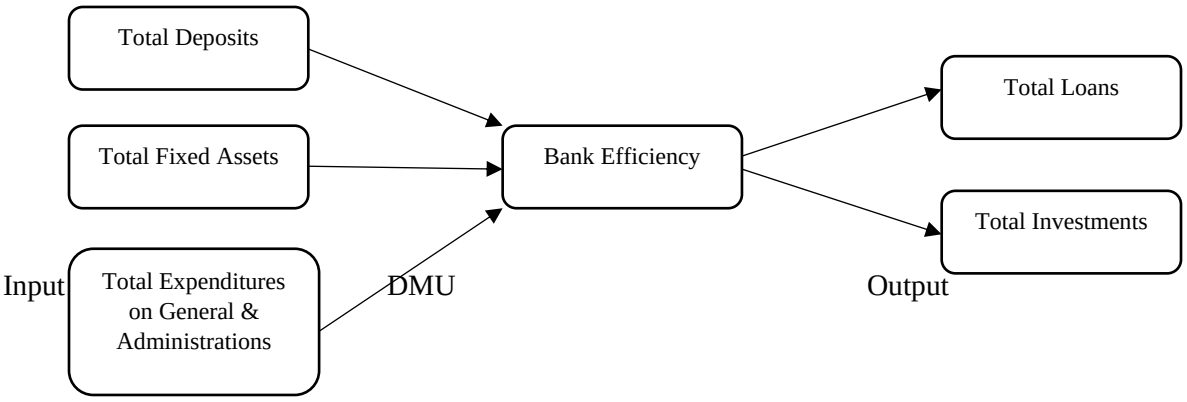

Figure 1: Inputs and Outputs for Islamic Bank Efficiency

Based on Figure 1, there are three elements involved in the intermediation approach, namely input, Decision Making Unit (DMU), and output. In this study, DMU refers to the bank. Under the intermediation approach, the researchers examined how efficiently the DMUs are transforming their input to generate the maximum level of output.

3.3 Efficiency Estimation

Normally, the efficiency score is measured as Efficiency = Output/Input. However, Technical Efficiency = Pure Technical Efficiency x Scale Efficiency. Technical efficiency relates to how much output can be obtained from a given input. A value of 1 or 100% indicates full efficiency and the operations are made on the production frontier. A value of less than 1 (or less than 100%) reflects operations below the frontier.

3.4 Data Collection

Table 1 shows the list of 10 Islamic banks in Indonesia (2011-2016) used as the sample in this study. The time frame was specifically chosen to study the impact of risk factors on the efficiency of Islamic banks. The data was obtained from the Orbis Bank Focus database which contains banks' annual report data (Mohd Noor et al., 2020)

Table 1: Islamic Banks in Indonesia (2011-2016)

Year	Country	No.	DMU
2011-2016	Indonesia	1	Bank BCA Syariah
		2	Bank Panin Dubai
		3	Bank Syariah Bukopin
		4	Bank Syariah Mandiri
		5	Bank Victoria Syariah
		6	Bank Mega Syariah
		7	Bank Maybank Syariah Indonesia
		8	Bank Muamalat Indonesia
		9	Bank BNI Syariah
		10	Bank BRI Syariah

4. Empirical Results

4.1 Descriptive Statistics Analysis

Table 2 shows the inputs and outputs used for descriptive statistics. It represents the descriptive statistics of input and output variables used in the DEA method in this study for Islamic banks in Indonesia for the year 2011 to 2016. Over the six years, the average total loan indicates an increasing trend of output. This is followed by total deposits which indicate an increasing trend of input

Table 2: Inputs and Outputs for Descriptive Statistics

YEAR			2011	2012	2013	2014	2015	2016
OUTPUTS AND INPUTS (USD)			USD	USD	USD	USD	USD	USD
INPUT		MEAN						
Total Deposit (x1)			772592.84	751515.61	1325725.74	1192030.14	1218805.54	1665813.39
Total Fixed Asset (x2)			10586.08	12191.47	14876.33	26054.45	31384.75	31996.81
Total Expenditure (x3)			52263.45	57695.86	73462.49	77347.18	66006.54	62516.00
OUTPUT								
Total Loan (y1)			633257.80	764123.69	840834.20	965486.57	986956.06	1054214.38
Total Investment (y2)			7521644.40	7280238.06	8048868.38	9913468.11	1486812.90	3069333.48
INPUT		MINIMUM						
Total Deposit (x1)			34307.77	54462.17	80765.93	86498.07	67110.68	50925.42
Total Fixed Asset (x2)			590.71	473.65	429.66	332.01	199.99	116.62
Total Expenditure (x3)			488.00	710.69	3541.93	3677.69	3214.83	3234.74
OUTPUT								
Total Loan (y1)			13711.75	27811.19	773.53	72998.52	71069.42	39647.72
Total Investment (y2)			970.57	21.77	18.59	14.47	20.92	25.26
INPUT								
Total Deposit (x1)			2637046.25	2850417.46	3970204.91	4169734.55	4299154.24	4923963.70
Total Fixed Asset (x2)			49346990.00	65454.40	60777.82	160794.91	173957.24	184671.53

Total Expenditure (x3)			3019597.86	303004.88	342863.01	3677.69	217189.24	240912.53
OUTPUT								
Total Loan (y1)			49429.56	3153764.74	133262204.00	3317854.35	3450578.68	3762322.74
Total Investment (y2)			262255.02	63309120.00	72191490.00	91993440.00	8659676.81	21835805.26
INPUT		STD. DEVIATION						
Total Deposit (x1)			891687.20	958992.43	1404958.64	1545041.21	1517069.21	1636796.41
Total Fixed Asset (x2)			16795862.32	20623.51	22996.20	49739.28	55270.95	57239.85
Total Expenditure (x3)			1057737.18	91367.14	103973.24	117933.01	70913.80	75084.03
OUTPUT								
Total Loan (y1)			16028.93	1074240.98	1259862.05	1195542.91	1192625.55	1258981.75
Total Investment (y2)			82425.45	19896983.01	22654560.00	28877281.37	2819156.43	7045811.62

Source: Orbis Bank Focus and author's calculation

4.2 Evolution of Efficiency Score over Years

Table 3: Summary of Indonesian Islamic Banks' Efficiency

YEAR	Technical Efficiency	Pure Technical Efficiency	Scale Efficiency
2011	0.877	0.969	0.907
2012	0.794	0.984	0.806
2013	0.766	0.909	0.767
2014	0.821	0.983	0.836
2015	0.885	0.990	0.894
2016	0.968	1.000	0.958
2011-2016	0.850	0.973	0.861

Table 3 shows the empirical result for the overall Technical Efficiency (TE), Pure Technical Efficiency (PTE), and Scale Efficiency (SE) level of Islamic banks in Indonesia for the years 2011-2016. Based on the table, the efficiency score for TE for the year 2011 was 87.7%. This implies 12.3% of the technical efficiency was being wasted by Islamic banks. The results indicate, in 2011, the efficiency score for PTE was 96.9% while the SE score was 90.7%.

In 2012, the overall TE was 79.4%. This result recommends that Islamic banks, in 2012, could have saved 20.6% of the input to produce the same amount of output in 2012. On average, in 2012, the efficiency scores for PTE and SE of Islamic banks were 98.4% and 80.6%

respectively. The efficiency score for TE of Islamic banks in 2013 was 76.6%. Hence, it shows that, in 2013, 23.4% of the technical efficiency was being wasted by Islamic banks. This result recommends that the Islamic banks could have saved 23.4% of the input to produce the same amount of output in 2013. On average, in 2013, the efficiency scores for PTE and SE of Islamic banks were 90.9% and 76.7% respectively

In 2014, the efficiency score of TE was 82.1%. It shows a decreasing trend of overall technical efficiency of the Islamic banks in Indonesia from 2012-2013. Therefore, this result recommends that the Islamic banks could have saved 17.9% of the input to produce the same amount of output in 2014. In 2015, TE for Islamic banks shows an increasing trend compared to previous years. The result shows that the overall TE of Islamic banks in 2014 was 82.1% before it goes up to 88.5% in 2015. Specifically, average efficiency scores for PTE and SE of Islamic banks too increased. On average, in 2015, the efficiency scores for PTE and SE of Islamic banks were 99% and 89.4% respectively. The efficiency score for TE in 2016 was the highest compared to previous years, which was 96.8%. The average efficiency scores for PTE and SE of Islamic banks were 100% and 95.8% respectively. The result in 2016 shows that 3.2% of input was being wasted by Islamic banks to produce the same amount of output in 2016. Hence, this indicates that Islamic banks in Indonesia were more efficient in 2016 when it comes to the efficiency score compared to previous years.

As we can see from the result, technical efficiency shows a fluctuating trend in all periods under study. However, it can be concluded that Indonesian Islamic banks are quite efficient. Overall, the result shows that the highest score for technical efficiency was in the year 2016 (96.8%) while the lowest score was in 2013 (76.6%). The result in 2013 shows the lowest score because of the impact of the financial crisis. From 2011 to 2016, Islamic banks exhibited an overall technical efficiency of 85%. This suggested that the mean input waste by Islamic banks is 15%. In other words, Islamic banks produce the same amount of output with only 85% of the amount of input. Meanwhile, from 2011 to 2016, Islamic banks exhibited an overall PTE of 97.3% and an overall SE of 86.1%. As a whole, it shows that SE contributed less towards the TE of Islamic banks in Indonesia during the six years compared to PTE.

The trend of efficiency score under Technical Efficiency (TE), Pure Technical Efficiency (PTE), and Scale Efficiency (SE) for Islamic banks in Indonesia from 2011 to 2016 can also be seen in Figure 2 below.

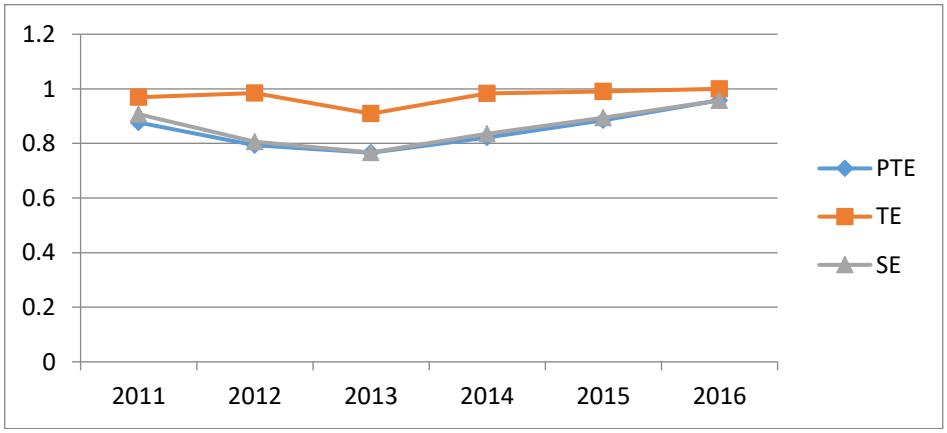

Figure 2: Efficiency of Islamic Banks in Indonesia 2011-2016

Figure 2 presents the average efficiency scores under the technical efficiency, pure technical efficiency, and scale efficiency of Islamic banks during the period 2011 to 2016. The result shows that Islamic banks' efficiency trend has slightly decreased during the year 2011 to 2012. With 87.7% and 79.4% of efficiency scores respectively, these results recommend that the Islamic banks could have saved 12.9% in 2011

and 20.6% in 2012 of the inputs to produce the same amount of outputs.

However, the overall technical efficiency of Islamic banks in Indonesia increased from 2013 to 2016, which is an increase from 76.6% to 96.8%. Thus, it shows the uptrend for these four years. In terms of pure technical efficiency, it increased from 2011 to 2012, went down in 2013, and continued its uptrend from 2014-2016. Therefore, the highest score of pure technical efficiency is in 2016 (100%), and the lowest score of pure technical efficiency is in 2013 (90.9%). In terms of scale efficiency, it decreased from 2011 to 2013 with a score of 90.7%, 80.6%, and 76.7% respectively. It continued its upward trend from 2014 to 2016 with a score of 83.6%, 89.4%, and 95.8% respectively. The highest score of scale efficiency is in 2016 (95.8%) and the lowest score is in 2013 (76.7%).

5. Conclusion

The study investigates the efficiency of Indonesian Islamic banks from 2011 to 2016. The preferred non-parametric Data Envelopment Analysis (DEA) methodology has allowed distinguishing between three different types of efficiency such as technical, pure technical, and scale efficiencies.

The mean overall technical efficiency, pure technical efficiency, and scale efficiency were 85%, 97.3%, and 86.1% respectively. As a whole, it shows that scale efficiency contributed less towards the technical efficiency of Islamic banks in Indonesia during the six years compared to the pure technical efficiency. A high value of scale inefficiency increases technical inefficiency.

The inefficiency of Indonesian Islamic banks shows that banks have not been optimal in managing output compared to inputs, therefore it is necessary to enlarge the customer base of financing products in accordance with shariah principles (Ali et al., 2013). This in turn will lead to more effective and optimal output growth. Moreover, the inefficiency is due to increasing operational costs. Therefore, Islamic banks should improve the quality of services, so that they can compete and contribute to the economy. Furthermore, results also suggest that the Increasing Returns of Scale (IRS) trend shows that Islamic banks are operating at a small scale of operation to achieve 100% efficiency. With the Decreasing Returns of Scale (DRS) trend, most Islamic banks in Indonesia have been operating at the right scale of operation. Overall, the majority of Islamic banks in Indonesia have been operating at the right scale of operation which keeps increasing or decreasing to maintain the right scale of operation indicating performance efficiency.

*__Acknowledgements:__

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