

Sharia Banking Efficiency Analysis: ASEAN Countries Comparison

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This study aims to analyze the comparative efficiency of Islamic banks in ASEAN. This study also investigates the reasons for inefficiency and provide suggestions for inefficient banks to improve their efficiency. The study measures and analyzes the pure technical efficiency (PTE), scales efficiency (SE) and technical efficiency (TE) scores of 26 Islamic banks from 4 different countries in ASEAN between 2013 and 2018. Data Envelopment Analysis (DEA), which is a non-parametric method was used. The results indicate that the average for six years of technical efficiency (TE) in the selected Islamic bank is 62,5%. Then for their pure technical efficiency (PTE) and scales efficiency (SE) higher than TE and the scores at 71% and 88%. This paper compares the efficiency of a sample of Islamic banks in 4 countries of ASEAN in very recent years and identifies the most and least efficient banks. It also includes benchmarks for interest-free banks and offers suggestions for improvement.

Keywords: Islamic Banks; Efficiency; DEA; Comparative Efficiency

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INTRODUCTION

Currently, the era of globalization is making financial institutions around the world better in terms of deregulation and liberalization. Sharia banking is one of the fastest-growing institutions that are very competitive with conventional banking. So that the practice of Islamic banking itself is currently spreading throughout the world, starting from the Middle East, Europe, and the USA (Kamarudin, et al., 2014). One of them is Southeast Asia, which is part of the region in the development of Islamic finance in the world.

According to the Public Life Project (2011) in Fakhrunnas (2017), the total Muslim population in Southeast Asia reached 257.7 million in 2010. In addition, according to the Islamic Corporation for the Development of the Private Sector in the 2019 Islamic Finance Development Report (IFDR), stated that the growth of Islamic financial assets in Southeast Asia in 2018 reached US \$ 621 billion (ICD, 2019). This means that this is a great opportunity for Islamic banking in Southeast Asia to continue to develop.

Currently, ASEAN is one of the groups of countries with the largest Islamic finance industry in the world after the GGC (Gulf Cooperation Countries) and MENA (the Middle East and North Africa Region). According to ICD Thompson Reuters (2019), the Southeast Asia region with ASEAN in it is ranked third in the world for the order of total assets of Islamic banks after GCC and MENA in 2018. The total assets of Islamic banks in Southeast Asia are US\$ 253 billion.

In 2016, business competition in the financial industry increased due to the existing MEA agreement, including the banking industry with the existence of the ASEAN Banking Integration Framework (ABIF). Of course, this is an opportunity for Islamic banking in ASEAN countries, especially Indonesia, to increase opportunities for wider growth. Islamic banking can increase performance capacity and competitiveness so that it can operate efficiently (Fiafifah & Darwanto, 2019).

The rapid growth of the Islamic finance industry has made Southeast Asia an important part of global Islamic finance. Where each country in ASEAN has its own variations in the development of Islamic banking. Malaysia is the fastest growing country in the development of Islamic banking in ASEAN countries. Indonesia is also aggressively developing Islamic banking, although its development is slower than Malaysia. Apart from these two countries, Brunei Darussalam is also intense in developing the Islamic banking industry. Furthermore, Singapore, the Philippines, and Thailand are equally ambitious to develop this industry (Ghozali et al., 2019).

Measuring the level of efficiency in the Islamic banking industry has also become an urgent matter given the intense competition in the Islamic banking industry, especially from 2005 to 2019. This is due to the rapid

growth in the number of Islamic banks that were established during that time. Therefore, measuring the efficiency of Islamic banks can be an important indicator in seeing the ability of Islamic banks. So that Islamic banks are able to survive and face intense competition in the Islamic banking industry as well as in national and international banking industry competition (Firdaus & Hosen, 2013).

The main objective of this study is to analyze and compare the efficiency of Islamic banking in ASEAN countries. The study aims to determine the causes of inefficiency and provide advice to practitioners and regulators to improve efficiency in Islamic banking.

In a literature review, summarizes studies related to efficiency analysis for Islamic banking. Then the scores for technical efficiency, scale, and pure technical efficiency of 26 Islamic banks in four ASEAN countries were evaluated using data envelopment analysis (DEA). DEA is the right analytical tool to measure the level of efficiency of Islamic banking. By choosing the right input and output combination to find sources of inefficiency and assist in decision making in improving performance.

LITERATURE REVIEW

Most financial institutions such as banks carry out their operations by determining the price of loans and deposits to customers with pre-adjusted interest rates. Unlike Islamic banking which relies on the concept of risk-sharing, where there is no predetermined fee or fixed profit for both depositors and investors. Thus, Islamic banks are considered to be the only substitutes for commercial or conventional banks. This competition between conventional and Islamic banks explains the increasing interest in Islamic banking around the world. This has led to many studies being conducted to test a more efficient banking system depending on three perspective measures, namely cost efficiency, income efficiency, and profit efficiency (Al-Khasawneh et al., 2012).

In line with this, Sutawijaya and Lestari (2009) explain that banking as one of the financial institutions has an important role and is required to have good performance. One of the important aspects of measuring banking performance is efficiency, which, among other things, can be improved by reducing costs in the production process. The level of efficiency achieved is a reflection of good quality performance.

According to Hadad et al. (2003) in Ascarya and Yumanita (2006), there are several approaches that can be used to explain the relationship between input and output of financial institutions, namely the production approach, intermediation approach, and asset approach.

a. Production Approach

The production approach sees financial institutions as producers in savings accounts and loan credits. This approach describes output as the sum of

the related accounts. While the input in this approach is calculated from the number of workers, capital expenditures on fixed assets.

b. Intermediation Approach

In this approach, it describes financial institutions as intermediaries between parties with excess funds and those with shortages. The output in this approach is measured through credit loans and financial investment, while the inputs used are labor and capital costs and interest payments to depositors.

c. Asset Approach

The asset approach sees the primary function of a financial institution as a loan maker. In asset efficiency, banks measure their ability to invest funds in the form of assets as output and inputs are actually used in the form of assets.

The 3 approaches above can be used as a reference in determining the input and output variables in measuring the efficiency of Islamic financial institutions. Where in this study the subject is Islamic banks. The following is a measurement of the efficiency of Islamic banking that has been carried out in several countries as an illustration of the efficiency of Islamic banking in the world.

[Ascarya and Yumanita \(2008\)](#) compared the efficiency of Islamic banking in Indonesia and Malaysia. The results of the study explained that the efficiency of banks in Malaysia on the efficiency scale of 92%. However, overall efficiency is still at 74% due to low technical efficiency. Meanwhile, the efficiency of Islamic banking in Indonesia has decreased from 86% in 2002 to 58% in 2005. Generally, the most efficient Islamic banks in Indonesia are banks that have been established for a long time.

[Hassan et al. \(2009\)](#) conducted research in measuring the efficiency of Islamic and conventional banking in Middle-Eastern countries, including Egypt, Bahrain, Tunisia, Jordan, Kuwait, Lebanon, Qatar, Saudi Arabia, Turkey, UAE, and Yemen. The overall average efficiency illustrates that there is no significant difference in overall efficiency. However, on average it is noted that banks use their resources more efficiently than their ability to generate revenue and profit. So that overall banking in Middle-East countries is more efficient at the average level of a cost than income efficiency and profit efficiency.

[Hadi and Saad \(2010\)](#) the research compare the level of efficiency of domestic and foreign Islamic banks in Malaysia. The result is that overall it can be seen that the respective overall technical efficiency is 92.4% and 90.4% for domestic and foreign Islamic banks. This study also concludes that the performance of domestic Islamic banks is better than foreign Islamic banks in Malaysia.

[Zeitun and Benjelloun \(2012\)](#) to measure efficiency in banks in Jordan. The results show that the majority of banks in Jordan are inefficient in their input (financial resources). In addition, the efficiency of banks

in Jordan is below the world's average efficiency. This is because the impact of the financial crisis was found to have a significant impact on bank efficiency.

There are other studies that measure the efficiency of Islamic banking in addition to countries in Southeast Asia, such as research conducted by [Majeed and Zanib \(2016\)](#). His research was carried out on Islamic and conventional banking in Pakistan using the DEA. From this research, it is known that conventional banks are more efficient in measuring technical efficiency and purely technical efficiency. Meanwhile, Islamic banks in Pakistan are more efficient at scale efficiency. Where Islamic banks are better at operating at an optimal scale than conventional banks.

Another research was also conducted by [Abdul-Wahab dan Haron \(2017\)](#) in measuring the efficiency of the performance of Islamic and conventional banking in Qatar. From this research, it is known that the efficiency of banking in Qatar is still not showing optimal performance and requires improvement. However, this study shows the same results as research conducted by [Majeed and Zanib \(2016\)](#), that conventional banks are more efficient in Qatar. The efficiency obtained by conventional banks is purely technical and technical efficiency. Meanwhile, Islamic banking in Qatar is superior in scale efficiency.

[Alfarisi and Lukman \(2019\)](#) in their research use an intermediation approach in measuring efficiency. His research was conducted on 12 Islamic banks in Indonesia in the 2014-2015 period with input-oriented. From the results of the analysis, it is known that during the 2014-2015 period the average efficiency score obtained decreased. Where in 2014 the average efficiency obtained was 0.843 down to 0.832 in 2015. One that affects this is the scale efficiency obtained. This indicates a decrease in the productivity of Islamic banks during the study period.

In addition, there are other studies that make efficiency comparisons using DEA, is [Noor and Ahmad \(2012\)](#), [Srairi and Kouki \(2012\)](#), [Ftiti et al. \(2013\)](#), [Hassan \(2013\)](#), [Rahim et al. \(2013\)](#), [Said \(2013\)](#), [Ada & Dalkilic \(2014\)](#), [Tai \(2014\)](#), [Wahab et al. \(2014\)](#), [Javed et al. \(2015\)](#), [Sillah and Harrathi \(2015\)](#), [Kamarudin et al. \(2017\)](#).

RESEARCH METHODS

Data Envelopment Analysis was first introduced by Charnes, Cooper, and Rhodes in 1978 and 1979. Since then the approach using the DEA has been widely used in research studies. There are two models that are often used in this approach, namely [CCR \(1978\)](#) and [BCC \(1984\)](#). In this study, both approaches were used. [Rusydia et al. \(2013\)](#) describe the two approaches in the data analysis of this study, namely.

a. CCR Model

The constant return to scale model of the CCR model was developed by Charnes, Cooper, and Rhodes in 1978. This model assumes that the ratio between additional input and output is at the same value (constant return to scale). It can be interpreted that in this model if there is an additional input x time, the resulting output will also increase x times as well.

b. BCC Model

This BCC model is a development of the CCR model developed by Banker, Charnes, and Cooper (BCC) in 1984. The assumption of this model is that the ratio of addition between input and output is not the same (variable return to scale). So it can be interpreted that if there is an additional input x time it will not cause the output to increase x times as well. It is possible to get x times greater or less.

The study was conducted to determine technical efficiency (TE), pure technical efficiency (PTE), and scale efficiency (SE) in Islamic banking in ASEAN with data envelopment analysis (DEA). The approach used is an intermediation approach with the CCR and BCC methods using the selected input and output methods.

DMU is determined based on specified criteria, namely having input and output which are used in the annual financial statements owned by the bank. Based on Table 1, there are several Islamic banks in ASEAN in several countries. The highest number of Islamic banks is in Malaysia and Indonesia, while Thailand and Brunei Darussalam each have one Islamic bank.

Table 1: Number of banks by country

Country	Number of Banks
Indonesia	11
Malaysia	13
Thailand	1
Brunei Darussalam	1
Total	26

RESULTS

The intermediation approach was chosen in this study because it is more widely used in studies related to the banking sector. The input variables used are total assets, human resource costs, and third party funds (TPF)/deposit, while the output variables used are bank financing and operating income. Before entering into the results of the analysis in this study, the following are descriptive statistics for the input and output used in the study, by year, with a minimum, maximum, average, and standard deviation values summarized in Appendix 1. Statistics of all banks and all variables used were

measured in millions of Rupiah. The results of descriptive statistics show that the maximum and average values of input and output generally tend to increase.

The summary of the efficiency scores for Islamic banking in ASEAN in this study is shown in Appendix 2. The result is that the TE scores obtained by banks are in the range of 0.349 to 1 in 2013, while in 2014 there were no banks that achieved full efficiency, namely ranging from 0.295 to 0.927. Furthermore, in 2015 it ranged from 0.345 to 1, then 0.346 to 1 in 2016, 0.304 to 1 in 2017 and 0.362 to 1 in 2018. The standard deviation obtained was 0.192; 0.186; 0.194; 0.196; 0.203; 0.198.

In 2018, one of the 26 Islamic banks sampled in this study found technical efficiency, with a TE score of 1. These Islamic banks can be a reference for inefficient Islamic banks. Meanwhile, the remaining 25 Islamic banks have efficiency scores lower than 1, so they are technically inefficient. 25 efficient Islamic banks can become efficient by reducing their inputs.

The average efficiency score during the study period tended to fluctuate, where the average TE of 26 banks was calculated at 0.645 in 2013; 0.669 in 2014; 0.742 in 2015; 0.759 in 2016; 0.699 in 2017 and 0.701 in 2018. The period with the highest TE and SE scores in the study was 2016, namely 15%; in the next position, namely 2015 at 12%; for the period 2013, 2017, 2018 the same was 4%; whereas in the 2014 period there were no Islamic banks that received a score of 1 on the efficiency of TE and SE. The efficiency of PTE is greater than TE and SE, which is 3% in 2013 and 2014; 27% in 2015; 23% in 2016; 8% in 2017 and 12% in 2018.

Furthermore, Appendix 3 describes the 6-year average (2013-2018) based on the TE, PTE, and SE scores of Islamic banks in each country in ASEAN. During the study period, Malaysian banks had a higher average efficiency with an efficiency score of 82.4%. This was followed by Thailand and Indonesia, which amounted to 65.6% and 59.1%, while the lowest efficiency was obtained by the Brunei Darussalam banking, which was 43.1%.

The results of Appendix 3 indicate that the average technical efficiency (TE) in the study sample for six years is 62.5%, meaning that the bank may have saved 37.5% of the input to produce the same amount of output. However, on the other hand, new banks have maximized their input by 62.5%. Meanwhile, for pure technical efficiency (PTE) and scale efficiency (SE) as a whole, it is higher than technical efficiency (TE), which is 71% and 88%, respectively. This finding is consistent with the findings made by [Sufian & Noor \(2009\)](#) and [Rosman et al. \(2014\)](#) state that on an efficient scale, Islamic banks in ASEAN are already operating on a good scale, but technically they are still inefficient.

The Above results also indicate that the bank as a whole has a more efficient scale efficiency score than the pure technical efficiency score. This illustrates on a scale

that the efficiency of the banking sector has carried out its operations correctly, however in terms of managing input is still not maximum so that the bank needs to maximize the input obtained for more optimum output.

Furthermore, based on the analysis results, the ranking of the average TE of Islamic banking in ASEAN for six years is shown in Appendix 4. The top ten banks are in Malaysia and Indonesia because these two countries have the largest number of Islamic banks in ASEAN. One in 13 sharia banks in Malaysia obtained an efficient score in the 2015 to 2018 period.

PTE is a measure of efficiency without the influence of scale and is related to skills in management conducted to use the resources owned by the bank to be efficient, regardless of the scale owned (Hassan, 2006). The analysis shows that there are no Islamic banks that get a full PTE score, but there are four banks that have an average PTE score above 90%, namely Bank Islam Malaysia Berhad, Maybank Islamic Berhad, Public Islamic Bank Berhad, and Bank Victoria Syariah.

While the scale efficiency is calculated based on the division between the CCR score and the BCC score, so that the CCR results are directly proportional to the scale efficiency, while the BCC tends to be inversely related. Based on the results of scale efficiency, there is one fully efficient bank, namely Maybank Islamic Berhad. Meanwhile, there are 9 banks that have almost full-scale efficiency, namely HSBC Amanah Bank Berhad, Kuwait Finance House Malaysia Berhad, RHB Islamic Bank Berhad, Affin Islamic Bank Berhad, Bank Muamalat Indonesia, OCBC Al-Amin Berhad, Bank Jabar Banten Syariah, and Alliance Islamic Bank Berhad. Scale inefficiency is related to optimizing the size of the bank's operations.

In addition, the scale efficiency at a bank is divided into three categories, namely, increasing return to scale (IRS), constant return to scale (CRS), and decreasing return to scale (DRS). IRS describes a situation where the proportion of output has increased more than an input. Whereas CRS, the level of increase in output tends to remain constant following the increase in input. However, if the output has increased less proportionally to changes in input, then the bank is in a DRS condition (Akin et al., 2013; Coskun & Balci, 2018).

The numbers and percentages of banks based on three return to scale categories are shown in Appendix 5. The majority of banks operated in DRS conditions during the study period, namely 50% in 2013 and 2016; 54% in 2014 and 2015; and 58% in 2017 and 2018. Where nearly half of the total sample of bank research experienced DRS conditions and each year continues to increase. A smaller percentage of banks can be seen in banks operating at an optimal scale, namely CRS of 4% in 2013, 2017, and 2018; 12% in 2015; 15% in 2016; whereas in 2014 there were none of the banks that were in a CRS condition. A low percentage was also obtained by banks in the IRS condition (46% in 2013 and 2014;

35% in 2015 and 2016; 42% in 2017; 38% in 2018). So that Islamic banks that demonstrate their operations in IRS conditions can save on existing inputs and financial efficiency by increasing the scale of their operations.

CONCLUSIONS

In this study, analysis and measurement were carried out on technical efficiency (TE), pure technical efficiency (PTE), and scale efficiency (SE) on 26 Islamic banks from four ASEAN countries in the period 2013 to 2018. Measurements were made using non-parametric data analysis. envelopment analysis (DEA). Over the past six years, the average TE score of Islamic banks is 62.5%, PTE is 71% and SE is 88%.

This efficiency score shows a fairly high inefficiency in Islamic banking in ASEAN. During the study period, Islamic banks were able to provide the same amount of output using only 62.5% of their input. In other words, banks can reduce 37.5% of the total input they consume without affecting the amount of output they produce. In addition, the TE score results show that Islamic banks in Malaysia are more efficient than other countries in ASEAN. Ten out of 26 Islamic banks have higher TE scores, eight of which are Islamic banking in Malaysia. The eight banks are Maybank Islamic Berhad, Public Islamic Bank Berhad, RHB Islamic Bank Berhad, HSBC Amanah Berhad, CIMB Islamic Bank Berhad, OCBC Al-Amin Berhad, Affin Islamic Bank Berhad, and Alliance Islamic Bank Berhad. The empirical findings indicate that banks in Malaysia show higher technical efficiency than other countries in ASEAN.

Based on the overall scale efficiency score (SE), the bank has a scale efficiency score that is more efficient than the pure technical efficiency score. This illustrates on a scale that the efficiency of the banking sector has carried out its operations correctly, but in terms of managing the input is still not maximum so that the bank needs to maximize the input obtained for more optimum output. However, the scale efficiency score obtained by the bank during the 2013-2018 period shows a value that tends to fluctuate, so that in scale it shows that the bank is still not optimal. The bank that obtained full-scale efficiency during the 2013 to 2018 period was Maybank Islamic Berhad with a score of 1.

On pure technical efficiency (PTE) it shows that the average Islamic banking in Malaysia tends to be higher than the three other countries in the study. However, the PTE scores in all the case study countries tended to fluctuate during the study years. So that managerial effectiveness is still not stable and it is necessary to improve and maintain its efficiency.

The calculation of the target value will help to show how each bank fits or does not create inequality, as an ideal strategy for increasing efficiency. This will also provide information for management to correct inefficient banks. DEA can also be used to evaluate the

measurement of the relative efficiency between banks. It can also be used to measure bank branches. The results of the analysis can also provide useful information such as determining which bank branches are inefficient or increasing the effectiveness of the performance of the branch banks.

REFERENCES

- Abd. Hadi, F. S., & Saad, N. M. (2010). An analysis on the efficiency of the Malaysian Islamic banking industry: domestic vs. foreign. *Review of Islamic Economics*, 14(1), 27–47.
- Abdul-Wahab, A.-H., & Haron, R. (2017). Efficiency of Qatari banking Industry: an empirical Investigation. *International Journal of Marketing*, 35(2).
- Ada, A. A., & Dalkilic, N. (2014). Efficiency Analysis in Islamic Banks : A Study for Malaysia and Turkey. *BDDK Bankacılık ve Finansal Piyasalar*, 8(1), 9–33.
- Akin, A., Bayyurt, N., & Zaim, S. (2013). Managerial and Technical Inefficiencies of Foreign and Domestic Banks in Turkey during the 2008 Global Crisis. *Emerging Markets Finance and Trade*, 49(3), 48–63. <https://doi.org/10.2753/REE1540-496X490304>
- Al-Khasawneh, J. A., Bassedat, K., Aktan, B., & Thapa, P. D. P. (2012). Efficiency of Islamic banks: case of North African Arab countries. *Qualitative Research in Financial Markets*, 4(2–3), 228–239. <https://doi.org/10.1108/17554171211252547>
- Alfarisi, M. F., & Lukman, S. (2019). Measuring efficiency of Islamic banks: Evidence from Indonesia. *Jurnal Ekonomi & Keuangan Islam*, 5(1), 1–9. <https://doi.org/10.20885/jeki.vol5.iss1.art1>
- Ascarya, & Yumanita, D. (2006). Mengukur Efisiensi Bank Syariah di Indonesia dengan Data Envelopment Analysis. *TAZKLA Islamic Finance & Business Review*, 1(2), 1–31.
- Coskun, A., & Balci, E. (2018). An Efficiency Analysis of Interest-Free Banks : An International Comparison. *Journal of Insurance and Financial Management*, 4(1), 78–97.
- Fakhrunnas, F. (2017). Efisiensi Perbankan Islam di Asia Tenggara. *Jurnal Ekonomi & Keuangan Islam*, 3(1), 27–35. <https://doi.org/10.20885/JEKI.vol4.iss1.art2>
- Fiafifah, A. L., & Darwanto, D. (2019). Technical Efficiency Level of Islamic Bank in Indonesia. *Al-Uqud: Journal of Islamic Economics*, 3(2), 114–132. <https://doi.org/10.26740/al-uqud.v3n2.p114-132>
- Firdaus, M. faza, & Hosen, M. N. (2013). Efisiensi Bank Umum Syariah Menggunakan Pendekatan Two-Stage Data Envelopment Analysis. *Buletin Ekonomi Moneter Dan Perbankan*, 16(2), 167–188. <https://doi.org/10.21098/bemp.v16i2.31>
- Ftiti, Z., Nafti, O., & Sreiri, S. (2013). Efficiency of Islamic banks during subprime crisis: Evidence of GCC countries. *Journal of Applied Business Research*, 29(1), 285–304. <https://doi.org/10.19030/jabr.v29i1.7615>
- Ghozali, M., Azmi, M. U., & Nugroho, W. (2019). Perkembangan Bank Syariah Di Asia Tenggara : Sebuah Kajian Historis. *FALAH: Jurnal Ekonomi Syariah*, 4(1), 44–55.
- Hassan, M. K. (2006). The X-Efficiency In Islamic Banks. *Islamic Economic Studies*, 13(2), 50–78.
- Hassan, T., Mohamad, S., & Bader, M. K. I. (2009). Efficiency of conventional versus Islamic banks: evidence from the Middle East. *International Journal of Islamic and Middle Eastern Finance and Management*, 2(1), 46–65. <https://doi.org/10.1108/17538390910946267>
- Hassan, W. M. (2013). Efficiency of the Middle East Banking Sector –A Non Parametric Approach: A Comparative Analysis between Islamic and Conventional Banks. *Business and Management Research*, 2(4), 116–128. <https://doi.org/10.5430/bmr.v2n4p116>
- ICD. (2019). *Islamic Finance Development Indicator (IFDI)*. Retrieved from https://icd-ps.org/uploads/files/IFDI_2019_DEF_digital1574605094_7214.pdf
- Javed, A., Ullah, N., & Malik, Q. A. (2015). Comparing the Efficiency of Islamic Banks of Pakistan and Malaysia : by using the Dea Approach. *Research Journal of Recent Sciences*, 4(6), 45–52.
- Kamarudin, F., Nordin, B. A. A., Muhammad, J., & Hamid, M. A. A. (2014). Cost, Revenue and Profit Efficiency of Islamic and Conventional Banking Sector: Empirical Evidence from Gulf Cooperative Council Countries. *Global Business Review*, 15(1), 1–24. <https://doi.org/10.1177/0972150913515579>
- Kamarudin, F., Sufian, F., Loong, F. W., & Anwar, N. A. M. (2017). Assessing the domestic and foreign Islamic banks efficiency : Insights from selected Southeast Asian countries. *Future Business Journal*, 3, 33–46. <https://doi.org/10.1016/j.fbj.2017.01.005>
- Majeed, M. T., & Zanib, A. (2016). Efficiency analysis of Islamic banks in Pakistan. *Humanomics*, 32(1), 19–32. <https://doi.org/10.1108/H-07-2015-0054>
- Noor, M. A. N. M., & Ahmad, N. H. B. (2012). The Determinants of Islamic Banks' Efficiency Changes: Empirical Evidence from the World Banking Sectors. *Global Business Review*, 13(2), 179–200. <https://doi.org/10.1177/097215091201300201>
- Rahim, A., Rahman, A., & Rosman, R. (2013). Efficiency of Islamic banks: A comparative analysis of MENA and Asian countries. *Journal of Economic Cooperation and Development*, 34(1), 63–92.
- Rosman, R., Wahab, N. A., & Zainol, Z. (2014). Efficiency of Islamic banks during the financial crisis: An analysis of Middle Eastern and Asian countries. *Pacific Basin Finance Journal*, 28, 76–90. <https://doi.org/10.1016/j.pacfin.2013.11.001>

- Rusydiana, A. S., Devi, A., Solihin, A. I., Firmansyah, I., & Nashrulloh, A. A. (2013). *Pengukuran Efisiensi Lembaga Keuangan Syariah: Pendekatan Data Envelopment Analysis (DEA)*. Bogor: SMART Publishing.
- Said, A. (2013). Evaluating the overall technical efficiency of islamic banks operating in the MENA region during the financial crisis. *International Journal of Economics and Financial Issues*, 3(2), 426–434.
- Sillah, B. M. S., & Harrathi, N. (2015). Bank Efficiency Analysis: Islamic Banks versus Conventional Banks in the Gulf Cooperation Council Countries 2006 - 2012. *International Journal of Financial Research*, 6(4), 143–150. <https://doi.org/10.5430/ijfr.v6n4p143>
- Srairi, S., & Kouki, I. (2012). Efficiency and Stock Market Performance of Islamic Banks in GCC countries. *ISRA International Journal of Islamic Finance*, 4(2), 89–116. <https://doi.org/10.2307/j.ctt1df4hbd.9>
- Sufian, F., & Noor, M. A. N. M. (2009). The determinants of Islamic banks' efficiency changes: Empirical evidence from the MENA and Asian banking sectors. *International Journal of Islamic and Middle Eastern Finance and Management*, 2(2), 120–138. <https://doi.org/10.1108/17538390910965149>
- Sutawijaya, A., & Lestari, E. P. (2009). Efisiensi Teknik Perbankan Indonesia Pascakrisis Ekonomi: Sebuah Studi Empiris Penerapan Model DEA. *Jurnal Ekonomi Pembangunan: Kajian Masalah Ekonomi Dan Pembangunan*, 10(1), 49. <https://doi.org/10.23917/jep.v10i1.808>
- Tai, L. (2014). Efficiency and Performance of Conventional and Islamic Banks in GCC Countries. *Middle East Journal of Business*, 9(2), 60–71. <https://doi.org/10.5742/mejb.2014.92387>
- Wahab, A., Hosen, M. N., & Muhari, S. (2014). Komparasi Efisiensi Teknis Bank Umum Konvensional (BUK) dan Bank Umum Syariah (BUS) di Indonesia Dengan Metode Data Envelopment Analysis (DEA). *Al-Iqtisad: Jurnal Ilmu Ekonomi Syariah*, 6(2), 179–194. <https://doi.org/10.15408/aiq.v6i2.1229>
- Zeitun, R., & Benjelloun, H. (2012). The Efficiency of Banks and the Financial Crisis in a Developing Economy: The Case of Jordan. *International Review of Accounting, Banking and Finance*, 4(2), 28–60.

APPENDIX

Appendix 1: Descriptive statistics of input and output for the period 2013-2018

	Max	Min	Average	St.Dev
Inputs				
2013				
Total Assets	434,822,135	1,323,398	65,463,717	92,309,885
Personnel Expenses	5,668,692	27,432	570,075	1,130,500
Deposits	404,684,254	1,153,799	56,138,535	83,076,398
2014				
Total Assets	509,013,350	1,439,983	70,276,426	102,627,845
Personnel Expenses	2,082,904	30,717	394,294	466,090
Deposits	473,706,692	1,235,687	62,114,700	94,690,721
2015				
Total Assets	543,637,483	1,379,266	76,477,056	111,497,022
Personnel Expenses	1,647,417	23,124	376,375	413,707
Deposits	429,215,164	958,724	62,269,725	88,369,975
2016				
Total Assets	632,099,675	1,344,720	84,294,019	128,515,515
Personnel Expenses	1,761,702	24,991	384,083	439,195
Deposits	480,344,348	727,506	68,483,417	99,610,114
2017				
Total Assets	704,075,299	1,275,648	94,112,969	145,389,805
Personnel Expenses	1,979,606	29,903	408,104	470,867
Deposits	549,837,415	618,139	77,173,827	114,475,011
2018				
Total Assets	783,072,767	661,912	104,074,476	162,790,404
Personnel Expenses	2,172,902	30,695	489,236	563,957
Deposits	625,706,609	618,139	85,341,332	130,832,754
Outputs				
2013				
Financing	299,493,947	43,593	38,950,854	63,054,489
Income	16,250,340	112,047	2,756,998	3,468,617
2014				
Financing	374,574,564	41,418	43,404,092	75,354,675
Income	20,033,737	153,013	3,108,414	4,204,803
2015				
Financing	452,588,395	58,634	51,389,510	91,303,383
Income	24,528,072	145,596	3,619,429	5,047,356
2016				
Financing	516,415,549	233,406	57,402,348	104,639,528
Income	28,031,863	113,756	4,122,818	5,639,737
2017				
Financing	563,526,726	40,579	63,093,622	116,121,961
Income	30,792,924	108,334	4,474,402	6,275,419
2018				

Financing	605,930,542	40,579	70,059,060	127,241,463
Income	36,052,015	67,796	5,044,343	7,440,038

Appendix 2: Summary of Efficiency Scores

Summary of DEA	Number of fully efficient banks	Number of inefficient banks	Average Score	Number of below average score banks	St.Dev	Min. Score
2013						
TE	1	25	0.645	13	0.192	0.349
PTE	1	25	0.727	12	0.160	0.454
SE	1	25	0.727	2	0.161	0.502
2014						
TE	0	26	0.669	11	0.186	0.295
PTE	1	25	0.742	10	0.158	0.424
SE	0	26	0.896	9	0.137	0.483
2015						
TE	3	23	0.742	9	0.194	0.345
PTE	7	19	0.811	13	0.169	0.502
SE	3	23	0.910	8	0.130	0.503
2016						
TE	4	22	0.759	12	0.196	0.366
PTE	6	20	0.857	12	0.135	0.534
SE	4	22	0.882	8	0.170	0.491
2017						
TE	1	25	0.699	10	0.203	0.304
PTE	2	24	0.815	9	0.173	0.305
SE	1	25	0.869	8	0.194	0.458
2018						
TE	1	25	0.701	10	0.198	0.362
PTE	3	23	0.820	10	0.167	0.403
SE	1	25	0.866	8	0.197	0.362

Appendix 3: Average scores of TE, PTE, and SE of Islamic banking (2013-2018)

Country	Number of banks	Mean of TE all years	Mean of PTE all years	Mean of SE all years
Malaysia	13	0.824	0.857	0.963
Thailand	1	0.656	0.709	0.928
Indonesia	11	0.591	0.758	0.791
Brunei Darussalam	1	0.431	0.518	0.839
MEAN		0.625	0.710	0.880

Appendix 4: Top ten banks with an average TE for six years (2013-2018)

Banks	Country	2013	2014	2015	2016	2017	2018	Average	Ranking
Maybank Islamic Berhad	Malaysia	0.827	0.883	1.000	1.000	1.000	1.000	0.952	1
Public Islamic Bank Berhad	Malaysia	0.863	0.871	0.890	0.969	0.925	0.949	0.911	2
RHB Islamic Bank Berhad	Malaysia	0.751	0.826	0.869	0.966	0.959	0.972	0.891	3
HSBC Amanah Berhad	Malaysia	0.795	0.793	0.826	1.000	0.940	0.903	0.876	4
CIMB Islamic Berhad	Malaysia	0.743	0.874	0.898	0.896	0.873	0.869	0.859	5
OCBC Al-Amin Berhad	Malaysia	0.828	0.847	0.907	0.860	0.862	0.820	0.854	6
Bank Muamalat Indonesia	Indonesia	1.000	0.912	0.971	1.000	0.562	0.625	0.845	7
Bank Panin Dubai Syariah	Indonesia	0.556	0.928	1.000	0.817	0.845	0.862	0.835	8
Affin Islamic Bank Berhad	Malaysia	0.578	0.642	0.802	0.933	0.899	0.866	0.787	9
Alliance Islamic Bank Berhad	Malaysia	0.730	0.736	0.794	0.803	0.830	0.809	0.784	10

Appendix 5: Return to Scale for period 2013-2018

	Number of efficient banks	Number of inefficient banks	Total	Percentages
2013				
IRS	0	12	12	46%
CRS	1	0	1	4%
DRS	0	13	13	50%
Total	1	25	26	100%
2014				
IRS	0	12	12	46%
CRS	0	0	0	0%
DRS	1	13	14	54%
Total	1	25	26	100%
2015				
IRS	3	6	9	35%
CRS	3	0	3	12%
DRS	1	13	14	54%
Total	7	19	26	100%
2016				
IRS	2	7	9	35%
CRS	4	0	4	15%
DRS	0	13	13	50%
Total	6	20	26	100%
2017				
IRS	1	10	11	42%
CRS	1	0	1	4%
DRS	0	14	15	58%
Total	2	24	26	100%
2018				
IRS	1	9	10	38%
CRS	1	0	1	4%
DRS	1	14	15	58%
Total	3	23	26	100%